



University of Reading

Ageing and the Aged: The Social and Physical Implications of Senescence AD 900 – 1550

PhD Bioarchaeology

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Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abstract

Medieval documents confirm the existence of longevity and senescence in society, however osteological studies have struggled to identify the oldest individuals in the archaeological record, using '46+ years' to encompass all older people. Longevity was explored through application of five traditional and six recently developed ageing methods, providing upper age estimations beyond this artificial cut-off point. The experience of senescence was investigated through palaeopathological analysis, including age-related disease and indicators of care provision, or the presence of physical abuse. Contemporaneous views regarding ageing and old age were explored through surviving literature, and varied according to an individual's health, and their ability to contribute to society.

The study sample comprised 700 adult males and females aged 35+ years at death, from four sites in the north-east of England, incorporating a cross-section of medieval society; Barton-upon-Humber, North Lincolnshire (n=309), Fishergate House, York (n=70), St. Helen-on-the-Walls, York (n=130) and Wharram Percy, Yorkshire (n=191).

Re-ageing resulted in 108 (15.4%) individuals being between 60 and 69 years, and 40 (5.7%) being 70+ years. Using multiple ageing techniques enabled a review of the methods themselves; and with palaeopathological analysis, exploration into the potential of assessing individuals for frailty and ability, informing on their lived experience. Frailty scores increased from 1.85/individual to 3.13/individual from 35-45 to 70+ years.

Conclusions suggest chronological age was not linked to decline of worth, unless also associated with loss of ability, through increasing morbidity. This was not limited to the very old, any individual exhibiting high frailty, meaning low ability, was significantly more likely to suffer abuse.

The findings of this thesis challenge accepted notions of early mortality in archaeological populations and provide a significant contribution to the further understanding of the life course in the past, at a time when the world is facing an old-age crisis.

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Chapter 1 - Introduction

1.1 Background to study

Ageing is a fundamental aspect of living; no single individual can escape the inevitability of the ageing process whether chronological or biological. Yet, unlike chronological ageing which is linear; the effects of biological ageing are unique for every individual, despite the seemingly homogenous progression through the same sequence of events from birth to death (Adams and White, 2004). The impact of advancing age varies from one person to another due to a combination of factors, such as genetics, diet, activity and disease (Cave and Oxenham, 2016). These in turn vary in their influence on the ageing body, most relevantly increasing variation in skeletal degeneration with advancing age, meaning quantifying chronological age becomes more challenging. It is this complexity that may explain why older individuals have been largely ignored within archaeology (Appleby, 2010).

Until recently, popular opinion has asserted that life span in the medieval period was limited (Smith et al., 2017). An example is a BBC (1998) article, stating that a male in the 13th century may have just managed to attain 50 years of age, but only if he could reach the age of 30 first. This view of a limited life span stems from oversimplified interpretations of life tables generated by anthropologists, which are influenced by the age profile of the cemetery population from which they were generated (Schäfer, 2016). This means they are impacted by high numbers of infant or child deaths, and poorer preservation of older remains (Gowland, 2007). Furthermore, standard ageing techniques typically underage the very old, skewing age profiles to the 'middle', as well as potentially incorporating skeletal traits that do not directly correlate with advancing age, or provide extremely large imprecise older age ranges (Cave and Oxenham, 2017, 2016; Falys and Lewis, 2011). These methodological limitations mean that scientists use, and accept, an artificially low cut-off point when ageing skeletons (e.g. 46+ years) which is then misinterpreted as an end point (Powers, 2012; Smith et al., 2017). This thesis aims to rectify this neglect, in order to

investigate and further understand the lived experience of older individuals in medieval England from AD 900 – 1550.

The medieval period provides a lucrative area for study with large skeletal samples and a rich historical record. Previous research has focused on the social implications of being old through burial treatment and grave goods (Cave and Oxenham, 2016; Gowland, 2006), rather than directly studying the ageing body itself; and are limited in time period (Aykroyd et al., 1999; Cave and Oxenham, 2017; Gowland, 2007), or are heavily inclined towards privileged or older males (Gilchrist and Sloane, 2005). This research resonates with modern concerns about the fate of our ageing population.

1.2 Approach

This research was developed to assess the feasibility of an archaeology of old age.

Bioarchaeologists have highlighted the need to develop research questions that identify and highlight the social implications of being old (Appleby, 2017, 2010; Cave and Oxenham, 2017; Gilchrist, 2012a). As well as the need to explore various statistical, theoretical and practical systems for identifying old age (Aykroyd et al., 1999; Cave and Oxenham, 2016; Falys, 2012; Gowland, 2007). But thus far there have been no large-scale studies which have combined the two, particularly when focused on the medieval period.

This study first explores whether living past 46 years was possible in the different sectors of medieval society, utilising contemporaneous historical records to explore the existence of individuals, both male and female, in excess of the accepted 'cut-off' age. Before using newly developed (Falys, 2012; Falys and Prangle, 2015) and standard ageing techniques (Brooks and Suchey, 1990; Brothwell, 1981; Buckberry and Chamberlain, 2002; DiGangi et al., 2009; İşcan et al., 1984b, 1984a, 1985), on the dentition, vertebrae, clavicle, ribs, and pelvis, to re-age c.700 individuals from four medieval archaeological collections, originally aged as 35-45 and 46+ years. The ageing methods are either specifically developed to age beyond 46+ years, have the capability to do so, or are habitually used within bioarchaeology for age-at-death estimation.

Physical health, treatment, and frailty, will be explored through assessment of pathology, while direct social value can be discerned through the funerary archaeology (Gowland, 2006). Frailty is defined in this study as a “fluctuating physical state based on exposure to and survival from diseases and other stressors”, this does not reflect an individual’s susceptibility to death, rather it measures their resilience in overcoming stressors (Marklein et al., 2016:209). Social contemporaneous attitudes towards ageing and the old, as well as individual agency in the latter stages of life, will be gleaned from historical and sociological resources, such as Christine de Pizan’s (2003) *Treasure of the City of Ladies* (c.AD 1405), or Gabriel Zerbi’s AD 1489 treatise *Gerontocomia: On the care of the Aged* (Lind, 1988).

The collections used represent a full cross section of society, from a relatively confined geographical area. Barton-upon-Humber represents a population of higher socioeconomic standing, from a semirural market town in North Lincolnshire; whereas Fishergate House, located in the suburbs of York, represents a population of very low socioeconomic standing. St. Helen-on-the-Walls, is an urban population, situated in the very heart of the City of York, and in contrast, Wharram Percy represents a rural community, located in an isolated area of the Yorkshire Wolds. *Rural* in this context is understood to mean a small population, whose residents are predominantly involved in agriculture (Halfacree, 1993). *Urban* is understood to indicate a large densely packed population, involved in complex and diverse primarily non-agricultural economic and social organisation, often with a dedicated local administration system (Weeks, 2010). Socioeconomic status is defined as a combination of both economic and social status, which are dictated by occupation, and levels of education and income (Baker, 2014). This cross-section allows for conclusions to be drawn between the social and physical implications of advanced age, across a wide spectrum of medieval society.

A comprehensive review of each ageing method; to suggest each techniques’ value in ageing older adults, element preservation, age estimation accuracy, consistency in producing older or younger age estimations, and ease of use; will be undertaken to further develop the foundations

for an archaeology of old age. However, the societal importance of chronological age in comparison with personal ability level, or biological age, particularly due to the increased variation in degeneration of bones with advancing age, needs to be considered. This will be undertaken by assessing frailty levels (Marklein et al., 2016), based on disease accumulation and resultant mortality risk to assess if chronological age for older individuals should have a place within the archaeology of old age.

1.3 Aims and objectives

The aims of this study are multidisciplinary, incorporating bioarchaeological and historical methods and questions, to assess the life course of the old in the medieval period in north-east England. Specifically, this research will assess:

1. Whether it is possible to identify older individuals (over 46 years) within the archaeological record?
 - Contemporaneous historical documents recording older individuals in the medieval period will be collated and presented to demonstrate their presence.
 - In total 700 individuals will be re-assessed for age-at-death using a combination of recently developed and standard ageing techniques. Furthermore, a review of these methods' worth, will contribute to progression of the study of old age in archaeology.
2. How did an individual's role in society change with advancing age, and did this experience differ for males and females?
 - Frailty will be calculated, in conjunction with abuse and/or neglect assessment, to see if chronological age or biological age (ability level) is the marker of value in society.
 - Consideration of contemporaneous literature on senescence and longevity will provide information on agency and social treatment trends in the medieval period.
3. Can evidence for the agency, and societal or individual treatment, of older individuals be identified on the skeleton, and does this vary between individuals of high or low socioeconomic status or in urban and rural settlements?

- Palaeopathological analysis of each individual, with emphasis on evidence for care or abuse/defence, will be compared against their social background according to burial environment and individual frailty, in order to provide comparisons between sites.
- Osteobiographies of the oldest, and most frail individuals will demonstrate agency and/or treatment at a personal level, and highlight contrasts between individuals dependent on health status and age.

1.4 Structure

The following chapters provide critical discussion of old age and the medieval life course, demonstrating the importance of accurate and precise age estimation into old age, both chronologically and biologically, for demographic and ability level assessment. Chapter Two focuses on the physicality of ageing, exploring the science behind why and how the body ages, and modern social perceptions regarding growing old, before reviewing both new and traditional ageing methods used in bioarchaeology. Finally, diseases typically associated with old age are presented, in relation to their prevalence, aetiology and symptoms. Finishing with a discussion of disease accumulation and frailty.

Chapter Three introduces the life course, exploring the reasons why older individuals in the archaeological record are ignored, before examining contemporaneous historical documents for proof of individuals living to advanced ages. Before exploring medieval beliefs about and attitudes towards old age.

A contextualisation of the sites used in this research is carried out in Chapter Four; focusing on the lived experience of the people from each site, through consideration of their social status, occupations, diet and living conditions, with each site representing one of the four elements of society; rich, poor, urban and rural. The second part of this chapter is dedicated to the ageing methods that will be employed during the course of this study, presenting their written descriptions, scoring systems and diagrammatic or photographic representations. Diagnostic

criteria for assessing frailty and those diseases most closely related to advancing age is also outlined, along with how these will have impacted the life course of those they affected.

The results of this study, in Chapter Five, are introduced by sample preservation and age and sex distributions, before presentation of an intensive analysis of the utilised ageing techniques, focusing on their accuracy and precision, feasibility and usability. Frailty assessment, by age, site and pathology type is presented in relation to inferred ability. The results from thorough pathological assessment are presented, divided into dental, skeletal and trauma, with a focus on those which increase in prevalence with advancing age, as well as markers for physical abuse. Finally, information regarding the burial archaeology of the individuals under study is presented.

Discussion of the results is presented in Chapters Six and Seven; following the format of the preceding chapters. Chapter Six reviews the ageing methods, with conclusions drawn about each techniques' worth, both in regard to their usability and the age estimations they provide. While Chapter Seven explores the lived experience of the individuals studied. This is accomplished through discussion of chronological vs. biological age, ability and frailty, male and female experiences, burial, age related pathology, and finally through the presentation of osteobiographies of a selection of the oldest and most frail individuals. Final conclusions, and future directions are presented in Chapter Seven.

1.5 Limitations

Of the newly developed methods employed within this study, only one is currently published (Falys and Prangle, 2015) and has undergone peer review to assess its accuracy, precision and observer error (Blatt et al., 2020; Blom et al., 2018; Price, 2017; Veselka et al., 2021). The rest (Falys, 2012) remain unpublished and unreviewed, a limitation which impacts any results gained from them, until such a time as they are published and subsequently reviewed.

Additionally, analysis was hindered at two sites, Barton-upon-Humber and St. Helen-on-the-Walls. At Barton-upon-Humber, only a subsample of this large collection could be analysed due to time constraints, owing to the store housing the remains being closed for many months, while lead was

removed from the walls. At St. Helen-on-the-Walls, co-mingling of the remains when multiple individuals were excavated from a grave or small area restricted analysis to single inhumations.

Chapter 2 - Ageing

2.1 Introduction

This chapter will explore the ageing process. It will delve into theories on why humans age, and the biological process it encompasses, before focusing on the specifics of how the skeleton, cartilage and dentition degenerate. Modern views regarding old people and ageing will be examined to provide context for why this study is so important today. Ageing methods that are frequently used in archaeological studies, or are newly developed, that age over 45+ years will be highlighted and discussed, focusing on their benefits and drawbacks. Finally, diseases that commonly affect older people will be explored focusing on their impacts on quality of life. This section will be finished by consideration of elder abuse, disease accumulation and frailty.

2.2 What is ageing?

The World Health Organization (WHO, 2021) defines ageing at a biological level as resulting from “the impact of the accumulation of a wide variety of molecular and cellular damage over time” and concludes that this “leads to a gradual decrease in physical and mental capacity, [in conjunction with] a growing risk of disease and ultimately death”. This, when coupled with the bodies decreasing ability to repair and renew, can be classed as senescence (Crews, 2003:4). Importantly the WHO definition goes on to note the complex and variable relationship between biological, chronological and social ageing, stating that “these changes are neither linear nor consistent, and they are only loosely associated with a person’s age in years. The diversity seen in older age is not random. Beyond biological changes, ageing is often associated with other life transitions such as retirement, relocation to more appropriate housing and the death of friends and partners” (WHO, 2021).

The different forms of ageing and their definitions as they will be used within this study are set out below:

- Chronological age – refers to the amount of time that has passed since birth, usually expressed in years lived.
- Biological age – refers to the physical development and subsequent degeneration of the body and mind (senescence).
- Social age – refers to how individuals act and are perceived by society.

(Gowland, 2002:10).

Other terms which go hand in hand with ageing but need their own descriptions include the following:

Lifespan – the maximum chronological age to which an individual may live.

Longevity – a general term that reflects length of life, which can be quantified in several ways.

Life expectancy – a demographic measure of the average life span of a cohort or population.

(Chamberlain, 2006:52–53; Crews and Ice, 2012).

2.2.1 Why do we age?

Senescence is universal to all organisms, the deterioration in structural and functional manifestations (i.e. appearance, strength, immunity) and reduced ability to maintain and repair physiological damage combine to lower the probability of reproduction, and increase susceptibility to morbidity and eventual mortality (Crews, 2003:4; Rockstein et al., 1977:5). In humans, Gompertz's (1825) law of mortality, demonstrates that once biological adulthood is reached, at around 30 years of age, mortality rates double once every eight years. This model is still valid today (Avraam et al., 2014; Gavrilov and Gavrilova, 2001; Karin et al., 2019). The onset and effect of senescence, however varies dramatically between individuals, and between organs and tissues within the same individual (Rattan, 2006:1230).

Although no current definitions of senescence and ageing satisfy all gerontologists (Crews and Ice, 2012), there are two leading theories on why the body and mind age. Although more than 300 exist (Medvedev, 1990; Rattan, 2006:1230). The first is the, 'non-programmed' ageing theory

which posits, that after our 'essential lifespan' has been reached our bodies no longer need to combat deteriorative processes (Goldsmith, 2014; Vanhaelen, 2019). The essential lifespan (ELS) is defined as the length of time required for an individual to complete successful reproduction (Rattan, 2006:1231). Adams and White (2004:332) support the non-programmed theory, speculating that senescence occurs in protected environments due to the body's evolutionary prediction of ELS, meaning it is most efficient to invest in maintaining the body to the end of ELS but no longer. This 'life history principle' dictates that in order to live past ELS, individuals need to inhabit a suitably advantageous environment which prolongs the lifespan beyond the essential; for females this is post-menopause (Adams and White, 2004:332; Rattan, 2006:1231). This principle, however, ignores phenomenon such as the grandmother hypothesis (discussed in section 2.2.4), as well as the fact that women need to survive for some considerable time post-birth in order to raise, protect and support the child, and it could therefore be argued that female post-natal and post-menopausal survival is still essential.

The second ageing theory, 'programmed ageing', posits that a suicide mechanism has evolved with us, specifically within our cells, as individuals began to live beyond ELS. This programmed cell death is termed apoptosis (Crews and Ice, 2012). The cellular mechanism is triggered to curtail this longevity (Goldsmith, 2014), and ageing is therefore a physiological function (Libertini, 2019). Hence, senescence occurs as part of a genetically programmed method for limiting population size and to accelerate the turnover of generations so that species can adapt more quickly to changing environments (Kirkwood and Austad, 2000:233; Libertini, 2019).

Whilst mechanisms do exist that prompt cell death (discussed in detail below), they are processes that exist to maintain and promote overall health for as long as possible, and over time it is only natural that they fail. Crews and Ice (2012:658) state succinctly that "senescence is the natural outcome of living systems" and suggest that an incorporation of both programmed and non-programmed ageing systems is the most logical explanation, one which this author can subscribe to.

2.2.2 The biology of senescence

The visible physiological changes associated with senescence can include sagging and wrinkling of the skin, thinning and greying of hair, curving of posture, a decrease in the momentum and force of muscle contractions and locomotor functions, a general decline in capacity to react to environmental stresses, and a potential for a lower emotional demeanour and outlook, particularly towards the latter end of life (Appleby, 2010; Chalise, 2019; Rexbye and Povlsen, 2007; Rockstein et al., 1977). The accumulation of age stresses can also affect the function and reparative potential of the skeleton over time, resulting in the biological ageing of the bones, joints and dentition (Hand and Frank, 2014; Rahmati et al., 2017; Tonna, 1977:470), as well as the reparative potential of the cells in the body (Karin et al., 2019; Kowald and Kirkwood, 1996). This occurs due to defective maintenance mechanisms which results in an accumulation of cell damage and eventual cell death (Adams and White, 2004:332; Crews and Ice, 2012). The rate of damage and the ability of the cells to defend and repair themselves is influenced by both genetic and environmental factors. As people age, immune functions decrease causing progressive impairment of adaptive responses, resulting in an increase in diseases which affect multiple tissues, such as cancer and autoimmune disorders (Adelman, 1970; Hayflick, 1985; Makinodan, 1977). Degeneration of neurological and endocrine systems will also cause alteration of neural and hormonal factors and affect the overall wellbeing of the individual (Hayflick, 1985).

The body's repair mechanisms are reliant on DNA checking and repairing systems, as well as antioxidant vitamins (vitamins C and E) and minerals (e.g. selenium and magnesium) that aid antioxidant enzymes in scavenging free radicals (Adams and White, 2004; Santos-Sánchez et al., 2019). Both defence and repair mechanisms are highly dependent on these enzymes. Damage to genes controlling production and function of these enzymes will increase the rate of cellular damage (Adams and White, 2004:332), leaving the individual susceptible to diseases such as neoplasms (cancer) and atherosclerosis (arterial plaque build-up).

Four types of cellular damage can occur:

1. Somatic mutation - DNA replication error resulting in mutation of the gene, can cause neoplastic disease (Adams and White, 2004; Tomasetti et al., 2017). Abnormal cell division also results in loss of telomere length, a major factor linked to ageing (Aviv and Shay, 2018; Vaiserman and Krasnienkov, 2021).
2. Oxidative stress – production of highly reactive molecular fragments with one or more unpaired electron. Damage occurs when there is an over production of reactive oxygen species (ROS – free radicals) with a deficiency in antioxidant enzymes to combat them (Poprac et al., 2017). This is thought to be one of the primary causes of ageing (Crews and Ice, 2012; Kowald and Kirkwood, 1996).
3. Mitochondrial changes – mutations within the mtDNA, combined with decreasing function of the mitochondria with advancing age, can result in ageing and age-related diseases (Sun et al., 2016).
4. Accumulation of aberrant proteins and other waste products in cytosol – due to errors in synthesis, damage, misfolding, cross-linkage, post translational modification and denaturation. Free radicals are released to clear the waste products resulting in production of pigmented inclusion bodies, which contribute to the ageing of the cell (Hayflick, 1985; Kowald and Kirkwood, 1996).

The cumulative damage and therefore biological ageing experienced by cells is assessed through the study of sections of DNA called telomeres (Adams and White, 2004). Telomeres are simple sequences of non-coding chromosomal DNA repeated many times at the ends of eukaryotic chromosomes. In humans, the telomere sequence is TTAGGG, and it is involved in cell cycle control and maintenance of chromosomal stability (Samani and Van Der Harst, 2008). The number of repeats each cell possesses at birth is genetically determined but varies between individuals (Whittemore et al., 2019). With each cell division, the telomeres are progressively shortened due to the inability of DNA polymerase to replicate the last three prime ends of the linear DNA

sequence during mitosis (i.e. the corresponding AATCCC's), an issue termed the 'end replication problem' (Samani and Van Der Harst, 2008 p. 537; Vaiserman and Krasnienkov, 2021). Telomeres are not repaired by DNA repair mechanisms; therefore, telomere length is a marker of cumulative cell damage (Adams and White, 2004). The quantity of telomere lost with each cell division varies, increasing with poor cell health, and is influenced by a variety of genetic and environmental factors (Aviv and Shay, 2018). Cells experience senescence and commonly die via apoptosis, when telomere length reaches a critical value, cells that do not die remain inactive within tissues and can contribute towards neoplastic developments (Crews and Ice, 2012). This acts as a form of biological clock within each cell and has prompted new research into ageing to focus on these short strands of DNA (Aviv and Shay, 2018; Crews and Bogin, 2010; Crews and Ice, 2012; Samani and Van Der Harst, 2008; Vaiserman and Krasnienkov, 2021). The reason telomeres are thought to influence biological ageing rests on their presence within somatic (non-reproductive) cells, meaning mutation or loss of DNA can have a large effect. An individual's transition into senescence may be driven by signals from these shortened telomeres (Samani and Van Der Harst, 2008:537).

Free radicals in ageing were first proposed by Harman (1956), the theory postulated that ageing occurs due to the harmful effects of free radicals on tissues (Nohl, 1993; Poprac et al., 2017). Free radicals are molecules or molecular fragments possessing one or more unpaired electrons, making them generally very highly reactive (Cheeseman and Slater, 1993; Poprac et al., 2017). Free radicals are produced continuously within cells, both as by-products of metabolism or deliberately, for example during phagocytosis (the cells ingestion and breakdown of another particle, often bacteria) (Cheeseman and Slater, 1993; Poprac et al., 2017). By-production of free radicals occurs most frequently within the mitochondrial respiratory chain, which is an essential reaction producing the energy molecule adenosine triphosphate (ATP) which is required for all metabolic processes (Kowald and Kirkwood, 1996:211; Poprac et al., 2017). The relationship between mitochondria and free radicals is cyclical. Mitochondria produce free radicals which can react and damage the mitochondria itself; damaged mitochondria then produce more free

radicals which in turn cause further damage. This hinders mitochondrial biochemical activities (e.g. oxidative phosphorylation, protein synthesis and degradation) leading to cell damage and death, which can affect the surrounding tissues (Kowald and Kirkwood, 1996). Free radicals can be formed in three ways, the two most common ways are via electron transfer, this means either loss or addition of a single electron from a normal molecule ($A \pm e^- \rightarrow A^\bullet$) ($\bullet$ = free radical). The third way is via homolytic cleavage of a covalent bond (i.e. fragmentation of a normal molecule) with each fragment retaining one of the paired electrons ($X:Y \rightarrow X^\bullet + Y^\bullet$), overall this process is less extensive because it requires high energy input from high temperatures, UV light or deionising radiation (Cheeseman and Slater, 1993:482). Oxygen derived free radicals, termed reactive oxygen species (ROS) or occasionally reactive nitrogen species (RNS), can be regarded as the most important types of free radical (Santos-Sánchez et al., 2019). These include the hydroxyl radical ($\bullet OH$), the superoxide radical ($O_2^{\bullet -}$), nitric oxide ($NO^\bullet$) and the peroxy radical ($ROO^\bullet$) as well as the non-radical ROS, singlet oxygen ($^1O_2$), hydrogen peroxide (H_2O_2), peroxynitrite ($ONOO^-$) and hypochlorous acid ($HOCl$) (Poprac et al., 2017:592). Most of the ROS are not damaging to cell organelles in their original forms, but they can react with each other and transition metal ions (e.g. ferrous iron - Fe^{2+}). For example, reduction of oxygen by a single electron transfer creates superoxide ($O_2 + e^- \rightarrow O_2^{\bullet -}$), two superoxide molecules can react together to create a hydrogen peroxide molecule and an oxygen molecule ($2O_2^{\bullet -} + 2H^+ \rightarrow H_2O_2 + O_2$) this is termed a dismutation reaction. The hydrogen peroxide molecules are particularly reactive with transitional metal ions, this reaction will produce the most highly reactive and damaging ROS, the hydroxyl radical ($H_2O_2 + Fe^{2+} \rightarrow \bullet OH + OH^- + Fe^{3+}$) (Cheeseman and Slater, 1993:483). Hydroxyl radicals can react with DNA causing oxidative damage, cell mutation and cell death; it can also continue its reaction chain to eventually form peroxy radicals which can cause lipid peroxidation (cell wall damage and degradation –Figure 2.1) (Poprac et al., 2017:593). Cell defence towards ROS prevents and repairs damage created by free radicals, this defence is carried out by antioxidants. Antioxidants include enzymes which decompose peroxides, scavenge free radicals and proteins that isolate transitional metal ions, more commonly these antioxidants are

known as vitamins C and E, carotenoids, catalase and the superoxide dismutase enzyme (Cheeseman and Slater, 1993; Poprac et al., 2017). As individuals age their body's ability to respond to these challenges decline, meaning the harmful effect of ROS build up, contributing to an overall decline in health (Kowald and Kirkwood, 1996).

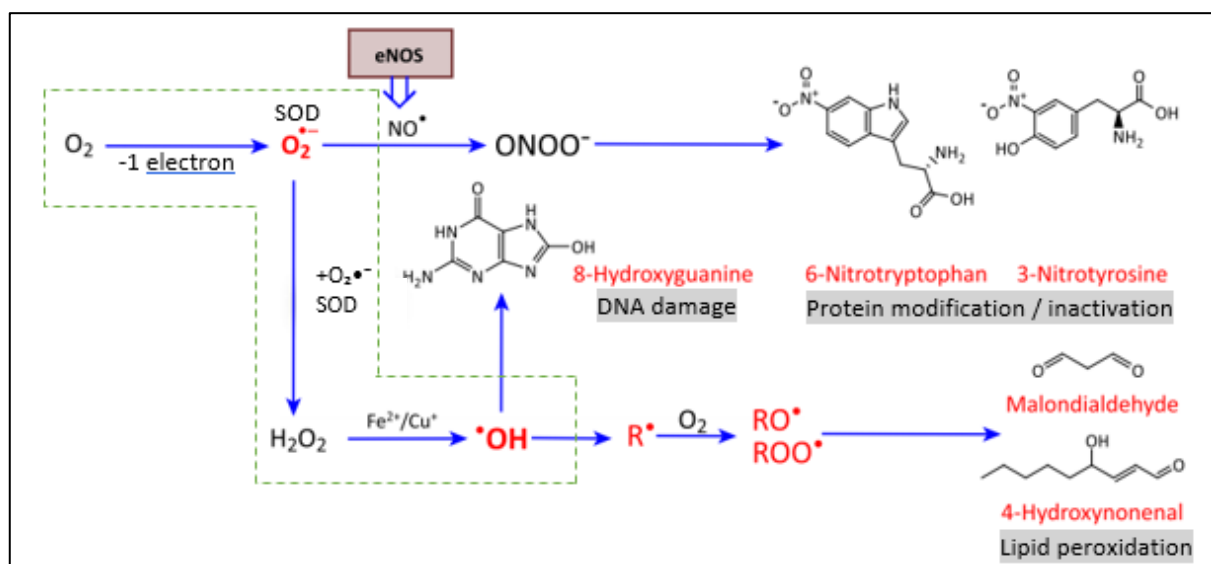


Figure 2.1. The reactive oxygen species pathways. Demonstrating the formation and transformation of ROS and NOS from Oxygen to the various damaging radicals, and the damage they cause. The reaction process outlined in text is highlighted by the dashed line. SOD – superoxide dismutase enzyme. NOS – Nitric oxide synthases enzyme (Poprac et al., 2017:593).

2.2.3 Menopause and andropause

The menopause or climacteric, usually occurs between 45 and 55 years of age in modern populations (Pocock et al., 2018). Documentary evidence suggests that the age of menopause in the medieval period occurred similarly at around 50 years (Gilchrist, 2012b; Lachmann, 2011). The menopause marks the end of the fertile period and the permanent cessation of menstruation (amenorrhea), caused by loss of ovarian cells or follicular oocytes (Jaspers et al., 2015; Pocock et al., 2018). At birth, ovaries contain one to two million oocytes, which are progressively lost over time. The menopause is triggered when the ovaries contain less than one thousand oocytes (Jaspers et al., 2015). This depletion occurs due to atresia (follicular degeneration) and the decrease in ovarian responsiveness to gonadotrophins (ovulation hormones) (Pocock et al., 2018:786). The associated traits of the menopause, for example, hot flushes, night sweats and depression, result from the loss of ovarian oestrogens (Pocock et al., 2018). It must be noted that

not all women experience all or any of the typical traits associated with the menopause, and they can vary considerably between societies, for example, western women experience 'hot flushes' at a much higher rate than those of eastern decent, who in turn can be more prone to alterations in mood (Lock and Kaufert, 2001; Shea, 2020). It is impossible therefore to know the true symptoms of menopausal woman from the medieval period.

The male equivalent, termed the andropause, has no obvious event marking the decline in reproductive capacity, however between the ages of 50 to 80 years sperm production declines, and a corresponding increase in pituitary hormones related to a loss of oestrogen is experienced. Although many males are capable of reproduction until death (Pocock et al., 2018).

2.2.4 Grandparent hypotheses

Female, and to some extent male longevity, is thought to extend past the reproductive period, due to the evolutionary need for grandparents, known as the 'Grandmother Hypothesis' or the 'Grandparent Hypothesis' (Coall et al., 2016; Hawkes, 2004). This theory mainly focuses on grandmothers, stating that women who survive post-menopause into grandmother-hood allow and promote their offspring to have more children, earlier and more successfully (i.e. with a low infant mortality rate) (Coall et al., 2016; Lahdenperä et al., 2004). This is due to the assistance a grandmother can provide in childcare and procurement of food, promoting both the survival of their grandchildren, and the good health and fertility of their children (Hawkes, 2004; Lachmann, 2011). Whether the menopause is a genetically expressed way of removing older, but still vigorous women out of reproductive competition with younger generations; or a genetic signal that older women would struggle with the complexities of pregnancy and childbirth, as well as the stringencies of raising a small child; is unknown (Coall et al., 2016; Towner et al., 2016). The role of the grandmother for healthy post-menopausal women, may be an advantageous cultural adaptation for all generations (Lachmann, 2011). More recent research has explored the role of grandfathers, and both the grandparents as care givers (Coall et al., 2016), and is occasionally termed the Nestor effect (Greve and Bjorklund, 2009). However, there does not seem to be a link

between grandfather longevity and grandchild survival; and grandparental aid may only be given to ensure reciprocation of care when it is needed by the grandparents in very old age (Coall et al., 2016; Lachmann, 2011; Lahdenperä et al., 2007). The structure of care given by grandparents favours the maternal grandmother, who is biologically the most invested in the grandchildren as they are most closely related socially, this is followed by the maternal grandfather. The paternal grandmother and grandfather (respectively) are socially seen to have the least biological investment in their son's children and will invest more of their time in any daughter's offspring (Coall et al., 2016).

2.2.5 Ageing of the skeletal system

A bone's ability to continually adapt to its mechanical and physiological environment, along with its anisotropic and viscoelastic qualities provides an element for in depth study that can tell a story of the lived experience (Viguet-Carrin et al., 2006). Living bone is a composite of the mineral calcium phosphate (hydroxyapatite $\text{Ca}_5(\text{PO}_4)_3$ – 60%), and the protein, type-1 fibrillar collagen (25%), with water constituting roughly 14% of the total, and the final 1% comprised of bone cells and extracellular proteins (Augat and Schorlemmer, 2006; Pocock et al., 2018:841). This composition provides tensile strength, whilst retaining flexibility which combine to resist mechanical forces and fracture (Viguet-Carrin et al., 2006).

There are two types of bone within the skeleton, compact, dense or cortical bone and spongy, cancellous or trabecular bone (Barrett et al., 2016; Pocock et al., 2018) (Figure 2.2). Cortical bone is dense with few spaces within its structure, it makes up 80% of the skeleton, including the outer structure of all bones. Cortical bone provides protection and support, and reduces weight bearing stresses (Saladin, 2014), it is made up from osteons or Haversian systems. An osteon is composed of a central channel called the Haversian canal, which contains blood vessels, nerves and lymphatics, it is surrounded by concentric rings of lamellae (a solid intercellular substance) (Pocock et al., 2018:842). Between the lamellae are lacunae (spaces) which contain osteocytes (mature bone cells). Radiating from the lacunae are canaliculi (miniscule channels) which connect

adjacent lacunae and allow the transport of nutrients and waste products to and from the osteocytes (Pocock et al., 2018:842). Trabecular bone (20% of skeleton) does not contain osteons, it is composed of trabeculae which are thin spicules of bone, containing lacunae in a large lattice-like formation, the cavities in this lattice are filled with bone marrow. Nourishment for the osteocytes within the lacunae of the trabeculae comes from blood circulating in the bone marrow, provided by blood vessels penetrating the periosteum (Pocock et al., 2018:842). Trabecular bone is found at the epiphyses of the long bones and makes up the majority of the mass of flat, short and irregular bones (Pocock et al., 2018).

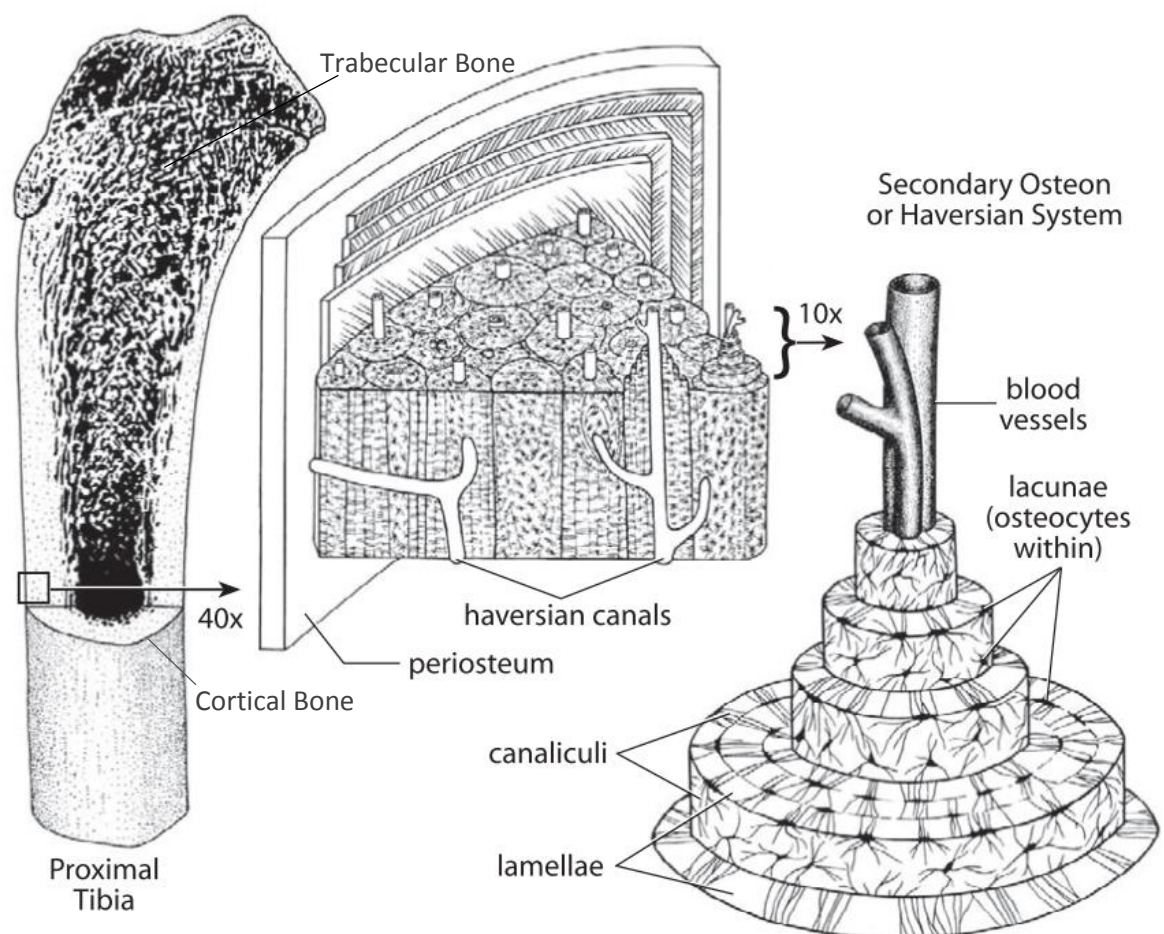


Figure 2.2. An example of the anatomical composition of cortical bone (White and Folkens, 2005:45).

Remodelling of the skeleton occurs continuously, with between 5% and 20% of bone being resorbed and replaced each year (Pocock et al., 2018; Walsh, 2017). Bone functionally adapts to meet its mechanical demands, this process is called 'Wolff's Law' (Chen et al., 2010). There are

three distinct types of bone cells, osteocytes, osteoblasts and osteoclasts. An osteocyte is a mature bone cell that has become trapped in the lacunae, within the matrix which they themselves have secreted, they are derived from osteoblasts. Osteoblasts originate from progenitor cells within the osteogenic tissue of the bone (Pocock et al., 2018:843). An osteoblast is a bone builder, they occur on the surface of every bone and line the internal marrow cavities. Osteoblasts secrete the constituents of osteoid, collagen, proteoglycan, glycoproteins, and are crucially involved with the process of mineralisation of the organic matrix in order to fill resorption cavities left by osteoclasts (Lane, 2006).

Osteoblasts contain numerous mitochondria and golgi apparatus associated with rapid protein synthesis and specific receptors for the parathyroid hormone and calcitriol (Pocock et al., 2018). Osteoclasts on the other hand, destroy and resorb bone through proteolytic digestion and acidification (Lane, 2006). Osteoclasts are large multinucleated cells containing numerous mitochondria and lysosomes and are thought to develop from the fusion of several precursor cells. They initially differentiate from mononuclear phagocytic cells and have a 'ruffled' appearance with a border of microvilli (Pocock et al., 2018; Walsh, 2017). Osteoclasts are highly mobile, their activity being regulated by osteoblasts, and via the hormones oestrogen, parathyroid, calcitonin, thyroxine and the metabolites of vitamin D (Pocock et al., 2018).

Dissolution of the bone is caused by secretion of collagenase, lysosomal enzymes, and acid phosphatase at the site of resorption (Pocock et al., 2018). The dissolved components of the bone matrix and the incorporated calcium and phosphate are released into the extracellular fluid as bone mass is reduced (Pocock et al., 2018:844). Quiescent bone is bone not undergoing remodelling, it is covered by lining cells derived from osteoblasts following bone formation (Pocock et al., 2018) (Figure 2.3).

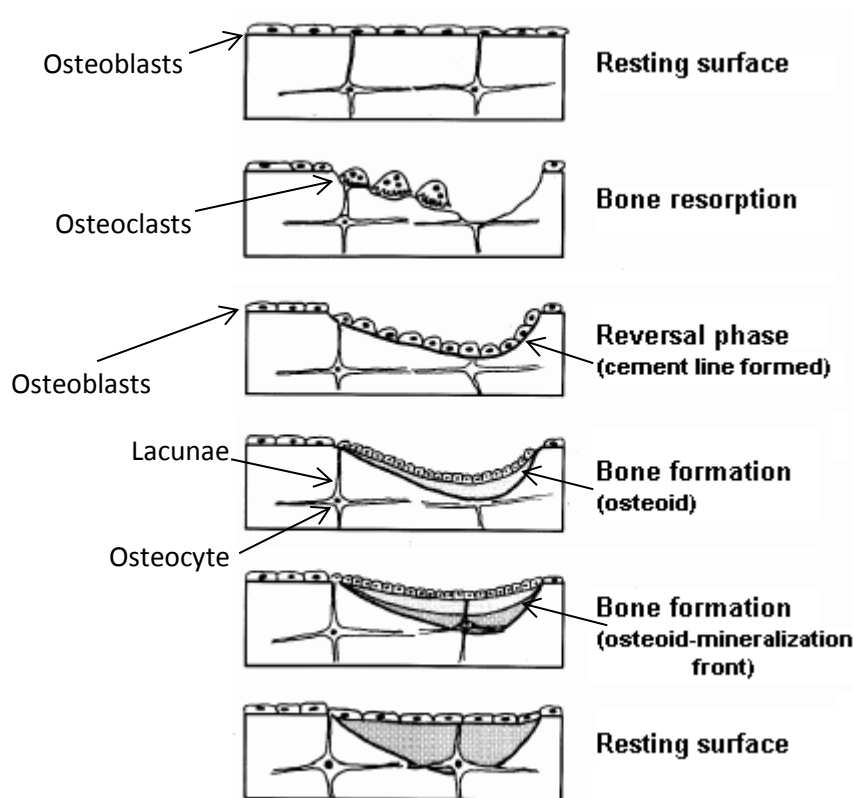


Figure 2.3. The process of bone resorption and formation by osteoclasts and osteoblasts (Mosekilde, 1999).

The rate of bone turnover increases as individuals age, it is thought that this occurs due to a shortening of osteoblastic lifespan and a prolonging of osteoclastic lifespan (Lane, 2006). This is caused by the imbalance in regulating hormones (e.g. decrease in oestrogen verses an increase in parathyroid hormone), other endocrine changes, and reduced muscle mass and loading (Walsh, 2017). When this occurs the quantity of mature mineralised bone decreases, due to larger remodelling cavities caused by the increased activity of bone resorbing osteoclasts (Walsh, 2017) (Figure 2.4). Imbalances in the rate of turnover, can cause diseases such as osteoporosis (Saladin, 2014); this is exacerbated by the collagen composition of bone decreasing by up to 50% towards old age, due to the proteins it is formed of denaturing. This creates a highly mineralised, less flexible, more brittle bone, susceptible to fracture and microcracks (Augat and Schorlemmer, 2006). Post-menopausal women are particularly prone to loss of bone mass, due to hugely accelerated bone resorption caused by oestrogen deficiencies (Lane, 2006; Walsh, 2017). Ageing also effects the levels of nutrients and minerals which can be absorbed through the gut, such as

calcium, which is essential for good bone health. The parathyroid hormone (PTH) an 84 amino acid peptide, maintains the levels of calcium within bones, but also aids resorption; if calcium from the diet cannot be transported to the skeleton, PTH production is increased to balance the loss, contributing to the bone turnover imbalance (Walsh, 2017).

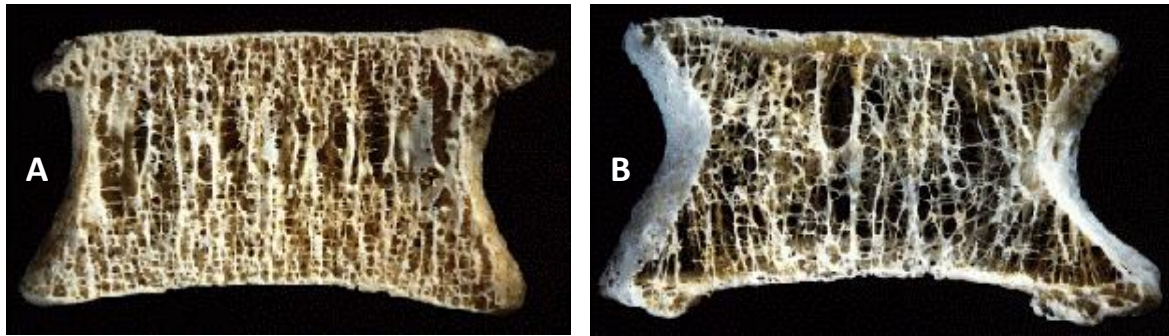


Figure 2.4. An example of the loss of bone mass between a young individual (A) and an old individual (B) in the body of two vertebrae (Mosekilde, 1999).

2.2.6 Cartilage biology and ageing

Articular cartilage is found at diarthrodial (moveable) joints, it is the connective tissue covering the surface of the bones and aids with support and weight bearing. It also allows smooth movement of the joint preventing the erosion of the articular surfaces (Rahmati et al., 2017).

Articular cartilage is a non-vascularised tissue composed of collagen (Type II) and non-collagenous proteins, collectively termed the extracellular matrix (95%), and chondrocyte cells (5%), which secrete the matrix before becoming entrapped within it; this matrix provides the articular cartilage with its biomechanical properties (Louati and Berenbaum, 2016; Rahmati et al., 2017). Chondrocytes regulate this composition by responding to changes within the chemical and mechanical configuration of their environment. Catabolic (break-down) and anabolic (build-up) processes controlled by chondrocytes, regulate the turnover and remodelling of cartilage (Louati and Berenbaum, 2016). These processes will be compromised by chondrocyte senescence and death (Rahmati et al., 2017). Chondrocyte senescence can contribute towards the ageing and degradation of cartilage tissue and is caused by general ageing stresses (e.g. mechanical loading or oxidative stress). Characteristics of cell senescence include loss of proliferative capacity, growth

arrest and change of metabolism, this can occur when telomere length reaches its critical value or from somatic mutations compromising DNA (Rahmati et al., 2017). The resulting disease which is caused by loss of articular cartilage, leading to friction and rubbing between articular surfaces is osteoarthritis (Rahmati et al., 2017) (Figure 2.5).

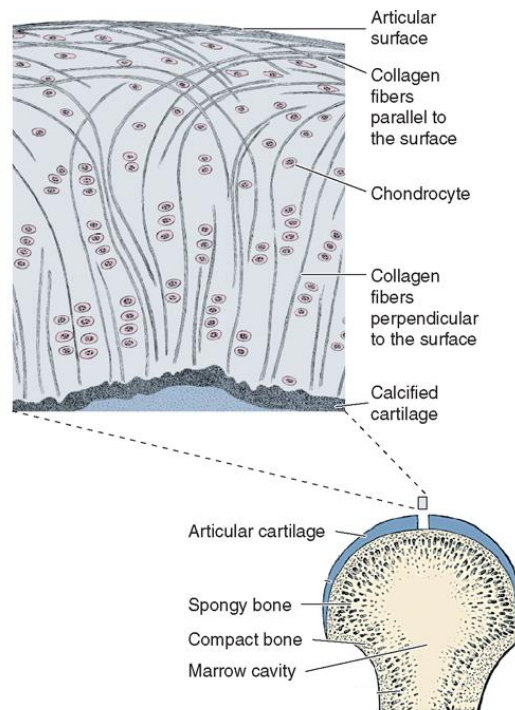


Figure 2.5. Demonstrating the composition of hyaline cartilage covering the articular surface of proximal humerus (Mescher, 2013:355).

2.2.7 Dental biology and ageing

Teeth are made up of three mineralised materials, enamel, dentine and cementum, and contain a central cavity containing a blood and nerve supply, known as the pulp cavity (Hand and Frank, 2014). In adults, dental ageing of the permanent dentition occurs via the ‘wearing away’ of the enamel and dentine, this occurs through three processes, abrasion, attrition and erosion (Kaidonis, 2008). Abrasion is the predominant wear mechanism (d’Incau et al., 2012), it occurs due to solid particles in food being forced into and over the tooth surface during mastication. If the dentine is exposed this type of wear will form a ‘scoop’ on the occlusal (biting) surface of the tooth, especially in the molars and premolars (Kaidonis, 2008). Abrasion has a direct linear correlation with age, however the use of this for ageing is unreliable without exact knowledge of diet. Attrition is caused by tooth on tooth contact, without the presence of food, it is

characterised by corresponding facets between two teeth. When the dentine is exposed due to attrition, it will form a flat surface with matching striations on both teeth (Kaidonis, 2008). Erosion is a more modern condition which has arisen with the advent of farming and fermenting, and the production of acidic foods. It involves the chemical dissolution of the tooth, with a pronounced and advancing 'scooping' form if the dentine is exposed. Odontoblasts cannot seal the dentine tubules caused by erosion, resulting in sensitivity and pain (Kaidonis, 2008). The mechanisms of abrasion, attrition, and erosion act together to form the overall ageing of the dentition (d'Incau et al., 2012; Kaidonis, 2008). The physiological adaption of the dentition to these wear mechanisms is further eruption of the teeth, this retains the original level of the tooth (d'Incau et al., 2012; Kaidonis, 2008). If wear continues, the eruption mechanism will respond until the tooth is worn to the root and is lost because it can no longer retain its anchorage within the alveolar bone (Kaidonis, 2008). This process does not always occur, in which case the dentition will simply be worn down in situ (d'Incau et al., 2012). In past populations tooth wear was unavoidable and rapid (d'Incau et al., 2012; Kaidonis, 2008).

2.3 Modern social outlook

Part of the reason for lack of interest in the old in the past is the negative attitudes towards older people today. Understanding current motivations and views towards the aged section of society can help to understand past motivations and views. The proportion of the population who can be classed as old, is higher today than it has ever been, and this number is continuing to rise (Howdon and Rice, 2018). Debate on how to, and who should care for the growing geriatric population is a political minefield (Bu, 2019; Tinker, 2002), and research into age-related disease uses up large proportions of medical research budgets (50%+ in the US) with geriatric diseases accounting for the majority of deaths in developed countries (Goldsmith, 2014). This has resulted in what has been termed the 'ageing crisis' in many developed countries (Bu, 2019). Today, the image of old age and ageing is a largely negative one. Our overriding views are learnt from birth, and enhanced by advertising to combat the signs of ageing, creating a fear culture, hostile towards older people, meaning the beginning of 'old age' is postponed for as long as possible

(McDonald, 2017; Nelson, 2011; Raina and Balodi, 2014). These views are not, however, a modern conception, with schemes and recipes to hide the onset of ageing dating back to the Hippocratic corpus (Parkin, 2003:81; Porck and Soper, 2022:8).

2.3.1 Retirement age

The current retirement age in the UK is between 65 and 68 years, dependent on date of birth, once this age is reached the individual becomes eligible to receive a state pension from the government to cover expenses in retirement (Pension Advisory Service, 2020). The 'Old Age Pension Act' of 1908 was the first legislative move towards an institutionalised retirement in the UK. This act was means tested and non-contributory (i.e. recipients did not have to pay into it) and was followed in 1925 by a compulsory contributory scheme for low income workers and in 1946 by the 'National Insurance Act' a universal contributory coverage scheme known today as National Insurance. This had the objective of providing a flat rate of income to all older individuals as safety net against poverty in old age (Bozio et al., 2010), and a secondary objective of moving an increasingly aged labour force out, without harming them financially (McDonald, 2017). Increasing life expectancy, combined with the retention of good health in older people, means many governments have introduced policies upping the age of retirement with mixed results. Many individuals want to enjoy their time while they are still able to (the third age), but prolonged retirement can also be seen to have a negative impact on long term health and wellbeing, especially of those individuals that were not proactive previously (Duberley and Carmichael, 2016; Mazzonna and Peracchi, 2015). A general decline in activity, mental health and cognitive abilities can be the result of retirement, as individuals lose the incentive to be social, complete physical activity, or consume healthy foods (Mazzonna and Peracchi, 2015). The type of career undertaken prior to retirement can also have an effect; long professional careers can leave individuals (especially women) feeling empowered and confident in retirement to continue living actively, compared to those who had more fragmentary career paths (Duberley and Carmichael, 2016; Man and Man, 2019). The evolution of retirement has also had the effect of placing a chronological age upon the concept of 'old age' socially, old age can now be ascribed to anyone

who has reached the 65 year threshold (Costa, 1998). This then incites ageism towards retired individuals who may be just as vital as those five or even ten years younger than themselves, purely due to their lack of contribution towards society post-retirement (McDonald, 2017). A phenomenon which, if present, was limited to the very old and infirm prior to the institutionalisation of retirement (Finley, 1981).

2.3.2 The third and fourth age

Old age in modernity can be divided into two distinct phases; the third and fourth ages.

Differentiation between the two is based on what can be termed active independent old age and inactive dependent old age (Gilleard and Higgs, 2002). The third age commences at retirement and lasts until the individual is too physically and mentally impaired to care for themselves (usually 65 to 80+ years), at which time the fourth age commences (Barnes, 2011; Gilleard and Higgs, 2002). The span of time that each phase takes up can vary dramatically between individuals. The onset of age related diseases, such as cancers and osteoarthritis, can cause rapid descent into the fourth age with little to no opportunity to enjoy the third age, or conversely sudden illness and death may negate the possibility of a fourth age (Gilleard and Higgs, 2015). Of course, this could also negate the possibility of a third age too, depending on when it occurs. Research suggests that the third and fourth ages are dictated by more than just physical health, the third age is linked with a positive social outlook, whereby additional spare time post-retirement, and secure finances (either savings or pension) allow for self-fulfilment and achievement of life goals (Barnes, 2011; Gilleard and Higgs, 2002). This promotes self-esteem, emotional stability, and overall well-being, and is termed the 'positivity effect' whereby older adults experience more positive emotions, and regard the past in an increasingly sanguine light compared to younger individuals, despite a general decline in their overall health and cognitive functions (Barnes, 2011). The fourth age is conversely linked to 'social death' whereby a decline in involvement in society leads to a loss of one's self, abjection and frailty (Gilleard and Higgs, 2015), as well as an overall decline in psychological and physiological function leading to death (Smith, 2002). The transition between the third and fourth ages is not clearly defined, it cannot be

ascribed to a particular chronological age (although many authors use 85 years as the upper limit for the third age), but is more associated with a decline in health and quality of life, and linked to the cultural and economic capital possessed by the individual (Kafková, 2016).

2.3.3 Positive aspects to ageing

More than ever before, advancement into the third age of life has positive connotations.

Retirement is often regarded as a 'badge of success' and a reward for working hard (Dychtwald and Morison, 2020). The large number of people currently within and entering this period of life, funded by savings and personal and governmental pensions, provides this cohort with unprecedented economic power (Dychtwald and Morison, 2020; Huber and Skidmore, 2003). This has given rise to the "longevity economy", whereby industries increasingly cater for the engaged and vital older community (Migliaccio, 2019). Governments particularly, are promoting independence and vitality into older age with the 'Active Ageing Index' (United Nations, 2019). A movement to curtail any potential ageing crisis, by encouraging retirees to maintain themselves, economically and physically, removing pressure from government and health care services. Overall the freedom created by retirement and financial stability enables those in the third age to focus on recreation and relaxation, promoting feelings of positivity and happiness (Dychtwald and Morison, 2020). However, this does not mean that the views and outlook of those not yet in the third age towards those already in it, or beyond, has altered positively.

2.3.4 Treatment of the aged

In a world with an ever-increasing older population, the treatment of and views towards this sector of society are often negative, particularly towards the oldest or frailest, as increasing numbers put pressure on resources and restrict the lives of their carers (Howdon and Rice, 2018; Nelson, 2011). Neglect of the very old in recent years has led several countries to enact laws promoting frequent familial contact with aged relatives (Bu, 2019; The Age, 2004). In France this came to a head, when in 2003 a heatwave killed over 15,000 people, mostly older isolated individuals many of whom were not discovered for several weeks due to lack of contact by

families (Fouillet et al., 2006). In London, the same heatwave caused mortality in those over 75 years of age to increase by 59% (Johnson et al., 2005).

Ageism and age related stereotypical views towards the geriatric proportion of the population are rife today (Raina and Balodi, 2014). Something that has become increasingly apparent during the recent and ongoing Covid-19 pandemic (Han and Mosqueda, 2020). Ageism is an entirely prejudiced attitude, going beyond simple personal beliefs to involve negative actions towards old people, whether these are direct or indirect. Age related stereotypes on the other hand are simply held beliefs, which may be either positive or negative, and although they are ingrained into younger individuals they do not result in any negative action towards an older individual (Raina and Balodi, 2014). For example, a commonly held negative stereotypical view is that all older individuals are bad drivers and drive slowly, conversely an act of ageism would be aggressively overtaking just because the driver is old. These beliefs and attitudes can arise from the fear of our own imminent demise because older adults remind us of our own mortality. This is a concept termed the 'terror management theory' and is based on anxiety about death, giving rise to negative feelings, which perpetuates further stereotyping and ageist views against older people (Nelson, 2011). Ageism and stereotyping, however, is not limited to the young and middle aged; 'young old' people (those in the third age) also class themselves as distinct from 'old old' people (those in the fourth age) (Nelson, 2011; Raina and Balodi, 2014). An act of ageism common to most younger people is that of 'over-accommodation', in which younger individuals speak louder, slower, enunciate, in simple sentences, while retaining an unnatural politeness which downplays the mental capacity of the older individual and emphasises their dependency (Raina and Balodi, 2014). Interestingly, a study by Nelson (2011) found that individuals at different stages of ageing reacted differently to this form of ageism, individuals in the fourth age did not perceive any prejudice, they were not bothered by ageist views and even liked over-accommodation as it conveys a sense of caring (Raina and Balodi, 2014). Individuals in the third age however found ageism insulting and upsetting (Nelson, 2011). Ageism is not limited to the general population; medical professionals validate the 'reluctant therapist' theory, in which they shun older patients

believing they either do not have any real medical issues and just want a captive ear, or are less responsive to treatment and therefore not worth it (Nelson, 2011). This then extends into and exacerbates active ageism, or elder abuse which may go unnoticed or unchecked (Raina and Balodi, 2014).

2.3.5 Elder autonomy, care and abuse

In the UK, the Care Act of 2014 (The National Archives, 2022) placed the legal duty of care for older people with local authorities. This, however, does not negate the moral responsibility of family members to care, nor does it affect the older persons right to autonomy. The conflict between informal familial caregiving and elder agency can lead to unintentional neglect by the family, or self-neglect by the older person (Andersen et al., 2020; Wylie and Brank, 2009). Self-neglect is the most common form of elder abuse, as is it perpetrated by the old person themselves, and is directly linked with a decrease in physical and psychological well-being (Melekis, 2019). It is also the most difficult form of abuse to overcome, as it relies on the older person giving up some level of autonomy and accepting aid (Bergeron, 2006).

Elder abuse can be defined as “a single or repeated act, or lack of appropriate action, occurring within any relationship where there is an expectation of trust, which causes harm or distress to an older person” (WHO, 2002). The types of abuse this encompasses can be divided in to physical abuse, psychological abuse, sexual abuse, financial abuse and neglect (either active or passive) (Lacher et al., 2016; Lachs and Pillemer, 2004; Pillemer et al., 2016). Studies have found that women are more likely to experience abuse than men, especially psychological abuse (Lacher et al., 2016; Pillemer et al., 2016), and that abuse most often occurs when the victim cohabits with the aggressor. Conversely, neglect (whether active or passive) occurs when the victim lives away from the abuser (Lacher et al., 2016). Physical abuse occurs most often towards individuals suffering from a debilitating disease, such as dementia; and elder abuse in general is often carried out by those dependent on the victim financially, or those who have a history of mental illness or have been associated with substance abuse (Lachs and Pillemer, 2004).

2.4 Ageing techniques in bioarchaeology

Chronological age is one of the fundamental characteristics assigned to any skeleton, it aids formation of individual life histories and paleodemographic studies in both archaeology and anthropology (Boldsen et al., 2022). It therefore follows that it is important to calculate chronological age as accurately and precisely as possible from the physiological changes to bones. Accuracy and precision can be defined as follows, “accuracy is the degree to which a determination conforms to reality [, and] precision is the degree of refinement with which a determination is made” (White et al., 2012:380). The ageing of the human body is a complex and highly variable process, despite a somewhat linear progression from young to old, the relationship between this physiological process and chronological age is little understood and does not appear to closely correlate (Falys and Lewis, 2011). To try and quantify the physiological changes to the bones with age, standard skeletal collections are used to develop ageing techniques on individuals of known age-at-death. Although these have their own drawbacks, to date it is the most reliable and widely used method of creating age estimation techniques in archaeology. The known lack of clear correlation between chronological and physiological age has lead researchers to call for an alternative way of quantifying age in archaeology (Appleby, 2010; Falys and Lewis, 2011; Gowland and Penny-Mason, 2018). This is centred upon physiological age, linked to a cultural or social age, based on an individual’s appearance, health status, contributions they could make to their community, and how they as an individual would have been viewed by that community, it is termed biological age. Biological age has three strands, changes to bones, which have no visible effects on the individual, changes to appearance, such as tooth loss, and finally changes to physiological function, such as fractures. Each strand is not mutually exclusive, for example a fracture can alter appearance, or bone alteration (e.g. osteoporosis) can cause a fracture (Appleby, 2010).

Chronological age in immature individuals is assessed through the development and fusion of the epiphyses of bones and the development of the dentition, i.e. growth patterns (Falys and Lewis, 2011). These processes occur in a standard series of events at similar chronological ages for both

males and females and across populations; they have been extensively and systematically recorded (Fazekas and Kosa, 1978; Schaefer et al., 2009). Maturation is a distinct phase of growth and can be assessed through the fusion of specific bones, such as those of the wrist (Cox, 1997), or the iliac crest (Lewis et al., 2016, 2015). Once physiological adulthood is reached, at around 30 years of age (Avraam et al., 2014), chronological age estimation becomes more difficult as ageing methods now record deterioration and degradation of bones, teeth and joint surfaces. Processes which can become highly variable, especially with advancing age (Buckberry, 2015).

Maintenance of bone health requires three main components, these are regular physical activity, adequate nutrition and normal hormone levels, if these requirements are not met and maintained degeneration of the bones can occur, particularly over the age of 30 years (Bloomfield, 2001).

Physical activity should be weight bearing, high impact, aerobic and involve multiple muscle groups. This can halt the loss of bone and in some cases improve bone mineral density (BMD) in older individuals (Bloomfield, 2001). It can aid in prevention of diseases such as osteoporosis, cardiovascular disease and hypertension (Amato et al., 2018). In turn, bone loss can be exacerbated by a sedentary lifestyle, with little mechanical loading or lack of adequate nutrition (Amato et al., 2018). Calcium is a key nutrient to retaining BMD, but other nutrients such as, vitamin D, protein, magnesium and fluoride (among others) all play a role in retaining bone health particularly into old age (Palacios, 2006). The final and most influential of the factors that affect bone health are hormones. For males a decline in the production of testosterone with age, and more severely for females the lack of oestrogen post-menopause, can induce loss of bone mass and therefore incite declining bone health (Bloomfield, 2001). An increase in the parathyroid hormone can also cause demineralization of bone, and is often associated with older males and females (Amato et al., 2018).

The movable joints in the body are made up of three major components, bone, articular cartilage and the synovium, any one of which can deteriorate and cause the breakdown of the joint (Louati and Berenbaum, 2016). With age the regenerative capacity of articular cartilage is reduced

(Rahmati et al., 2017), potentially causing the joint to lose its original formation developed in childhood (Plomp et al., 2015b). The resultant irritation, promoting the development of osteophytes, pitting and bony sclerosis (hardening) is indicative of osteoarthritis (Felson et al., 2000a). In some of the more static joints, such as the auricular surface, a transfer with age from hyaline articular cartilage to fibrous cartilage has a similar effect in the development of pitting and osteophytes, without the advent of bony sclerosis (Lovejoy et al., 1985b).

It is then these processes of decline which are seen in dry bone that are used to estimate adult age in archaeological collections. Current techniques encompass macroscopic, microscopic, digital and statistical methods to predict chronological age from physiological changes (Aiello and Molleson, 1993; Corsini et al., 2005; Otárola-Castillo and Torquato, 2018; Telmon et al., 2005; Wärmländer and Sholts, 2011:132). The subsequent variation in these processes between individuals and populations has resulted in an almost universal assigning of 45+ as the upper age limit in site reports (Appleby, 2017; Powers, 2012). This not only dramatically under ages older individuals but excludes a significant percentage of a population from accurate demographic study (Appleby, 2010).

2.4.1 Standards

All ageing techniques are based on what are known as standards. These standards are the skeletal or radiographic collections that the techniques have been developed using. Radiography on living individuals is useful as a standard, as the bones can be studied in situ and all parameters can be recorded. However, radiography is not ideal because it does not clearly show all the subtle variations on the surface of the bone, that may be seen in dry bone (White and Folkens, 2005).

Skeletal reference collections are derived from various sources, with basic knowledge of age, sex, ancestry and social status attached to each individual (Table 2.1). Each collection has its own limitations; age-at-death is often estimated by the coroner based on the appearance of the individual; race and ancestry information is often limited to 'black' or 'white', and samples are often made up of unclaimed adults (over 25 years at death) of low socioeconomic status who died

of unnatural causes, obtained from local hospitals, meaning little is known of their life history (Komar and Grivas, 2008; White and Folkens, 2005). For example the Hamann-Todd collection, accumulated between 1912 and 1938 consists of 3592 individuals of low socioeconomic status, collected from local hospitals of which only 16% could be reliably aged (White and Folkens, 2005).

Table 2.1. Selected standard osteological collections from around the world, an interactive map can be found at <http://forensicanthropology.eu/osteological-collections/> (Forensic Anthropology Society of Europe, 2018).

Collection Name	Location	Source	No. Ind.	Date Collated	No. M/F	Age Range	Race & Social status	Reference
Athens Reference Collection	Greece	Modern cemetery clearance	225	1996 -2003	M=114 F=100	0-99	Native. Poor.	Eliopoulos et al., 2007
Chiang Mai University	Thailand	Familial donation	472	1993 -1996	M=289 F=183	15-97	Local region only. Middle to lower class.	Traithepchanapai et al., 2016
Christ Church, Spitalfields	UK	Post-medieval cemetery clearance	968	1981 -1986	M=311 F=312 J=215	<1-90	Native. Poor.	Molleson and Cox, 1993
Filipino Collection	Philippines	Modern cemetery clearance	75	2016	M=39 F=23	15-90	Native. Poor.	Go et al., 2016
Grant Collection	Canada	Unclaimed Individuals	202	1928 -1955	M=175 F=27	>40	European ancestry. Poor.	Usher, 2002:34
Hamann-Todd Collection	USA	Local hospitals	3592	1912 -1938	M=397 F=69	16-90	Mixed white and black. Poor.	Todd, 1920, 1921
Khon Kaen Research Centre	Thailand	Familial donation to department	745	1973 -2014	M=466 F=216	1-109	Local Region only.	Techatawee-wan et al., 2017
Lisbon Collection	Portugal	Modern cemetery clearance	1692	1985 -1991	M=326 F=373	0-98	Native. Poor.	Cardoso, 2006
Pernambuco CEAF 21 st century Collection	Brazil	Modern cemetery clearance	239	2015 -2016	M=122 F=117	13-109	Native. Poor.	Cunha et al., 2018
Raymond Dart Collection	South Africa	Unclaimed Individuals & familial donation	2605	1920-current	M=1840 F=765	0-106	Mixed.	Dayal et al., 2009
Suchey Pubic Collection	USA	Modern autopsies	1225	1977 -1979	M=739 F=273	14-99	Mixed.	Brooks and Suchey, 1990
Tedeschi Collection	Italy	Gift/exchange with museums. Cemetery clearance. Unclaimed Bodies	1580 (293 known age)	1869 -1931	M=102 F=86	<1-71+	Mixed. Includes prehistoric remains.	Carrara et al., 2018
Terry Collection	USA	Unclaimed individuals	1608	1920 -1965	M=944 F=658	20-90	Mixed white and black. Poor.	Hunt and Albanese, 2005
University of Torino	Italy	City prisons and hospitals	1064 (skulls)	1880 -1915	M=384 F=680	0-100	Mixed. Includes prehistoric individuals.	Giraudi et al., 1984

This can cause tension over the reliability of techniques developed using these collections (Meindl et al., 1990). Standard reference collections rarely contain individuals who lived under similar subsistence conditions to our ancestors, meaning direct comparisons cannot be made. It has also been noted that techniques based on modern collections tend to skew age profiles of past populations, a phenomenon termed age-structure mimicry (Konigsberg, 2015; Mays, 2010; Usher, 2002). This occurs because a larger group of people of a certain age will capture more of the range of variation in degeneration at that age, than will be captured by a small number of individuals.

Another form of standard is that of the methods and age ranges used within osteological studies. Publication of guides regarding standard practice (Mitchell and Brickley, 2017; Powers, 2012; Roberts and Connell, 2004) do not stop researchers using their preferred methods of age estimation, and collating their results in different ways (Buckberry, 2015). A review of 200 skeletal research articles highlighted this, with the findings revealing that although the same ageing techniques were being utilised regularly (pubic symphysis, auricular surface, fourth rib, dentition and cranial sutures) the resultant age ranges differed dramatically, with an upper age range discrepancy of 35 years (35+ to 70+), and the additional use of descriptive age categories by some papers (Falys, 2014b; Falys and Lewis, 2011). This significantly limits future comparison of these sites and indicates a lack of universal understanding in interpretation of both the methods themselves and the age ranges provided. Finally the collections used to provide demographic data from the UK are often limited to the same sites time and again (Roberts and Mays, 2011), which does not provide a clear picture of the differences to populations and communities throughout the UK.

2.4.2 Cranial suture closure

Cranial suture closure as a method of determining age of death has its roots in the 16th century when the relationship between advancing age and increasing fusion of the bones in the skull was first noted (Meindl and Lovejoy, 1985). A suture is the immobile fibrous joint between the bones

that make up the cranium which gradually fuse and eventually become obliterated (Mays, 2010). A study by Meindl and Lovejoy (1985) on 236 crania provided somewhat ambiguous results. A composite score based on level of fusion was developed for both the ectocranial lateral-anterior (side and rear) sutures (up to a score of '15 – closed') and the vault sutures (up to a score of '21 – closed'). The associated age ranges, 34 to 68 and 40+ years respectively, are both broad and imprecise. The ambiguity occurs when the age range of a lower composite score of, for example, 5 to 7 is examined resulting in a lateral-anterior age range of 23 to 68 years and a vault range of 24 to 60 years (Meindl and Lovejoy, 1985). This demonstrates that ageing using cranial suture closure is not of much use outside a general indicator of the juvenility versus maturity of an individual, and no use at all when ageing an older population due to the wide variation in fusion timings and rates. A conclusion, that has been backed up by Konigsberg (2015) who assessed the correlation of cranial suture closure with age-at-death, using a cumulative (log) age probit model. Results, based on the sutures of 1152 individuals, revealed that the variation in fusion could only be explained by (log) age in a maximum of 35% of cases using the sphenofrontal suture, with the mid-lambdoid suture showing the lowest correlation at only 29% (Konigsberg, 2015).

2.4.3 Tooth wear

The dentition is widely used in age-at-death assessment in bioarchaeological studies because the teeth have a high mineralisation content, which means they preserve well in the archaeological record (Kinaston et al., 2019). Assessment of age from tooth wear was created by Miles (1962) after an abortive attempt to age older individuals using what he termed the 'intuitive method', which significantly underaged adults past 40 years (Miles, 1958). The 1962 sample consisted of 190 skulls from the Anglo-Saxon cemetery (AD 700 -900) at Breedon-on-the-Hill, Leicestershire. Due to the nature of the site only the skulls could be recovered, and therefore ageing using post-cranial methods could not be attempted. Using previously understood eruption times for the permanent molars (M1 at 6 years of age, M2 at 12 years and M3 between 18 and 21 years), Miles (1962) hypothesised that if the rate of wear remained constant throughout life the M1 would show six years of wear upon the eruption of the M2, and a minimum of 12 years wear upon the

eruption of the M3. This could then be extended so that if the M3 was showing 18 years of wear, the M2 and M1 would be showing 24 and 30 years respectively, meaning the individual was 36 years of age. Upon assessment it was found that the M2 and M3 demonstrated slightly slower wear patterns than the M1, so a ratio of 6 : 6.5 : 7 was established (i.e. the M2 takes 6.5 years to reach the same stage as the M1 after 6 years, and the M3 7 years) (Miles, 1962). This technique is limited by time and access constraints to calibrate the rate of wear in children for each population. Providentially Brothwell (1981) studied children's teeth from sites across Britain and found that wear rates did not alter significantly between the Neolithic (c.4000 BC) and medieval period ($\leq 16^{\text{th}}$ century AD). This finding has been backed up by more recent research (Field, 2019). Brothwell (1981) summarised his findings in a chart which is now widely used to estimate age-at-death in archaeological British populations, up to 45+ years of age; it is presented, along with a description of the method in section 4.3.3.1. Molleson and Cohen (1990) tested the accuracy of these stages on eight permanent molars (two upper M1's and M2's and two lower) from the Winchester medieval collection, by mechanically grinding them down to simulate attrition. It was found that the stages did not proceed regularly but were more consistent than expected. When wear stage 5++ was reached, the height of the crown must also be measured, as the tooth will not show increased wear until the root is reached (Molleson and Cohen, 1990). A modification of Miles' (1962) method, was developed using 311 adults of unknown age-at-death, using reported eruption timings from non-industrialised societies (Gilmore and Grote, 2012). Due to this, the authors suggest it is more applicable to a wider variety of individuals, particularly to adults. Additionally, the method provides formulae to estimate the error from each age estimation. A test of this method (Field, 2019) found that it has the ability to produce adult dental wear rates for populations, however they are based upon the assumption that dental wear is linear with age. Currently the differences in molar wear rates between the sexes, the maxilla and mandible, and due to anti-mortem tooth loss are little understood (Field, 2019; Gilmore and Grote, 2012), and limit the accuracy of tooth wear in age estimation, particularly past 45 years (Mays, 2010:76).

2.4.4 Cervical vertebrae

Ageing research using the cervical vertebrae has focused primarily on their development (Schaefer et al., 2009; Shapland and Lewis, 2014). However age related degeneration on the cervical vertebrae has long been noted (Sager, 1969), with a few attempts made to link these degenerative changes to chronological age-at-death estimation (Listi and Manhein, 2012; Watanabe and Terazawa, 2006). The method developed by Falys (2012) is the first to directly utilise Sager's (1969) research, and to focus specifically on the cervical vertebrae. The technique employs macroscopic assessment of the appearance and enlargement of porosities, the development of osteophytes and the presence or absence of eburnation. This recording criteria is used throughout, despite distinct ageing criteria for the dens facet of the atlas, the dens process of the axis, the combined dens facet and process, the bodies of the cervical spine, the facets of the cervical spine, and the combined bodies and facets of the cervical spine (Falys, 2012:93–151). When tested, Falys (2012) found that the accuracy of the methods using the dens facet and process was higher when they were used singly rather than combined. Conversely, the bodies and facets of the vertebrae were found to be more accurate when assessed in conjunction with each other, rather than separately. The ageing criteria and diagrams for the dens facet, dens process and third cervical vertebra can be seen in sections 4.3.3.2 to 4.3.3.4 .

The benefits of this method are twofold, and both involve preservation, firstly assessment may be undertaken on any cervical vertebra from C3 to C7, and secondly if either the body or the facets are not preserved, age estimation can still be carried out using the alternative 'single' system. This is of considerable advantage to bioarchaeology due to the common nature of poor preservation in the archaeological record. A study by Ezra et al. (2019) on 1365 vertebral bodies, found that osteophyte development in the cervical spine (C3-7) was linked to motion, and that at advanced ages (60+) it was broadly consistent across each body. The authors speculated that degeneration was primarily due to the anatomical structure of the spine, rather than excessive load bearing (Ezra et al., 2019). A finding that corroborated earlier cervical movement research (Knüsel et al.,

1997). If this is the case, it means age related changes to the cervical spine will be less likely to be amplified by weight-bearing stresses and more consistent with chronological age.

2.4.5 Sternal end of the clavicle

The sternal clavicle is a relatively static element that articulates with the manubrium, it is not weight-bearing, and has a limited range of movement (Dhawan et al., 2018). However, it will experience loading forces from movement of the arm, as it is the single skeletal articulation between the upper limb and the axial skeleton (Dhawan et al., 2018; Hoogervorst et al., 2019). This means that degeneration to the sternal clavicle will be mainly attributable to the ageing process, with more limited input from joint mobility and loading forces (Blatt et al., 2020).

Ageing using the medial epiphysis of the sternal end of the clavicle is regarded as a standard ageing method when implemented on adolescents and young adults (roughly 11 to 30 years) (Schaefer et al., 2009). However, the sternal end of the clavicle has only recently been regarded as a method for ageing beyond 45 years. Falys and co-workers (Falys, 2012; Falys and Prangle, 2015) have developed a technique focusing on three degenerative features visible macroscopically, these are surface topography, porosity and osteophyte formation (further information can be found in section 4.3.3.5). The method was developed on a sample of 564 individuals (318 male, 246 female) of white origin with an age-at-death of over 40 years from diverse geographic locations (St Bride's Documented Collection, UK; Hamann-Todd Osteological Collection, USA; Coimbra Identified Collection, Portugal; Pretoria Bone Collection, South Africa). The technique was tested by this author on 98 individuals from St Oswald's Priory, Gloucestershire, with the results demonstrating low inter- and intra-observer error (Mills, 2013). A subsequent study on 46 well preserved individuals (80 clavicles) of known age-at-death from the 19th century Dutch Middenbeemster collection found that the method was accurate in over 87% of cases (Blom et al., 2018). The authors report that reproducibility of the method was more difficult, but that the results were consistent, and when tested, a Spearman's rank correlation revealed a positive relationship between the features scored, composite scores and the documented ages-at-death

(Blom et al., 2018). Higher inter-observer error was also reported by Price (2017) and Blatt et al. (2020), however the former consisted of only two observers (experience unknown), and the latter primarily involved acknowledged 'beginners' (n=15), provided with the trait scores and descriptions, high-resolution photographs of the subsample and no apparent training. A final recent study (Veselka et al., 2021), using the method on the burnt remains of 40 known age-at-death individuals found that the age ranges correlated strongly with true age ($\alpha = 0.828$). Consequently the method was used on an archaeological cremation deposit (MNI=5) considerably advancing age-at-death estimations (Veselka et al., 2021).

2.4.6 Sternal rib ends

Age-at-death estimation using the ribs is primarily through assessment of the level of ossification of the costal cartilage. The costal cartilage is found at the anterior ends of the ribs, joining the ribs to the sternum creating the anterior limit of the thorax. The ossification process begins at the osteochondral junction of the ribs and advances ventrally. It is most likely hormone related, due to the differences in ossification rates and morphology between males and females (Semine and Damon, 1975). This age related process has long been noted (McCormick, 1980; Semine and Damon, 1975; Teale et al., 1989).

The phase method for determining age from ossification of the costal cartilage at the sternal rib ends was developed and tested by İşcan, Loth and Wright in the 1980's (İşcan and Loth, 1986b, 1986a; İşcan et al., 1984a, 1984b, 1985, 1987). Previous works studying the presence of age-related changes to the ribs, were limited to radiographic analysis of the rib cage in both the living and the dead, making İşcan et al. (1984b) the first study using dry bone. Results and conclusions suggested that ossification was most pronounced after 50 years of age, and that costal cartilage is one of the only sites of endochondral ossification that continues into adult life therefore more work needed to be carried out (McCormick, 1980; Semine and Damon, 1975).

The fourth rib was chosen purely for ease of access during routine post-mortem examinations maximising the sample size (İşcan et al., 1984a), although the authors note that if positive

identification of the fourth rib cannot be made, use of the third or fifth ribs may be undertaken reliably (İşcan et al., 1984b). Several independent tests of this have been carried out (Dudar, 1993; Loth et al., 1994), with the result that ribs three through to nine may be used to assess age to an accuracy of within one phase of the fourth rib, although the third and fifth remain the most ideal alternatives. İşcan et al. (1984b) used metamorphosis of the rim and pit of the sternal rib, focusing on the shape and depth of the pit, and the regularity of the rim to test which was the most useful indicator of age, on a sample of 93 white males aged from 17 to 85 at death from autopsies, roughly 21 of which were over 50. They found that the regularity of the rim had the highest continuous correlation with advancing age, followed by the shape of the pit, with the depth of the pit being the least reliable in age estimation, especially after the fifth decade of life. From this research the sex specific phase method was developed, using a sample of 118 white males (17-85 years, with 34 over 50 years) (İşcan et al., 1984a) and a sample of 86 white females (14-90 years, with 34 over 50 years) (İşcan et al., 1985). For both sexes an eight phase method (viewable in section 4.3.3.7) was utilized, differing in description, photographic stages and resultant age ranges up to a 95% confidence interval of 65.0 to 78.0 years for males and 70.4 to 82.3 years for females (İşcan et al., 1984a, 1985). İşcan and Loth (1986b, 1986a) then carried out tests on the male and female phase methods using 15 males (11 to 78 years) and 10 females (14 to 84 years) of known age-at-death from autopsies; two independent panels blind tested the methods and found that age-at-death could be reliably predicted to within one phase for both the male and female methods. The effect of ancestry was subsequently explored using 53 males and 20 females of African American descent, with the conclusion that significant differences in the rate and morphological patterns of ageing exist, resulting in the need for modifications of the technique for non-white populations (İşcan et al., 1987).

The method was tested by Gupta et al. (2007) on 395 individuals of Indian descent to assess its use on an independent sample of different heritage from the original reference sample. The authors divided the sample in to three age categories, 17-30, 31-44, and 45+, they found that the methods were statistically significant for all age groups. As would be expected the youngest two

age categories (17-30 and 33-41) were the most significant ($t=208.38$ and $t=102.00$ respectively) followed by the elder age group (45+) with a T value of 49.09. The authors found the technique to be relatively reliable, although they suggest a multifactorial approach should still be utilised (Gupta et al., 2007). A review of the technique focusing on inter-observer error showed that each observer's results correlated closely. The only individuals upon which there were larger discrepancies were those of middle age, both the young and old were aged similarly by all observers (Kimmerle et al., 2008). Other more recent tests have agreed that although not perfect, the phase methods devised by İşcan et al. (1984a, 1985) are easy to use and provide accurate results (Blaszkowska et al., 2019; Verzeletti et al., 2013).

The primary drawback with ageing on the fourth rib is identification of the rib within the burial context when the bones, and particularly the ribs, can become disarticulated, broken and comingled (DiGangi et al., 2009; Kunos et al., 1999). Therefore, an alternative method of ageing using the distinctive first rib was developed by Kunos et al. (1999) measuring the size, shape and texture of the rib and the alteration in morphology of the rib head, tubercle facet and costal face. This was undertaken on 74 individuals of various ancestries, ranging in age from 0 to 80+ years, with no separation by sex, from the Hamann-Todd collection. Those above and below 20 years of age were analysed separately, leaving a sample of 61 individuals between the ages of 20 and 80 years to undergo analysis in changes in morphology of the rib head, tubercle facet and costal face. Morphology of the three features were further divided into five categories; shape, surface topography, surface texture, margins and prearticular margins; descriptions of the changes with age were included in a table, with illustrations provided for guidance. Alteration in the morphology of the rib head, tubercle facet and costal face were found to continue up to the 8th decade of life. The authors then tested their method on 182 individuals (89 males, 93 females) spanning from 1 to 80 years at death from the same collection, and found that there were no significant differences ($p > 0.05$) in intra- and inter-observer error (Kunos et al., 1999).

Schmitt and Murail (2004) tested the validity of Kunos et al.'s (1999) method using 39 individuals, 24 males, 15 females (60 ribs) from the Thai collection, on mainly older (50+) individuals. In total only 55% of the sample were correctly classified by age, with all individuals over 60 years being underaged. The authors also found the technique hard to follow and difficult to apply, with the method being too subjective, and conclude that although the original method was developed on individuals of various descents, the technique may not be applicable to a Thai population (Schmitt and Murail, 2004). A further test by Kurki (2005) on 30 individuals indicated that the error margin for ageing using the sternal end of the first rib is high. However, it does not alter with age unlike many other ageing methods, so it can become a useful technique when determining the age of older individuals (Kurki, 2005:349). The author goes on to agree with Schmitt and Murail's (2004) findings that the method was ambiguous and difficult to follow (Kurki, 2005:349).

Ageing on the first rib was redeveloped by DiGangi et al. (2009) using the basis of Kunos et al.'s (1999) method. Using 470 documented males from the Balkans with an age-at-death range from 12 to 90 years. The authors tested Kunos et al.'s (1999) method on the three skeletal aspects of the rib, confining trait analysis to shape, topography, texture and margins for each feature, which they termed variables. A log-age cumulative probit model was used to discover if the various traits prescribed are age dependent, this was done by calculating the mean predicted age at the occurrence transition for each of the variables. Thus, each transition becomes a distinct event which forms the basis of a scoring system with which chronological age can be predicted. Of the variables, the authors found only two which did not correlate with each other but did correspond with age;

- 1) Costal face – geometric shape
- 2) Tubercle facet – surface texture

The descriptive characteristics, scoring system and age ranges for these can be found in section 4.3.3.6 . However, conclusions drawn indicate that although the method may be of use in a multifaceted approach to ageing, or if other elements are absent, readings from the two variables

can provide divergent results, producing a large age range. The authors do suggest its use as an all-encompassing ageing technique from adolescence to senescence (DiGangi et al., 2009).

2.4.7 Iliac crest of the ilium

The ageing method developed by Falys (2012) using degeneration in the form of osteophyte formation on the iliac crest is an innovative concept; and a detailed account of the method can be found in section 4.3.3.8 . All previous ageing research was limited to the formation and ossification of the epiphyses, or microscopic examination of iliac trabeculae (Bartolini et al., 2018; Falys, 2012:37; Lips et al., 1978; Schaefer, 2008; Webb and Suchey, 1985). The iliac crest is not movable or weight-bearing, and it is not a joint, therefore degeneration should be age or disease related (Augat and Schorlemmer, 2006:30). Disease refers to the development of osteophytes on the iliac crest in individuals with DISH, potentially hindering its use as an ageing method. However when tested, Falys (2012:212) found that osteophyte development on the iliac crest of those with DISH did not exceed the osteophyte development of those without DISH.

When tested Falys (2012:215–216) found that only 18.2% of males and 10.0% of females of known age-at-death, fell within the 95% confidence interval and therefore developed a series of age phases which aged 90.0% of males and 100.0% of females correctly. In these age phases, no change (Score 0) has an age estimate of <80 years, which may be accurate, but it is not precise. Upon investigation it was established that some males aged up to 90 and females aged up to 85 years were found to exhibit no change (Score 0) to the iliac crest (Falys, 2012:211), demonstrating the reasoning for this high age estimate.

2.4.8 Auricular surface of the ilium

Age related metamorphosis on the auricular surface was first noted by Sashin (1930) however it was not used as a tool for ageing human remains until 1985. Lovejoy et al. (1985b) developed their technique using a sample of 250 individuals of unknown age-at-death from the prehistoric native American Libben population (AD 800 – 1100 Ohio, USA) (Lovejoy et al., 1977), combined with 514 individuals of known age-at-death from the Hamann Todd collection. The exact age

range and numbers of males and females was not disclosed, but assumptions that the sample was aged between 18 and 70 years can be made from graphs presented in Lovejoy et al. (1985b:20–22) that use this age range. The method contains eight descriptive stages which cover five and ten year increments up to 60+ years of age, for both males and females, in which the development and degeneration of various features, including porosity and osteophyte formation, are assessed macroscopically at distinct zones on and around the iliac joint (Lovejoy et al., 1985b:19). The authors carried out two blind tests using their method on 98 and 108 individuals of known age-at-death, not previously analysed from the same collections, they found that the technique had a high rate of reproducibility by independent observers (Lovejoy et al., 1985a).

Several independent reviews of the technique (Murray and Murray, 1991; Saunders et al., 1992) found that it appeared to be unbiased by ancestry and sex, but that particularly towards the older age categories, individuals were underaged. Buckberry and Chamberlain (2002) concluded that the issue may arise from the descriptive, often overlapping nature of the stages described by Lovejoy et al. (1985b), they therefore developed a quantitative scoring system which deals with each feature separately (viewable in section 4.3.3.9). A sample of 180 individuals (86 males and 94 females) from the cemetery at Christchurch, Spitalfields spanning in age from 16 to 92 for males and 16 to 89 for females were used to develop this system, with 86 individuals over the age of 60 (42 males, 44 females) (Buckberry and Chamberlain, 2002). The authors retained the format (both sexes combined), and terminology of the previous technique but assessed each feature independently. Assigning a numerical score depending on its presentation and morphology, to provide the individual with a composite score. The retro-auricular area was excluded after being found to correlate poorly with age (Buckberry and Chamberlain, 2002). The highest composite score of 19, provides an estimated age range of 53 to 92 years, significantly advancing on the Lovejoy et al. (1985b) upper estimate of 60+ years. A blind test of this revised method was carried out on 309 individuals of known age, sex and ancestry (157 males, 152 females) revealing that the technique was easier to apply than the original, provided a similar level of accuracy for both males and females of any ancestry, and crucially is more accurate for ageing older individuals (Mulhern

and Jones, 2005). A subsequent study (Falys et al., 2006) highlights the variation in age related changes, among individuals and populations, and calls for a reduced number of stages with an increased age range for each, which would help reflect inter-individual variation. This would, however, limit this methods utility in demographic studies considerably.

Overall the auricular surface has become an integral part of the criteria for ageing due to its higher survival rate within the archaeological record, and its continued predictable development of morphological characteristics past 50 years of age (Buckberry and Chamberlain, 2002; Lovejoy et al., 1985b). However it is best used in combination with other ageing techniques, particularly because the degree of movement experienced by the joint on a day to day basis, or for females, during parturition, is largely unknown, along with the effect this has upon the morphology of the joint surface over time (Lovejoy et al., 1985b; Sashin, 1930; Waltenberger et al., 2021).

2.4.9 Pubic symphysis of the os pubis

Ageing on the pubic symphysis was originally devised by Todd (1920, 1921) on a total sample of 465 white and mixed ancestry individuals (396 males, 69 females) of known age-at-death. The sample spanned from 16 – 88 years of age, with 199 males and 22 females over the age of 45 (Todd, 1920, 1921). The technique used ten descriptive phases, based on the changing morphology of the pubic symphysis in roughly five year increments up to 50+ years of age.

Separate descriptive phases were developed for both sexes, and between the white and mixed ancestry individuals (Todd, 1920, 1921). Over the years various reviews and revisions of this technique (Brooks, 1955; Meindl et al., 1985b) have resulted in the development of the Suchey-Brooks method, which is widely used in age estimation today (Brooks and Suchey, 1990), and is viewable in section 4.3.3.10 . Brooks and Suchey (1990) used a sample of 1225 individuals, 739 males and 273 females aged between 14 and 99 at death, derived from modern autopsies. They condensed Todd's (1920, 1921) ten phase model in to six phases, and broadened the resultant age estimates to account for variability in the onset of degeneration of the morphological characteristics used (Brooks and Suchey, 1990:229). The phases are descriptive, with 12

accompanying casts demonstrating the onset and latter stage of each phase for both sexes, as well as statistical age ranges up to 42-87 years for females and 34-84 years for males from the 95th percentile (Brooks and Suchey, 1990:230–233).

Since its publication in 1990 the Suchey-Brooks method for age estimation using the pubic symphysis has undergone a rigorous review process, upon individuals of various ancestries (Berg, 2008; Joubert et al., 2019; Kimmerle et al., 2008; Overbury et al., 2009; San Millán et al., 2013; Savall et al., 2016; Telmon et al., 2005; Wärmländer and Sholts, 2011). Three main drawbacks have been highlighted in the literature, first that the age ranges are very wide, particularly towards the upper phases, making age estimation from the pubic symphysis for older individuals possibly accurate, but not precise, which limits its usefulness to demographic studies (Berg, 2008). To combat this Berg (2008) has suggested the use of a 7th stage, to reduce the age ranges and more precisely age older individuals, however this has only been developed for females and lacks clear testing of the method so far. Additionally, over the age of 40 years, the technique appears to underage individuals significantly (up to 20 years) when tested on non-American populations (Berg, 2008; Joubert et al., 2019; Kimmerle et al., 2008; Savall et al., 2016). The reasons for this lie in the morphological differences between populations, particularly towards old age (past phase 4), and can be combatted by analysis and development of older stages appropriate to each population (Joubert et al., 2019). It is possible that the inaccuracy of the Suchey-Brooks method when used on older individuals is due to the initial sample, which was heavily weighted towards younger individuals, potentially resulting in age-structure mimicry (Joubert et al., 2019). Particularly because the original sample did contain individuals from many ancestral backgrounds, which should account for much variation (Brooks and Suchey, 1990; Wärmländer and Sholts, 2011). Finally, the formation and subsequent degeneration of the ventral rampart can be confused, skewing age estimation results (Kimmerle et al., 2008). Indeed, Brooks and Suchey (1990:237) note this issue in their initial report. Asymmetry between the left and right sides, and between the formation and degeneration of features has also been raised as a concern, particularly when studying older individuals. However, Overbury et al. (2009) concluded that

asymmetry does not compromise the use of the technique, providing age is estimated using the features with the highest phase, as it appears that although some features may lag, once a morphological stage has been reached by either side the individual will have reached that age.

Several other studies (Acsadi and Nemeskeri, 1970; Gilbert and McKern, 1973; McKern and Stewart, 1957) have contributed to the overall understanding of the age changes to the pubic symphysis. McKern and Stewart (1957) developed their technique using a sample consisting of 349 American soldiers killed in Vietnam. This necessarily restricted both the age range of the sample (17 to 50 years) and the sex of the sample. They developed a three component method whereby three morphological characteristics (dorsal plateau, ventral rampart, symphyseal rim), are scored from 0 to 5 using descriptive and photographic stages, with a highest combined score of 15 giving an age estimate of 36+ years (McKern and Stewart, 1957). The nature of this study, with its one sided sex structure and limited sample age range, as well as the resultant upper age estimate of 36+ years, limits its usefulness in bioarchaeology. Sinha and Gupta (1995:76) tested the method on 82 males of Indian descent from autopsies, aged from 12 to 75 years and found that younger individuals were often overaged and older individuals were consistently and significantly underaged, with the technique allowing for no age changes over the age of 40 years, demonstrating its lack of wider use. A subsequent study by Gilbert and McKern (1973) on 103 American females aged from 13 to 57 years at death used the same three component method (dorsal plateau, ventral rampart, symphyseal rim), scored in a similar manner (0 to 5) edited to fit the more rapid morphological changes of females. The highest composite score of 15 reveals an upper age range of 52 to 59 years. The authors note that although their original sample age range was 13 to 97 years, no regular alteration in morphology could be discerned over the age of 55, they therefore curtailed their sample accordingly (Gilbert and McKern, 1973:34). A review of this method by Suchey (1979) demonstrated its poor rate of reproducibility with widely divergent age estimates for all individuals. It can therefore be concluded that this technique is of little use to bioarchaeologists, especially when concerned with ageing an older population.

Acsadi and Nemeskeri (1970) developed their method using 105 autopsy individuals (61 males, 44 females; 23 to 90 years) supplemented by individuals from Hungarian cemeteries (numbers unknown). The majority of the autopsy individuals were over 50 years at age of death (34 males, 31 females) (Nemeskeri et al., 1960). The technique uses the appearance of the symphyseal face of the pubic symphysis, with five descriptive and photographic stages, up to 80 years of age (Acsadi and Nemeskeri, 1970). A review of this technique by Brooks and Suchey (1990:234) on their sample of 1225 individuals found that the pubic morphology of almost half of the males (48%) and females (47%) did not correspond with any of the descriptive phases set out by Acsadi and Nemeskeri (1970). They put this down to the predominance of older individuals in the Acsadi-Nemeskeri sample and state that the method appears to use the symphyseal face for determining if an individual is over, under or around 50 years of age (Brooks and Suchey, 1990). The high proportion of older individuals that make up this sample, could make this technique useful for ageing individuals over the age of 50, however the original sample size was relatively small, and the age ranges associated with the five phases are obscure. Phase 1 is relatively broad for the youngest stage (23-40 years), phases 2 (35-55 years) and 3 (40-60 years) overlap significantly, and phases 4 (≤ 70 years) and 5 (≤ 80 years) have only upper limits defined, which is perplexing as surely there is not a limit to degeneration (Brooks and Suchey, 1990:234). The technique also does not differentiate between the sexes, something which has long been noted to affect the morphology of the pubic symphysis (Brooks and Suchey, 1990; Gilbert and McKern, 1973; Todd, 1921; Waltenberger et al., 2022).

Overall the pubic symphysis is a useful measure of age in bioarchaeology, providing a general age category which can be further refined by the use of other ageing methods to determine biological age (Brooks and Suchey, 1990; Kimmerle et al., 2008).

2.4.10 Upper tuberosity of the ischium

Ageing on the upper tuberosity of the ischium was developed by Falys (2012). This is an entirely new method, with all previous ageing research related to the development and fusion of the

ischial tuberosity in childhood and young adulthood (Cardoso, 2008:164). Falys (2012:83) created the technique using four known age-at-death collections (St Bride's Documented Collection, UK; Hamann-Todd Osteological Collection, USA; Coimbra Identified Collection, Portugal; Pretoria Bone Collection, South Africa). The sample comprised 564 individuals (318 males, 246 females) of white origin, with an age-at-death of over 40 years. This geographical distribution ensured the technique would be as universally applicable to all individuals of white origin as possible. The technique, developed specifically to age individuals over 45 years at death, focuses on scoring surface degeneration macroscopically (including topography, porosity and osteophyte formation). The technique is simple to understand with both short, written descriptions and pictures of how each stage of degeneration should appear (Falys, 2014a). The score then directly translates into an age-at-death estimation, which is the same for both sexes. The descriptive information and age ranges are set out in section 4.3.3.11. This technique as yet remains unpublished, however a study carried out by the author of this thesis critiqued the method and found that it was simple to use, with or without training (Mills, 2013). Inter- and intra-observer error were both low with a slight tendency to underage by one stage. Comparison was drawn between this technique and other more established ones (e.g. Suchey-Brooks pubic symphysis method) by establishing age-at-death estimates using each technique. It was found that Falys' method on the upper tuberosity of the ischium provided comparable and more precise results than many standard ageing techniques. The age ranges assigned are relatively broad but retain the essential precision over the 46+ year mark, making it a valuable addition when used in relation to other techniques which age over 45 years. This evaluation was carried out on 98 individuals from St Oswald's Priory, Gloucestershire who had previously been assigned the age ranges 35-45 and 45+ (Mills, 2013).

2.4.11 Microscopic ageing techniques

2.4.11.1 Histomorphometry

Microscopic alteration to the structure of bone with increasing age was noted in the 1930's. The first ageing technique using microscopic changes was developed some 30 years later (Kerley,

1965). The sample comprised 126 apparently healthy midshaft cross-sections of the femur, tibia and fibula of 88 males, 29 females, and nine juveniles of unknown sex, from birth to 95 years, including 53 adults over the age of 45 years (40 males, 13 females) (Kerley, 1965). Four features of the bones were quantified, the number osteons, the number of old osteon fragments, the percentage of circumferential lamellar bone and the number of non-haversian canals. It was found that the number of osteons and osteon fragments increased with age, while the percentage of lamella bone and number of non-haversian canals decreased with age, with changes taking place up to 95 years of age. The age range for each individual was calculated using regression equations and exhibited a high level of accuracy for both sexes, and different ancestries (Kerley, 1965). A test of this method found that 30% of a sample of 20 individuals from Christchurch, Spitalfields were aged to within five years of their known age-at-death, with a further seven (35%) within ten years (Aiello and Molleson, 1993). The authors go on to state that out of a potential sample of 387 individuals, only twenty fit the criteria for analysis, demonstrating its more limited use on archaeological samples (Aiello and Molleson, 1993:695).

As histomorphometry involves grinding transverse slices of, most commonly long bones or ribs, into thin sections in order to quantify the frequency of osteons under a microscope. The method has been subject to considerable criticism from both an ethical perspective, and due to the fact that few researchers are appropriately qualified to carry out the method or have access to the necessary equipment (İşcan et al., 1984a). Which sections of the skeleton should be sampled and subsequently which portion of the sample should be quantified is also under debate (Mays, 2010:61). It may therefore be best to leave microscopic ageing techniques for those individuals too poorly preserved to undergo macroscopic, non-destructive methods of age determination. A comprehensive review of further methods using microscopic histomorphometry and its future direction can be found in Khan et al. (2017), who state that its benefit lies in age analysis of very fragmentary or burnt bone.

2.4.11.2 Cementum annuli

Tooth cementum annulation (TCA), or cementochronology, as a method of age determination was first proposed by Gustafson (1950), despite an accrual of cementum with age having been long noted (Buikstra, 2022; Foster, 2017). The method involves the counting of light and dark layers of cementum deposition, with a single year thought to be represented by one light and one dark layer (Turner-Walker and Mays, 2008 p. 130). The reported high accuracy and precision of the technique, with apparent correlations between enhanced cementum deposition and pregnancy, as well as diseases and even season of death (Buikstra, 2022), are encouraging. However, as with many ageing techniques, the accuracy and precision of the method has been found to decline with increasing chronological age (Gualdi-Russo et al., 2022; Lanteri et al., 2018).

Traditionally, assessment of age by TCA involved the extraction of a normally single rooted, tooth from a jaw, and sectioning of that tooth either transversely or longitudinally (Wittwer-Backofen et al., 2004). However recent work by Le Cabec and colleagues (2019) on a non-destructive method of recording TCA through synchrotron X-ray microtomography has provided promising results ($r=0.76$, $p<0.001$) on individuals of known age-at-death. The authors do note that this method requires further testing before it is used on archaeological individuals of unknown age-at-death (Le Cabec et al., 2019). This is also the case with the destructive method as until recently limited efforts have been made to apply this technique to archaeological populations (Pubert et al., 2022; Roksandic et al., 2009; Turner-Walker and Mays, 2008:130). Particularly in relation to taphonomy, and how post-depositional histological processes affect the presentation of cementum annuli (Roksandic et al., 2009).

2.4.12 Statistical methods

2.4.12.1 Bayesian statistics

Bayes' theorem was developed in the 18th century, but its use in archaeology first occurred in the late 20th century (Otárola-Castillo and Torquato, 2018). Bayesian statistics are an alternative to both the more traditional null hypothesis significance testing, which can be used to produce the

widely utilised confidence intervals and probability values, as well as regression equations which can mimic the age range of the reference population (Falys and Lewis, 2011; Gowland and Chamberlain, 2002; Otárola-Castillo and Torquato, 2018). The drawback of the null hypothesis method is that the relationship between the probability values (p-value) and the null hypothesis can often be confusing, for example, 'p=2.00 that the individual is not over 50 years of age', means that the individual is most likely over 50 years of age, because the p-value is not significant (i.e. it is over 0.05) (Otárola-castillo et al., forthcoming). The drawback with regression equations is that they are based upon two elements, one dependent and one independent variable. In age estimation this makes age the dependent variable, and the skeletal element the independent variable, which is the reverse of the actual biological relationship (Gowland and Chamberlain, 2002).

Bayesian statistics calculate the probability of a hypothesis occurring, and can be compared against all prior data (the prior probability), for example:

- Hypothesis 1: the individual is over 50 years of age
- Hypothesis 2: the individual is under 50 years of age
- Result 1: 0.97 probability the individual is over 50 years of age
- Result 2: 0.000003 probability the individual is under 50 years of age

This very clearly demonstrates that the probability of the individual being over 50 years of age is much higher than under 50 years. Bayesian statistics are used in age estimation and flip the conventional 'age is inferred using growth and development' to 'age causes growth and development' (Otárola-Castillo and Torquato, 2018). The use of prior probabilities is unique to Bayesian statistics. They allow for the formal incorporation of previous knowledge or understandings regarding the topic under study (provided that prior information can be established before the probabilities are calculated), and provide weighting to the resultant probability (Otárola-Castillo and Torquato, 2018). In age-at-death estimation, the prior probability

could be the range of lifespans experienced by a population. Bayesian statistics have not been used in this study as the aim was to compare the results of standard and untested ageing methods as they would be used by osteological observers.

The development of Bayes' theorem in the sphere of age estimation lead to the 'Rostock protocol' which formalised the use of prior knowledge in age-at-death estimation, and is the basis of transition analysis and multivariate ageing methods (Boldsen et al., 2002; Holman et al., 2002; Hoppa and Vaupel, 2002).

The 'Rostock protocol' or 'Rostock manifesto' was developed over a three day paleodemography workshop at the Max Plank Institute in Rostock, Germany (Hoppa and Vaupel, 2002). It is a theoretical framework for paleodemographic research, and covers four major elements that are intrinsically interlinked:

1. A call for development of more rigorously validated osteological age indicators.
2. Development of methods or models to estimate probability of observing those indicators at certain ages.
3. Use of Bayes' theorem to calculate chronological age-at-death from that probability.
4. Estimation of the distribution of lifespans from each target population, prior to the estimation of chronological age-at-death for individuals.

(Hoppa and Vaupel, 2002:2)

It was developed to highlight the current issues in paleodemographic studies and as a framework for moving forward, with the aim of increasing the accuracy and precision of age-at-death estimations and therefore the complete age structure of populations (Hoppa and Vaupel, 2002).

2.4.12.2 Transition analysis

Transition analysis was developed by Boldsen et al. (2002) specifically to be applicable to small samples, or individual adult skeletons. The technique was developed using 186 individuals from the Terry collection (92 females, 94 males) of both black and white descent, with an age range of

<20 to >99 years at death, 92 of which were over 50 years of age (51 females, 41 males). The authors state that transition analysis is applicable to any skeletal trait which exhibits an invariant series of senescent phases, and apply it to the pubic symphysis, auricular surface and the cranial sutures (Boldsen et al., 2002). The aim was to fit an individual in to a known population age range (either based on demographic studies, or modern equivalents) which was termed the 'uniform prior distribution' and uses the known transitional stages in the skeletal elements to calculate the probability of an individual being a certain age-at-death. This works on the premise that each age stage on a skeletal element is an independent event (or transition), and each element has to go through all events, and cannot skip events or go backwards once each event is reached. It can therefore be calculated that if a certain event has been reached, the probability of the individual being significantly younger is very low. A resultant age range bell curve is produced by plotting age against probability density on a graph (Boldsen et al., 2002). The authors note that, as with the majority of other ageing techniques, the width of the curve, and therefore the probable age range of the individual increases with advancing age, which incorporates the variation in rates of degradation between individuals. Milner and Boldsen (2012) subsequently tested transition analysis on 252 known age-at-death individuals from the Bass and Mercyhurst collections (122 females, 130 males), 181 of which were 50 years or older at death, and 83 that were 70+ years at death. They concluded that for individuals aged 40-70 the technique was inaccurate and imprecise, although for individuals outside this window, it could be both accurate and precise, so it may be useful for ageing the very old. The authors ascribe this inaccuracy to the prior distribution (overall age range) used, but state that traditional ageing methods appear to be more accurate currently (Milner and Boldsen, 2012). More recent research into the uses of transition analysis has been focused on the development of the third molar in younger (c.18 years), living individuals (Arge et al., 2020; Tangmose et al., 2015).

2.4.12.3 Multivariate ageing

The theory behind Holman et al.'s (2002) multivariate ageing method is that statistical analysis can be used to overcome the absence of one or more skeletal indicators of age, and to allow

multiple indicators of age to be combined to provide a probable statistical age range. Contrary to Boldsen et al.'s (2002) transition analysis theory, multivariate ageing does not assume each feature is conditionally independently linked with chronological age, it also does not require multiple parameters to be estimated, as with older multivariate methods (Holman et al., 2002). The authors used a sample of 737 males of known age-at-death (roughly 15 to 70 years), aged using the pubic symphysis, they then calculated the most probable ages for each individual, and found that the standard error range is large, and that more work is needed to develop a true multivariate reference sample to account for this error (Holman et al., 2002). A more recent study by Konigsberg (2015) using a multivariate system to assess age using cranial suture closure, concludes that it is feasible to analyse age using elements (in this case sutures) that do not independently correlate with age-at-death. The study uses five areas of suture closure, specifically chosen for their acknowledged lack of direct correlation with age-at-death, on a sample of 1152 individuals. Resulting in 72% of the variation in cranial suture closure being accounted for, although the author notes that if each suture is treated as entirely independent the results only account for 20% of the variation (Konigsberg, 2015). These results suggest that, as with previous studies, further work is needed before multivariate methods can be deemed reliable in archaeological age-at-death studies.

2.5 Pathology affecting older individuals

The following sections review the presentation, aetiology, typology, diagnosis and impact of pathologies either commonly recorded on older individuals in the archaeological record, or that are specifically associated with advanced age. The final sections then review the morbidity-mortality paradox through disease accumulation and frailty. The impact of a pathology on the quality of life of an individual can inform personal ability levels and therefore societal worth, meaning that assessment and understanding of pathologies is crucial when assessing the life course. Additionally, old age in archaeological studies is often 'diagnosed' through the presence of pathologies associated with advanced age (Appleby, 2010). Care must be taken when doing this for two reasons; 'age-related' pathology can present in younger people (e.g. degenerative joint

disease), and many older adults can be affected from the around the fortieth year, negating more accurate age estimation.

2.5.1 Edentulism

Edentulism can be defined as the total or partial loss of natural teeth (Eckert, 2018), it is linked to factors such as social status, diet and genetics (Kinaston et al., 2019; Ogden, 2008). Its significance however, is not in how many or how few teeth an individual may possess, but in its effect upon the health and social wellbeing of the individual, with evidence suggesting a link to increased mortality (Gil-Montoya et al., 2015). Loss of dentition may be caused by excessive wear, injury or periodontal disease. Periodontal disease, and its forerunner gingivitis, are caused by the various pathogenic bacteria found within dental plaque, which results in the destruction of alveolar bone causing pain, and a systematic loosening and eventual loss of the tooth (Gil-Montoya et al., 2015; Waldron, 2009). Although dental hygiene was lacking in the medieval period, the concept and methods of treatment were available (Anderson, 2004); although for the majority of the population this would have been limited to herbal remedies, or tooth extraction, carried out in the local urban centre (Bifulco et al., 2016). Edentulism does not only mean tooth loss, long term absence of dentition also effects the bone, nerves and muscles surrounding the lost dentition. Remodelling of the alveolar bone after tooth loss results in reduction of the height of the dental ridge, altering facial shape, which can become more shrunken around the mouth, with the chin appearing more pronounced, therefore having a negative impact on self-image and self-confidence (Polzer et al., 2010). Prostheses although they existed, were either inadequate, made of wood or iron screws (Bifulco et al., 2016), or high status items, and made from human teeth and cattle bone (Anderson, 2004; Bali et al., 2021). Mastication of foods is a primary role for teeth, which aids in swallowing and digestion, and some studies say enjoyment of foods (Rajaraman et al., 2018:550). Edentulism therefore decreases the ability to chew and swallow firmer or elastic foods, resulting in avoidance and dietary restriction, which can lead to malnutrition (Gil-Montoya et al., 2015; Polzer et al., 2010; Rajaraman et al., 2018). The combination of declining self-confidence due to appearance, if not infirmity with advancing age,

and the lack of ability to eat a normal diet can lead to self-isolation and neglect. In the past, loss of dentition would have been a common occurrence, particularly among lower socioeconomic groups (Freeth, 2000). It is possible therefore that the effects of edentulism on self-confidence may not have been felt to the same extent as today. The lack of ability to chew rough foods however, coupled with the lack of effective dental health care (Bifulco et al., 2016), could have led to prolonged and excessive pain, loss of quality of life and malnutrition for older people in the past.

2.5.2 Arthropathies

Arthritis is a general term for conditions that affect the joints and their surrounding tissues. There are many differing forms of arthritis; the conditions most commonly found in archaeology are osteoarthritis (degenerative joint disease), spondylosis (spinal arthritis), rheumatoid arthritis, and gout. However only osteoarthritis and spondylosis are indicative of degeneration with advancing age. Rheumatoid arthritis is classed as an autoimmune disorder (NIH, 2018; Smolen et al., 2016; Waldron, 2009) and gout is a disorder of the metabolism (Dalbeth et al., 2016; Waldron, 2009) meaning therefore that although their prevalence may increase with advancing age, they are not a direct effect of ageing, and may occur at any stage of life.

2.5.2.1 Osteoarthritis

Osteoarthritis is a degenerative joint disorder, of the synovial (movable) joints, classed as a chronic, progressive pathological condition, characterised by inflammation and loss of joint cartilage, osteophyte formation, cysts, sclerosis, eburnation and loss of normal anatomical joint contour (Lepetsos and Papavassiliou, 2016; Rahmati et al., 2017; Waldron, 2009:27). It is the most common form of joint pathology both today and in the past, and can affect men and women alike, usually from their fortieth year (Aufderheide and Rodríguez-Martín, 1998:93–95; Felson et al., 2000a; Rahmati et al., 2017). Although, Lewis (2016) found evidence for degenerative joint disease in individuals as young as 10 years, potentially related to intense occupational activity.

Osteoarthritis can be idiopathic, having no apparent trigger; or traumatic, from previous injury or overuse, with the knee and hip joints being most commonly involved, especially in women, although any synovial joint in the body can be affected (Plomp, 2017; Plomp et al., 2015b; Roberts and Manchester, 2001:106). It has been argued that osteoarthritis is not one but a multitude of differing disorders which progress along similar pathways to a common end (Felson et al., 2000a:636; Lepetsos and Papavassiliou, 2016). This is demonstrated through the different aetiology and development within each individual case; however no single classification or division has been set as the standard. Options include, division between genetic predisposition and mechanical factors or trauma; splitting of cases with known and unknown aetiology; and separation of hip and knee osteoarthritis, because they are associated with different risk factors. As well as classification of hip osteoarthritis into either hypertrophic (linked with pyrophosphate crystal deposition and diffuse idiopathic skeletal hyperostosis) or atrophic (linked with calcium phosphate crystals and osteoporosis) (Felson et al., 2000a:636). Although the precise aetiology of osteoarthritis is largely unknown, reasons for its onset are thought to be multifactorial, they can include advancing age, genetic predisposition, obesity (increased load bearing), repetitive activity and environment (NIH, 2018; Roberts and Manchester, 2001:106). In the past, it is likely that some people in later life would have endured debilitating pain and disability with little to no hope of alleviation (Felson et al., 2000b; Mays, 2010:198). In archaeology eburnation is taken as indicative of osteoarthritis, but a combination of the other characteristics may be used for diagnosis if three or more are present (Aufderheide and Rodríguez-Martín, 1998:93–95; Rogers and Waldron, 1995).

2.5.2.2 Spondylosis

Spondylosis or vertebral osteophytosis, is arthritis of the body of the spine affecting the fibro-cartilaginous joint, or intervertebral discs (Plomp, 2017). When the articular facets (apophyseal joints) of the spine exhibit arthritis, this is osteoarthritis as the joints are synovial. Spondylosis occurs when degeneration of intervertebral discs causes interaction of the vertebral bodies, resulting in irritation and stimulation of the periosteum, which promotes osteophyte formation

(Nathan, 1962; Plomp, 2017). Although the formation of the osteophytes themselves is asymptomatic, their development can cause radiating pain, stiffness and reduced range of movement in the limbs. Particularly if they develop to impinge on the vertebral nerves or into the spinal canal, causing spinal cord compression (Plomp, 2017:146). In severe cases the osteophytes may become large enough to cause osseous ankylosis, which results in axial stiffness and limited movement (Plomp, 2017:146). This will affect an individual by diminishing their ability to carry out day to day activities, generally lowering their quality of life (Plomp, 2017). Porosity and pitting of the vertebral bodies may also be present as this condition can be an indicator of osteoporosis (Aufderheide and Rodríguez-Martín, 1998:96).

Nathan's (1962) study of 346 individuals from the Todd Collection (Museum of Natural History, New York) and 54 individuals from the dissecting room (University of Pennsylvania) was carried out to assess for degree of spinal osteophyte development with age. The results demonstrated that the initial development of osteophytes on the spine occurred in several individuals from the second decade of life with a direct increase in the number of individuals affected thereafter; 100% of individuals exhibited first degree osteophyte formation by 40 years of age (Figure 2.6). By 80 years of age, every individual exhibited second degree or higher osteophyte formation including pronounced lipping and osseous ankylosis (Nathan, 1962:264). Nathan (1962:264) also noted several patterns of osteophyte development on different regions of the spine and each vertebral body. He suggests that anterior osteophyte formation often occurs first and is greater than posterior formation, with development at its most prolific at the natural curve of the spinal column, suggesting abundant osteophyte formation occurs in response to pressure as a defence mechanism (Nathan, 1962:264). The individuals chosen for study were all without obvious skeletal symptoms of widespread bone disease, trauma or disease to the spine (e.g. Pott's disease or neoplasms) (Nathan, 1962:244).

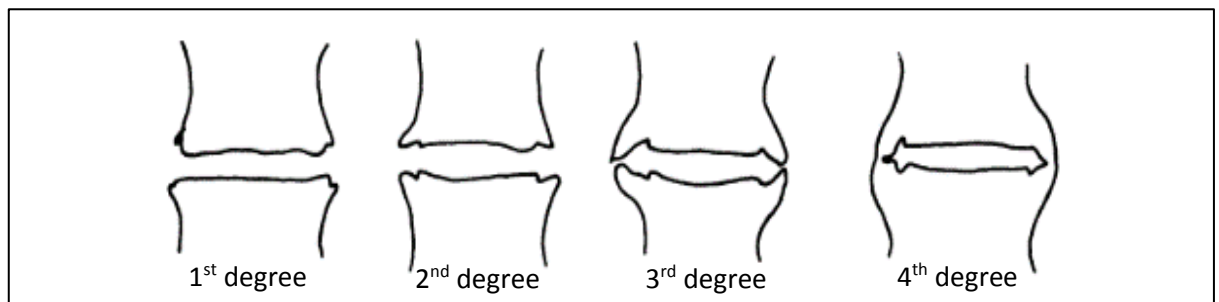


Figure 2.6. A systematic representation of the degrees of osteophyte development (Nathan, 1962:244)

2.5.2.3 Schmorl's nodes

Schmorl's nodes are caused by vertical intervertebral disc herniation of the nucleus pulposus, whereby the disc protrudes through the endplate of the vertebral body, either superiorly or inferiorly into the trabecular bone resulting in pitting of the vertebral surface (Plomp, 2017; Plomp et al., 2015a). The exact aetiology of Schmorl's nodes and all other intervertebral disc herniations is unknown, however two distinct phases of development have been outlined. Those which develop during late adolescence or early adulthood, potentially due to 'weak spots' caused by previous vascular channels (Chandraraj et al., 1998; Hamanishi et al., 1994). Those which develop later in life, potentially linked to senescence of the cells making up the intervertebral disc (Abbas et al., 2018; Amelot and Mazel, 2018; Da Silva Baptista et al., 2015; Hadjipavlou et al., 2008). Both of which are then secondarily linked to genetics, physical activity and strain, and trauma (Benzakour et al., 2019; Sonne-Holm et al., 2013). Some studies found no direct link between the presence and prevalence of Schmorl's nodes and advancing age (Plomp et al., 2015a; Trzciński et al., 2017), however the link between senescence of the intervertebral disc and advancing age seems certain, with significant impacts on quality of life. Evidence from modern populations suggest that Schmorl's nodes can be linked with episodes of acute and chronic back pain (Faccia and Williams, 2008), disabling the individual temporarily and affecting quality of life, especially when the herniation is in the centre of the vertebral body, which has the highest density of nerves (Plomp, 2017:147). Schmorl's nodes are the most common pathology found in

current and past populations, although the prevalence between populations varies drastically (5% to 77%) (Plomp et al., 2015a).

2.5.2.4 Diffuse idiopathic skeletal hyperostosis

Diffuse idiopathic skeletal hyperostosis (DISH) (also known as Forestier's disease) is an ossifying diathesis which can produce severe ankylosis of the spine through ligament ossification, primarily through the anterior longitudinal ligament, while retaining the integrity of the intervertebral discs and apophyseal joints (Resnick et al., 1975, 1978; Rogers and Waldron, 2001). Indicative syndesmophytes form on the anterolateral aspect, of particularly the thoracic vertebra, producing a 'candle wax' like appearance specifically to the right of the vertebral column, away from the superior mesenteric artery (Mader et al., 2017; Moses et al., 2005). Diagnosis in an archaeological context involves four or more vertebrae fused by syndesmophytes (Mader et al., 2017). However, calcification of muscle attachments on the pelvic girdle are also symptomatic, with the potential for other peripheral joints to also be involved (Aufderheide and Rodríguez-Martín, 1998:98; Mader et al., 2017). Although its aetiology is unknown, genetics, endocrine systems, metabolic disorders and environmental factors have all been suggested in pathogenesis. DISH has also been linked with gout, rheumatoid arthritis and diabetes mellitus, but claims do not appear to be substantiated (Kiss et al., 2002; Sencan et al., 2005). DISH is more prevalent in males over the age of 40 years, but this does not mean the disease does not also affect females (Kiss et al., 2002; van der Merwe et al., 2012). The relationship between DISH and obesity, or the intake of rich foods, has long been noted in both males and females (Milner et al., 2018; Rogers and Waldron, 2001). In archaeology this can also be linked to social status; although not conclusively proven, studies suggest a general link between social status, rich foods and the prevalence of DISH (Quintelier et al., 2014; Rogers and Waldron, 2001). Symptoms, if present, can include stiffness of affected areas, numbness and tingling of the extremities, or musculoskeletal pain; and in more extreme cases cervical myelopathy (spinal cord compression), or spinal fracture of the ankylosed area due to inability to absorb impacts, both leading to long term impairment at best (Mader et al., 2017; Resnick et al., 1975, 1978; Rogers and Waldron, 2001).

2.5.3 Metabolic conditions

2.5.3.1 Osteoporosis

Osteoporosis is a multifaceted chronic condition, delineated by a progressive reduction in the total mass and strength of bone, whilst maintaining a normal bone to mineral ratio, predisposing individuals to increased risk of fracture (Lane, 2006; Melton and Cooper, 2001). Its aetiology is unknown, although ageing, genetic factors, certain drug usage, low activity levels and poor diet can all be linked to compromises in bone strength (Gurevitch and Slavin, 2006; Lane, 2006). There are two forms of osteoporosis, primary and secondary, primary is again divided in to post-menopausal (Type 1) and senile osteoporosis (Type 2)(Brickley and Ives, 2008). Post-menopausal osteoporosis effects women normally from the age of 50 at the cessation of menstruation, whereas senile osteoporosis effects both sexes at advanced age (Brickley, 2002). Post-menopausal osteoporosis is influenced by the gonadal hormone, oestrogen (Aufderheide and Rodríguez-Martín, 1998:314). Declines in oestrogenic levels post-menopause decrease the life of bone building osteoblasts and prolong the life of bone resorbing osteoclasts, hastening the turnover and subsequent loss of bone (Lane, 2006). Senile osteoporosis usually occurs from forty years of age in most sufferers, after peak bone mass is reached and the rate of bone formation declines. The decline in bone formation is caused by a decrease in the production of mesenchymal progenitor cells which differentiate into bone forming osteoblasts (Gurevitch and Slavin, 2006; Lane, 2006). A corresponding but smaller loss of stromal and hematopoietic cells, which differentiate into bone resorbing osteoclast cells, means bone resorption continues at a relatively higher rate (Aufderheide and Rodríguez-Martín, 1998:314; Gurevitch and Slavin, 2006). This decline however, can be delayed by regular high impact exercise or activity (Curate, 2014; Griffin, 1990). Agarwal and Grynpas (1996) note that in the past, day to day physical activity would have been much higher than it is today, so although exercise may not have been undertaken as we understand it today, the higher rates of general activity may have staved off the onset of senile osteoporosis (Griffin, 1990; Miskiewicz, 2019; Pinheiro et al., 2020; Tong et al., 2019). Secondary osteoporosis can occur due to trauma, chronic malnutrition (Brickley, 2002;

Brickley and Ives, 2008) or disease, for example sufferers of haematological disorders such as sickle cell anaemia, beta thalassemia major (Lane, 2006), or the degenerative joint disease, ankylosing spondylitis, are prone to development of secondary osteoporosis (Klingberg et al., 2012).

Osteoporosis in archaeological samples is often diagnosed through the presence of osteoporotic fractures. The distal end of the radius (colles' fracture), proximal femur (at the femoral neck), and the vertebrae (compression fracture) are all high-risk osteoporotic fracture areas (Brickley, 2002; Melton and Cooper, 2001). Vertebral compression fractures are the most common type of osteoporotic fracture reported in archaeology (Brickley, 2002), they are caused by the mechanical pressure of weight bearing, initially causing the walls of the vertebra to bow outwards until the structure gives way and collapses becoming crushed or 'wedged' (Aufderheide and Rodríguez-Martín, 1998:315). This type of fracture is often asymptomatic, or with sufferers experiencing minor, short lived back pain. Clinical indications of compression fractures include, loss of stature and kyphosis (curvature of the spine) (Brickley, 2002), which will affect an individual's strength and mobility and impact negatively on quality of life. Femoral neck fractures are the most severe, with up to 40% of individuals dying within six months of fracture occurrence, only 30 years ago, (Keene et al., 1993). More recent research suggests that currently up to 30% of people die within the following year (Chiarello et al., 2016). Massive blood loss is associated with this kind of fracture (whether it pierces the skin or not), and an overall shortening of the affected femur is typical, due to strong muscle action in the leg, causing prolonged disability, and reduced quality of life in survivors (Brickley, 2002:365; Chiarello et al., 2016). Colles' fractures occur when breaking a fall with the hand. A fracture to the distal radius does not result in the high morbidity or mortality of a femoral fracture, but it can be associated with deformity and a resultant restriction or lack of movement of the wrist and hand, and causes issues with grasping objects for example (Brickley, 2002:368), once again impacting on quality of life. Osteoporosis can be under-represented in archaeological samples because it may only be noticed, and therefore recorded, when severe osteopenia (low bone mineral density) or osteoporotic fractures occur (Gilchrist, 2012a:63). Even

then it may be missed, as peri-mortem fractures can easily be overlooked or misdiagnosed as post-mortem breaks (Brickley, 2002:366). Modern prevalence rates for senile osteoporotic hip fracture in males is 1%, and for post-menopausal hip fracture in females is 9%; combined modern hip and spine prevalence rates for males is 7% and for female is 27% (Wade et al., 2014).

Evidence for an inverse relationship between osteoarthritis and osteoporosis has been demonstrated (Felson et al., 2000a; Im and Kim, 2014; Mays, 2016; Nevitt et al., 1995). It was found that women with osteoarthritis had an 8-12% increase in bone density compared to those without, protecting them from osteoporosis (Felson et al., 2000a; Nevitt et al., 1995). Conversely those with a higher bone mineral density were found to be more prone to osteoarthritis (Felson et al., 2000a; Zhang et al., 2000).

2.5.3.2 Paget's disease

Paget's disease of bone (or osteitis deformans) is a chronic disease of largely unknown aetiology. It is characterised by rapid resorption of bone usually along the axial skeleton, accompanied by substantial formation of new bone, resulting in a combination of lytic (active bone forming and resorbing) and sclerotic (stasis of activity) lesions of disorganised, weak woven and stronger lamellar bone (Brickley and Ives, 2008:217; Ralston et al., 2008). Histologically, the pattern of rapid bone resorption and deposition produces a 'mosaic' appearance from the mixture of woven and lamellar bone. Visually, affected areas will appear thickened and pitted and may exhibit deformities or fracture due to the disordered construction and diminished mechanical strength of bone (Ralston et al., 2008). Radiographically, Pagetic bones appear mottled with a wider somewhat chaotic medullary cavity. The definition between the diseased and unaffected section of bone presents as a sharp 'V' or 'flame' as the disease advances (Mays, 2010:195). Paget's affects 3% of the population on average by the age of 40 and 8% once 80 years is reached, these prevalence rates are roughly applicable to historic populations (Resnick, 2002:1948). A male predisposition for the disease is apparent with men being affected on average twice as often as women in both modern and historic populations (Rogers et al., 2002; Sutcliffe, 2010). Research

suggests that genetic factors have an important effect on the development of Paget's, with mutations in four genes being linked to Paget's disease or its associated syndromes (Ralston et al., 2008). However only one gene mutation is related to classical Paget's, the SQSTM1 gene (Shaw et al., 2019). This is a scaffold protein encoding for ubiquitin-binding protein p62 (Sequestosome-1) (which disassembles unnecessary or dysfunctional components of cells). When mutated this stimulates nuclear factor κ B, activation of which leads to increased bone lesions (Lucas et al., 2006; Ralston et al., 2008; Singer, 2015). These lesions are created by an increased number of osteoclasts (bone resorbing cells), which are larger in size and contain many more nuclei than standard. Within these nuclei are microcylindrical structures which resemble virus particles, termed nuclear inclusion bodies (Ralston et al., 2008). Due to the presence of these microcylindrical structures, researchers have speculated that the aetiology of Paget's may be due to viral infection (Roberts and Manchester, 2001; Singer, 2015). Tests subjecting bone marrow cultures to certain viruses (such as the canine distemper virus) have indeed produced a form of Pagetic osteoclast cells, but thus far the evidence is inconclusive and widely debated (Singer, 2015:32). Paget's disease is also linked to the development of osteosarcoma's in later life (Hansen et al., 2006; Li et al., 2019). An individual over the age of 40 years with Paget's disease is thirty times more likely to develop an osteosarcoma than an individual of similar age without Paget's disease (Hansen et al., 2006:59). Despite this, Paget's is often asymptomatic, resulting in only mild bone pain or stiffness, although when symptoms do occur they are related to bone deformity and increased risk of fracture, considerably impacting quality of life (Rogers et al., 2002).

2.5.3.3 Hyperostosis frontalis interna

Hyperostosis frontalis interna (HFI) occurs on the endocranial surface of the frontal bone of the skull, it involves the usually bilateral, deposition of bone in a normally billowing or lobulated pattern of smooth surfaced bone, which leads to an overall thickening of the frontal bone (Western and Bekvalac, 2017). The aetiology of HFI is unknown, but in the past it has been widely postulated to be influenced by pregnancy, menopause, ageing, obesity and upon occasion, insanity (Barber, 1997:75; She and Szakacs, 2004:208; Waldron, 2009; Western and Bekvalac,

2017); more recently a link to urbanisation has been suggested (Szeniczey et al., 2019; Western and Bekvalac, 2020). A general consensus that HFI occurs due to some unknown and little understood imbalance in endocrine systems, with a predominance for affecting post-menopausal women, is the current standpoint of researchers (She and Szakacs, 2004; Western and Bekvalac, 2017). Indeed a male to female ratio stands at 1:9 in modern populations, with a peak incidence between 40 and 60 years of age (Barber, 1997:74). Although recent research has postulated that the occurrence of HFI in males may not be as rare as it appears, but that it does not present as severely in males and is therefore overlooked (Western and Bekvalac, 2017). However advancing age does not seem to affect the prevalence and severity of HFI in males, whereas in females the incidence and severity increases significantly with age, which therefore argues some link to sex hormones in its aetiology (Western and Bekvalac, 2017). HFI is generally an asymptomatic condition, that is occasionally linked to the presence of a persistent headache. However its presence is also linked to the conditions of virilism and hirsutism, as well as instances of neuropsychiatric disorder, meaning that it may affect the sufferer socially through these secondary symptoms (Szeniczey et al., 2019).

2.5.4 Neoplastic disease

A neoplasm can be defined as a mass of tissue that exhibits uncontrolled growth distinct to its origin and surrounding tissues, that progresses and persists in a continuous fashion even after the stimulus which evoked the change has ceased (Roberts and Manchester, 2001:168). Neoplasms can be either benign or malignant; benign neoplasms can be deemed clinically insignificant, in that they remain at their site of origin and only affect the local area through swelling and possible localized pain, however if untreated their growth may affect local bodily functions, and cause significant morbidity. Malignant neoplasms involve the local uncontrolled spread of the neoplasm on and into other organs of the body and the spread of cells to the universal body (Brothwell, 2008; Marques, 2019). Symptoms can include extreme local swelling and acute pain (Fletcher et al., 2002). A neoplasm may affect any individual, in any organ, at any stage of life, although the incidence increases with advancing age (Blackburn, 2014; Cancer Society Of Finland, 2016;

Hansen, 1998). Table 2.2 demonstrates the primary cancers commonly associated with older people and ageing. In archaeology, skeletal neoplasms are most frequently identified due to the decomposition of other flesh and organs. Differential diagnosis of a neoplasm in archaeological samples can often be quite complex with separate forms of neoplasm overlapping in appearance, formation and developmental location (Brothwell, 2008).

Table 2.2. The most prevalent locations for the occurrence of neoplasms in older people today, including the general age of onset (Cancer Society Of Finland, 2016; Hansen, 1998).

Type of cancer	Sex	Prevalence ratio (m:f)	Age of onset
Prostate	Male	-	>65 years
Breast	Female	-	>65 years
Lung	Male and Female	4:1	M - >65; F - ~65
Colon	Male and Female	2:1	M - >65; F - ~70
Stomach	Male and Female	2:1	M - >65; F - <80

2.5.4.1 Benign tumours

Brothwell (2008) divides benign tumours into seven categories based on their origin. The categories are as follows, osteoid origin (bone), chondroid origin (cartilage), cysts of bone, giant cell tumour, fibrous origin, other tumours and tumour-like conditions (Brothwell, 2008). Most affect younger individuals and a full account of them can be found in Lewis (2018). Some benign tumours of chondroid origin however can affect individuals at any age. A developmental mishap in the ossification of the growth plate is called an osteochondroma (chondroid origin) (Levine and Seeger, 2019), although not technically a neoplasm, confusion often occurs in diagnosis (Roberts and Manchester, 2001). It is defined by a cartilage capped bony projection on the external surface of the bone containing a marrow cavity linked with that of the underlying bone (Fletcher et al., 2002:234). The tumour will cease growth when bone maturity is reached. Multiple osteochondroma's are termed 'diaphyseal aclasia' or 'hereditary osteochondromatosis' among other names. The lesions are mainly asymptomatic but can cause issues related to their size and location, including fractures (Fletcher et al., 2002; Levine and Seeger, 2019; Roberts and Manchester, 2001).

2.5.4.2 Malignant neoplasia

Brothwell's (2008) classification of malignant bone tumours divides them into eight categories; osteoid origin, chondroid origin, fibrous origin, marrow tumours, notochordal origin, synovial origin, other tumours and metastatic neoplasia of bone. Once again many of these affect primarily young individuals, and a complete account can be found in Lewis (2018). Despite malignant neoplasm's prevalence within modernity, the presence of both primary and secondary tumours within archaeological samples is rare and diagnosis is difficult, although not impossible (Capasso, 2005; Hunt et al., 2018; Roberts and Manchester, 2001). Osteosarcoma is the most common modern non-haemopoietic malignant primary bone disease, which develops in the cortex of the bone (Fletcher et al., 2002:264). Its symptoms include acute local pain in the affected bone and possible pathological fracture (Fletcher et al., 2002). It most commonly affects individuals under 30 years of age but can also affect older individuals, and is associated with Paget's disease (Brothwell, 2008; Li et al., 2019; Roberts and Manchester, 2001). The appendicular skeleton is often the site of origin with rapid spread of neoplastic cells to other parts of the body (Fletcher et al., 2002; Roberts and Manchester, 2001).

Primary chondrosarcoma is most prevalent in those over the age of 50, with a peak incidence from 50 to 70 years. It is characterised by long term swelling and pain, with the ilium and rest of the pelvis involved most commonly, followed by the proximal femora, proximal humeri and ribs, the distal limbs are rarely involved (Fletcher et al., 2002:247). Myeloma is a neoplastic disease of the plasma cells of the blood within the bone marrow. It mostly effects older individuals, over 60 years of age and both sexes equally (Fletcher et al., 2002:302), and is the most common malignant neoplasm found in the archaeological record (Brothwell, 2008; Roberts and Manchester, 2001). It often presents as myelomatosis (multiple myeloma) which consists of multiple widespread lesions throughout the skeleton, which are defined by small round indentations with sharp edges (Brothwell, 2008). The lesions in myelomatosis arise as independent developments in a systematic neoplastic disease of the bone marrow rather than as secondary spread (Fletcher et al., 2002:302; Roberts and Manchester, 2001:191).

Reticulum cell sarcoma (also known as malignant lymphoma) affects mainly older adults, with a male predominance. It affects the red bone marrow predominantly in the femur, spine and pelvis. It can present with or without a palpable mass (tumour), and will cause intense bone pain, but usually without secondary symptoms such as fever or night sweats (Fletcher et al., 2002:306). Secondary neoplasms, known as metastases have originated away from the bone and are most commonly linked with lung, breast, prostate, kidney, stomach and thyroid gland cancers in older individuals (Brothwell, 2008; Fletcher et al., 2002). They are the most common form of malignant neoplasm found in archaeological populations (Hunt et al., 2018). Metastatic neoplasms form in the marrow cavities and expand out to destroy the cortex and breach the bone. Metastases which have not expanded externally can often only be discovered through radiography (Roberts and Manchester, 2001).

2.5.5 Elder abuse

In archaeology elder abuse and ageism has only recently begun to receive attention (Gowland, 2007; 2017; 2015; 2016; Raina and Balodi, 2014; Wiener and Willborn, 2011), however marginalisation of older individuals has been prevalent throughout history (Gowland, 2015; Thane, 2000). Archaeologically, physical abuse is most evident, but it does not mean that individuals did not experience other more archaeologically invisible forms, such as financial or psychological abuse. Women are almost twice as likely to be physically abused as men, with those who are mentally or physically impaired also likely to experience violence (Gowland, 2015:516, 2017b). Lesions indicative of physical elder abuse are normally contained to the face and neck, with the upper body most often involved. Dental damage, facial and rib fractures (multiple, at different levels of healing) are also indicative (Gowland, 2015:517). Decubiti (pressure sores) are symptomatic of being bed or chair ridden, and they can indicate both care (the individual survived to develop them) and abuse (the individual may have been left static for long periods of time), the depth and severity of the decubiti can be indicative of their reason for formation (Gowland, 2015:518).

2.5.6 Disease accumulation

Disease accumulation can be viewed from various standpoints, all of which influence the health of an individual in old age. Life course epidemiology focuses on the build-up of risk towards health throughout the life course, from gestation upwards (Kuh et al., 2003). With the theory that any or all diseases experienced in later life are due to exposure to a catalyst earlier in life, whether this be physical, social or environmental (Kuh et al., 2003; Lynch and Smith, 2005). However, the severity and speed of onset of these inevitable diseases in old age is also influenced by historic factors, such as education, continued activity, and sociability (Dekhtyar et al., 2019).

Paleoepidemiology, on the other hand, focuses on the increasing risk of death incurred by previous diseases or trauma. With the premise that the risk of succumbing to a disease or trauma increases with age, because the total time an individual has been at risk also increases, the accumulation of which promotes the likelihood of death occurring (Buikstra and DeWitte, 2019; Milner and Boldsen, 2017). This is in conjunction with the physical and social effects the disease or trauma has on the individual and their community. Individuals who required care or could not contribute fully to their community put pressure on resources (Milner and Boldsen, 2017:36). At its simplest disease accumulation can refer to an injurious event which causes long term issues, a bone fracture for example, which later in life results in osteoarthritis of the joint, resulting in declining functional ability and a resultant downturn in quality of life, which is perhaps a combination of life course epidemiology and paleoepidemiology.

2.5.7 Frailty

Frailty can be defined as a “biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes” (Marklein et al., 2016). This means the accumulation of morbidities over life, in conjunction with advancing chronological age can affect the functional capacity of an individual and indicate increased risk of mortality. Increased frailty does not itself lead to mortality, but it does indicate the increased risk of mortality in those deemed the frailest (Mitnitski et al., 2002). Frailty itself is a fluctuating physical state between stressor accumulation

and improved resilience, which can be termed the morbidity-mortality paradox (Marklein et al., 2016). There are 13 outlined biomarkers of frailty that can be used, these are linked to growth, nutrition and infection, activity and trauma (Marklein et al., 2016). Cumulatively they provide a frailty score, which can be used to assess functional capacity or 'ability' in the archaeological record. A subsequent study (Marklein and Crews, 2017) revealed that using a minimum of six biomarkers increased the applicability to a wider population, which is of use when assessing archaeological populations due to differing preservation rates. It is possible, and advisable, to develop different indices of frailty for distinct populations (Marklein and Crews, 2017; Vidovič and Crews, 2012).

Chapter 3 - The Life Course

3.1 Introduction

Chronological age in modern culture is one of the principal factors governing how individuals interact in society, dictating how they are viewed and treated both socially and legally. It follows that bioarchaeologists place emphasis upon age-at-death assessment to better understand the life course in the past (Buckberry, 2015). However, past perceptions of age may not have been linked to chronological age, instead focusing upon life stage or more importantly physical ability (Cummins, 2000; Johnson, 1998; Minois, 1989; Rosenthal, 1996). The study of human skeletal remains can contribute to our understanding of an individual's life history and consequently produce better defined representations of past ways of life, but care must be taken to limit imposition of modern ideas on to the past. This does not mean that precise age-at-death estimation is not important. It is fundamental to demographic studies, as age makes up one strand of personal identity along with gender, social status, ethnicity and sexuality (Gilchrist, 2004). Health and ability also play a key role in social identity (Johnson, 1998:6). In archaeological site reports, the chronological upper limit to age-at-death estimation is often 46+ or 50+ years (Falys and Lewis, 2011). As well as being imprecise, it lumps together a wide range of individuals who would have been at different ages, stages of life and exhibited a variety of ability levels, severely restricting the accuracy of research questions.

This chapter explores the reasons older people are hidden within archaeological studies, presenting some of the reasons behind the overriding belief in absolute early mortality in the past, and why these beliefs are erroneous. Historical records documenting old age will be presented and the advantages and drawbacks of such documents will be discussed. Finally, the history of geriatric study and portrayals of the very old in the medieval period will be considered. The timespan of this study (AD 900 – 1550) covers 650 years, meaning beliefs, perceptions and actions about and towards old age and ageing must have undergone changes over this time period (Porck, 2020; Shahar, 1997; Thane, 2003). This however was not visible to any considerable

extent through the historical documents studied. The most significant recorded alteration was the recognition of the aged as a specific group requiring aid by the church in c.AD 1244 – 1254 (Shahar, 1997:165). An alteration which was largely ignored, according to other concurrent documents. The reasons for this lack of major change, are difficult to delineate, but it is potentially related to old age not figuring as a major issue in society. The old and infirm would be cared for by family members, and those that weren't could be cared for in alms houses. The old and able bodied continued to undertake work, and contribute (Shahar, 1997; Thane, 2003).

3.2 Where are the aged?

Preconceived notions of early mortality in the past are contributing factors for the invisibility of older individuals within the archaeological record. These include low life expectancy, poor systematic recording of births and deaths, the relative lack of ageing techniques which age accurately and precisely past 45 years, and the possibility of poor differential preservation of mature bones (Buckberry, 2015; Walker, 1995; Walker et al., 1988). Whether these challenges led to a lack of interest towards the older sections of society, or whether an initial lack of interest led to poor resource development, is still up for debate. It is only within the last few decades that attention has turned to old age, and researchers have highlighted the need to find older people within the archaeological record (Gilchrist, 2004; Gowland, 2007). Modern scientific interest in the study of the aged and geriatric disease has been gaining ground since the 1970s, primarily due to the current increasingly aged population (Hayflick, 1985). Archaeological interest in our aged ancestors may have been sparked, in part, by this scientific interest (Gowland, 2007:154).

3.2.1 Ageing techniques

It is an accepted practice in skeletal analysis and therefore osteological reports, to curtail age-at-death estimation to around 46+ years (Powers, 2012), primarily due to the increasing degenerative variation that occurs on the bones used by standard methods to assess and assign chronological age (Appleby, 2010). The negative effects of this age limit on demographic studies have been highlighted (Cave and Oxenham, 2016; Falys and Lewis, 2011), with researchers noting that reports which use this upper age limit drastically underage the older sectors of the sample

(Buckberry, 2015). The increase in biological variation between individuals with advanced age is often seen as insurmountable, researchers therefore settle for these lower all-encompassing age estimates, which in turn contributes to the belief in early mortality.

3.2.2 Early mortality

It is a common perception that individuals aged faster, and consequently died younger in the past (Cave, 2018; Chamberlain, 2006; Ruggeri, 2018; Shahar, 1997). From a purely biological standpoint, there is no evidence that individuals in the past aged biologically faster than they do today (Olshansky, 2015); although lower standards of health and nutrition may have caused people to look and feel older at an earlier age (Parkin, 1998). A substantial number of individuals did die before they reached old age, for a variety of non-age related reasons (Blagosklonny, 2010; Cave and Oxenham, 2016; Sharpe, 1909). Nevertheless, a proportion of the population lived past their fifth, and even their seventh decade, although these latter individuals will have been the exception rather than the rule (Rosenthal, 1996). One of the key reasons for belief in early mortality is low life expectancy. Life expectancy can be defined as a reflection of the overall mortality level of a population (WHO, 2020), meaning the average length of life expected for individuals at birth, calculated using all recorded ages at death. It therefore follows that a high infant mortality rate is reflected in the average life expectancy of a population. This is true of the medieval period when estimates of child mortality are as high as 30% in Europe (Augenti and Gilchrist, 2011), with roughly 27% of children dying before the age of one year in 16th century England (Lewis and Gowland, 2007). Infant mortality is calculated using the ratio of deaths per 1000 live births in one calendar year (Lewis and Gowland, 2007). Birth and death records, which came in to common usage in England around AD 1500 (Youngs, 2006), suggest the average life expectancy for an individual at birth, from the sixteenth to the eighteenth centuries, was approximately 30 years of age (Schäfer, 2011:8). After ten years of age, data from historical records suggests average life expectancy rose to roughly 50 years of age (Goodich, 1989; Schäfer, 2011; Shahar, 1997). Although some authors (Jonker, 2003; Rosenthal, 1996) argue that young adulthood was equally as perilous as childhood, and that life expectancy for individuals only

reached 50 years once they had attained 21 years of age. Low average life expectancy has therefore given rise to the popular theory that all individuals died before reaching what today would be termed middle age. In modernity middle age commences at around 45 years and lasts until roughly 60 years (Aykroyd et al., 1999).

3.2.3 Birth and death records

In England, institutional recording of baptisms, and therefore births¹, weddings and deaths did not occur until 5th September 1538 (Gairdner, 2019; Gordon, 2018; Shahar, 1990:46). Sadly, even then these records were at the mercy of local clerical officials, and therefore their accuracy and completeness may be questionable (Turvey, 2020). It does mean however, that from 1538 average life expectancy of individuals and populations can be calculated using these records, replacing life expectancies calculated from life tables derived from skeletal samples (Chamberlain, 2006; Pinhasi and Bourbou, 2008). Life tables should be viewed with caution, their misapplication from using incorrect contexts, as well as imprecise ageing of skeletal material and inadequate population sampling; are all errors which will provide flawed life expectancy estimation (Pinhasi and Bourbou, 2008), once again playing into preconceived notions of early mortality. To overcome these flaws, a move towards using hazard models has been made, these consider the average length of life of a population as a continuous random variable (Chamberlain, 2006), with the benefit of being usable on smaller samples due to the limited number of parameters required for analysis (DeWitte, 2018).

3.2.4 Preservation

This thesis is concerned with previously interred skeletal remains, and therefore the taphonomic processes which have led to their preservation within the archaeological record (see Stodder, 2019; Turner-walker, 2008). Consideration must also be made of what material may have been lost over time. Preservation of skeletal material within the archaeological record is dependent upon several factors, including temperature, humidity, soil pH, burial depth and method, as well

¹ Baptism occurred very shortly after birth in the medieval period (Shahar, 1990).

as post-depositional damage due to soil pressure, overcrowding and truncation, or excavation and storage (Stodder, 2019). It has been well documented that children's bones containing a low bone mineral density (BMD), do not persist within the archaeological record to the same extent as adult bones (Gordon and Buikstra, 1981; Manifold, 2012; Pinhasi and Bourbou, 2008; Stodder, 2019; Walker et al., 1988). The effects old adult low BMD on preservation rates has been less widely acknowledged. What research has been directed towards assessing the preservation of older individuals in the archaeological record has led palaeodemographers to argue that differential preservation is a contributing factor to the invisibility of the aged (Gowland, 2007:162).

Specifically, that much of the mature and old adult remains are lost prior to excavation, or if they are recovered that they constitute a large proportion of the individuals who cannot be more precisely aged than simply 'adult' due to poor preservation (Gowland, 2007).

Of the limited studies which directly consider the preservation of old adult (>45 years) skeletal remains, results vary. Walker et al. (1988) carried out a study on 32 individuals of known age-at-death, from the Purisima Mission cemetery in southern California, USA, in use between AD 1813 and 1849. Burial occurred in sandy type soil, with yearly wet and dry climatic conditions causing poor preservation throughout the sample. The authors calculated the percentage loss of skeletal material by comparing the estimated ages of the recovered remains with the burial records. They found that non-adult (<18 years) and mature (>45 years) bones were the least well accounted for and therefore preserved; with the 18-25 (young adult) and 26-45 (adult) age categories being the most well preserved. Demonstrating differential preservation bias will occur towards young and middle adults, when compared with adults over the age of 45 years. This study is flawed in two respects; firstly, the cemetery is recorded, however the location of individual burials was lost, so age and sex of recovered remains was estimated and compared with burials records. Secondly, the number of excavated individuals only represents a small proportion of the buried population so sampling error cannot be ruled out (Walker et al., 1988).

Stojanowski et al. (2002) in contrast, found no association between preservation and age-at-death, in a well-preserved sample (n=110) of Early Archaic period remains (burial occurred c.7,330 to 7,100 radiocarbon years BP), from Windover Pond, Florida. Estimated ages ranged from infants to 65+ years using standard ageing methods, and preservation was assessed using a total of 80 observable features on the skull, dentition, long bones, pelvis, sternum and scapula. Although no relationship between advanced age and poor preservation was found, the authors did report a significant correlation between poor preservation and low bone density ($r=0.77$; $P=0.005$). This could then be argued to apply to older human remains with lower BMD, particularly those with osteoporosis. Although this study demonstrated no clear preservation bias between younger and older adults, this could be accounted for due to the waterlogged nature of the burials, which had preserved not only skeletal material but also brain matter, organic plant material and fabric (Stojanowski et al., 2002). One clear difference in preservation was recorded between those buried at higher and lower levels stratigraphically, the individuals buried at a higher level experienced periodic drying and were therefore, significantly less well preserved than those buried deeper, whose graves remained waterlogged ($r=-0.31$; $P=0.005$).

Additional studies regarding preservation of human remains which are important in their own right, but do not highlight the rates of preservation of old adults include those by Gordon and Buikstra (1981), who carried out a study on 95 individuals excavated from burial mounds in Illinois, USA (c.AD 830 – 1200). They found that the rates of preservation decreased as the acidity of the soil increased for all individuals. Mays et al. (2012) assessed the importance of sieving basal grave fills, particularly in poorly preserved inhumation burials, from the 7th to 9th century cemetery at Whitby, England. The study found that recovery of bone fragments and loose teeth can be increased by up to 54% when sieving is carried out down to 4mm. This may be particularly important when excavating the remains of older, poorly preserved individuals with lower BMD, due to their potentially fragmentary nature, meaning elements may easily be missed.

In order to explore if research into poor preservation of non-adult remains could be applicable to old adults with a similarly low BMD, comparative studies researching bone mass in living individuals were assessed (Table 3.1; Table 3.2). Peak bone mass, and therefore peak BMD is reached in early adulthood (Mays, 2008), and declines thereafter at a rate dictated by environmental and genetic factors (De Sousa e Silva Araujo et al., 2016).

Table 3.1. Male and female average bone mineral density (g/cm²) for living adolescents (Boot et al., 1997:60).

Age (years)	Bone mineral density (g/cm ²)			
	Male	Count (n)	Female	Count (n)
4-5	0.78	9	0.80	9
6-7	0.84	10	0.83	11
8-9	0.87	11	0.86	11
10-11	0.89	11	0.86	8
12-13	0.96	18	0.97	15
14-15	1.03	16	1.08	32
16-17	1.13	11	1.14	26
18-20	1.20	12	1.16	21

Table 3.2. Male and female average bone mineral density in healthy old adults (De Sousa e Silva Araujo et al., 2016:3).

Age (years)	Count (n)	Bone mineral density (g/cm ²)	
		Male	Female
60-64	26	1.22	1.06
65-69	43	1.88	1.08
70-74	33	1.17	1.05
75-79	18	1.16	0.99
80+	12	1.06	0.93

These comparisons show that male BMD does not decline below that of the 18-20 year comparable, until 70 years is reached, whereas the female BMD at 60 years is already roughly equivalent to that of a 14-15 year old. In the 80+ cohort male BMD is comparable to a mid-teen (15-16 years), whereas the female BMD is equivalent to an 11-12 year old (Boot et al., 1997; De Sousa e Silva Araujo et al., 2016).

Although bone mineral density levels are not directly comparable between living subjects and skeletal remains (Agarwal and Grynpas, 2009), Mays (2008:228) suggests that patterns of bone loss with advancing age can be compared. Therefore, BMD patterns between the young and old

could be equally comparable. For example, the BMD of a 58 year old individual with osteoporosis from the Coimbra Identified Skeletal Collection, was just 0.71g/cm² (Curate, 2014), which was higher than that of a 3-5 year old from Hulton Abbey, Staffordshire who had an average BMD of 0.62g/cm², but lower than that of a 10-12 year old from the same site who had an average BMD of 0.77g/cm² (Manifold, 2014). This demonstrates that the BMD of older osteoporotic adults can be equal to or lower than that of children. Particularly given that preservation at Hulton Abbey was poor (Klemperer and Boothroyd, 2004), suggesting that recorded bone mineral densities may have been particularly low due to advanced taphonomic processes.

However, Agarwal and colleagues (2009; 2004), found; when studying individuals from Wharram Percy; that BMD differed throughout the body, and that declines in BMD were more apparent in middle age than old age. Therefore, care must be taken when comparing BMD from different sites, as the elements used for analysis may be providing non-comparable results (e.g. femur vs. vertebral trabeculae). The reasons for the lower rates of bone mineral loss in older adults from Wharram Percy is less clear, but it is speculated to be linked to maintenance of BMD through continued intense physical activity into old age (Agarwal and Grynpas, 2009).

Other than advancing age and the associated hormonal changes that occur (Walsh, 2017), bone loss can be triggered or exacerbated by a variety of factors, these include, genetics, diet, exercise, reproduction, disease and injury. Nutritional deficiencies (Palacios, 2006) and low physical activity levels (Amato et al., 2018) can both cause lack of maintenance of bone density, the effects however are somewhat reversible with resumption of nutritional intake or physical activity. It is likely that communities like Wharram Percy experienced seasonal nutritional deficiencies, although associated bone loss may have been combatted by the extensive physical activity undertaken by the inhabitants (Agarwal and Grynpas, 2009). Diseases (Metzger and Narayanan, 2019), particularly those associated with inflammatory response, such as rheumatoid arthritis or type-2 diabetes; as well as injury (Osipov et al., 2018) can cause local or general loss of BMD, through over stimulation of bone cells. Reproduction is accepted to negatively impact BMD

throughout its duration, with 'bounce back' of BMD occurring after cessation of lactation (Li et al., 2021). Levels of reproduction were not found to impact postmenopausal bone loss to any significant degree (de Bakker et al., 2020).

In summary, additional studies directed towards assessing differential preservation in older individuals, particularly those who experienced osteopenia or osteoporosis in life, need to be carried out to evaluate how advanced age affects preservation within the archaeological record, and how this can be combatted during excavation. In the interim, the studies do suggest that the less dense bones of older individuals do not preserve to the same level as the denser bones of young and middle adults.

3.3 Literary and documentary evidence of the aged

Despite a lack of systematic age records prior to 1538, evidence for people living into old age in the past can be derived from a variety of primary sources. These include censuses, commemorative inscriptions, taxation data, family genealogies, wills, and court and guild records (Chamberlain, 2006; Rosenthal, 1996). The majority of these, as with much of written history, primarily record the wealthier elements of society, those who retained property and had reason to create and continue recordings of themselves and their families, or to be recorded by the state (Chamberlain, 2006). Two of the most plentiful documents referencing age from the medieval period are; The Inquisitions Post-Mortem (c.1236 to 1640), a record of inheritance (The National Archives, 2020); and the Calendar of the Letter Books (c.1275 to 1509), a recording of important city business in London, including age-related exemptions from public service after 70 years of age (Shahar, 1993; Sharpe, 1909).

These sources, both pre- and post-1538, cannot be considered wholly reliable (Hunnisett, 1971), due to what is termed 'normalisation' of records, for the convenience of the information gatherers. The majority of the ages recorded, appear to have been rounded to the nearest whole number, a phenomenon termed age heaping (Chamberlain, 2006; Rosenthal, 1996). This occurs both for recorded chronological age and for the year that events occurred. A large scale

(n=167,226) life span study of European nobles and aristocrats revealed up to 55% of all recorded birth years ended in zero up to AD 800, this had declined to 25% by AD 1550 and 10% by AD 1800. Recorded years of death ending in zero remained between 10-15% throughout the entire time period (AD 800-1800), showing only a slight tendency towards age heaping (Cummins, 2017). Along with age heaping, a greater generalisation of age occurs in records as individuals increase in chronological age, with many entries citing age as '40 and more', or '50 and more', reducing the reliability of the source exponentially (Rosenthal, 1996). This error in the accuracy of chronological age could be due to either the individual, or a relative, not knowing their exact age or date of birth, or simply be an approximation by the records keeper (Chamberlain, 2006:45).

Chronological age, however, became important over questions of law, including inheritance by minors, retirement dispensations or historical disputes. Therefore the majority of individuals would have some notion of their own age (Beam, 2006; Minois, 1989), or how many years had passed since certain events, normally based on the occurrence of another significant event (Rosenthal, 1996). The question of accuracy surrounding age is significant due to a tendency by older individuals to exaggerate their age, in order to gain prestige for being very old (and still healthy), or to avoid having to pay taxes or hold public office. This demonstrates the use of chronological age for personal gain without acknowledgement of the importance of its accuracy (Shahar, 1997). In later medieval records (c.AD 1000 onwards), the onset of old age is often recorded at around 60 years of age, with affirmations such as "very old, being over 60" serving as a social indicator that an individual was regarded as old, even if they were chronologically younger or much older (Porck, 2020; Shahar, 1997; Thane, 2003). Prior to AD 1000, early medieval commentators; for example, Byrhtferth of Ramsey c.986-c.1016; set this demarcation of old age at around 50 years (Porck, 2020), demonstrating fluctuations in perceptions over time.

3.3.1 Age-at-death

Calculating age-at-death from historical sources usually involves a previously recorded date, or year of birth. It therefore follows that individuals with a recorded date of birth are likely to be of

higher status; for example those belonging to royal blood lines or other wealthy lineages. Despite this, age-at-death can often be calculated for those of more modest birth (although usually still relatively wealthy at death, and male), through surviving records of their careers in life (Rosenthal, 1996; Sharpe, 1909). These can then be used to demonstrate longevity in the past.

Between the years of AD 900 and 1550, thirteen rulers (36.1%) and thirteen consorts (33.3%) of England lived to exceed 50 years at age-of-death, with Elizabeth I dying aged 70 and Eleanor of Aquitaine living to age 84 (Table 3.3).

Table 3.3. English rulers and consorts that lived to over 50 years between AD 900 – 1550 (Compiled from Barlow, 2006; Davies and Edwards, 2004; Dunn, 2004; Hicks, 2011; Howell, 2004; Hudson, 2019; Jones, 2004; Miller, 2004; Minois, 1989; Parsons, 2004; Stafford, 2004; The Royal Household, 2020; Trindade, 1999; Vale, 2010; van Houts, 2008; Vincent, 2004).

Kings and Queens	Birth (year AD)	Death (year AD)	Age-at-death (years)	Consorts	Birth (year AD)	Death (year AD)	Age-at-death (years)
Edward the Elder	871	924	53	Eadgifu of Kent	c.904	c.966	c.62
Edward the Confessor	1002	1066	64	Emma of Normandy	c.980	1052	c.72
William I	1028	1087	59	Matilda of Flanders	c.1031	1083	52
Henry I	1069	1135	66	Eleanor of Aquitaine	1120	1204	84
Stephen	1097	1154	57	Berengaria of Navarre	c.1165-1170	1230	c.60-65
Matilda	1102	1167	65	Isabella of Angoulême	c.1188	1246	c.58
Henry II	1133	1189	56	Eleanor of Provence	c.1223	1291	c.68
Henry III	1207	1272	65	Isabella of France	1295	1358	63
Edward I	1239	1307	68	Philippa of Hainault	c.1310	1369	c.59
Edward III	1312	1377	65	Joan of Navarre	1368	1437	69
Henry VII	1457	1509	52	Margaret of Anjou	1430	1482	52
Henry VIII	1491	1547	56	Elizabeth Woodville	1437	1492	55
Elizabeth I	1533	1603	70	Catherine of Aragon	1485	1536	51

A genealogy of the ancestors of Louis IX, King of France records the dates of birth and death for 82 prior Kings, Queens and lesser nobles. Of these, 30 (36.9%) lived to over 60 years at death, with six women and five men (13.4%) exceeding 70 years, with one lady, Douce of Provence living to 95

years of age (Minois, 1989:199) (Table 3.4). Prior to this the records for the male line (n=38) of the Carolingian royal family (c.AD 742 – 929) includes only nine men living beyond 50 years (23.7%), with the head of the house, Charlemagne himself (AD 742-814), living the longest and dying at 71 years of age. Of the records for the female line (n=10) only two lived beyond 50 years (20%), Rothilde – 57 years and Bertha – 62 years (Dutton, 1990).

Table 3.4. Selected European Royalty who exceeded the age of 60 years at death, divided by sex (Chibnall, 2004; Minois, 1989:199).

Name (male)	Birth (year AD)	Death (year AD)	Age-at- death (years)	Name (female)	Birth (year AD)	Death (year AD)	Age-at- death (years)
Thibaud III of Champagne	1011	1089	78	Gertrude of Saxony	1035	1113	78
Alphonse of Castile	1030	1109	79	Hildegard of Burgundy	1045	Post 1114	69+
Albert III of Namur	1030	1102	72	Hedwig of Eppenstein	1050	1112	62
Geoffrey de le Perche	1040	1110	70	Hermesind of Longwy	1058	Post 1129	71+
Godfrey of Namur	1068	1139	71	Adela of England	1062	1137	75
Englebert II of Carinthia	1075	1141	66	Ermesinde of Luxembourg	1080	1143	63
Uta of Passau	1080	Post 1140	60+	Douce of Provence	1095	1190	95
Thibaud IV of Champagne	1085	1152	67	Matilda of England	1102	1167	65
Thierry of Flanders	1108	1168	60	Alix of Champagne	1140	1206	66
Baudouin IV of Hainaut	1110	1170	60	Blanche of Castile	1188	1252	64
Louis VII	1120	1180	60	Marguerite of Provence	1221	1295	74

An alternative source of longevity data throughout the ages is the Church, however it must be remembered that these men most likely originated in prominent families. Of the 20 Popes whose age-at-death is recorded between AD 900 and 1550, only three died prior to their fiftieth birthday, with Paul III (Pontificate AD 1534 – 1549) attaining the highest age-at-death of 81 years (Minois, 1989; The Guardian, 2016) (Table 3.5). Prior to this, of the 17 popes that have known ages at death from AD 314 to 882 only one died before the age of 50 (Sergius II, aged 47), and only one other died before the age of 60 (Leo IV, aged 55), with Pope Agathon (Pontificate AD

678-682) attaining the highest (possibly questionable) age of 107 years at death (Minois, 1989:152).

Table 3.5. Selected list of Popes who exceeded the age of 50 years at death, prior to and within this studies time period (Minois, 1989:152; The Guardian, 2016).

Name	Dates of pontificate (year AD)	Age-at-death (years)	Name	Dates of pontificate (year AD)	Age-at-death (years)
Sylvester I	314-335	65	Sylvester II	999-1003	68
Julius I	337-352	72	Innocent VII	1404-1406	67
Damasus I	366-384	80	Martin V	1417-1431	62
Siricius	384-394	74	Eugene IV	1431-1447	63
Sixtus III	432-440	80	Nicholas V	1447-1455	57
Leo I	440-461	71	Callixtus III	1455-1458	79
Simplicius	467-483	63	Pius II	1458-1464	58
Silverius	563-568	78	Paul II	1464-1471	54
Gregory	590-604	64	Sixtus IV	1471-1484	70
Theodore I	642-649	69	Innocent VIII	1484-1492	59
Martin I	649-655	65	Alexander VI	1492-1503	72
Agathon	678-682	107	Pius III	1503-1503	64
Leo III	795-816	66	Julius II	1503-1513	59
Leo IV	847-855	55	Adrian VI	1522-1523	64
Nicholas I	858-867	67	Clement VII	1523-1534	56
John VIII	872-882	62	Paul III	1534-1549	81
			Julius III	1550-1555	67

Of the eleven English Bishops, nominated between AD 1399 and 1485 with a recorded birth year, eight were over 50 years at age of death (Table 3.6). Out of the remaining 80 Bishops nominated within this time period, 28 of them (35.0%) served the Church for 40 years or more from their first benefice, meaning they were almost certainly over 50 years at death² (Rosenthal, 1996:152–154). A further 13 (16.3%) served for over 30 years, making it likely that they were at least 50 at age-of-death. Therefore, within an 86 year period, 53.8% (n=49) of the Bishops lived to at least 50 years. These advanced ages may be the consequence of a privileged lifestyle and not reflect a similar longevity in the general population, therefore some comparisons with less regal individuals must be made.

² The youngest individual found to be granted their first benefice was Richard Courtenay at the age of eleven years. Born: AD 1381, first benefice: 1392, nominated as Bishop of Norwich: 1413, died: 1415, aged 34 years (Rosenthal, 1996 p. 152). This is the exception rather than the rule, most others were granted their first benefice at 16 or 18 years.

Table 3.6. English Bishops nominated between AD 1399 – 1485 with a known age-at-death of over 50 years (Rosenthal, 1996:152–154).

Name	Birth (year AD)	Death (year AD)	Age-at-death (years)
Arundel, Thomas	1352	1414	62
Chichele, Henry	1362	1443	81
Waynflete, William	1394	1486	92
Neville, Robert	1404	1457	53
Bourgchier, Thomas	1410	1486	75
Rotheram, Thomas	1423	1500	77
Courtenay, Peter	1432	1492	60
Fox, Richard	1448	1528	80

The Inquisitions Post-Mortem, a record of inheritance, documents age somewhat consistently, it is not however concerned with the age of the deceased, but with that of the heir. Thankfully the relationship of the heir with the deceased is recorded, meaning therefore that a minimum age-at-death can be approximated for those succeeded by their progeny. Although the legal age for marriage was 12 years for girls and 14 years for boys, it was rare for individuals to marry before the age of 20³ (Carmichael et al., 2016; Hallam, 1985), particularly after Pope Alexander III (AD 1159-1181) granted the freedom of consensus in choice of spouse (Donahue, 1983). Therefore, direct descendants exceeding the age of 30 years, have been recorded as having parents 50 years or over at age-of-death. A total of 443 individuals (343 males, 100 females) were calculated to be at least 50 years of age, using sons and daughters from 30 years and grandchildren from 10 years (Rosenthal, 1996:24–27).

The Calendar of the Letter Books, among many other things, records dispensations granted to professional tradesmen from “serving on juries &c. owing to increasing old age” (Sharpe, 1909). Although the exact age of the individuals is rarely mentioned, exemption from public service was not granted to any man under the age of 70 years, and indeed enquiries were carried out to ensure this was the case (Shahar, 1993:338). This ‘retirement age’ was stipulated by the Statute of

³ Although younger marriages did occur, generally of those with larger inheritances, with brides recorded as young as five, and widows as young as ten years in *Rotuli de Dominabus* (Stenton, 1957 pp. 38–40).

Westminster 1285 (Spindler, 2011:10). From AD 1375 – 1496 a total of 483 exemptions were granted due to increasing old age or *vergitur senium* (Table 3.7) (Spindler, 2011:11).

Table 3.7. Selected individuals recorded within the Calendar of the Letter Books, discharged from service to the Crown and Court due to increasing old age (Sharpe, 1909).

Date	Name	Employment
24 th February 1401	John Page	Draper
24 th February 1401	Thomas Melton	Fourbour (metal worker)
18 th March 1402	John Lakford	Capper (cap maker)
25 th August 1402	Henry Porter	Pye baker (pie baker)
13 th September 1402	Thomas Cotoun	Bowyer (bow maker)
16 th September 1402	John Burnel	Cordwainer (shoemaker)
2 nd March 1403	Elias Broun	Butcher
29 th March 1403	William Chamberleyn	Tailor
16 th May 1403	Thomas Couper	Couper (trader)
7 th September 1403	William Gyffard	Skinner
17 th September 1403	John Willyam	Skinner
27 th October 1403	John Aldrychessay	Butcher
24 th Jan 1404	John Conesburgh	Pulter (poultry supplier)
28 th April 1404	Robert Sudbury	Cordwainer
30 th April 1404	William Combertone	Skinner
4 th June 1404	William Mortone	Tailor
11 th August 1404	John Grove	Armurer (armourer)

It was not just tradesmen who applied for and received dispensations on the grounds of age and infirmity, Peers of the Realm also sought pardons from attending Parliament (Table 3.8).

Table 3.8. Selected list of Peers granted absence from Parliament over the age of 50 at death (Rosenthal, 1996:127).

Name	Birth (year AD)	Death (year AD)	Age-at-death (years)	Exemption reason
John, Lord de la Warre	1345	1398	53	Poor eyesight
Richard FitzAlan, Earl of Arundel	1346	1397	51	Political disfavour
Aubrey de Vere, Earl of Oxford	1340	1400	60	Incurable infirmity
Thomas, Lord de la Warre	1355	1437	72	Unknown
William, Lord Lovell	1397	1455	58	Infirmity
John Tuchet, Lord Audley	1398	1459	61	Unknown
Henry Bromflete, Lord Vesci	1390	1469	79	Unknown
John de Vere, Earl of Oxford	1408	1462	54	Infirmity and good service
Ralph Butler, Lord Sudeley	1395	1474	79	Age and weakness
John, Lord Beauchamp of Powick	1417	1475	58	Old age and debility

Within general society accounts are less specific; election records from Florence between AD 1429 – 1435 document the age of the 2173 holders of a communal office and Guild Captains, the average (living) age of which was 50.09 years, with the Guild of Innkeepers (n=27) having the

highest average age at election of 59.51 years (Herlihy, 1990:153). A census in the Tuscan towns of Pistoia and Arezzo (AD 1427 – 1430) recorded 2194 (or 13.9%) and 644 (or 16.2%) respectively, of the inhabitants as being over the age of 60 years (Minois, 1989:213).

In England, the Scrope and Grosvenor Depositions c.AD 1385-1390, a dispute over the right to bear a certain coat of arms, resulted in individuals being called to provide evidence in the Court of Chivalry on the length of time they had seen each family bear the arms. Scrope called 207 witnesses, of whom 54.6% were over 50 years of age (n=113), with 29.4% (n=61) over 60 years of age; Grosvenor called in 197 witnesses of whom only 27.4% (n=54) were over the age of 50 and only 7.6% (n=15) were over the age of 60 (Nicholas, 1832; Stewart-Brown, 1937). Scrope won the dispute, primarily due to more old and powerful men attesting to his right to bear the coat of arms (Rosenthal, 1996:46), including the future King Henry IV and Geoffrey Chaucer himself, aged 44 at the time (Nicholas, 1832; Stewart-Brown, 1937).

Potentially most importantly of all, because it involves the poorest levels of society, a 9th century cartulary from the Abbey of St. Victor of Marseille documents the ages of the serfs living within the abbey's domain (Minois, 1989:149). Ages span from 20 to 99 years (n=308), with 64 individuals (or 20.8%) over 50 years, including four individuals recorded to be between 80 and 99 years old, clearly demonstrating that longevity and old age was not a state reserved for the wealthy.

In summary, evidence suggests that a considerable proportion of individuals (>20%) of all levels of society, and both sexes, did exceed 50 years of age on a regular basis, and indeed 60 or 70 years of age, whilst actively retaining their roles in society. It then follows that within skeletal assemblages a proportion of the individuals excavated will have been over 50 years of age at death, emphasising the importance of more precise age-at-death estimates in the discipline of biological anthropology.

3.4 Geriatric study and medieval medicine

Geriatrics, a term used to describe the scientific study of the diseases and impacts of old age, was coined by Nascher (1909) in a paper introducing the term and outlining its intended usage. The study of geriatrics and ageing is not a twentieth century phenomenon (Table 3.9). The recognition of the decline which accompanies advancing age has long been noted, for example the Ancient Egyptian hieroglyphic (c.2800 BC) for ‘old’ depicts a bent person leaning on a stick, while the Ebers Papyrus (c.1550 BC) specifically mentions ‘senile decay’ (Morley, 2004). The initial concept of geroconomy, or the care of the old, as a specific sector of medicine, was developed in antiquity by Galen of Pergamum (AD 129-216) in the fifth book of his treatise *De Sanitate Tuenda* or ‘On the Preservation of Health’ (better known today as Galen’s Hygiene) (Montraville Green, 1951; Schäfer, 2011). It consists of six medical texts which are viewed as part of the foundation of modern medicine (Schäfer, 2011). They state, in contrast to earlier works, for example those by Aristotle, that old age is a naturally occurring irreversible process rather than a recoverable illness (Ross, 2009; Schäfer, 2002). Galen based many of his ideas upon those of Hippocrates of Cos (c.460 – 375 BC) and the combined treatise known collectively as the Hippocratic Corpus, the earliest writings of which date from c.420 BC (Nutton, 2004; Smith, 2020). The key difference however is that the Hippocratic Corpus refrains from a specific focus upon ageing and old age, while Galen addresses these issues (Nutton, 2004; Schäfer, 2011).

Table 3.9. Selected key authors and medical works up to AD 1550.

Name	Date	Title	Reference
Hippocrates of Cos	c.400 BC	The Nature of Man	Jones, 1959
Aristotle	c.350 BC	On Youth and Old Age	Ross, 2009
Dioscorides	c.AD 40 - 90	Herbarium <i>Materia Medica</i>	Osbaldeston, 2000
Galen of Pergamum	c.AD 160	On the Preservation of Health – Book V	Johnston, 2018; Montraville Green, 1951
Claudius Ptolemy	c.AD 200	<i>Tetrabiblos</i>	Thayer, 2009
Ibn-Sīnā (Avicenna)	c.AD 1000	The Canon of Medicine	Gruner, 1973
Constantinus Africanus	c.AD 1000	<i>Pantegni</i> and others	Green, 1994, 2009
School of Salerno	c.AD 1100	<i>Regimen Sanitatis</i>	Gillies, 1911
Roger Bacon	c.AD 1250	On the Prolongation of Life	Tavormina, 2006
Gabriel Zerbi	AD 1489	Gerontocomia: On the care of the Aged	Lind, 1988
Alvise Cornaro	c.AD 1548	Discourses on the sober life	Cornaro, 1916

English medieval medical texts can be divided into two categories; those prior to AD 1100 and those post AD 1100 (Cameron, 1983). Before AD 1100; after the loss of much of the Greek medical tradition to the East with the fall of Rome in AD 476; medical treatment became focused around a series of works termed the 'herbals' which emerged around AD 500 (McCall, 2019). The most famous was the Herbarium or *Materia Medica*, attributed to Greek physician Dioscorides (c.AD 40-90) (McCall, 2019; Osbaldeston, 2000). The Old English Herbal c.AD 1025 (the first known written in the vernacular), contained medicinal recipes, and treatment practices, which were based upon on the teachings of Hippocrates, Dioscorides and Galen, demonstrating a continuation of Greek and Roman medical traditions (Horden, 2011; McCall, 2019). Indeed, Bald's *Leechbook*, an c. early 10th century clinical manuscript demonstrates medical knowledge and practices, traditionally not thought to have entered England for another two centuries (Cameron, 1983; Meaney, 2000; Talbot, 1965).

The first Crusade c.1199 and the growth of trade with the east, resulted in an influx of Arabic medical texts to the West, such as Ibn-Sīnā's (Avicenna's) *Canon* (Gruner, 1973), and *Constantinus Africanus' Pantegni*; a translation of Alī ibn al-'Abbās al-Majūsī's earlier work *Kāmil al-ṣinā'ah al-ṭibbiyah* (The Complete Book of The Medical Art) (Green, 1994); which together with the development of universities (c. late 12th century) and the scholarly physician, redefined the approach to medieval medicine (Horden, 2011; McCall, 2019). However, aside from a more formal structure to the later works, the two forms of medical text were both derived from Greek (e.g. Hippocrates) and Roman (e.g. Galen) sources (Banham, 2011; Cameron, 1988; McCall, 2019). Indeed, both sets of texts deal directly with the balance needed to retain or restore health, via the humours (Wallis, 2000), and both are regarded at a macroscopic level as two interlinked phases of the development of modern medicine (Horden, 2011). A full account of humoral medicine can be found in Section 3.4.2 .

Gerocomy as an area of scientific interest gained ground in c.1600 with a profusion of written texts dedicated to old age, a comprehensive list of which can be found in Schäfer (2011:105-109).

A non-medical, non-academic text which helped spark contemporaneous interest in gerocomy was Cornaro's *Vita Sobria*, written c.1548, at the age of 80; although he reportedly lived to 103 years; as a first-person account of how dietetics can prolong life (Schäfer, 2006:13, 2011). Prior to this very few texts were written with a focus upon old age and ageing, with one significant exception. Gabriel Zerbi, a 15th century physician wrote his treatise *Gerontocomia: On the Care of the Aged* in AD 1489, based upon Galen's theory that old age was not an illness that could be combatted, but a continuation of the natural life course. It was not however widely received being a preliminary dissertation (Demaitre, 1990; Schäfer, 2002, 2006).

Other earlier medieval authors, such as Roger Bacon (c.1240) and Arnald of Villanova (c.1300), continued to subscribe to the Aristotelian theories that ageing was an illness that could be reversed under the correct conditions (Schäfer, 2002). Both Bacon and Villanova experimented with alchemy (aiming to promote strength and prolong life), and often expressed non-standard scientific and religious views which resulted in imprisonment for Bacon (Molland, 2004; Sidebottom, 2013) and accusations of heresy for Villanova (McVaugh, 2008; Vaulted Treasures, 2007). Despite the slow uptake of ideas and variety of approaches towards old age, all authors tried to combat the inevitable cooling that occurred with old age, according to humoral theory. Thus, retaining balance within the humours for prolonged health maintenance, using Hippocratic and Galenic theory (Demaitre, 1990), the ideas of which were maintained until the 19th century (Schäfer, 2011).

3.4.1 The ages of man

Old age has been defined by authors throughout history in different ways depending on their scientific and religious beliefs and understandings. At the most basic level definitions were qualitative, based upon physiological age rather than quantitative by chronological years lived. Early Hippocratic medicine (c.400 BC) ascribes to this theory, distinguishing only between the young or old individual. This basic segmentation of life was recorded by Varro (c.116 – 27 BC) a

Roman scholar who mistakenly attributed the scheme to the Ancient Egyptians (Table 3.10) (Schäfer, 2011).

Table 3.10. The ages of man at their most basic, according to Varro (Schäfer, 2011:13).

Age (years)	Life stage	Attribute
Up to 50	Youth	Increase in heart weight
Over 50	Old age	Decrease in heart weight

In his writings, Plato (c.400 BC) broadened the traditional two phases with an intermediary third stage, a culmination point, which shared attributes from both the young and old, literally a ‘middle age’ where the individual is neither old nor still young (Table 3.11) (Kosior, 2016; Schäfer, 2011). This tripartite scheme was carried forward by Plato’s student Aristotle (c.350 BC) (Kosior, 2016).

Table 3.11. The ages of man according to Plato (Kosior, 2016:88).

Age (years)	Life stage
Up to 30	Youth (<i>neotes</i>)
30 – 50	Culmination age (<i>akme</i>)
Above 50	Old age (<i>geras</i>)

An alternative Hippocratic theory was based upon the number seven, an ideal number constituting the universe, with seven planets, seven colours, metals and spheres. It was also linked with chronological age specifically, unlike the earlier Hippocratic division of youth and old age (Table 3.12). Interestingly different versions of this theory exist, with one classing 98 years as the upper limit of life, but two others ascribing anything over 56 years of age as ‘old age’ (Kosior, 2016).

Table 3.12. The ages of man according to the Hippocratic Corpus in *De hebdomadibus* (Kosior, 2016:91).

Age (years)	Life stage
0 – 7	Early childhood (<i>puerulus</i>)
7 – 14	Childhood (<i>puer</i>)
14 – 21	Adolescence (<i>adolescens</i>)
21 – 35	Youth (<i>juvenis</i>)
35 – 49	Maturity (<i>vir</i>)
49 – 63	Ageing (<i>senior</i>)
63 – 98	Old age (<i>senex</i>)

Alternate numerical theories on the stages of life have included Pythagorean (c.570 - 490 BC) number symbolism with seven year chronological stages, up to 98 years of age (14 stages in total) (Schäfer, 2011), and Ptolemy's (c.AD 200) seven stage astrological theory (Table 3.13), whereby the later stages of life are governed by Jupiter (elderly age; 57 – 68 years) and Saturn (old age; 68 years until death) (Thayer, 2009). St Augustine of Hippo's (c.AD 354 – 430) six stage Christian version was based on the six epochs of human history, with 70 years until death as the sixth stage, and a final seventh stage reserved for death (Shahar, 1997).

Table 3.13. The ages of man according to Claudius Ptolemy in Tetrabiblos Book IV - 10. Of the Division of Time (Thayer, 2009).

Age (years)	Life stage	Attribute	Astrological link
0 – 4	Infancy	Suppleness and moisture	Moon
4 – 14	Childhood	Intelligence and personality	Mercury
14 – 22	Youth	Love, desire and passion	Venus
22 – 41	Young manhood	Ambition and seriousness	Sun
41 – 56	Manhood	Severity and misery	Mars
56 – 68	Elderly	Modesty and dignity	Jupiter
68 – death	Old age	Coolness and sluggishness	Saturn

However, the most prevalent and pervasive of the theories throughout the medieval period, was one that linked the ages of man with the four seasons and the four elements (earth, air, fire and water), and ultimately with the four humours as the basis of medical treatment (Schäfer, 2011; Shahar, 1997). This theory was most clearly defined by Galen (c.AD 160) but Hippocratic teachings incorporate it, as do 6th century BC Pythagorean works (Table 3.14) (Kosior, 2016; Schäfer, 2011).

Table 3.14. The ages of man according to Galen, which became the most commonly utilized system within the medieval period (Schäfer, 2011:14;26).

Life Stage	Attributes	Season
Childhood	Warm / moist	Spring
Youth	Warm / dry	Summer
Adulthood	Cold / dry	Autumn
Old age	Cold / moist	Winter

Medieval authors, such as Bede (c.AD 672 – 735) and John of Gaddesden (c.AD 1280 – 1361), incorporated a mixture of all the above classical theories in their works, including three stage

divisions based upon Aristotelian biology (Porck, 2022), four stage divisions based upon Galenic humoral physiology (Gilleard, 2015), or seven stage divisions based upon Ptolemaic astrology (Cameron, 1993; Cholmeley, 1912; Shahar, 1997:15). The terminology used differs depending upon the source and the number of stages, but the usual terms for advanced age include, *senectus* (old age), *senium* (extreme old age), *decrepita* (decrepitude) and *mors* (death) (Kosior, 2016; Shahar, 1997). One similarity held by many of the systems is the separation of ‘young old’ age and ‘old old’ age, with young old age commencing around 40 or 50 years and finishing around 60 or 70 years (Porck, 2022), depending on the system; old old age then commences ‘until death’ (which itself often gets its own distinct stage). This division of old age is something which can be seen today in the development of the third and fourth age (discussed in section 2.3.2) although the reality of these divisions in past society for many, would not have been felt, with individuals continuing to work until they were no longer capable (Schäfer, 2011; Shahar, 1997).

One thing many of these manuals for the care of the aged and medical texts have in common, is that they predominantly refer to men. The term ‘senex’ means old man, and although this is not explicitly defined it is obvious through the terminology that men were the author’s primary concern (Beam, 2006:100; Shahar, 1997:43). This does not mean that women were not treated medically, nor that they did not also fulfil the role of physician in medieval society (Green, 1989). A unique text *Tractatus de quaternario* (c.AD 1150) by an unknown author, depicts the fourfold humoral system with female figures (Porck, 2022:65), the reasons for this variation in form are not elaborated upon, but it serves to demonstrate that medieval theories regarding the life course were applicable to women as well as men.

3.4.2 The theory of humours

Humouralism was a system of medicine that focused upon the unity of the body. The tradition states that illness is derived from unbalance of the mental and physical processes in the body, disturbing the equilibrium of the humours and causing ill health (Nutton, 1993). The word ‘humour’ can literally be translated from the Greek to mean liquid or juice; as would have been

seen in every living thing, blood in animals, sap in trees, pus in infected wounds; therefore its importance to medicine could not be ignored (Nutton, 2004). The origins of the theory lie in the 6th or 5th century BC Greece, with healer-philosophers such as Empedocles of Acragas (c.492 – 432 BC), who posited that everything was made up of a mixture of the four elements: earth, air, fire and water. Bone, for example, was thought to be made up of two parts water, two parts earth and four parts fire, whereas blood was made up of equal parts of all four elements. Health was maintained through balance of these elements (Nutton, 1993:283). The Hippocratic Corpus assigned qualitative terms to the elements; hot, cold, wet and dry, as well as defining how the seasons of the year could influence the balance of health. Galenic theory was the first to link the elements, seasons, planets and dispositions, ascribing a humour to each. Galenic humoral theory was the most prevalent medical concept in the medieval period in Europe; for example in the *Rosa medicinae* by John of Gaddesden (c.1280-1361) (Cholmeley, 1912); and is still used in folk medicines today (Encyclopaedia Iranica, 2012; Nutton, 1993).

The four humours are blood, phlegm, yellow bile and black bile. They and their relative associations with the elements, seasons and quantitative components can be seen in Figure 3.1, with a contemporaneous example from c.AD 1110 in Figure 3.2. The theory taught, for example, that yellow bile was produced by the fire in the body, it is hot and dry and associated with the summer of life, or adolescence and led to a choleric, irritable disposition. Phlegm and black bile had a major role in the cause or indication of sickness, while blood retained its ambiguity being either good or bad depending on its abundance or lack thereof. The humoral makeup within every individual was crucially unique, being influenced by both age and sex. Meaning medieval physicians would take the specific humoral makeup of the individual into account when making diagnoses (Augenti and Gilchrist, 2011). Demonstrating that chronological age was important on at least a personal level. Healthy individuals of good disposition had an equal balance of the humours. Illnesses or poor temperament were explained by excess or deficiency of one or other of the humours and could usually be cured by alteration of diet, herbal remedies, cautery or bloodletting, depending on the humour affected (Augenti and Gilchrist, 2011; McCall, 2019).

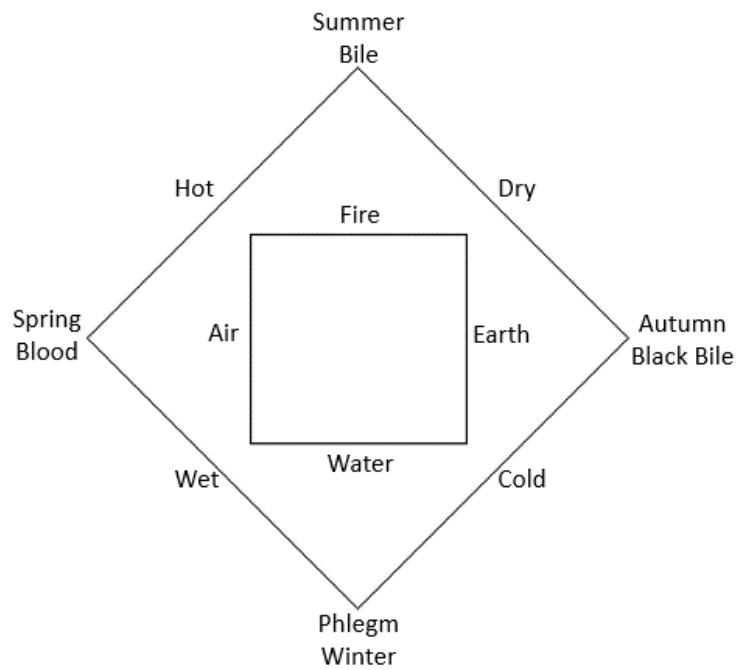


Figure 3.1. The Hippocratic humoral system and its associations (Nutton, 1993:25).

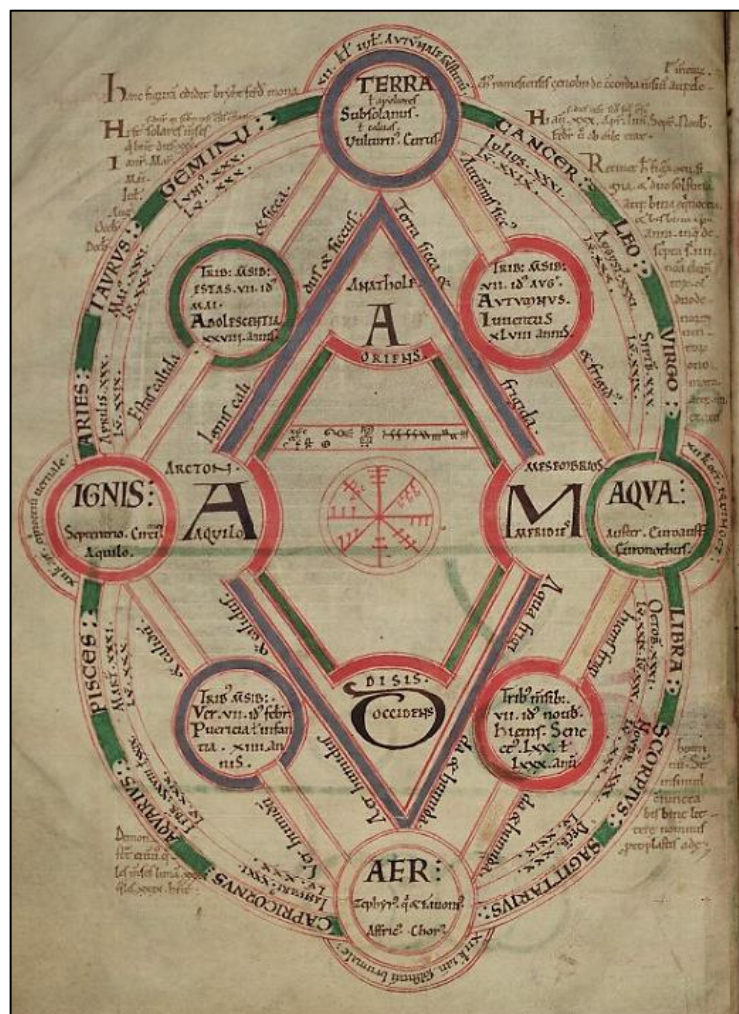


Figure 3.2. Byrhtferth of Ramsey's diagram of the elements, seasons, heavens and human life found in his work *The Enchiridion* produced c.AD 1110 (St. Johns College Library Oxford MS 17, 2021).

The qualitative elements which are specifically related to old age are cold, dryness and moisture. Cold old age is the principal concept regarding ageing and death. Loss of internal heat commences at birth and continues until old age is reached when the body can no longer be maintained, and death occurs. Loss of heat in the body is described by the Aristotelian lamp metaphor (Schäfer, 2011). This metaphor was a visual representation of an internal lamp in the body, in which old age occurs as the life-fuel (heat) runs out and the flame (life) dies (Schäfer, 2002). Dryness is linked to the drying out of leaves and fruit with age and is compared to the appearance of older people who become shrunken and wrinkly. Once again, a perpetual 'drying out' occurs from birth throughout life, until the heart dries up at death, losing its innate warmth, or the oil for the flame of the lamp runs out. Moisture then, appears to contradict the above, however cold and moist old age was linked to the watery excretions of old age, for example, runny eyes and incontinence, and therefore the loss of fluids leading to the drying out (Schäfer, 2011). These three traits are linked to the autumn and winter of life, and a gradual loss of health (Nutton, 1993). The fact that moisture, or wetness is also linked to the spring of life could be interpreted as the circle of life repeating itself.

3.5 Medieval social outlook

The following section will present contemporaneous medieval ideas on old age and ageing. This compliments the previous sections in Chapter 2 on the ageing process and modern perceptions.

3.5.1 Memory holders and wise old men

Storytelling is a fundamental instinct for our species, we grow up listening to and learning from stories, and pass on information and entertainment through them. Prior to the advent of the written record, storytelling and personal communication were the sole ways to deliver information; but stories are intrinsically linked with our imagination and can easily become enlarged and distorted into myths and legends, with the original facts practically indiscernible (Gottschall, 2012). For this reason, much of what we 'know' about old age in the past is anecdotal, passed down and distorted over the generations.

Contemporary ideas about old age in the past ascribe it to a 'golden age' of life, where veneration and respect in the community, and care from the family featured heavily, however, research now suggests these assumptions are largely untrue (Johnson, 1998). The concept of 'wise old men' appears to have been derived from oral traditions. The theory, states that older men (and occasionally postmenopausal women) known as 'elders' were seen as a fund of wisdom and knowledge, and so possessed a place in society as the memory holder, educator and judge (Minois, 1989). However, in reality only a certain few would attain these heights, and could only retain it with continued health, whereas other older infirm individuals would be neglected, abandoned and even sacrificed; and in times of hardship nobody's position was secure (Minois, 1989; Shahar, 1998). Wisdom often had little to do with advanced chronological age and more to do with social status and life experience. Rulers in particular were always considered to be mature men, despite their actual youth (Amos, 1990; Minois, 1989). The old testament teaches that true old age is wisdom, but it does not follow that wisdom is gained with age, for example Job 32:9 "It is not the old that are wise, nor the aged that understand what is right" (The Bible, 1971). By the central medieval period, the role and prestige granted to the old as memory holders was a limited one, with the advent of the more widely available written record (c.12th century) and the printing press (c.mid-15th century) (Clanchy, 2013; Febvre and Martin, 1997). Older people were often still relied on to provide accurate testimony on events that had happened in the past (Clanchy, 2013; Rosenthal, 1996:53), and would have provided fireside entertainment (Minois, 1989). Although the extent of the fireside tradition of storytelling in northern Europe in the middle ages is debated (Shahar, 1997:158).

3.5.2 Perceptions of old age in society

The burden of old age in the past would have differed, dependant on time period, location, personal health, social and familial status. As well as the degree of personal involvement in society and family, and the presence or absence of support networks provided by that society or family (Parkin, 1998; Rosenthal, 1996:95). These factors, as well as the prevalent religious teachings, and medical understandings would have influenced views about ageing and the aged.

Indeed, an old man may be sub-human and superhuman all at once and treated in all manner of ways depending on the prevailing traditions at the time (Minois, 1989). The aged may have been feared and hated, but treated with respect due to fear of repercussions from their spirit, such as in modern Japan, where old individuals are treated with respect according to tradition, but privately regarded by the young as silly, laughable objects of pity (Nelson, 2011); alternatively the aged may be revered but sacrificed due to an overriding need for resources (Minois, 1989). In medieval England, the old often did not represent a specific category deserving of succour, unlike the poor, or the sick (although many old individuals may have fallen into both of these categories), demonstrating that advanced age in itself was not perceived as a social issue (Jones, 2011; Shahar, 1997).

Age perception also differed depending on the phase of life an individual was in, a young man who had married and procreated would be thought of as socially older than his unmarried counterpart (Rosenthal, 1996:18). For example, William the Marshall (c.1147 – 1219), later the Earl of Pembroke, became a knight in his uncle's household and was regarded as *juvenis* (a young man) until his marriage and the birth of his heir at the age of 42 (Cummins, 2000). With advancing age, so long as physical incapacity did not severely affect the individual, little difference would have been drawn between the mature man and the old man, especially when individuals did not themselves feel or act old (Minois, 1989). For men, there was no fixed age that maturity became old age, despite the different schemes for the ages of man (Rosenthal, 1996:96), individuals were marginalised depending on their degree of ability and chronological age was of little importance in day to day life as they carried out their role in society (Johnson, 1998:7).

For women, the perception of age could be affected by their marital status prior to the menopause. A widowed woman would be regarded as socially older than an unmarried or still married woman of the same chronological age (Beam, 2006). Contemporaneous advice for all women, regarding the treatment of and attitudes towards, widowed and older women can be found in Christine de Pizan's *Treasure of the City of Ladies* (c.AD 1405). Respect towards these

women is emphasised, potentially denoting that this did not occur in day to day society (de Pizan, 2003). Widowed women were often seen to be in the final segment of their lives socially as they had progressed from maidenhood, potentially through motherhood, to widowhood; they could of course alter this situation by remarrying (Campbell, 2006). The menopause demarked the actual onset of old age for women (Roberts, 2011). The lack of explicit reference to older females in many (male written) medieval medical texts implies the perceived gender neutrality of postmenopausal women (Porck, 2016; Schäfer, 2011:9). Some authors go so far as to state that when postmenopausal women are referred to, they are regarded as having a man's body with a female reproductive system installed (Niebrzydowski, 2011). The menopause in the medieval period was a significant event, menstrual blood was deemed an impure and poisonous substance that women expelled from their bodies each month, therefore with the onset of the menopause women were no longer able to expel this dangerous impurity which built up in their bodies, causing them to become dangerous and venomous, as they had no natural heat left to control the build-up (Shahar, 1997:44). *De secretis mulierum* (The Secrets of Women c.AD 1300) a treatise on female health and reproduction, specifies that poor postmenopausal women were exceptionally venomous because they subsisted on 'coarse meat' which promoted bad humours (Rodnite Lemay, 1992; Shahar, 1997). Although this venomousness did not stop them from contributing to their families and communities into extreme old age (Porck, 2016; Thane, 2003).

3.5.3 Portrayals of old age in art, drama and literature

The theory in patriarchal society that old men in the past retained power and influence whilst declining in strength, is one which medieval commentators diverge from. Old age, in much medieval literature, is portrayed as a time of deprivation, want and humiliation rather than the classical ideas of security and comfort (Herlihy, 1990). For example, in Chaucer's 'A Merchant's Tale', a 60 year old man marries a young woman, becoming a cuckold when he cannot satisfy her, and she turns to another man for solace (Covey, 1989). Discussions on old age and attitudes towards the aged and old people can be found in art, drama and literature in all time periods with conflicting and ambiguous representations (Johnson, 1998:5; Thane, 2003:106). The bodies of

both old men and women were depicted with scorn and cruelty in art and literature in the 16th century (Shahar, 1997:50). Medieval Christian teachings state that decrepitude and ugliness accrue with sins committed, therefore old age was regarded as a form of divine punishment (Minois, 1989:120). Medical texts also portrayed old age in a negative light, with the old man described as having the negative qualities of a child in his senescence, due to the changing psychosomatic qualities of the humours with age (Shahar, 1997:39).

Despite this, to seemingly reconcile the layman's need for consolation over old age, Christian theoretical works portray old age as full of wisdom and abounding in virtue (Schäfer, 2011). For example, *The History of Joseph the Carpenter* (c.AD 600), portrays Joseph as old, wise and free from lusts, explaining why his wife Mary could be a virgin at the birth of her child Jesus (Boff, 2009:18; Walker, 1886). This attained wisdom, serene freedom from lusts, and acquired ability to counsel others, meant older men and women could look to the salvation of their own souls (Shahar, 1997:4). These portrayals demonstrate the contradictory attitudes towards old age present in medieval society on a daily basis.

3.5.4 Old age laws

Institutional retirement across all sectors of society in the UK was not developed until the mid-20th century (Bozio et al., 2010), however forms of retirement and pensions were common to the infirm in the medieval period (Clark, 1990; Rosenthal, 1996:94). The manner of retirement depended largely on what sector of society a person belonged to. The rich and influential gained dispensations from serving on councils and juries either due to sickness and infirmity, or due to advanced old age, normally 70+ years; often without stepping down from their roles as landowners or heads of households (Rosenthal, 1996; Spindler, 2011). The poor planned their care during senescence and decline through property devolution, either delayed or conditional, using property rights to leverage support in old age from inheritors, whether these be children, neighbours, or the local priest (Clark, 1990). Delayed devolution meant control of the property reverted to the inheritors on the death of the property holder, but only upon fulfilment of a

contractual agreement by the inheritors normally relating to the care of the property holder in their extreme old age and infirmity. Conditional devolution meant surrender of control of the property to the inheritors by the property holder during their lifetime, in return for subsistence, money, house room and care in extreme old age. If this care was not provided in either form of devolution the property holder could apply to the courts who would either revert the land to the manorial lord to be re-tenanted or disinherit one inheritor in favour of another (Clark, 1982, 1990). Most commonly devolution would benefit the children of the property holders, however childless peasants, or those whose family had moved away often created contracts with neighbours or friends and cohabited as kin. Providing the contract was agreed by the court and lord, peasants could settle land on whom so ever they chose (Clark, 1990). Devolution was not limited to the poor, those in more affluent circumstances could also undertake a similar form of agreement to maintain themselves during senescence (Rosenthal, 1996). It must be noted that the very poorest in society, even if they held property to create devolution contracts, could not realistically expect aid from equally poor relatives, as they simply would not have had the resources to either fulfil the contract or provide adequate care and maintenance for an infirm individual (Thane, 2003).

Retirement was something that was normally imposed upon a person by declining health, and usually only occurred a relatively short time before death, as it was of most benefit to retain independence and continue working until late old age (Minois, 1989; Thane, 2003). It was not therefore seen as a prestigious event, retirement meant you were unable to contribute to society and involved a loss of status and increased marginalisation, particularly for men; women would have experienced less change as they were customarily more marginalised to begin with (Shahar, 1997:158). Specific jobs were provided for the very oldest in communities, to earn income and retain their independence, for men these included road mending, fetching, carrying, caring for horses on market days and caring for the churchyard; for women old age jobs could include childcare, cleaning, washing, spinning or taking in lodgers, the income from which would be supplemented by poor relief systems (Thane, 2003).

Ecclesiastical retirement came in several forms, for churchmen; for laymen who joined the church, and for laymen who lived in or upon the church as corrodians or pensioners. For those already part of the church, particularly the higher echelons, honourable withdrawal from active life in the church and a comfortable leisure was an option (Rosenthal, 1996). An example is Bishop Porteus who “enjoyed the retirement of St. Cross; and is reputed to have planted some of the elms in the park” (Humbert, 1868:50). For those who joined the church, entering a monastery upon retirement from political life was seen as cleansing of past sins, and brought with it an aura of reverence which was very sought-after in medieval thinking. This usually occurred in late life, when death was felt to be near (Knowles, 1963:477). Women, usually widows, would join convents to escape either remarriage or isolated old age, as nuns or vowesses (a lady that has taken a vow of chastity, but retains her own property) (Oliva, 1998:47). In return the church would receive some form of payment, either monetary or land holdings, either upfront or bequeathed upon the death of the individual (Knowles, 1963; Oliva, 1998). Corrodians were granted an allowance of food, clothing and shelter by the church for the duration of senescence (Oliva, 1998). Corrodies were paid for either by the transfer of goods from the individual to the church, or funded by an ecclesiastical or secular patron for the old age support of a servant or associate (Rosenthal, 1996:108). Whereas pensioners were granted an annual monetary sum to maintain their livelihood, which was often apportioned from church funds (Oliva, 1998:117).

Institutionalised poor relief commenced at the end of the medieval period in the mid-16th century with the 1536 Henrician Poor Law (Kunze, 1971). This established the parish as the unit for poor law administration within local governments, and tried to end the church’s practice of indiscriminate charity, i.e. giving alms upon request, regardless of physical capacity for labour, promoting begging (Kunze, 1971). Prior to this law there was no centralised form of poor relief outside the church, which was dependent upon the charity of parishioners and the earning of tithes from the late 8th century (Brodman, 2009; Clark, 2002). It must be noted that old people were not specified amongst those who were defined as requiring, or deserving assistance in the

scriptures, this only changed under Innocent IV (AD 1244-1254) who included the aged specifically (Jones, 2011; Shahar, 1997:165).

The first hospitals were established in England in c.AD 1085 and by AD 1200 over 400 had been founded, run by both the church and laymen (Dyer, 2012a; Watson, 2006). They were often funded by income appropriated from church tithes, for example, the Hospital of St. Cross, Winchester, was supported financially by the churches of Fareham and Twyford (Humbert, 1868:14). Once again, amongst the deserving and worthy poor that these establishments catered and cared for, little mention is made of the aged, particularly as a group requiring succour or end of life care (Rosenthal, 1996). Indeed research suggests that it is only after 1700 that old age becomes recognised as a condition requiring societal assistance purely on its own merit (Gilleard, 2002; Schäfer, 2011:182). Despite the ageless nature of the deserving poor, many old individuals must have been included within the categories of diseased, disabled and poverty stricken peoples that these establishments cared for (Minois, 1989).

3.5.5 Summary

Sources suggest that old age in the medieval period applied to those who could not actively contribute to society (Thane, 2003). Individuals would become marginalised by their communities and family, as the ratio between what they could produce and what they consumed increased (Rosenthal, 1996:174). Older people would not be subjected to persecution purely because they were chronologically old, but nor would they be venerated for obtaining advanced age; rather the biological process of ageing and infirmity with advancing decrepitude was what marginalised individuals and defined them as 'old' (Rosenthal, 1996:190).

Chapter 4 - Materials and Methods

4.1 Introduction

This chapter will contextualise the sites utilised in this study. Each site will be discussed in relation to its social status, primary occupations, dietary evidence and living conditions to demonstrate

the lived experience of the individuals in each study sample. Additionally, the ageing techniques, and diagnostic criteria employed to assess age-at-death and pathology for each individual are set out to demonstrate their usage, and how each pathology may have impacted the life course of those they affected.

4.2 Materials

To explore longevity in the medieval period, care was taken to ensure the combined sample accounted for intra- and inter- population variability by selecting sites fitting a variety of important considerations. These considerations included geographic location, with all sites studied from the north-east of England, in Yorkshire or North Lincolnshire (Figure 4.1). This was to ensure that each site could be directly compared with another, as they would have undergone similar religious, political, economic, environmental and social fluctuations. The sites also had to represent a cross-section of society, incorporating high and low socioeconomic status and urban and rural communities. As well as being in use during the time period of this study, AD 900 – 1550 (any inhumations outside of this time period were excluded from analysis). Preservation and sample size were considered in conjunction with good overall preservation of a high proportion of adults exceeding 46+ years at death, which was important for the feasibility of the study (Table 4.1).

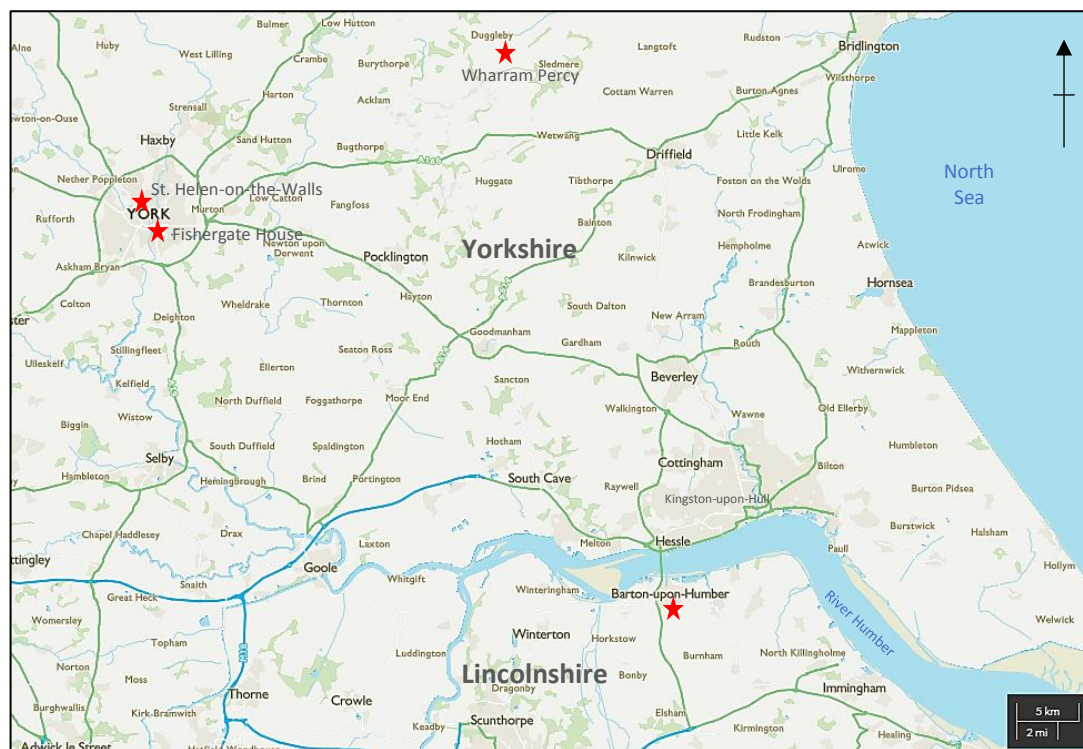


Figure 4.1. The location of the four sites chosen for analysis (Ordnance Survey, 2021).

Table 4.1. Details of the study sites.

Site	Date (AD)	Location	Status	Sample size	Individuals reported to be 45+ years (n)
Barton-upon-Humber	c.950 – c.1855	North Lincolnshire	Wealthy	2750	311
Fishergate House	c.1000 – c.1500	York	Poor	244	39
St. Helen-on-the-Walls	c.900 – c.1550	York	Urban	1041	109
Wharram Percy	c.950 – c.1850	North Yorkshire	Rural	687	140

As a relatively large market town, Barton-upon-Humber (Barton) can also be classed as sub-urban, although its fortunes fluctuated over the years, in comparison with the other sites Barton retained its wealth. Fishergate House (Fishergate) and St. Helen-on-the-Walls (St. Helens) are both located within the City of York, approximately one kilometre apart, meaning they could both therefore be classed as urban and poor (both being situated in poorer districts) however, St. Helens lies within the city walls only a few hundred meters from York Minster and would have been an intense urban hub, whereas Fishergate lies outside the city walls in an area which did not see development physically or economically for much of the medieval period (Dawes and

Magilton, 1980; Spall and Toop, 2005a). Finally, Wharram Percy (Wharram) is situated in a rural part of North Yorkshire, it's desertion does not appear to have been due to the decline in wealth of the landlord, but the natural decline of the parish (Harding and Wrathmell, 2007:1)

4.2.1 Barton-upon-Humber, Lincolnshire

The Barton-upon-Humber individuals are held within the Church of St. Peter in Barton. The assemblage consists of individuals excavated from within St. Peter's Church itself, and the associated graveyard. The study sample was transported to the English Heritage store at Helmsley, North Yorkshire, for analysis, which took place between 23rd September and 13th December 2019.

4.2.1.1 History of the area

Barton-upon-Humber is a small market town, located in the northern most part of North Lincolnshire. It lies on the floodplain of the River Humber, 4 miles (6.4 km) inland from the southern bank of the estuary, at the base of the Lincolnshire Wolds; on a mixed geology of chalk, glacial till, boulder clay and alluvial salt (brick earth); approximately 31 miles (50km) south-east of York (see Figure 4.1). It's place-name was first recorded in the Domesday Survey of AD 1086, and appears to be derived from the Old English *bær-t_n* meaning "barley farm" (Rodwell, 2011a:29), a nod to its importance in supplying barley malt for beer brewery (Osgerby, 2009).

The area experienced sporadic prehistoric inhabitation, with flint flakes found in situ at the site of St Peter's church; as well as suggestions of Roman activity, with a minor Roman road along the western boundary of the parish (Rodwell, 2007b:5). However, no permanent settlement occurred until the 5th century AD, which is associated with an Anglo-Saxon sub-circular enclosure, the western arc of which passes below St. Peter's Church (Figure 4.2); as well as the Anglian cemetery some 250 meters south-west of St. Peter's at Castledyke South (Rodwell, 2011a:4). Prior to the construction of the of the Humber Bridge, which opened in 1981, the connection between Lincolnshire and Yorkshire was maintained by ferries, the primary terminal of which was developed at Barton in the Late Saxon period, with evidence of these extending back to the 1st

century AD, meaning that although Barton lies within a rural area, it was certainly not isolated (Rodwell, 2007b, 2011b). This resulted in Barton being recorded as one of the most important settlements in North Lincolnshire by the AD 1086 Domesday Survey, with a population of c.1000 persons (Rodwell, 2011a:4). Its decline occurred towards the late 16th century, with the development of Kingston-upon-Hull as a prosperous port and town which lies 5 miles (8km) away on the northern bank of the River Humber. This is in conjunction with a plague in c.1593 which killed over a quarter of the population (Rodwell, 2011a:64).

Barton today is a typical small English market town, serving the needs of its population, and does not appear to have altered considerably over the previous millennia, which makes it the ideal location for long term demographic population study (Rodwell, 2011b). It is likely that the original marketplace and focus of the town was between the two medieval churches of St. Mary's and St. Peter's, at Beck Hill (Rodwell, 2007b).

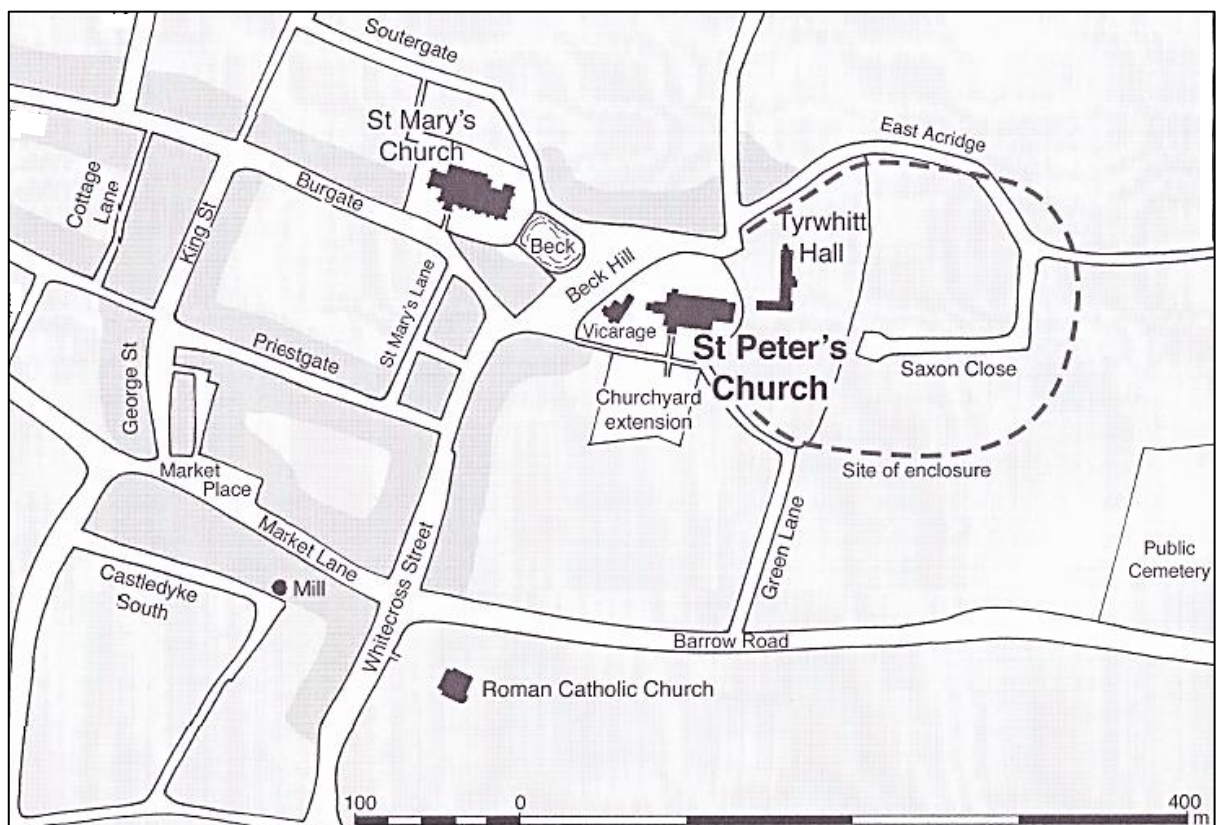


Figure 4.2. Plan of the historic centre of Barton (Rodwell, 2007b:3).

4.2.1.2 The population of Barton

Initially burial at Barton-upon-Humber occurred in a cemetery at Castledyke South, 250 meters south-west of St. Peters (see Figure 4.2) (Rodwell, 2007b, 2007a). Although not fully excavated it is estimated that a minimum of 400 burials took place at Castledyke South between the late 5th and early 8th centuries. It is possible that this is a pagan forerunner of the later Christian cemetery at St. Peter's. Funerary archaeology suggests that the individuals buried at Castledyke South were relatively wealthy, with the earlier graves containing individuals of potentially Germanic descent (Rodwell, 2007b:5). Lack of evidence for burial in the late 8th and 9th centuries at either site, calls a continuation of use into question. However neither cemetery has been fully excavated, so the later Castledyke, and earliest St Peter's burials may not have been uncovered (Rodwell, 2007b).

Excavation revealed that the site of St. Peter's church had originally been occupied by early Saxon timber buildings that were later sealed by an earthen platform, this platform was then used as the site of a late Saxon cemetery (c. pre-AD 950). These individuals were exhumed prior to the building of the first church at the beginning of the 11th century, indicating long standing knowledge of their location, and continuation of some existing form of chapel or religious area which has not yet been uncovered (Rodwell, 2011b). Limited evidence for medieval dwellings has been excavated at Barton, but historical records and the small amount of surviving evidence demonstrate these would have been timber built, modest buildings, built primarily as need arose, lending them a crowded largely irregular organisation (Rodwell, 2011a:53).

The isotopic evidence for diet at Barton (Beavan et al., 2011), suggests consumption of primarily terrestrial foods (vegetation and protein), but with enrichment from both fresh water and marine resources. This makes sense considering Barton's location on the banks of the River Humber, and its relative proximity to the coast (28miles or 45km). Evidence suggests that from c.11th century the level of marine and salmonid consumption increased at Barton, with a corresponding decline in consumption of terrestrial foods (Beavan et al., 2011:764). Overall, this indicates that the

individuals at Barton consumed a complex and varied diet throughout the time period under study.

The primary occupation of the inhabitants of Barton was farming, both arable and animal, according to the Domesday Survey of AD 1086 (Rodwell, 2011a:4). The presence of a thriving market at Barton is demonstrated by St. Mary's church (immediately adjacent to St. Peter's), which was built by prosperous tradesmen in the c.12th century specifically to serve the traders, which subsequently became more grandiose than St. Peter's. Additionally, a small harbour (now called the Haven) was created (c.1050) off the River Humber, to allow easier access for tradespeople, and to act as a location for the ferry terminal between Barton and Kingston-upon-Hull. It also acted as a centre for the fishing and water-borne trades around Barton, and was the location of a mill c.1086 (Rodwell, 2011a:53). This demonstrates considerable investment into the town's development highlighting its prosperity. This prosperity was due to sheep farming and the wool trade (Lloyd, 1977). Evidence for late Saxon artisan workshops at adjacent Barrow upon Humber (Rodwell, 2011b), suggest the development of local trade to serve the more prosperous town of Barton. It is likely that the individuals buried in St. Peter's churchyard, represent the local community, with additional individuals associated with trade and paid agricultural labour, who either relocated to Barton or died whilst there (Crook, 2021).

4.2.1.3 History of excavation

The church of St. Peter's at Barton was taken into public guardianship by the Department of Environment (now English Heritage) in 1978 after being declared redundant in 1972 (Cool and Bell, 2011; Rodwell, 2007b). A major program of excavation followed over seven seasons from 1978 to 1984 under the direction of Warwick Rodwell (Rodwell, 2007b:14). It makes St. Peter's Church one of the most intensively studied and recorded in the country (Figure 4.3), providing a unique insight into the local community over a span of at least 900 years, and producing one of the largest collections of human remains excavated in the UK, to date (Cool and Bell, 2011).

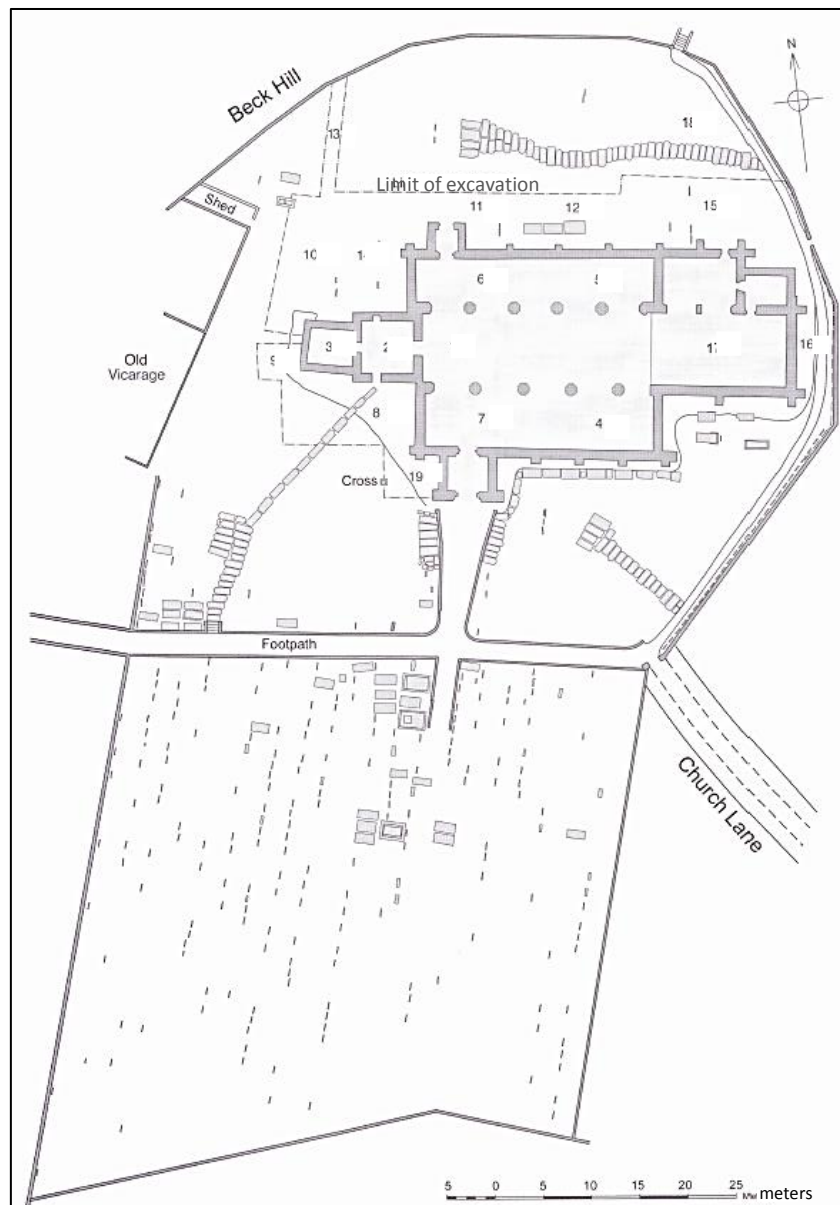


Figure 4.3. Plan of St. Peter's church and churchyard, with the limit of the excavation outlined (Rodwell, 2007b:9).

4.2.1.4 The cemetery

A total of 2803 skeletons were uncovered during excavation of the church and graveyard, with 2750 individuals analysed in the site report. The earliest burials were dated to the Saxo-Norman period (c.AD 950), and are broadly contiguous with the first church (Cool and Bell, 2011). Burial at St. Peter's took place both within the church itself and in the churchyard, which at an original size of 0.96 acres, was a close approximation of the traditional 'God's Acre' (Oakleaf, 1905). The final burial to take place within the church, in 1844, was located in the Preston vault in the nave. However burial in the graveyard continued sporadically for some time after this, with an adjoining

field being converted into a graveyard in 1850, and all burials from St Peter's and St Mary's taking place there after 1855 until the establishment of a new cemetery outside the town in 1867 (see Figure 4.2 for location), meaning all unused plots at St Peter's were abandoned. However, plots already purchased were used until the early 20th century. This newer burial area, along with the chancel of the 14th century church, remains unexcavated.

A total of 464 burials were excavated from within the church, although many would have originally been external to the earlier churches, before the footprint of St Peter's extended. More than three tonnes of disarticulated bone from disturbed graves was uncovered during excavation demonstrating that the number of articulated burials lifted were nowhere near the number that had been buried over St. Peter's 1000 year history. A number of graves, indicated by a grave cut, were lacking any skeletal material, either because it had been previously removed or due to poor soil conditions meaning preservation of the bone had not occurred (Rodwell, 2007a).

Within the church there were an average of 1.2 interments per square meter (m²), compared to an external average of 4.1 interments/m². Towards the south-west of the church, typically the most sought-after spot to be buried (Daniell, 1998; Parker Pearson, 1999), 910 burials were recovered from 136m², giving a density of 6.7 burials/m². Overall babies and small children were very underrepresented within the sample, so burial density was probably higher than estimated. If four individuals per square meter is estimated it results in 18,000 interments, over the 1000 years of activity, meaning 18 individuals were buried at St. Peter's per year. This could be roughly accurate, as burial was also occurring at St. Mary's from the early 12th century. Evidence from combined burial records for both churches c.1566-1580 provides a total of 357 deaths, 24 per annum (Rodwell, 2007a).

The majority of the graves lie in a west-east orientation, with heads at the western end, in relation to the orientation of the church, which is slightly off true west-east. Any deviation from this is normally ascribed to features in the graveyard, such as paths or trees, rather than some other specific reason. Burial depth ranged from 30cm to 170cm, with the majority being 60 – 70

centimetres below modern ground level. Later burials were often interred much deeper destroying the evidence of previous burials. The majority of individuals were supine with the legs extended and the hands either at their sides or over the stomach. Multiple burials, where a child is seen to overlay an adult, have generally been interpreted as a later inclusion to a previous grave. Preservation across the whole site was good, with the oldest graves often being the most well preserved, as they lay below the water table. The worst preservation occurred in the post-medieval graves within the church (Rodwell, 2007a).

The cemetery could broadly be divided in to five distinct phases (Table 4.2; Figure 4.4). Cross phases have also been used, which incorporate the dates from both phases, for example Phase D/E = 950 – 1300 (Waldron, 2007). The sample was limited to phases applicable to this study, which were C, D and E. Individuals from cross phase B/C were also included due to the fact that phase C does not reach the termination of the time period proposed and many of the B/C individuals were on the border between the two meaning they fall very close to, if not into, the study time period.

Table 4.2. The phases of the cemetery at Barton (Rodwell, 2007a:29).

Phase	Year (AD)	Period
A	c.1700 -1855	Georgian and Victorian
B	c.1500 - 1700	Early post-medieval
C	c.1300 – 1500	Late medieval
D	c.1150 – 1300	Early medieval
E	c.950 – 1150	Anglo-Saxon to Norman

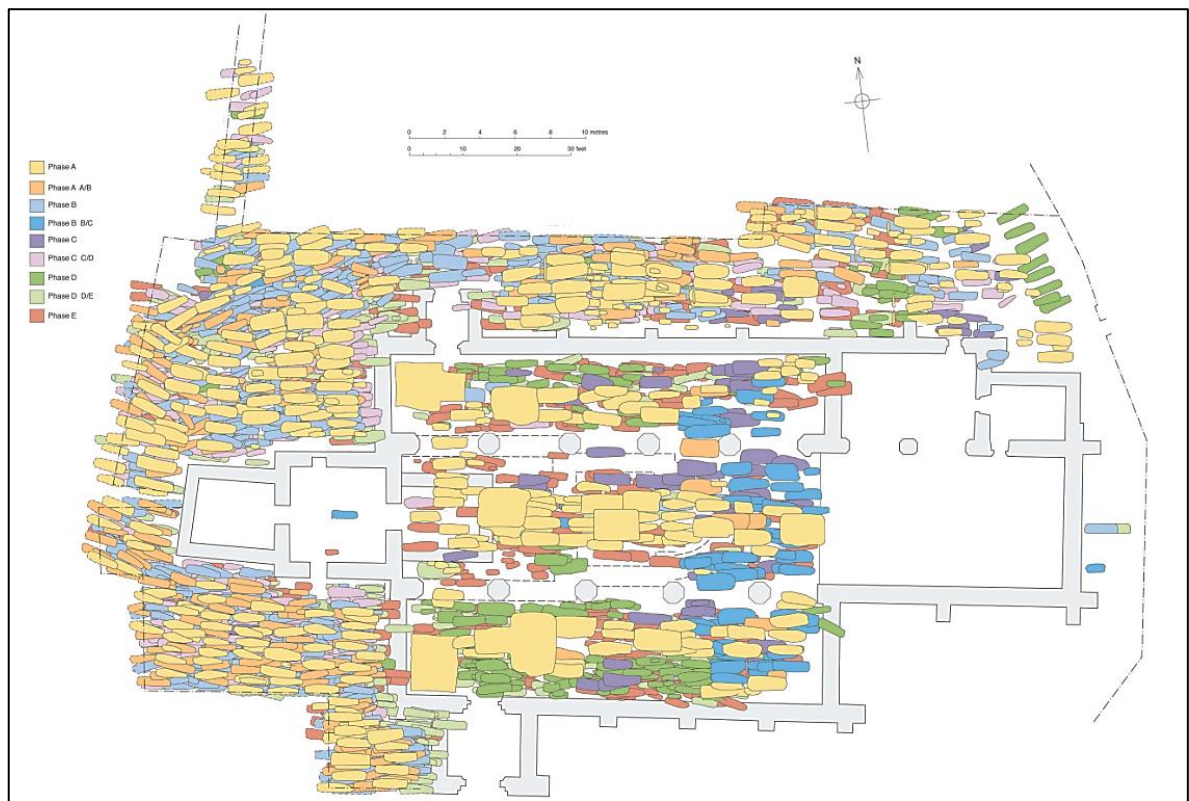


Figure 4.4. Plan of burials excavated in and around St. Peter's, by phase (Rodwell, 2007a:16).

4.2.1.5 The study sample

The Barton-upon-Humber osteological collection consists of 988 adult individuals that were eligible for study by date phase, 292 of which were aged to 35+ years at death, with an additional 696 simply designated as 'adult' (Waldron, 2007). Priority was given to those individuals provided with a numerical age-at-death estimation in the site report, as this indicated these individuals experienced better preservation of the bones used to estimate age. Due to time constraints the entire proposed sample could not be analysed, therefore the sample comprised 309 individuals, consisting of 279 numerically aged individuals and 30 additional individuals aged to 'adult' in the site report. The 30 additional individuals were chosen at random by English Heritage staff from a list compiled by SHM of 'adult' skeletons boxed individually; meaning they exhibited the most complete preservation of the 'adult' cohort.

4.2.2 Fishergate House, York

The Fishergate House individuals are curated by the University of Durham. The assemblage consists of individuals excavated from a graveyard linked to an undiscovered church, situated under the modern building of Fishergate House. The study sample was analysed at Durham University between 6th August and 7th September 2018.

4.2.2.1 A brief history of York

York is the capital of the county of Yorkshire, situated approximately midway between London and Edinburgh. It lies at the confluence of the Rivers Foss and Ouse, a strategic location chosen by the Roman army for its natural defence and supply routes (Raine, 1955; York Museums Trust, 2019). By the 7th century, York had become an Anglican city, whose rulers were impressed by, and used the decayed Roman grandeur to accent their power (Raine, 1955). It is in this period that York became a trading settlement known as *Eofoforwic*, most evidence of which comes from an excavation located at 46-54 Fishergate (a site distinct to that of Fishergate House).

In c.AD 866 the Viking invasion and capture of York, led by King Halfdan and Ivar the Boneless resulted in a name change to Jorvik, and in York becoming a thriving trading centre (York Museums Trust, 2019). It remained in Viking possession until the advent of William the Conqueror, who marched on it in AD 1068. Jorvik opened its gates to the Conqueror without fight, and William I stamped his control on the city and the North by constructing two castles at York. This made York politically powerful, as the only place in the country with two castles outside London. In AD 1212 King John furthered this power by signing a charter allowing the people of York to manage themselves under a Mayor, the first city in the country to be able to do so (York Museums Trust, 2019). The town of medieval York extended beyond the walls for up to one mile and the area between the city boundary and the city walls was filled with common land belonging to the citizens, called strays (Raine, 1955). Medieval York developed into a thriving centre for trade, with freemen providing various crafts to the city, including the production of textiles, foods, buildings, or more specialist craftsmen like leatherworkers, or glaziers. Records show that

most women worked in household service, with a privileged few becoming landladies or specialist seamstresses (York Museums Trust, 2019). This prosperity did not mean however, that York was a sanitary place to live, as demonstrated by a King's order passed in 1332 demanding that its streets be cleaned as "The abominable smell abounding, in the said city more than in any other city of the realm, from dung and manure and other filth and dirt wherewith the streets and lanes are filled and obstructed" (Raine, 1955:xiii).

York's prosperity did not continue unchecked, and by AD 1485 York was experiencing an economic downturn with loss of much of its industry to other less expensive and less regulated towns, such as Halifax and Leeds. This was partly linked to York's stance on the "wrong side" of the Wars of the Roses, and continued over the next few centuries, with uprisings over religion, the Royal succession (both for and against the monarchy) and taxes (York Museums Trust, 2019).

4.2.2.2 Fishergate

The area of Fishergate has seen activity since the Roman period, as the road follows the line of a major Roman thoroughfare, and sometime after the fall of Rome, developed into the trading settlement *Eofofawic* (Spall and Toop, 2005a; York Museums Trust, 2019). In the context of the cemetery under study, Fishergate was a medieval suburb of York, founded around the 10th century and remained a small residential suburb until the later 13th century when the York city walls were built dividing the area in two (Figure 4.5). This division is thought to have led to a significant decline in the area outside the walls, leading to depopulation and the eventual closure of several smaller churches including the church associated with the cemetery uncovered at Fishergate House (Spall and Toop, 2005a).

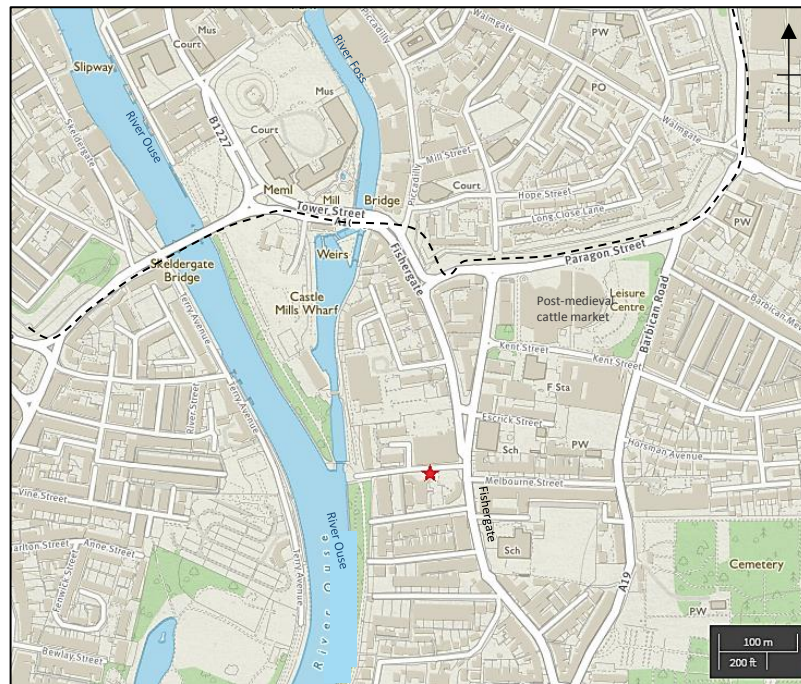


Figure 4.5. Map of the location of Fishergate House (starred), in relation to the road of Fishergate and the two rivers. The medieval walls are marked by the dashed line (Ordnance Survey, 2021).

4.2.2.3 The population of Fishergate

Limited isotopic analysis of the individuals from Fishergate has been undertaken (Burt, 2013, 2015), so additional information from local isotopic data, and faunal remains was incorporated. The faunal remains come from the concurrent excavation that was carried out immediately to the north of Fishergate House, termed 'Blue Bridge Lane' (Rowland, 2005). This lies within the boundaries of the medieval Gilbertine Priory of St. Andrew's and therefore may not be fully representative of the diet consumed by the individuals buried within the cemetery at Fishergate, as the monastic diet was often impressively rich and varied (Rogers and Waldron, 2001). It will however demonstrate the types of contemporaneous food stuffs available in medieval York. Overall, the faunal remains were largely of terrestrial species, including cattle, caprovid and pig, a large variety of bird taxa, and small and large wild mammals (such as rabbits and deer). The high proportions of pig and bird taxa present in the layers representing the 12th and 13th centuries demonstrate the sites high-status. However, the stratigraphically later faunal remains are poorer with a high proportion of scavenger bones, implying an economic downturn (Rowland, 2005). This alteration coincides with the building of the city wall in the late 13th century, and demonstrates

the subsequent stagnation of the area (Spall and Toop, 2005a). Isotopic analysis of the same site (Müldner and Richards, 2007) demonstrates consumption of mainly terrestrial species and freshwater fish from the mid-11th to late 12th centuries, with a significant shift towards consumption of more marine foods in the 13th to 16th centuries (as was seen in many places across England at this time) (Müldner and Richards, 2007). It is likely that the poorer individuals of Fishergate House would have relied heavily on cereal based foods such as course breads or pottage (Dyer, 1998:154). Although isotopic evidence does suggest a higher than expected proportion of high trophic level proteins, such as pork and marine fish (Burt, 2013, 2015).

Occupation at Fishergate during the study time period is difficult to discern, as much of craft and industry evidence appears to terminate in the mid to late 9th century, leaving scant evidence for continued industry in the area (Spall and Toop, 2005a), demonstrating the poverty experienced by the residents. Of the limited evidence available, textile-working and some metal-working appears to have been undertaken in the area during the 10th to 16th centuries (Mortimer, 1995; Spall and Ashby, 2005), although once again their prevalence declines drastically after the 9th century.

It is likely that this lay cemetery served the local poor community directly around Fishergate House, this is due to the nature of the burials (shrouded, opposed to coffined) suggesting their poverty, and the presence of other local cemeteries which would have served the needs of other local areas (Spall and Toop, 2005a). Their poverty is also denoted by the general poor health exhibited by the sample overall (Holst, 2005). The recorded link between St. Helens Church, Fishergate and a hospital of the same name (Raine, 1955) suggests that burial of the infirm may have occurred in this cemetery. However, as a confirmed leprosarium, the distinct lack of leprous individuals at Fishergate suggests that either these individuals have yet to be uncovered, or were buried elsewhere (Holst, 2005).

4.2.2.4 Evidence for a church

Due to the early decline and closure of many smaller churches along Fishergate in the later 13th century, the church associated with the burials excavated at Fishergate House is unknown and its exact location remains undiscovered. However, speculation using historical records and the excavation of other similarly abandoned local churches has provided several possible options, with one being slightly more likely than the others. This is the Church of St. Helen, (not to be confused with that of St. Helen-on-the-Walls), recorded to be located on Fishergate between the 11th and 16th centuries, dates which fit with those produced from the Fishergate House inhumations (Spall and Toop, 2005a). It has been described as “a small, unimportant church [...] assessed for the lowest taxation rate” (Raine, 1955:301).

4.2.2.5 History of excavation

The site of Fishergate House was excavated between 2000 and 2002 in advance of new building work in the area. This was after an initial test pit dug in 1994 by York Archaeological Trust (YAT) revealed the feet of an inhumation in the grounds of Fishergate House, and a 2x2m excavation at nearby Marlborough Grove uncovered three inhumations in 2000 (Spall and Toop, 2005c) (Figure 4.6). Excavation at Fishergate was carried out in tandem with the excavation of ‘Blue Bridge Lane’, which lies across the modern road of Blue Bridge Lane from the site of Fishergate House, however no burials were encountered at this location. A total of c.400 square meters was excavated at Fishergate House, and inhumations were recovered in three main areas, termed Interventions 1, 2 and 4 (Spall and Toop, 2005c).

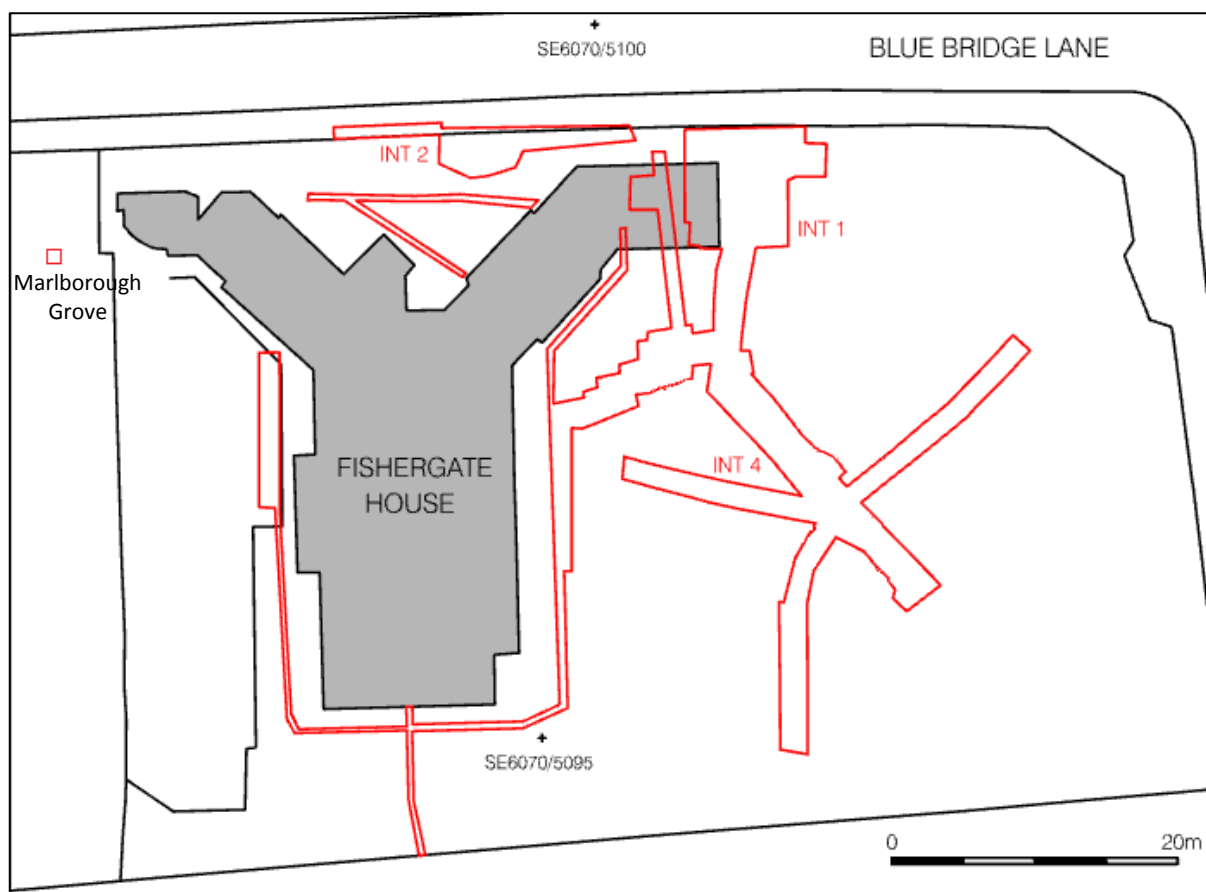


Figure 4.6. Plan of each intervention in relation to Fishergate House and Blue Bridge Lane, also showing the location of the Marlborough Grove trench (Spall and Toop, 2005a).

4.2.2.6 The cemetery

The inhumations were excavated in three areas, Interventions 1, 2 and 4, totalling 250 individuals, although six were not lifted because they were not threatened by the development (Spall and Toop, 2005c) (Table 4.3). Of the 40 individuals excavated from Intervention 2 only eight were adults, with the rest comprising of children of all ages. In accordance with the prevailing medieval trend of burying children to the north of the church building (Craig-Atkins, 2014), an estimated location for the church has been made (Figure 4.7). In Interventions 1 and 4, all individuals were buried together with no clear divides by sex or age (Holst, 2005).

Table 4.3. Interventions and the number of individuals excavated from each (Holst, 2005).

Intervention	No. Individuals
1	158
2	40
4	46

Burial positioning for all individuals was supine and extended, with hands by the pelvis. This positioning indicates burial in shrouds, although little evidence of shroud pins has been recovered (Holst, 2005). Evidence for two coffins was discovered, one wood, indicated by the presence of 46 iron nails in the grave (FGH 81), and the other constructed by stones lining the grave (FGH 244 – not lifted) (Spall and Toop, 2005a). Grave goods were limited, however a few examples exist, including a copper alloy finger ring (FGH 139), a pierced scallop shell indicating pilgrimage (FGH 108), a key (FGH 214) and a probable mortuary cross (FGH 123) (Holst, 2005; Spall and Toop, 2005a). Overall this indicates that parishioners were poor, rather than representing Christian burial practices which did not exclude the possibility of coffin burial (Daniell, 1998). Preservation at the site was good overall, with 53.5% (n=131) of the individuals recorded as exhibiting either excellent, or good preservation (Holst, 2005).

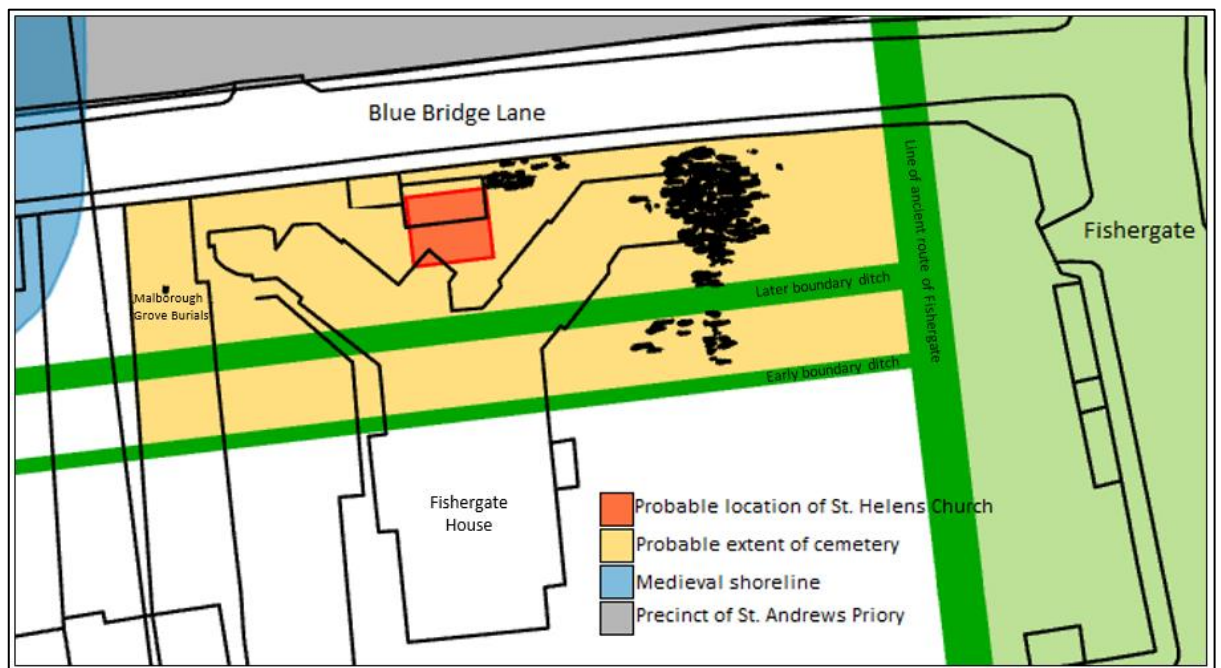


Figure 4.7. Layout of Fishergate House in relation to the cemetery, with probably location of St. Helen's church (Spall and Toop, 2005a).

4.2.2.7 The study sample

The Fishergate osteological collection, consists of 244 individuals. In total 29% (n=70) of the individuals excavated from Fishergate House were aged to over 35 years at death, 13% (n=31)

were aged between 36 and 45, and 16% (n=39) were aged to 46+ years. It was these individuals that were analysed.

4.2.3 St. Helen-on-the-Walls, York

The St. Helen-on-the-Walls skeletons are held by the Yorkshire Museum, at a store in the suburbs of York. The assemblage consists of individuals excavated from within and around the church of St. Helen-on-the-Walls which was located in York city centre. The study sample was analysed at the store, one day a week, between the 5th July and 1st November 2019.

4.2.3.1 The population of St. Helens

The church of St. Helen-on-the-Walls was situated on Aldwark, arguably the oldest street in York, which gets its name from the pre-Viking, old English (E)ald (ge)weorc meaning 'old fortification' (Figure 4.8). This refers to the walls of the Roman fortress which Aldwark crosses into at the northern end (Scott, 2019). The site is situated some 200m east of York Minster, and roughly 1.3km north of the site of Fishergate House.

No isotopic analysis has been conducted on the individuals from St. Helens, diet therefore has to be inferred. It is likely that a wider range of foods were available due to the location of the site in the centre of York with produce being brought in from the surrounding countryside (Woolgar et al., 2006). However, this parish, particularly towards the end of the study time period, was the poorest recorded in central York (Palliser, 1980:8), and so the inhabitants may not have had a dissimilar diet to those at Fishergate, of mainly coarse bread and pottage, supplemented by pork and marine fish (Burt, 2013; Dyer, 1998).

Living conditions in York, particularly in the poorer areas were squalid (Addyman, 1989; Raine, 1955), and the parish of St. Helens was no different. An attempt to redevelop the area resulted in the building of cottages in c.1330, however these rapidly dilapidated, and by the 15th century sex workers were recorded to be living in them (Rees Jones, 1988). Its proximity to the polluted and heavily industrialised neighbouring parish of Bedern (with a documented foundry, tannery,

brewery and apothecary) (Lewis et al., 1995), means St. Helens was a poor, dirty and polluted place to live.

The individuals buried within the cemetery of St. Helen-on-the-Walls represent the population of Aldwark, however this was likely to constitute a large variety of individuals, as migration into cities from rural areas was common (Walter and DeWitte, 2017). The effect of migration is seen at St. Helens through the large proportion of adult burials, many of which would have succumbed rapidly to new pathogens in the city. The lack of younger females may be due to late marriage, and therefore childbirth, as a result of immigration (Grauer and Roberts, 1996; Holst, 2005).



Figure 4.8. The parish of St. Helen-on-the-Walls, York (Palliser, 1980:3).

4.2.3.2 History of excavation

St. Helen-on the-Walls, also known as St. Helen in Werkdyke, or St. Helen-in-Aldwark (Palliser, 1980; Scott, 2019), was the first medieval cemetery to be excavated in York. The cemetery lies to

the east of the Roman legionary fortress, it is bounded by the medieval city walls to the north-east and Aldwark street to the south-west (Figure 4.9) (Dawes and Magilton, 1980).

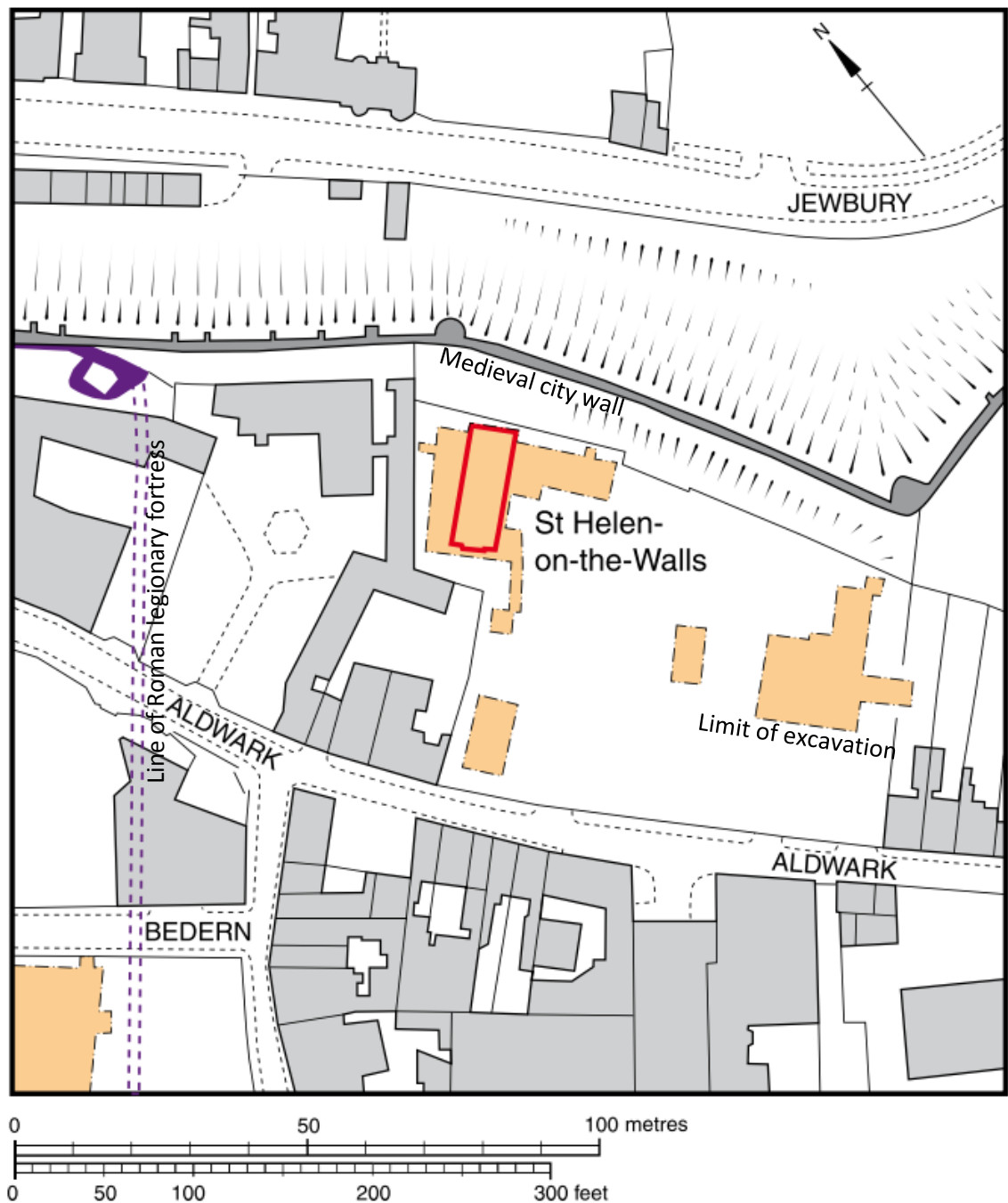


Figure 4.9. The church of St. Helen, excavated areas are shown orange (Dawes and Magilton, 1980:4).

In 1972 York Excavation Group dug exploratory trial trenches in the north-east corner of a newly exposed area created by the demolition of the Victorian Ebor brewery, which had been standing since 1830. These unexpectedly revealed substantial medieval wall footings, as well as several inhumations aligned to the structure, indicating the presence of a cemetery that would require

further analysis. The excavation occurred in two parts, initially in 1973-1974, and then again in 1976 when further development threatened the area. Excavation was carried out with twofold aims, firstly to determine the date and ground layout of the uncovered church, and secondly to uncover and lift as many skeletons as possible to provide a good sample of York's medieval population for osteological study. This resulted in St. Helens being the largest anthropological study of its kind in Britain in 1980 (Dawes and Magilton, 1980).

4.2.3.3 The cemetery

A minimum number of 1041 individuals (MNI) were excavated from the cemetery at St. Helen-on-the-Walls, with burials dating from AD 950 to 1550, and a single roman era burial pre-dating the advent of the church (Dawes and Magilton, 1980). The cemetery was excavated in five sections as laid out in Figure 4.10. Areas A and C were generally homogenous with a roughly equal mix of sexes and ages. Area B had a higher proportion of females and juveniles. Area D contained only four individuals in total, and none over the estimated age of 45 years. Limited burial here was possibly due to some indiscernible restriction in burial at this location, as it is noted the church never extended considerably in this direction either. Area E lay within the confines of the church, although as the church was significantly extended over its usage, a proportion of these burials would have been originally outside the church. Area E not only contained the highest number of older individuals, but also the lowest proportion of juveniles when compared with the rest of the site (Table 4.4) (Dawes and Magilton, 1980).

The south and north areas of the churchyard appear to have been used congruently and without the prejudice of superstition preventing burials from the north side of the church, which was normally reserved for unbaptised infants and suicides, unless severe over-crowding occurred (Dawes and Magilton, 1980:10). Over-crowding did occur at St. Helens, evidenced through the disturbance of graves prior to complete decomposition, from articulated remains in the backfill of other graves. However, this does not appear to have affected burial location, and it also does not appear that any attempt to overcome this problem by bringing in extra material and levelling the

area was attempted. Infants and neonates are poorly represented in the sample, this could be due to preservation, as infants were buried less deeply than adults, however it is also possible that these individuals were buried in a separate location, previously destroyed, or not yet excavated (Dawes and Magilton, 1980:11). Interestingly, in comparison, a high proportion of the adults excavated from St. Helen-on-the-Walls are older individuals (34%) (Dawes and Magilton, 1980:11).

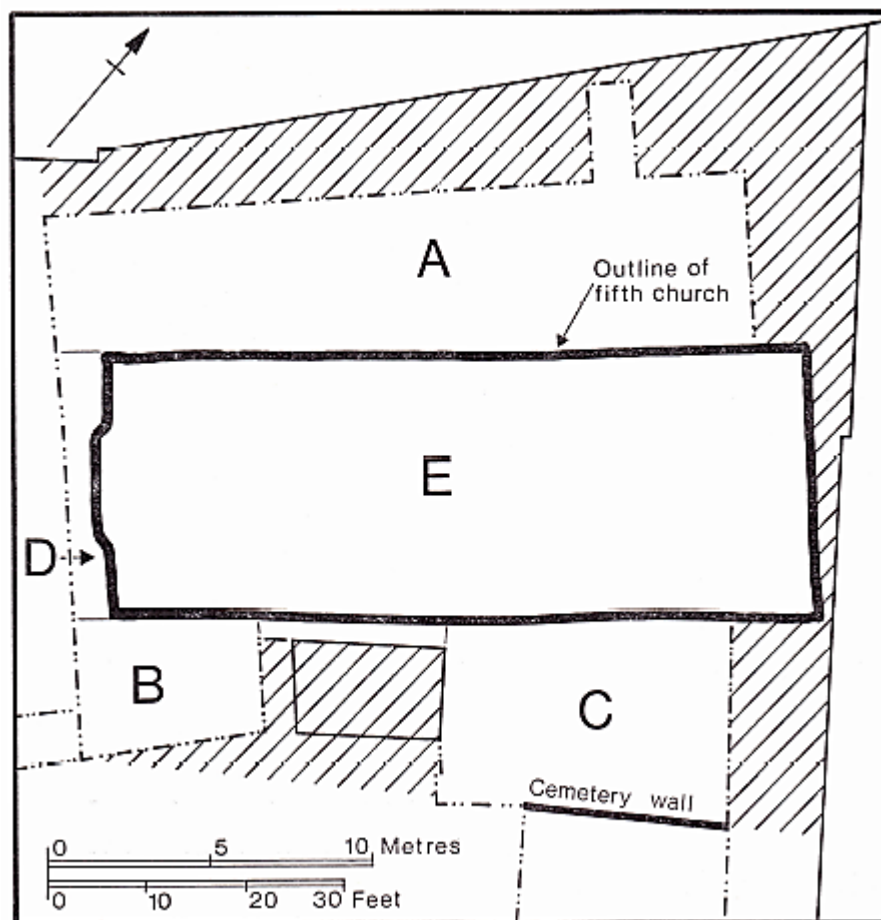


Figure 4.10. Excavated Areas A – E. The hatched area demonstrates the probable extent of the unexcavated graveyard (Dawes and Magilton, 1980:8).

Table 4.4. Number of individuals excavated from each area, and the percentage of those estimated to be over 45 years at death (Dawes, 1980:33; Dawes and Magilton, 1980:11).

Area	No. Individuals (n)	Adults 45+ years at death	
		% of all burials	% of aged adults
A	453	7.9	17.8
B	73	12.3	31.0
C	223	6.3	15.9
D	4	0.0	0.0
E	288	16.7	33.6

Four temporal groups were highlighted during excavation, these are summarised in Table 4.5 (Dawes, 1980:37). Groups 1 and 2 contained mostly males, whereas groups 3 and 4 contained mostly females. Group 3 exhibited the worst preservation due to post-depositional disturbances (Dawes, 1980:37–43).

Table 4.5. Temporal groupings, their description and the number of individuals excavated from each, as well as the percentage of those estimated to be over 45 years at death (Dawes, 1980:37–41). (NB. The percentages for aged adults in Groups 2 and 4 are incorrect in the site report, the correct percentages have been presented here).

Group	Description	Date (AD)	No. Individuals (n)	Adults 45+ years at death	
				% of all burials	% of aged adults
1	Later than the 2 nd Church	12 th century	59	27.1	47.1
2	Later than the 3 rd Church	14 th century	29	24.1	43.8
3	Later than the 4 th Church	15 th century	24	8.3	22.2
4	Earlier than the 4 th Church	Pre-15 th century	34	23.5	38.1

Overall it is estimated that excavations uncovered roughly two thirds of the original area of the cemetery (Dawes and Magilton, 1980). Therefore, if the unexcavated or previously destroyed parts of the cemetery were used to the same degree as the excavated parts, the original number of individuals buried in the cemetery could have been between 1500 and 2000, indicating three to four burials a year over a 600 year period (Dawes, 1980:37).

Grave alignment was almost entirely west – east (head at the western end), with a tendency to lie burials parallel with the nearest convenient straight line, i.e. the church or cemetery wall, meaning a general ‘west- east’ alignment was preserved. Individuals were interred supine with hands either over the pelvis, or arms by the sides. Limited evidence for coffins was found, but nails in graves indicated their presence, without indicating prevalence (Dawes, 1980).

Grave goods were typically rare, with bronze shroud pins and green stains indicating their previous presence, common to both adults and children in the cemetery. It must be noted that this does not necessarily mean these individuals were not also interred in a coffin. One individual

to be included in this study (SHOW 5539) had a fragment of a gold ring in its fill. A single charcoal burial was uncovered but was not included in this study as only the ankles and feet remained (Dawes and Magilton, 1980). Overall the cemetery exhibited much disturbed and incomplete material, with some of the bone collections in graves large enough to signify charnel pits (Dawes, 1980).

4.2.3.4 The study sample

The original study sample encompassed some 295 individuals, however due to co-mingling of the remains from multiple burials, and time constraints for analysis, a primary sample of 120 individuals was highlighted. These individuals, all from single burials, were aged numerically to over 35 years at age of death, or were labelled as middle aged or above, and finally each individual had some part of the pelvis present for study, according to the site report (Dawes and Magilton, 1980). A secondary sample (single burials, aged to adult, elements available not considered) of 70 individuals was held in reserve if time allowed. A total of 130 individuals were analysed, all 120 from the primary sample, and 10 from the secondary sample.

4.2.4 Wharram Percy, Yorkshire

The Wharram Percy skeletons are held by Historic England at Fort Cumberland, Portsmouth. The assemblage consists of individuals excavated from the church and graveyard of St Martin's in the deserted medieval village of Wharram Percy, North Yorks. The study sample was analysed at Fort Cumberland between the 17th September and 19th October 2018.

4.2.4.1 History of the area

Wharram Percy is a deserted village on the north-west edge of the Yorkshire Wolds, some 18 miles (29km) north-east of York (Wrathmell, 2012) (Figure 4.11). The village lies on a chalk plateau overlooking the largest valley in a series along the northern scarp of the wolds. The church and churchyard are situated below the village on a terrace, roughly 13-16m beneath the lip of the plateau and 4-7m above the valley floor (Harding and Wrathmell, 2007).

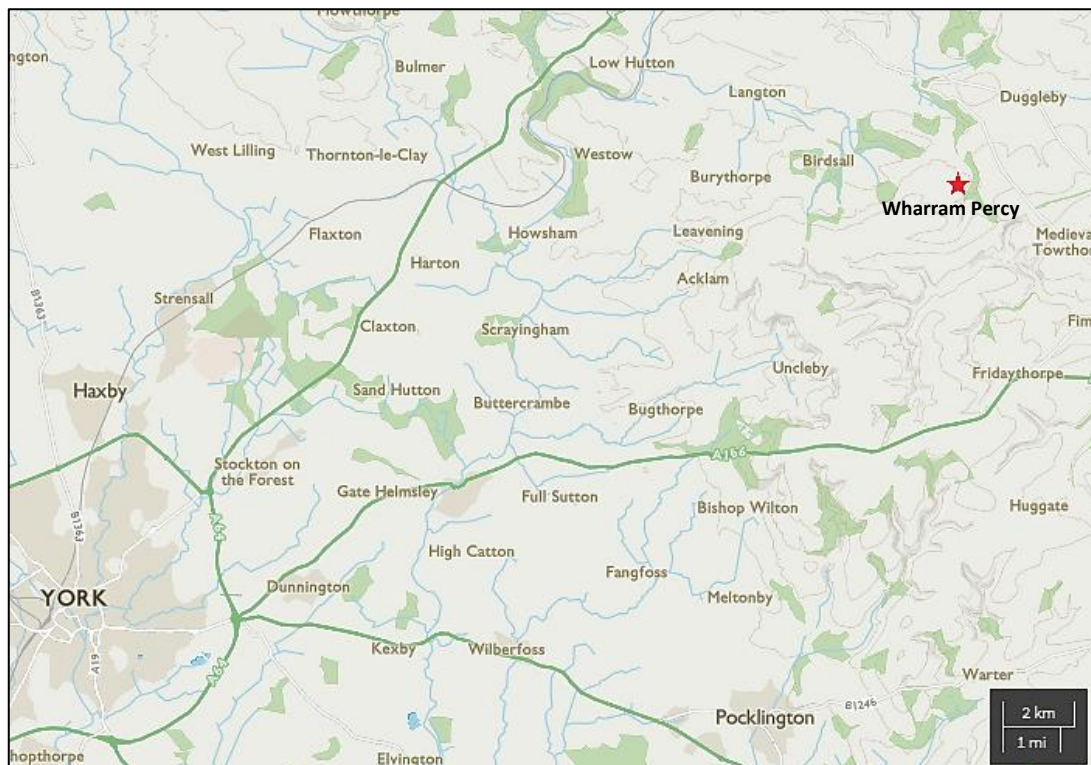


Figure 4.11. Map of the location of Wharram Percy in relation to York (Ordnance Survey, 2021).

The area has been inhabited since the Iron Age, with evidence for late Iron Age and Romano-British farming (termed ladder settlements), as well as Middle Saxon and Anglo-Scandinavian settlement in the area (Atha and Roskams, 2012; Oswald, 2021). The first permanent settlement was established between AD 850 and 950, and with it the development of the first church, constructed from wood. Wharram Percy continued thenceforth to be a small rural village populated by tenant farmers and smallholders, under the local landowner, until the middle of the 16th century. The de-population of Wharram Percy appears to have been a gradual, natural occurrence initially until the 16th century when many of the tenant farmers were evicted, in favour of turning their land from arable land into pasture for sheep farming, in accordance with the increasing price and desirability of wool. This led to the final collapse of village life, which occurred in 1527 (Harding and Wrathmell, 2007; Oswald, 2021). Several isolated farmsteads and cottages remained in use in Wharram Percy until 1976, with the final interment occurring at the church in 1906, but the village itself was deserted (Harding and Wrathmell, 2007). Wharram Percy is arguably the most extensively researched deserted village in the UK, making it ideal for demographic population study. Details and results from the 40 years of excavations that occurred

on site can be found in the series of publications, *Wharram I – XIII* (Andrews and Milne, 1979; Bell and Beresford, 1987; Dyer, 2012b; Harding and Marlow-Mann, 2010; Hayfield, 1987; Mays et al., 2007; Milne and Richards, 1992; Rahtz et al., 1986; Rahtz and Watts, 1983, 2004; Stamper and Croft, 2000; Treen and Atkin, 2005; Wrathmell, 1989).

4.2.4.2 The population of Wharram Percy

Wharram Percy's population was primarily focused on agriculture, with some 37 tofts and two manors constituting the village (Oswald, 2004:49). This is reflected in the diet of the individuals from Wharram; consumption of primarily terrestrial foods was evidenced by both the isotopic data (Fuller et al., 2003), and the faunal remains (Richardson, 2007), with minimal input from marine resources. The distinct lack of marine resources in the diet after the 13th century, when a shift towards marine consumption has been noted across the country (Müldner and Richards, 2007), could indicate both Wharram's isolated nature, and its relative poverty. The individuals buried at Wharram Percy constitute not only those who lived and worked in the village; but from the 12th century, the church served four other local rural villages of Burdale, Raisthorpe, Towthorpe and Thixendale (Harding and Marlow-Mann, 2007; Mays, 2007).

4.2.4.3 History of excavation

Wharram Percy was 'discovered' by historian Maurice Beresford in 1948, and it was he who promoted and helmed the project for many of the following seasons (Glasscock, 2007). The first excavation season occurred at the site a year later in 1949, with digs occurring yearly after this until 1990 (Oswald, 2021). Excavation of the church and graveyard at Wharram Percy took place between 1962 and 1984, with the site being divided into seven main areas, many of which were excavated over several years in different trenches. Each main area, excavated around and in the church was labelled according to its location in relation to the church (Table 4.6; Figure 4.12). Inhumations uncovered in these areas were labelled with the area code as a prefix (Harding, 2007a, 2007b; Harding and Marlow-Mann, 2007). The area between the south aisle and the southern churchyard (both termed SA), remains unexcavated, and contains headstones dated to

the late 18th century onwards (Oswald, 2004:35). Aside from the church nave (CN), all the excavated areas were external to the church.

Table 4.6. Area codes and descriptions for each phase of the cemetery excavation, with excavation dates and the number of inhumations recovered from each area (Harding, 2007a, 2007b; Harding and Marlow-Mann, 2007; Hurst, 1976; Mays, 2007).

Area code	Area	Date excavated	Number inhumations (n)
CN	Church nave	1962-1974	39
EE	East end	1962-1979	98
G	Site 26	1972-1978	117
NA	Northern churchyard	1962-1973	217
SA	South aisle & southern churchyard	1967-1984	32
V	Vestry	1973	52
WCO	West end	1972	132

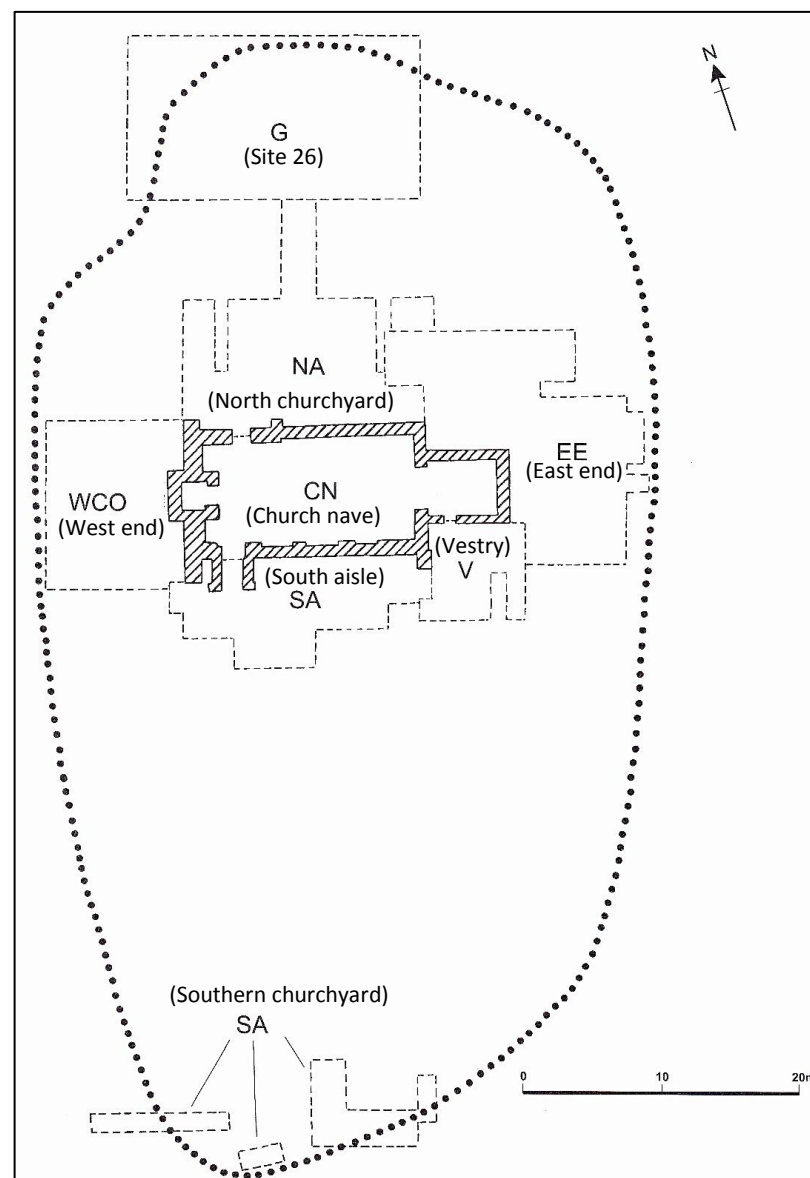


Figure 4.12. Plan of the excavation areas within the church and churchyard at Wharram Percy, the dotted line demonstrates the likely extent of the burials (Mays, 2007:78).

4.2.4.4 The cemetery

A total of 687 articulated burials were excavated from St. Martin's Church and churchyard. These individuals have been divided into four date phases (Table 4.7). Of the total sample, roughly half (n=326) could be assigned to a phase according to radiocarbon dates, coffin fittings, and stratigraphy (Mays, 2007:79). A total of 360 individuals have been aged as adult (over 18 years of age) in the site report and when broken down into age categories over 40% of the total population are over 30 years at age of death, with roughly 22% of that number over 50 years (Mays, 2007:88). Usage estimates for the whole of the churchyard spans between 5000 and 10,000 interments in total over the almost 1000 year period it was in use (Mays, 2007).

Table 4.7. The phases, approximate dates and description of the time periods for the inhumations at Wharram Percy (Mays, 2007:77).

Phase	Approx. Date (AD)	Description
1	950 – 1066	Late Anglo-Saxon
2	1066 – 1348	Earlier medieval
3	1348 – 1540	Later medieval
4	1540 – 1850	Post-medieval

Of the 360 adult inhumations 76% (n=273) were recorded as exhibiting 'good' surface preservation to the skeleton. Although, as with many medieval cemeteries, overcrowding and undercutting was an issue, and this affected the completeness of the recovered adults with 43% (n=156) possessing less than 60% of the skeleton (Mays, 2007:79–80).

Evidence of coffins was only present for a total of 34 individuals, 22 of which were adult burials, however no further association between age or sex was found. There was also no notable relationship between sex and burial location, either within the seven excavated areas, or overall. However when age and burial location are compared, results show that more adults than juveniles were interred within the nave of the church (CN), and juveniles, a high proportion of which were under one year at age of death, seem to have been predominantly buried within nine meters (30ft) of the north wall of the church (NA), which is the traditional location for unbaptised infants (Craig-Atkins, 2014; Mays, 2007).

4.2.4.5 The study sample

Of the sample of 360 adults, 191 individuals were available and eligible for study, these individuals were selected because they fell into the appropriate time period (phases 1-3) and because they were all aged to either 35+ years at death (n=150), or simply to 'adult' (n=41).

4.3 Methods

The methods used within this study are outlined below; each process has been presented according to how it was carried out. Each ageing method includes a written description, scoring systems and diagrammatic or photographic representations. The diagnostic criteria for each pathology is described, and photographic examples are presented. This ensures that the methods utilised are understandable, and repeatable, to independent observers.

4.3.1 Sample selection

In total, 700 individuals were observed from the four sites (as set out in section 4.2), these individuals were all from the correct time period and identified as being either over 35+ years at death, or 'adult' in the site reports (Table 4.8). Individuals as young as 35 were included in the study sample to ensure changes associated with the ageing process were accurately identified as they developed.

Table 4.8. Number of individuals observed from each site.

Site	Total observed (n)
Barton-upon-Humber	309
Fishergate House	70
St. Helen-on-the-Walls	130
Wharram Percy	191
TOTAL	700

For inclusion in the final study sample each individual was required to have at least one element available for analysis for both the new and standard ageing techniques, including either the pubic symphysis or auricular surface. This ensured consistency in age estimation and categorisation. The left side of the skeleton was used where possible but substituted by the right side, when the left

was fragmentary or absent. Comparison between the left and right side was carried out when the left was abnormal, pathological or exhibited poor surface preservation.

4.3.1.1 Preservation

Preservation is one factor which affects the worth of an ageing method. If the element used by the method is frequently lost or damaged within the archaeological record, the methods worth is limited. The number of each element available for use in this study was calculated by site and overall to provide comparable preservation data.

4.3.2 Sex estimation

Biological sex was established using standard techniques for the skull outlined by Buikstra and Ubelaker (1994), for example protrusion and rugosity of the nuchal crest, angle and size of the mastoid process, thickness of the supraorbital margin, prominence of the glabella, projection of the mental eminence and breadth and flexure of the ascending mandibular ramus. For the pelvis features included, the overall size and shape of the pelvis, the angle of the sciatic notch, the ventral arc, the subpubic concavity, the subpubic angle and the robustness of the ischiopubic ramus (Krogman, 1962; Meindl et al., 1985; Phenice, 1969).

Precedence was given to the pelvic features over the skull, due to the relative variation within cranial morphology when compared to the pelvis (Walrath et al., 2004:132; White and Folkens, 2005:386). Meindl et al. (1985:81) note that sex estimation using the skull for older females, provided more ambiguous results, these individuals had an average age of 48.1 ± 11.3 years at death. Necessitating that caution should be used when sexing older individuals using the skull independently. Furthermore, it has been suggested that women undergo a 'masculinisation' of cranial features post menopause (Meindl et al., 1985; Walker, 1995:36; White and Folkens, 2005), which causes errors in sex estimation when assessing these traits in older, post-menopausal women. Therefore, sex estimation using the skull was carried out, however precedence was given to sex estimation using the pelvis on all older individuals. If the elements for sexing on the pelvis were not available, the skull was used in isolation with consideration of the alterations with age.

The pelvis does not undergo post-menopausal related changes (Meindl et al., 1985a:81).

Comparison of the morphological traits of the skull between older and younger females have been drawn in section 5.5.2.1 to assess the impact of cranial masculinisation.

When either total or partial edentulism occurred in the mandibular incisors and canines, sexing using the mental eminence was not attempted. Maxillary loss of dentition does not affect the sexually dimorphic traits, and therefore accuracy, of the cranium to be recorded in this study (Small et al., 2016).

4.3.3 Age estimation

Individuals were aged using standard methods for the ribs and pelvis (Brooks and Suchey, 1990; Buckberry and Chamberlain, 2002; İşcan et al., 1984a; 1984b; 1985; Lovejoy et al., 1985) and additional methods based on the dentition, clavicle, cervical vertebrae, iliac crest and ischium (Brothwell, 1981; Falys, 2012; 2014; Falys and Prangle, 2015). Individuals were placed in four main age categories for comparison: 35-45 years, 46-59 years, 60-69 years and 70+ years. An ability level was subsequently assessed for each individual using the Skeletal Frailty Index (Marklein et al., 2016) based upon recorded pathology.

4.3.3.1 Dental ageing

Dental ageing was carried out using the technique developed by Brothwell (1981) using wear on the molars to estimate age-at-death. Each molar is scored from 1 to 7, depending on the amount of wear present on the tooth (Figure 4.13). As Figure 4.13(A) shows the first molar (M1) should exhibit considerably more wear than the second (M2), which in turn should be substantially more worn than the third (M3). The scoring system and resultant age ranges are the same for both sexes up to 45+ years.

Age period (years)	About 17–25			25–35			33–45			About 45+		
Molar number	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2	M3
Wear pattern			No exposed dentine							More advanced wear		
Or												
Or										Unequal wear		
A												

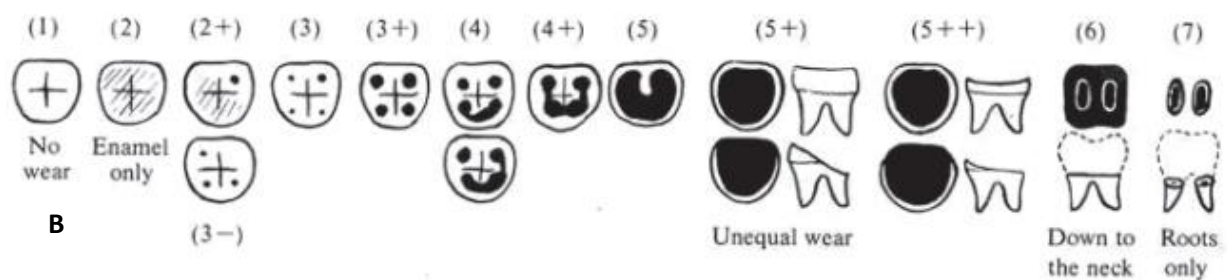


Figure 4.13. Dental wear stages. (A) – the ages associated with the amount dental wear on each tooth, with the first molar more worn than the second, which is in turn more worn than the third; (B) – the stages of wear for each molar from '1 - no wear' to '7 - root' (Brothwell, 1981).

4.3.3.2 Dens facet of the atlas

Assessment of the degradation of the dens facet of the atlas is a technique developed by Falys (2012) from Sager (1969). This method is based upon assessing the level of degenerative changes on the dens facet, with a descriptive scoring system for porosity, osteophyte formation and the presence of eburnation (Table 4.9). A pictorial image of the degeneration is also provided (Figure 4.14). The method allows a maximum mean age of 75 years to be determined for both sexes using the 95% confidence interval (Table 4.10). This was used in preference to the age phases, due to the need to complete direct comparisons between the methods, particularly because 95% confidence intervals are mathematically calculated. Whereas the age phases are subjective and do not present the accuracy needed in this study, both in terms of their open-ended estimations, as well as the considerable overlap between the age estimates. This makes them more suited to indicating life stage, i.e. mature adult, than numerical age-at-death estimation.

Table 4.9. Scoring criteria for the dens facet of the atlas (Falys, 2012 p.65).

Score	Porosity	Osteophytes	Eburnation
0	Element not present	Element not present	Element not present
1	No porosity	No osteophytes	No eburnation
2	MICRO porosity	Slight osteophytes	Eburnation
3	MACRO porosity	Severe osteophytes	-
4	Joint fusion	Joint fusion	-

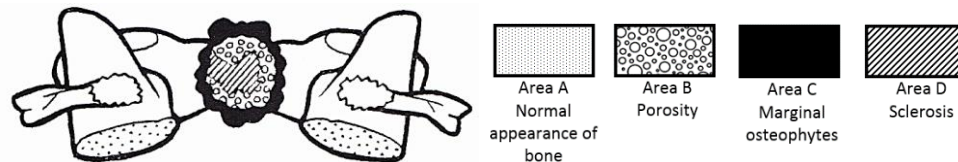


Figure 4.14. Degenerative changes on the dens facet of the atlas (Falys, 2012:357).

Table 4.10. Composite scores for the dens facet of the atlas, with 95% confidence interval, mean, standard deviation and age phases. Scores are combined for both sexes (Falys, 2012:99).

Composite score	95% Confidence interval (years)	Mean (years)	Standard deviation	Age estimate (age phase)
3	51 – 57	54.4	11.1	<70 years
4 - 5	62 – 65	63.9	12.8	45+ years
6 - 8	73 – 76	75.1	9.2	55+ years

4.3.3.3 Dens process of the axis

Assessment of the degradation of the dens process of the axis is a technique developed by Falys (2012), based upon the progression of degenerative changes to the dens process, as outlined by Sager (1969). This technique focuses upon porosity, osteophyte formation and the presence of eburnation exhibited by each feature (Table 4.11). A pictorial image of the degeneration is also provided (Figure 4.15). A maximum mean age of 74 years can be determined for males and 75 years for females (Table 4.12). Once again, the 95% confidence intervals were used in preference to the age phases.

Table 4.11. Scoring criteria for the dens process of the axis (Falys, 2012:65).

Score	Porosity	Osteophytes	Eburnation
0	Element not present	Element not present	Element not present
1	No porosity	No osteophytes	No eburnation
2	MICRO porosity	Slight osteophytes	Eburnation
3	MACRO porosity	Severe osteophytes	-
4	Joint fusion	Joint fusion	-

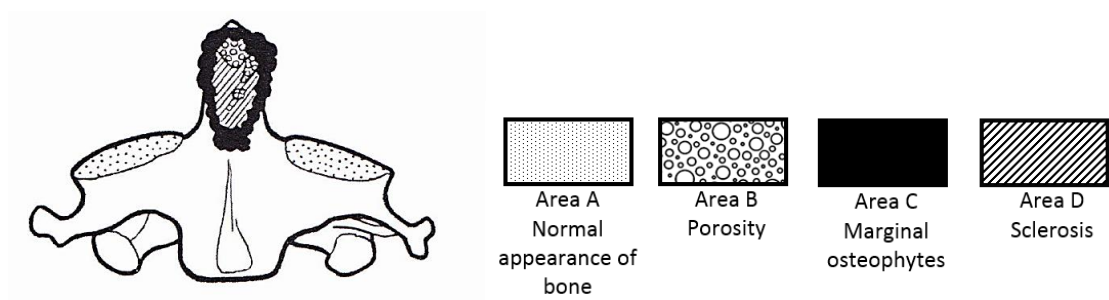


Figure 4.15. Degenerative changes on the dens process of the axis (Falys, 2012:357).

Table 4.12. Composite score for males and females for the dens process of the axis, with 95% confidence interval, mean, standard deviation and age phases. Scores are combined for both sexes (Falys, 2012:109).

Composite Score	95% Confidence interval (years)	Mean (years)	Standard deviation	Age Estimate (age phase)
Males				
3	51 – 59	55.1	10.1	<70 years
4 - 5	61 – 66	63.6	12.7	<80 years
6 - 8	72 – 76	74.5	9.4	55+ years
Females				
3 - 4	58 – 63	60.8	13.8	<80 years
5	66 – 73	70.0	11.8	50 - 80 years
6 - 8	72 – 77	75.1	10.3	65+ years

4.3.3.4 Third cervical vertebrae

Assessment of the degradation on the third cervical vertebrae is a technique developed by Falys (2012), based upon the degenerative changes of the superior and inferior aspect of the vertebral body, and the superior and inferior aspects of the articular facets, as outlined by Sager (1969). Ageing using the third cervical vertebra (C3) assesses the porosity, osteophyte formation and any eburnation exhibited by each element (Table 4.13) and allows for a maximum mean age of up to 77 years for males and 78 years for females (Table 4.14). A pictorial image of the degeneration is also provided (Figure 4.16). This technique may be applied to C4 through 7 if the C3 is absent, as the assessment criteria and resultant age ranges are the same (Falys, 2012).

Table 4.13. Scoring criteria for the third cervical vertebrae. Also applicable for the fourth to seventh cervical vertebrae (Falys, 2012:65).

Score	Porosity	Osteophytes	Eburnation
0	Element not present	Element not present	Element not present
1	No porosity	No osteophytes	No eburnation
2	MICRO porosity	Slight osteophytes	Eburnation
3	MACRO porosity	Severe osteophytes	-
4	Joint fusion	Joint fusion	-

Table 4.14. Composite scores for males and females for the third cervical vertebrae, with the 95% confidence interval and mean. Also applicable for the fourth to the seventh cervical vertebrae (Falys, 2012:147).

Composite Score	95% Confidence interval (years)	Mean (years)
Males		
7	46 – 55	50.6
8 – 10	55 – 59	57.4
11 – 17	70 – 73	71.8
18 – 22	74 – 80	77.6
Females		
7	44 – 56	50.3
8 – 10	57 – 62	59.7
11 – 16	71 – 75	73.1
17 – 22	75 – 81	78.1

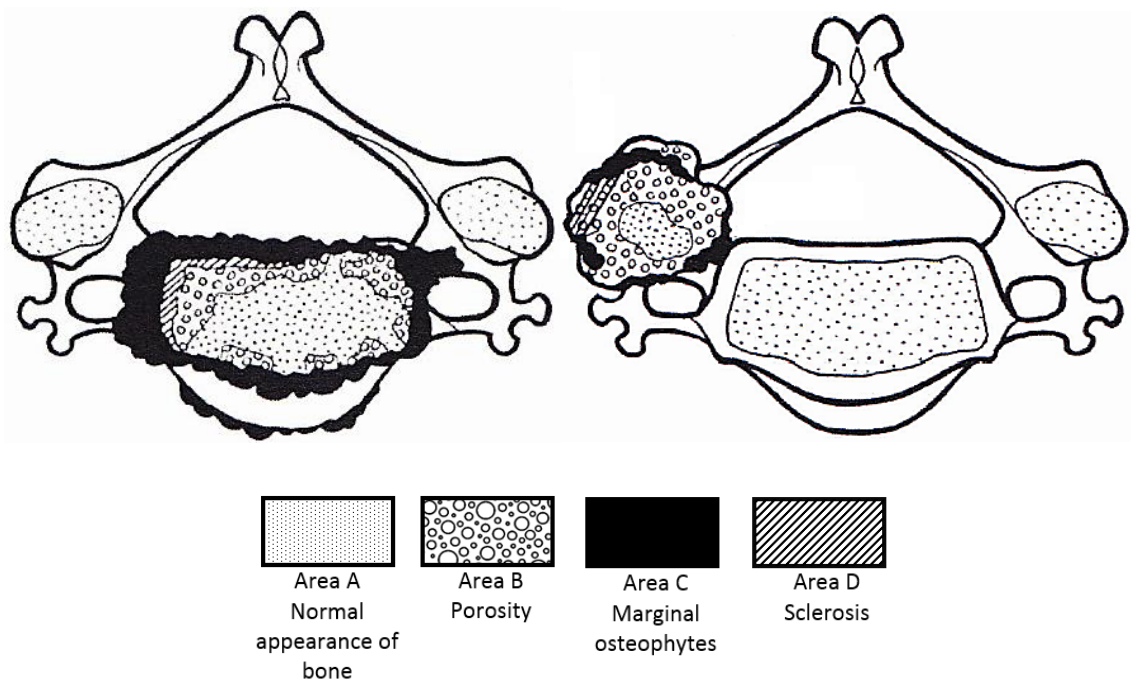


Figure 4.16. Degenerative changes to the body and facets of third through seventh cervical vertebra (Falys, 2012: 361-364).

4.3.3.5 Sternal end of the clavicle

Age estimation based on the sternal end of the clavicle is divided into three distinct characteristics: topography, porosity and osteophyte formation. Topography and porosity incorporate six stages of degeneration, scored from one to six, whilst osteophyte formation has four stages, scored from one to four (Table 4.15; Figure 4.17). The scores for each characteristic are then combined to produce a composite score which is used to estimate age. A maximum male mean age of 83 years and a maximum female mean age of 87 years are achievable (Falys and Prangle, 2015:211-212) (Table 4.16). In this technique the sexes have independent age ranges, however the composite score is gained in the same way. Photographic stages were provided by Falys and Prangle (2015:206-208) for each characteristic, and Falys (2012) for overall degenerative changes.

Table 4.15. Characteristic stages for advancing age based on topography, porosity and osteophyte formation for the sternal end of the clavicle (Falys and Prangle, 2015:205).

Score	Topography	Porosity	Osteophyte formation
0	element not present	element not present	element not present
1	Smooth (flat surface)	no porosity	None
2	slight granulation (flat surface)	MICROporosity (< 50% surface)	minimal – slight
3	coarse granulation (flat surface)	MICROporosity (> 50% surface)	Moderate
4	nodule formation (irregular surface)	MACROporosity (< 50% surface)	Severe
5	billowing (highly irregular surface)	MACROporosity (> 50% surface)	-
6	complete surface breakdown, possible eburnation	complete surface breakdown (very large porosities)	-

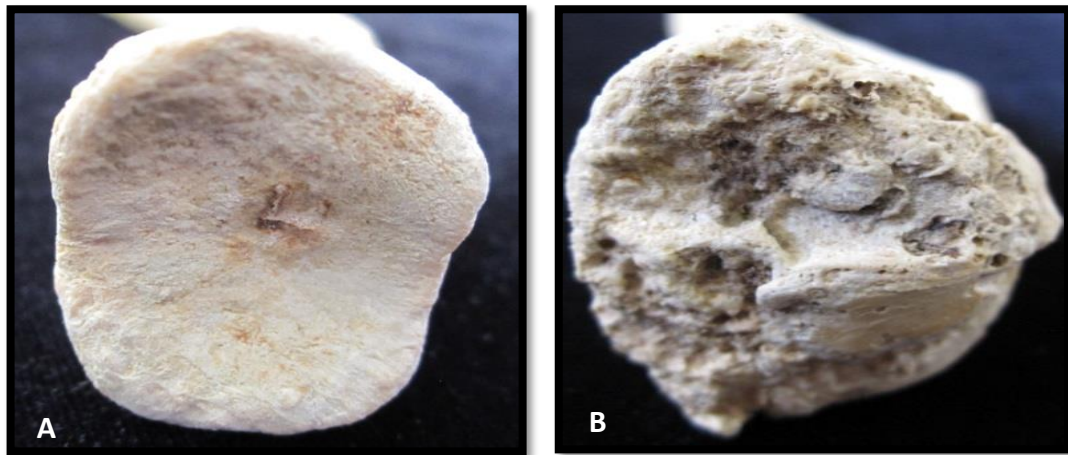


Figure 4.17. An example of the photographic stages provided by Falys (2012) demonstrating the combination of degenerative changes. A = Stage 1, smooth flat surface, fine granulation, no porosity or osteophytes; B = Stage 6, complete surface breakdown. Highly irregular topography, frequent macro-porosity, and osteophyte formation.

Table 4.16. Age range estimates for the sternal end of the clavicle based on the composite score of the characteristics from Table 4.15 including the age estimate range and mean age (Falys and Prangle, 2015:211-212).

Composite score	Mean (years)	95% confidence interval (years)
Male		
3 – 5	48.8	36 – 61
6 – 7	55.2	37 – 73
8 – 9	65.7	47 – 85
10 – 12	74.9	58 – 91
13 – 16	83.1	70 – 97
Female		
3 – 5	49.3	35 – 63
6 – 8	64.5	41 – 88
9 – 10	72.0	53 – 91
11 – 12	79.3	63 – 96
13 – 16	87.0	85 – 89

4.3.3.6 Costal face and tubercle facet of the first rib

Age estimation based on the first rib was carried out according to DiGangi et al. (2009), who tested and redefined the technique from Kunos et al. (1999). The technique is based on the geometric shape of the costal face of the sternal end of the rib and the surface texture of the tubercle facet at the proximal end of the first rib. Both elements are scored according to their shape, porosity and osteophyte formation. The tubercle facet is scored from 1 to 4 using descriptive definitions (Table 4.17), and photographic stages (Figure 4.18) supplied by DiGangi et

al. (2009). With the costal face scored from 1 to 5 also by descriptions and photographic stages (Table 4.17; Figure 4.19). The score from each is then aligned to provide the estimated age range and 'best point' (Table 4.18). The best point refers to the age which has the highest posterior density i.e. likelihood given the prior parameters. The age ranges are from the lower and upper extents of the 50% highest posterior density regions, and are used as suggested in text (DiGangi et al., 2009).

Table 4.17. Score and descriptive definitions for each stage of degradation for the geometric shape of the costal face and the surface texture of the tubercle facet (DiGangi et al., 2009:167-168).

Score	Costal face - Geometric shape	Score	Tubercle facet - Surface texture
1	Narrow, oval, flat surface, and shallow with ridges (line of fusion still evident)	1	Dense and smooth
2	Narrow, U-shaped, oval, slightly concave, no ridges on bottom surface	2	Surface depressed and irregular
3	Circular and/or wider U-shape, concave	3	Microporosity present
4	Irregular shape, hollowed shell	4	Lipping along margins; extensive porosity and lipping, altering texture
5	Cortical cavity filled in with bony growth; irregular shape	-	-

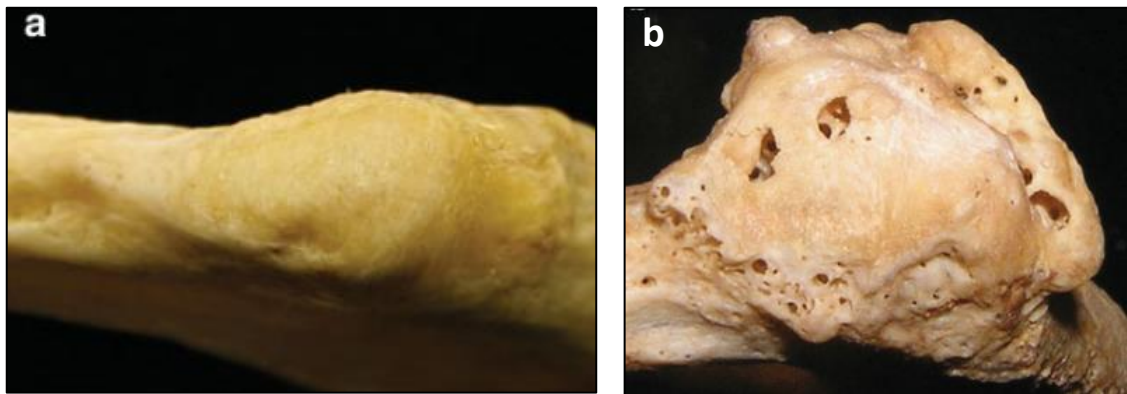


Figure 4.18. An example of the photographic stages for a young individual (a = 27 years, dense and smooth) versus old individual (b = 61 years, porosity and lipping) for the tubercle facet of the first rib (DiGangi et al., 2009:174-175).

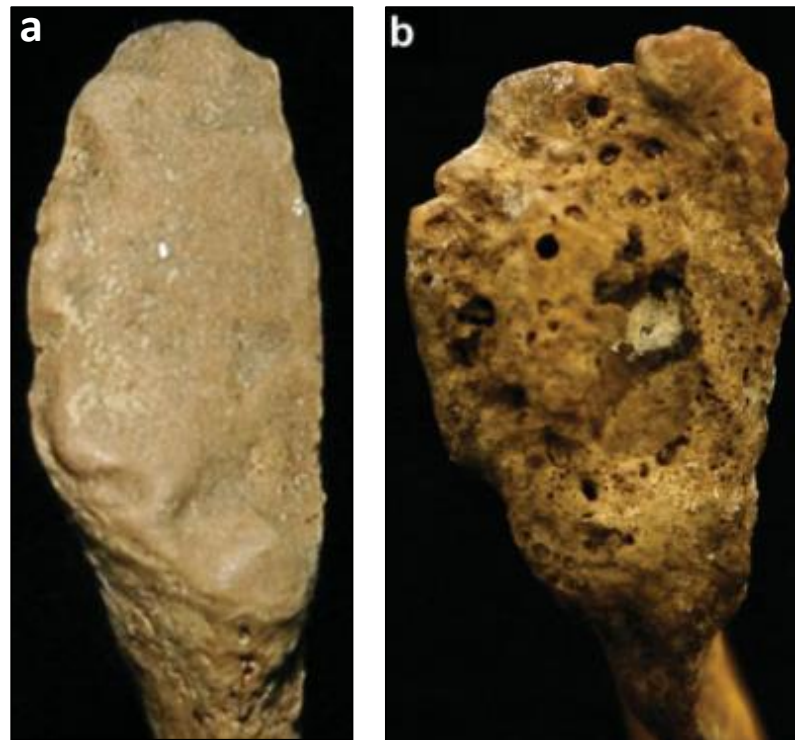


Figure 4.19. An example of the photographic stages for a young individual (a = 16 years, flat surface, no porosity) versus an old individual (b = 76 years, irregular surface, porosity, osteophyte formation) for the costal aspect of the first rib (DiGangi et al., 2009:172-174).

Table 4.18. Combined age estimates from the costal face and the tubercle facet (DiGangi et al., 2009:170). For example, if the costal face score = 3 and the tubercle facet score = 4, the age range = 38.94 – 61.35 years, best point 50.26 years.

Costal face	Tubercle facet	Age range (years)	Best point
1	1	12.00 – 18.24	12
2	1	12.00 – 23.40	15.10
3	1	13.72 – 29.65	20.19
4	1	21.27 – 42.79	30.46
5	1	37.74 – 60.82	49.45
1	2	12.00 – 24.28	16.34
2	2	17.78 – 35.93	25.26
3	2	23.10 – 43.90	32.07
4	2	33.11 – 55.59	43.95
5	2	46.27 – 67.44	57.26
1	3	14.58 – 31.02	21.29
2	3	22.74 – 43.35	31.59
3	3	29.20 – 51.17	39.34
4	3	39.13 – 61.18	50.23
5	3	50.35 – 70.49	60.87
1	4	21.15 – 42.81	30.31
2	4	32.06 – 54.87	42.98
3	4	38.94 – 61.35	50.26
4	4	47.45 – 68.43	58.39
5	4	56.34 – 75.05	66.19

4.3.3.7 Sternal end of the fourth rib

Age estimation based on the fourth rib was carried out according to İşcan et al. (1984a; 1984b; 1985) (Table 4.19). Each rib is scored from 0 to 9, depending on the degeneration of the sternal surface, including the appearance and thickness of the walls and rim, and the pit shape and depth (Figure 4.20). If the result falls between two age categories, the median age range is assigned up to 65+ years for males and 75+ years for females. The scoring system is the same for both males and females, but the resultant age ranges differ. This technique can be applied to both the third and fifth ribs, if the fourth is unavailable (Schwartz, 2007:245). Identification of the fourth rib was completed by comparisons with the other ribs available. Its relative size was considered, along with its pronounced curvature from the head, to its relative straightness at the sternal end, the head of the rib is also longer and thinner in comparison to the fifth rib and above.

Table 4.19. Ageing criteria and estimated age ranges from the fourth rib (Adapted from İşcan et al., 1984a, 1985).

Phase	Sternal Surface	Age Estimation (95% confidence interval)		Mean	
		Female	Male	Female	Male
0	Flat, smooth surface, billowy or ridged	<14 years	<16 years	-	-
1	Onset of change, some minor indentation possible, loss of most billowing	14.0 – 15.0	16.5 – 18.0	14.0	17.3
2	'V' shaped pit developing, rim smooth and rounded	15.5 – 19.3	20.8 – 23.1	17.4	21.9
3	'V' becoming wider 'U' shaped, arc along supero-inferior axis of pit, rim smooth but scalloping present	20.5 – 24.7	24.1 – 27.7	22.6	25.9
4	Pit deepening, broad 'V' or 'U', walls thin edges flaring, rim smooth, scalloping deteriorating	24.4 – 31.0	25.7 – 30.6	27.7	28.2
5	Broad 'V' or 'U', rim thin with sharp edge, bone becoming brittle	33.7 – 46.3	34.4 – 42.3	40.0	38.8
6	Pit becoming porotic, deep and wide 'V' or 'U', rim irregular and sharp	43.3 – 58.1	44.3 – 55.7	50.7	50.0
7	Pit flared 'U' shape, thin walls with bony projections to rim, increasing porosity, bone brittle	59.2 – 71.2	54.3 – 64.1	65.2	59.2
8	Boney projections to 'U' shaped pit, thin, irregular rim, perforations may appear in walls	70.4 – 82.3	65.0 – 78.0	76.4	71.5

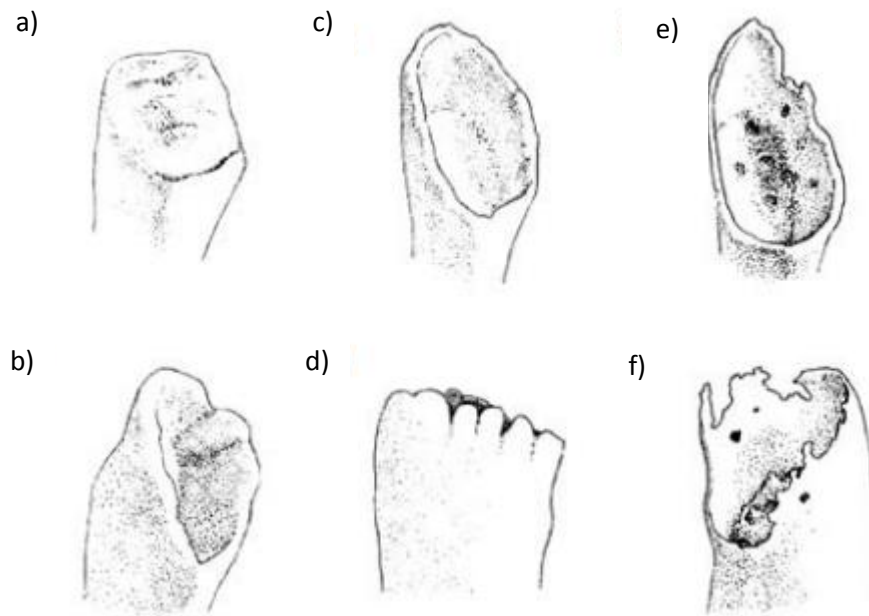


Figure 4.20. Degeneration of the sternal ends of the fourth rib. Showing an example of degeneration of the fourth rib with age a) stage 0; b) phases 2 – 3; c) phase 4; d) phase 5; e) phases 6 – 7; f) phase 8 (Schwartz, 2007:246; from İşcan et al., 1984ab; 1985).

4.3.3.8 Iliac crest of the ilium

Falys (2012:208) developed a method to estimate age using the iliac crest through the extent of osteophyte formation, causing ‘lipping’ on the lateral surface at the attachment for the external oblique muscles. The extent of the ‘lipping’ is recorded in five stages (0 to 4), with an additional stage (5) to indicate pathology (e.g. DISH), up to a maximum mean age of 75 years for males and 77 years for females (Figure 4.21; Table 4.20). The age stages are the same for males and females, but the resultant age estimates differ. Falys (2012:215-216) notes that when tested against the actual chronological age of individuals the 95% confidence interval is only accurate 18.2% of the time for males and 10.0% of the time for females, whereas the age phase estimate is accurate 90.9% of the time for males and 100.0% of the time for females. This technique will then be utilised in this study as a multifactorial method to provide a general sense of age for each individual.



Figure 4.21. The degrees of osteophyte formation on the iliac crest. a) none; b) minimal; c) slight; d) moderate; e) severe; f) pathological (Falys, 2012:82).

Table 4.20. Score for males and females for the iliac crest of the ilium, along with the age phase estimate, mean age and the 95% confidence interval (Falys, 2012:211).

Score	95% Confidence Interval (years)	Mean Age (years)	Age Estimate (age phase)
Males			
0-1	57-61	59.2	<80 years
2	66-70	64.8	50+ years
3-4	72-77	75.1	65+ years
Females			
0-1	57-63	60.4	<80 years
2-3	69-74	71.1	45+ years
4	73-82	77.8	65+ years

4.3.3.9 Auricular surface of the ilium

Age estimations based on the auricular surface were made according to Buckberry and Chamberlain (2002). Each characteristic is scored according to its degeneration (Table 4.21), before the results are combined into a composite score (Table 4.22). A maximum mean age of 72 years can be achieved using this method. Ageing on the auricular surface does not differ between sexes (Buckberry and Chamberlain, 2002). An illustration was provided of the location of each scorable element (Figure 4.22).

Table 4.21. Summary of stages from Buckberry and Chamberlain (2002:233–234) for age estimation using the auricular surface of the ilium.

Score	Transverse organisation	Surface texture	Micro porosity	Macro porosity	Apical changes
1	90%+ transversely organised	90%+ finely granular	None	None	Apex is sharp, auricular face possibly raised
2	50-89% transversely organised	50-89% finely granular; some coarse granularity	Present on one demiface	Present on one demiface	Some lipping at apex; margin still distinct
3	25-49% transversely organised	50%+ coarsely granular; no dense bone	Present on both demifaces	Present on both demifaces	Irregularity of apex
4	less than 25% transversely organised	less than 50% dense bone	-	-	-
5	No transverse organisation	50%+ dense bone	-	-	-

Table 4.22. Composite scores, age ranges and mean ages for the auricular surface (Buckberry and Chamberlain, 2002:237).

Composite Score	Age range (years)	Mean (years)
5 – 6	16 – 19	17.33
7 – 8	21 – 38	29.33
9 – 10	16 – 65	37.86
11 – 12	29 – 81	51.41
13 – 14	29 – 88	59.94
15 – 16	39 – 91	66.71
17 – 19	53 – 92	72.25

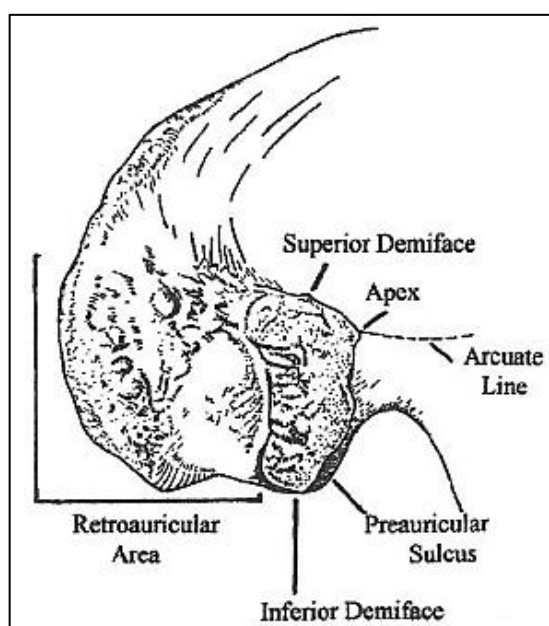


Figure 4.22. Regions of the ilium used for auricular surface ageing (Buckberry and Chamberlain, 2002:233).

4.3.3.10 Pubic symphysis of the os pubis

Ageing on the pubic symphysis is accomplished using the Suchey-Brooks (1990) method. It is based on three characteristics: the development of the symphyseal face, the formation of the ventral rampart, and osteophyte formation, all of which are scored from one to six (Table 4.23). Age estimations are determined using written descriptions and casts. Once a score for each trait has been established, the age range and mean age can be ascertained, up to a maximum of 60 years (Table 4.24). The stages do not differ between the sexes, but the resultant age ranges do (Brooks and Suchey, 1990). An illustration of the casts is provided (Figure 4.23)

Table 4.23. Phases for ageing the pubic symphysis (Adapted from Brooks and Suchey, 1990:232)

Phase	Development of Symphyseal Face	Formation of Ventral Rampart	Porosity
1	marked ridges and furrows	None	None
2	billows slightly flattened	early stages of development	None
3	little billowing, more fine grained	lower stage of ventral rampart complete	None
4	flat, some remnants of billowing may remain	distinct rim forming, may have connected in centre	micro porosity
5	face beginning to depress compared to rim	completed rim, little or no erosion	micro to macro porosity possible
6	face depressed compared to rim	rim eroding	face pitted and porous

Table 4.24. Age range and mean age (years) for each phase of ageing on the pubic symphysis, for each sex. (Brooks and Suchey, 1990:233).

Phase	MALE		FEMALE	
	Mean	95% Range	Mean	95% Range
1	18.5	15 – 23	19.4	15 – 24
2	23.4	19 – 34	25.0	19 – 40
3	28.7	21 – 46	30.7	21 – 33
4	35.2	23 – 57	38.2	26 – 70
5	45.6	27 – 66	48.1	25 – 83
6	61.2	34 – 86	60.0	42 – 87

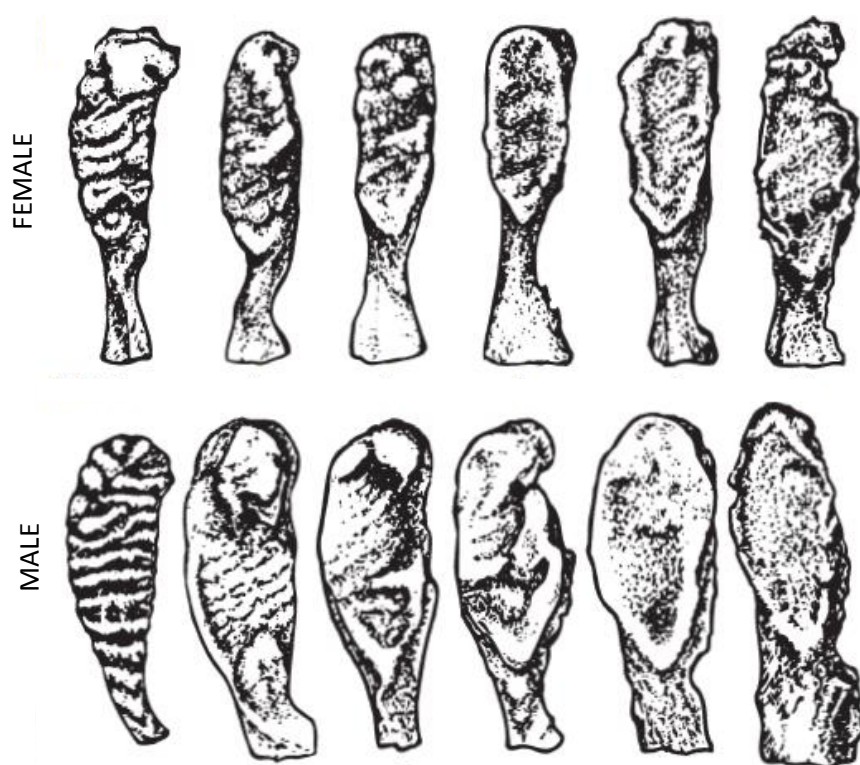


Figure 4.23. Age-related changes on the pubic symphysis of the Os pubis, showing examples of phases one to six for both males and females (White and Folkens, 2005:378)

4.3.3.11 Upper tuberosity of the ischium

Age estimation based on the upper tuberosity of the ischium was developed by Falys (2012;2014).

Scores from one to four are assigned depending on surface topography (Table 4.25). The age ranges apply to both sexes up to a maximum mean age of 78 years (Falys, 2014). Photographic stages were provided by Falys (2014) (Figure 4.24).

Table 4.25. Scoring system based on topography of the upper tuberosity of the ischium and the associated age range and mean age for each score (Falys, 2014).

Score	Topography	Mean (years)	Age Estimate (years)
0	Element not present	Element not present	Element not present
1	Smooth / fine granulation (flat surface)	45.8	38 – 54
2	Coarse granulation (flat surface)	55.6	41 – 71
3	Rugged with nodules (small areas of irregularity)	70.3	50 – 91
4	Surface breakdown (highly irregular surface)	78.9	64 – 93

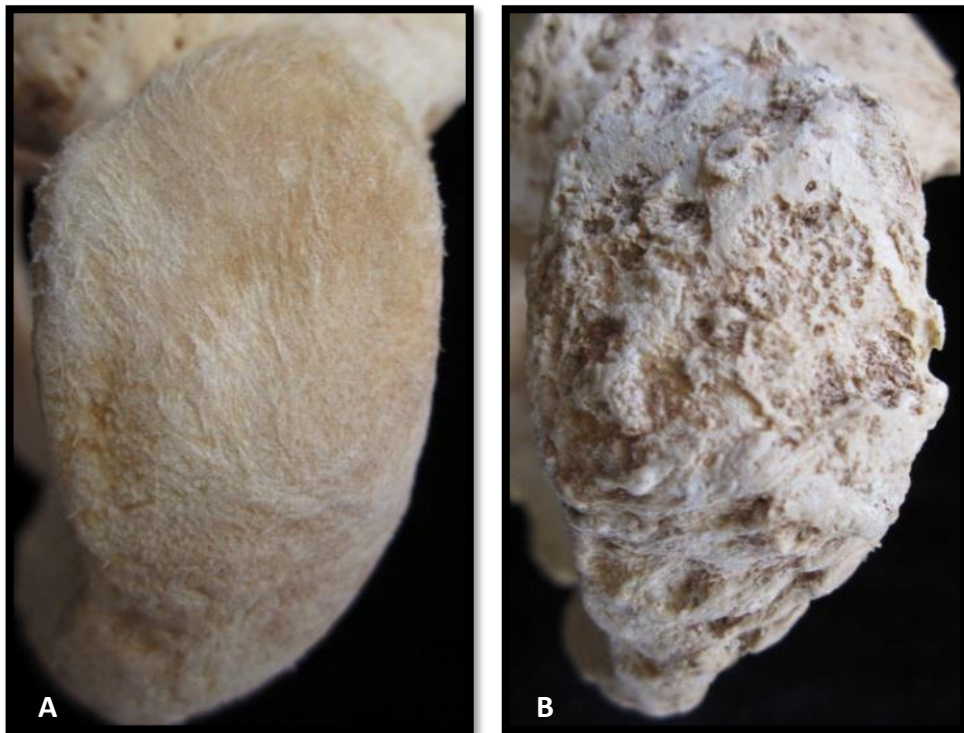


Figure 4.24. Example of the photographic stages demonstrating degeneration on the upper tuberosity of the ischium (Falys, 2014). A = Stage 1, smooth, flat surface; B = Stage 4, highly irregular surface breakdown.

4.3.3.12 Assigning an age

Individuals were placed into four age cohorts: 35-45 years, 46-59 years, 60-69 years and 70+ years. To place individuals into one of the four age cohorts, a total or an absolute mean age was calculated per individual. For example, an individual with an absolute mean age of 67.3 years was placed in the 60-69 year age cohort (Table 4.26). This mean was calculated from those provided by each method, with the exception of dental ageing, which does not provide a mean, and which was not considered reliable for calculating age-at-death in older adults (Field, 2019:328; Mays, 2010:76). A maximum of eleven and a minimum of two methods were used per individual, always including either the pubic symphysis (Brooks and Suchey, 1990) or auricular surface (Buckberry and Chamberlain, 2002).

Table 4.26. Age ranges and mean ages from each technique for Barton Sk.598, aged into the 60-69 year age cohort (N/A = not applicable, element not present).

Method	Age range (years)	Mean age (years)
Dentition	45+	N/A
Dens facet (C1)	45+	63.9
Dens process (C2)	<80	63.6
Third cervical (C3)	60+	74.0
Sternal clavicle	58-91	74.9
First Rib	37-60	49.5
Fourth Rib	N/A	N/A
Iliac crest	N/A	N/A
Auricular surface	53-92	72.3
Pubic symphysis	27-86	61.2
Ischium	64-93	78.9
ABSOLUTE MEAN AGE:		67.3

4.3.3.13 Ease of use

One of the primary features of an ageing method is its reproducibility. It is crucial that techniques are easy to understand and utilise by multiple researchers, multiple times, i.e. have low inter- and intra-observer error. To quantifiably assess the ease of use of each method, the scores produced by each observation were analysed, and the number of decisive and inconclusive results were calculated. A decisive result occurred when a single score, and therefore age range, was assigned to an element. An inconclusive result occurred when an element could be classed under more than one score, resulting in a wider 'combined' age range.

4.3.4 Frailty

Ability level was assessed according to the 'Frailty Index' (Marklein et al., 2016). This measures the level of morbidity each individual exhibits. From it we can infer an individual's functional capacity as a member of their community, including impacts on livelihood, physical appearance and social identity (Gowland, 2017a; Marklein et al., 2016; Tilley, 2017). In this study the Skeletal Frailty Index (SFI) incorporated nine indices, these were dental disease, osteoarthritis, spondylosis, periostitis and/or osteomyelitis, malignant neoplasia, osteoporosis, cribra orbitalia, rickets/osteomalacia and fractures. The more indices an individual exhibited, the higher their SFI score and the frailer they are predicted to have been, indicating increased dependence and

decreased ability. Frailty, morbidity and ability are all inextricably linked; however they are distinct, and therefore one cannot be fully defined by the others, but they can be used as an indicator.

4.3.5 Skeletal pathology

In order to explore the health of medieval individuals in later life, evidence for skeletal pathology was assessed and recorded macroscopically and with radiographs where necessary. A number of pathologies are considered to be directly related to the ageing process (for example, osteoarthritis, Paget's disease and osteoporosis), while others represent trauma and pathology accumulated over a lifetime. All conditions were identified in the first instance following the descriptions and criteria outlined by Ortner (2003), and then by disease specific primary clinical or archaeological literature. For systematic diseases, individuals needed a spine and lower long bones before a disease could be excluded, providing a crude prevalence rate. Trauma and osteoarthritis were scored by the number of bones present and those affected to give a true prevalence rate.

4.3.5.1 Arthropathies

Osteoarthritis (OA) was diagnosed following Rogers (2000). Osteoarthritis is the most common degenerative joint disease and is often linked to advancing age. Eburnation is indicative of OA, however if eburnation is not present osteophyte growth around the margin of the joint, loss of anatomical joint contour, porosity or pitting and new bone formation on the joint surface can be used in conjunction with each other to diagnose osteoarthritis (Rogers, 2000:169). OA affects synovial joints, such as the hip, knee and vertebral facets.

Spondylosis was diagnosed according to Plomp (2017), it is also very common in archaeological samples and related to advancing age. Degradation of the surface of the vertebral bodies is indicative, specifically of the mid to lower cervical, upper thoracic and lower lumbar vertebrae (Plomp, 2017; Rogers, 2000). Schmorl's nodes, representing vertical herniation of intervertebral

discs, either superiorly or inferiorly into the vertebral body, resulting in a depression on the vertebral end plate, are frequently associated with spondylosis (Plomp, 2017:146).

Other degenerative joint diseases, such as gout, rheumatoid arthritis and ankylosing spondylitis were diagnosed according to Rogers (2000).

4.3.5.2 Diffuse idiopathic skeletal hyperostosis

Diffuse idiopathic skeletal hyperostosis (DISH) was diagnosed following Rogers and Waldron, (1995; 2001) and Mader et al. (2017). This dictates that four contiguous thoracic vertebrae are fused due to ossification of the spinal ligaments, primarily the anterior longitudinal ligament, but with the preservation of the anatomical shape of the vertebrae and the intervertebral spaces (Figure 4.25).

DISH is characterised by gradual and complete fusion of the axial skeleton, with possible additional manifestations on the appendicular skeleton, (for example, at the iliac crest), by ossification of cartilage (e.g. cricoid, thyroid) and tendinous attachments. Osteophytes form in a 'candlewax' like appearance, especially on the right side of the thoracic vertebrae, as the aorta prevents development on the left side (Mader et al., 2017; Rogers and Waldron, 1995; 2001).



Figure 4.25. The thoracic spine exhibiting DISH, showing the 'candle wax' like osteophyte formation on the right side, with anatomical shape and intervertebral disc spacing retained (Rogers and Waldron, 2001: 358).

4.3.5.3 Osteoporosis

Osteoporosis was diagnosed following Brickley (1997:60) and Brickley and Ives (2008) using fractures in bones with high trabecular bone content such as the vertebrae, proximal femur and distal radius. Thin cortical bone and 'sparse' trabeculae are also indicators of osteopenia and osteoporosis (Figure 4.26), this was noted whenever post-mortem breaks allowed examination. Osteopenia is a precursor to osteoporosis, and is not associated with pathological fracture (Brickley and Ives, 2008:151). Osteoporosis is related to advancing age in adults, especially females, who undergo the menopause (Mays, 2008:227)



Figure 4.26. An example of sparse trabeculae in osteopenia (A) and osteoporotic bone (B) (Photographs by the author).

4.3.5.4 Paget's disease

Paget's disease or 'osteitis deformans' was identified following Brickley and Ives (2008) and Mays (2010). Paget's disease follows three distinct stages in the skeletal system 1) the osteolytic phase – characterised by a massive increase in osteoclastic activity, resulting in hypervascularity; 2) the intermediate phase – characterised by the 'mosaic' appearance of bone (Figure 4.27) from rapid repeated episodes of bone resorption and deposition, this new bone is disorganised and weaker than normal bone, prone to pathological fracture; 3) the sclerotic phase – characterised by almost complete cessation of osteoclastic and osteoblastic activity (Brickley and Ives, 2008:220–221). Distortion and enlargement in affected bones is indicative. Thickened cortical bone encroaches on the medullary cavity (which may only be visible radiographically), whilst also expanding outwards due to rapid bone turnover, specifically of the skull, innominate and lower long bones although

any bone can be affected (Brickley and Ives, 2008). On radiographs, affected long bones appear to have a 'flame' like 'V' from the advancing disease (Brickley and Ives, 2008:222; Mays, 2010:195), and a mosaic pattern of radiolucent and radio-opaque patches of bone.

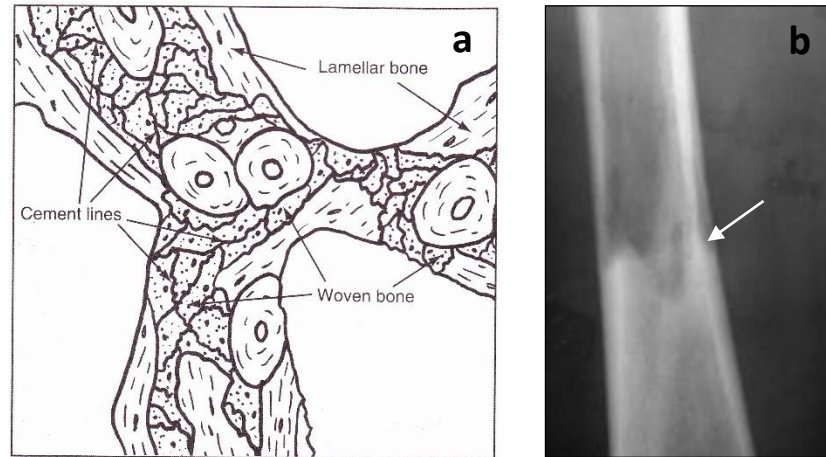


Figure 4.27. An example diagram of the disordered 'mosaic' features of bone in the second stage of the disease (a) (Brickley and Ives, 2008:220) and an example of the radiographic 'flame' like appearance of Paget's disease advancing along the femur (b) (Learning Radiology, 2015).

4.3.5.5 Vitamin C deficiency (scurvy)

Vitamin C deficiency was diagnosed according to criteria outlined by Brickley and Ives (2008:61).

In adults, ossification of sub-periosteal haematomas on the roof of the orbits and long bones can occur when the period of vitamin C deficiency ends, or if some level of vitamin C is obtained (Figure 4.28) (Brickley and Ives, 2008:61). These multiple localised areas of ossification can be used to indicate scurvy (Brickley and Ives, 2008; Mays, 2008).



Figure 4.28. An example of ossified new bone growth on the anterior tibia possibly indicating scurvy (Van der Merwe et al., 2010:73).

4.3.5.6 Vitamin D deficiency (osteomalacia)

Vitamin D deficiency, or osteomalacia, was diagnosed according to the criteria set out by Brickley and Ives (2008:125) and Mays (2008). Poorly mineralised areas on bone, pseudofractures (known as 'Looser's zones') and in severe cases, deformity of the bones, are indicative of osteomalacia, specifically in trabecular rich bones such as the scapular and pelvis (Figure 4.29). Adult vitamin D deficiency is most prevalent in post-menopausal women and elderly individuals with osteoporosis (Brickley and Ives, 2008:87). Bowed long bones in adults, can be indicative of childhood vitamin D deficiency, rickets (Mays, 2008).



Figure 4.29. An example of an osteomalacic pseudofracture (shorter arrow) on the infero-posterior aspect of the base of the scapular spine, with reactive bone formation (longer arrow). This is a 'Looser's zone, comprised of unmineralized osteoid (Mays, 2008:218).

4.3.5.7 Iron deficiency anaemia

Evidence for anaemia was recorded according to Walker et al. (2009). Iron deficiency anaemia causes pitting of the orbital roof through hyperplasia of the diploe, termed 'cribra orbitalia' (Figure 4.30), and the cranial vault, termed 'porotic hyperostosis'. In older adults the lesions associated with anaemia are nearly always 'inactive' and healing or healed (Walker et al., 2009:111). Healed or remodelled porotic hyperostosis and cribra orbitalia is characterised by smooth edges and bone filling of the peripheral porosities, compared to active which is characterised by sharp edges and microporosity (Mensforth et al., 1978:24).

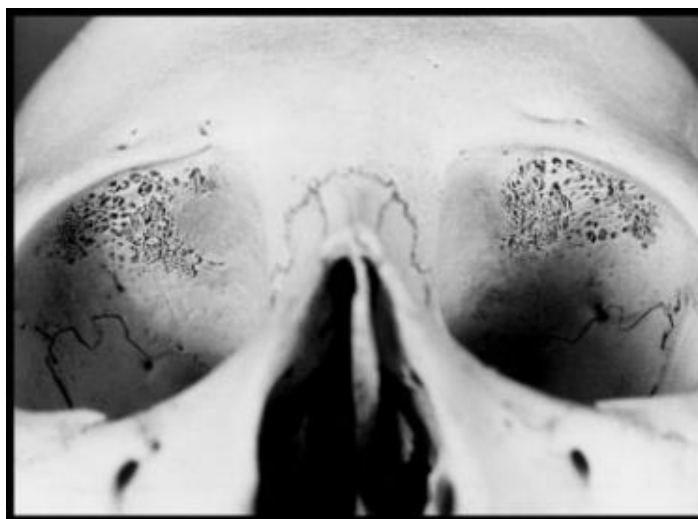


Figure 4.30. Remodelled cribra orbitalia lesions (Walker et al., 2009:110), demonstrated by the smooth edges and filled-in appearance.

4.3.5.8 Hyperostosis frontalis interna

Hyperostosis frontalis interna (HFI) of the endocranial surface of the frontal bone was recorded visually following Barber (1997:77) (Table 4.27; Figure 4.31). The overall thickness and friability of the skull was taken into consideration at this stage.

Table 4.27. The stages and visual changes associated with HFI (Barber, 1997:77).

Stage	Visual Change
0	No new bone formation
1	Early endosteal new bone on the inner table
2	More advance endosteal bone with a bosselated appearance
3	Severe change with much irregularity and increased thickness

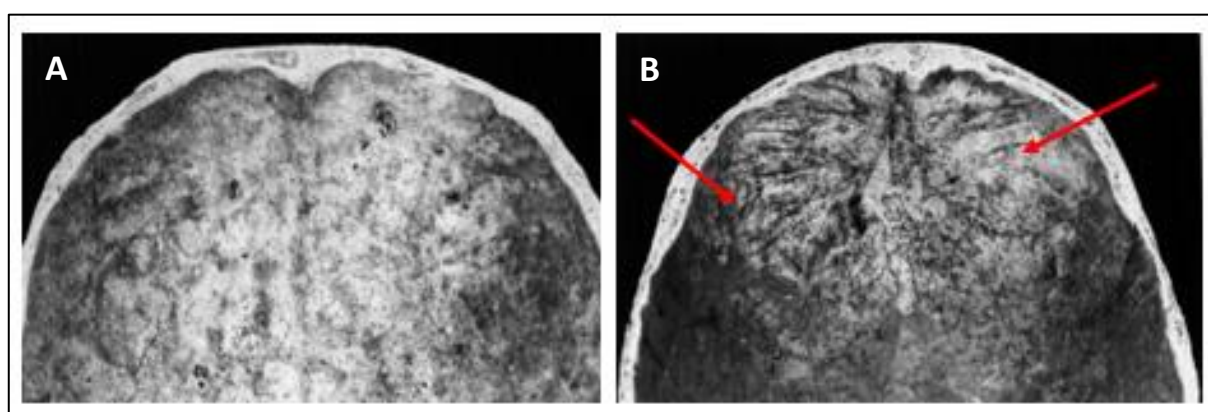


Figure 4.31. Two of the stages used to identify HFI on the endocranial surface of the frontal bone. A – stage 0, no new bone formation; B – stage 3, severe change with much irregularity and increased thickness indicated by the arrows (Barber, 1997:81-84).

4.3.5.9 Neoplastic disease and tumours

Bone and cartilage tumours were diagnosed according to primary clinical literature (Fletcher et al., 2002). Tumours affecting older individuals, for example, a bone tumour, osteosarcoma, affects primarily the long bones of individuals over 50 years of age. With a cartilage tumour, chondrosarcoma increasing in prevalence up to 75 years of age (Fletcher et al., 2002:227).

Cancerous lesions can be widespread, affecting both the axial skeleton and long bones, usually due to spread through the blood stream. The majority of metastatic cancers are lytic, although blastic varieties do exist (Mays, 2010). Bone cancers can be characterised by disorganised, uneven, uncontrolled, rapidly formed growths; lytic lesions and swellings. They can be benign or malignant and involve the skeleton primarily or as secondary (metastatic) spread from other organs (Brothwell, 2008; Roberts and Manchester, 2001). The great variety of cancers affecting the skeleton, and difficulty in identifying the specific cause, means that the diagnosis of metastatic cancer was made after thorough examination of the skeleton and elimination of any other potential diseases.

4.3.5.10 Trauma

Trauma was categorised into seven different categories, these are: fractures, spondylolysis, dislocation, sharp and blunt force trauma, osteochondritis dissecans and soft tissue trauma (Table 4.28).

Table 4.28. Trauma definitions (Compiled from Bennike, 2008; Meyers et al., 2019; Waldron, 2009).

Trauma type	Definition
Fracture	Discontinuity of skeletal material resulting from the application of mechanical forces exceeding the natural elasticity of the skeletal structure.
Spondylolysis	Separation of the neural arch from the vertebral body by fracture of a potentially underlying congenital weakness in the arch.
Dislocation	Partial (subluxation) or complete (luxation) loss of contact between joint components with or without disruption of the joint capsule.
Sharp force trauma	Inflicted by a sharp object or implement, usually associated with a cut mark, and can involve radiating fractures.
Blunt force trauma	Inflicted by a blunt object or implement, associated with concentric and radiating fractures.
Osteochondritis dissecans	Necrosis and fragmentation of articular cartilage and underlying bone from lack of blood supply, usually associated with external injury.
Soft tissue trauma	Diagnosed in archaeology via the presence of ossified material, termed heterotopic ossification, or fused joints in the absence of evidence for fracture etc.

Fractures were recorded and diagnosed following Roberts (2000:347) and Roberts and Manchester (2001:69) in order to assess possible cause of injury (Table 4.29; Figure 4.32). All other trauma was recorded by type, bone affected, side, positioning and state of healing, with additional note taken of any evidence of infection, underlying pathology or joint degeneration in the local area.

Table 4.29. Features recorded for fractures (Roberts, 2000:347).

No.	Fracture recording: features to note
1	Bone affected
2	Side affected
3	Fracture position (proximal, mid, distal etc)
4	Fracture type (see Figure 4.32)
5	State of healing (healed, unhealed, woven/lamellar/mixed bone)
6	Evidence of infection (pitting, new bone formation, osteomyelitis)
7	Evidence of underlying pathology
8	Evidence of joint degeneration in adjacent joints
9	Evidence of linear / rotational deformity in degrees
10	Amount of overlap / apposition in millimetres
11	Alignment of bone (consider features 9 and 10)

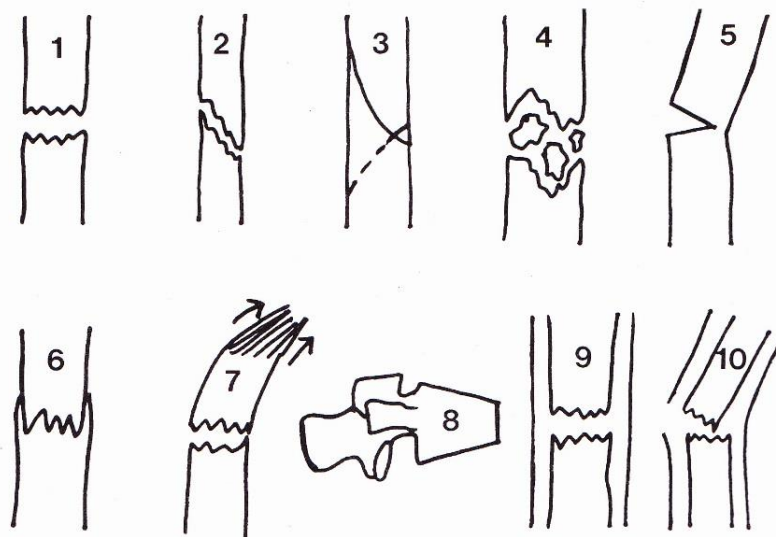


Figure 4.32. Types of fracture. 1) transverse; 2) Oblique; 3) Spiral; 4) Comminuted; 5) Greenstick; 6) Impacted; 7) Traction/Avulsion; 8) Compression; 9) Closed; 10) Open (Roberts and Manchester, 2001:69)

4.3.5.11 Indicators of elder abuse and neglect

Indicators of physical abuse were analysed and recorded according to Gowland (2015). Abuse indicators visible on the skeleton include: fractures of the head, face, dentition and neck; multiple fractures at various stages of healing; defensive fractures; indications of malnutrition from starving or lack of nutritional food, and pressure sores or decubiti (Table 4.30).

Conversely decubiti can also indicate care structures, meaning the bedbound individual is cared for and remained alive long enough to develop decubiti, inferring that the individual was valued

by the community (Gowland, 2015). Indicators of care were recorded according to the 'Index of Care' (Tilley, 2017:19-33) according to healed or advanced healing of debilitating traumas; prolonged life through debilitating disease; or a lack of apparent physical abuse trauma on the very elderly, who however active, would have required some form of care. This does not mean they did not suffer from alternative, archaeologically invisible, forms of abuse however.

Table 4.30. Typical indicators of physical abuse (Gowland, 2015:517).

Location	Injury
Dentition	• Fractured teeth • Subluxated or avulsed teeth • Fractures of maxilla and mandible • Poor oral care
Face	• Fractures to orbits, nasal bones and zygomatic bones
Cranium	• Blunt or sharp force trauma • Comminuted or radial fractures above the 'hat rim' line • New bone formation in response to scalp haematomas (NB. subdural haemorrhage secondary to inflicted trauma is a common cause of death in elder abuse)
Trunk	• Decubiti (pressure sores) located on the ischial tuberosity, sacrum, vertebral processes, (NB. decubitus ulcers in non-lumbar/sacral areas are thought to be more likely associated with abuse) • Multiple rib fracture • Fractures of the dorsal and lumbar spine • Skeletal trauma in location of breasts (i.e. ribs) or genitals (i.e. pubis)
Upper extremities	• Poorly aligned fractures indicting a lack of medical treatment • Spinal or oblique fractures are less likely to occur in immobile elderly • Defensive injuries of inner arms, dorsal hands or forearms • Decubiti on the scapulae or elbows
Lower extremities	• Defensive injuries on inner thighs • Decubiti on calcanei and greater trochanters

4.3.5.12 Disease prevalence

All pathologies were divided into their disease classifications: non-specific infection, specific infection, arthropathies, metabolic conditions, benign and malignant neoplasms. The crude prevalence rates (CPR) of each condition were calculated using the number of individuals observed at each site, in each age and sex cohort.

4.3.6 Funerary archaeology

All archaeological context and burial evidence was obtained from the site reports and excavation data (Dawes and Magilton, 1980; Mays et al., 2007; Spall and Toop, 2005; Waldron, 2007). Grave location within the cemetery, orientation, burial rites (e.g. shroud, coffin), body positioning and grave goods were recorded for each individual, where records allowed. This data was then considered in association with assigned chronological age estimations and frailty in order to ascertain an individuals' social identity in death, as well as life.

4.3.7 Statistical approach

The aims of this thesis involve comparison of individuals; between sites, age cohorts, sexes and pathologies. These are all qualitative variables, the proportions of which can be compared against each other in contingency tables to answer questions that have arisen. A chi-squared (χ^2) test can then be used to test whether the distribution of individuals in one variable is independent of the distribution in the other variable. If the distribution is independent, the result is significant, meaning that there is a low probability that the result arose by chance. If comparison needs to be made between one variable and the rest (e.g. one age cohort vs. the rest), the rest can be grouped, this is termed a continuous quantitative variable. Chi-squared tests were carried out according to Kirkwood (1988:87).

Chapter 5 - Results

5.1 Introduction

The results from this study are presented in the following chapter. The final study sample and element preservation rates are reported first, followed by presentation of the sex and age distributions, by site. This is followed by an intensive analysis of the utilised ageing techniques, focusing on their accuracy and precision, feasibility and usability. Finally, the results from palaeopathological analysis are presented, using the Frailty Index to explore ability by age, site and types of pathology; and by type, dental, skeletal and trauma; with a focus on those pathologies which increase in prevalence with advancing age and upon interpersonal violence and physical abuse. These results provide contextual evidence upon which the discussion in Chapters 6 and 7 are based.

5.2 The study sample

The final study sample comprised 564 individuals. A total of 136 individuals were excluded from the study due to poor preservation (Table 5.1).

Table 5.1. Number and percentage of individuals in the final study sample, by site.

Site	Total observed	Number included (%)	Number excluded (%)
Barton-upon-Humber	309	249 (80.6)	60 (19.4)
Fishergate House	70	64 (91.4)	6 (8.6)
St. Helen-on-the-Walls	130	111 (85.4)	19 (14.6)
Wharram Percy	191	140 (73.3)	51 (26.7)
TOTAL	700	564 (80.6)	136 (19.4)

5.2.1 The skeletally complete cemeteries

The proportions of individuals applicable to this study from each age cohort (35-45, 45+ and adult) of the skeletally complete samples is presented in Table 5.2, along with the number and percentage of each that was used in this study.

Table 5.2. Number of applicable individuals from the skeletally complete samples (site report), and number and percentage of those used in this study (Dawes, 1980; Holst, 2005; Mays, 2007; Waldron, 2007).

Site	35-45 years		45+ years		Adult	
	Site report	Study (%)	Site report	Study (%)	Site report	Study (%)
Barton-upon-Humber	41	39 (95.1)	230	183 (79.6)	649	27 (4.2)
Fishergate House	31	28 (90.3)	39	36 (92.3)	22	0
St. Helen-on-the-Walls	137	64 (46.7)	107	41 (38.3)	294	6 (2.4)
Wharram Percy	51	49 (96.1)	121	64 (52.9)	50	27 (54.0)

5.3 Preservation

Of the eleven methods used to estimate age across the combined sample, the auricular surface was the most commonly preserved area overall (n=546, 96.8%), as well as having the highest preservation at each site (Table 5.3; Figure 5.1). The ischium was the second most observed element (n=509, 90.2%). In contrast, the first rib was only available as an age estimator in 46.5% (n=262) of cases in the combined sample due to post-mortem damage, rather than absence of the entire element. With the exception of the first rib, all elements were available for analysis at least 60% of the time, with St. Helens having the highest percentage of bones available on average (79.4%), followed by Fishergate (74.1%), Wharram (71.4%) and finally Barton (68.5%).

Table 5.3. Number and percentage (%) of elements in each study sample, and overall. With the mean percentage of elements available per site. Arranged from most well preserved to least.

Method	Barton (%)	Fishergate (%)	St. Helens (%)	Wharram (%)	TOTAL (%)
Auricular surface	242 (97.2)	64 (100.0)	108 (97.3)	132 (94.3)	546 (96.8)
Ischium	222 (89.2)	61 (95.3)	108 (97.3)	118 (84.3)	509 (90.2)
Third cervical (C3)	188 (75.5)	48 (75.0)	94 (84.7)	108 (77.1)	438 (77.7)
Sternal clavicle	177 (71.1)	52 (81.3)	93 (83.8)	105 (75.0)	427 (75.7)
Dentition	183 (73.5)	46 (71.9)	92 (82.9)	96 (68.6)	417 (73.9)
Pubic symphysis	163 (65.5)	37 (57.8)	81 (73.0)	105 (75.0)	386 (68.4)
Iliac crest	163 (65.5)	53 (82.8)	88 (79.3)	80 (57.1)	384 (68.1)
Fourth Rib	160 (64.3)	51 (79.7)	77 (69.4)	88 (62.9)	376 (66.7)
Dens process (C2)	150 (60.2)	44 (68.8)	84 (75.7)	96 (68.6)	374 (66.3)
Dens facet (C1)	131 (52.6)	40 (62.5)	81 (73.0)	97 (69.3)	349 (61.9)
First Rib	97 (39.0)	26 (40.6)	64 (57.7)	75 (53.6)	262 (46.5)
Mean %:	68.5	74.1	79.4	71.4	72.0

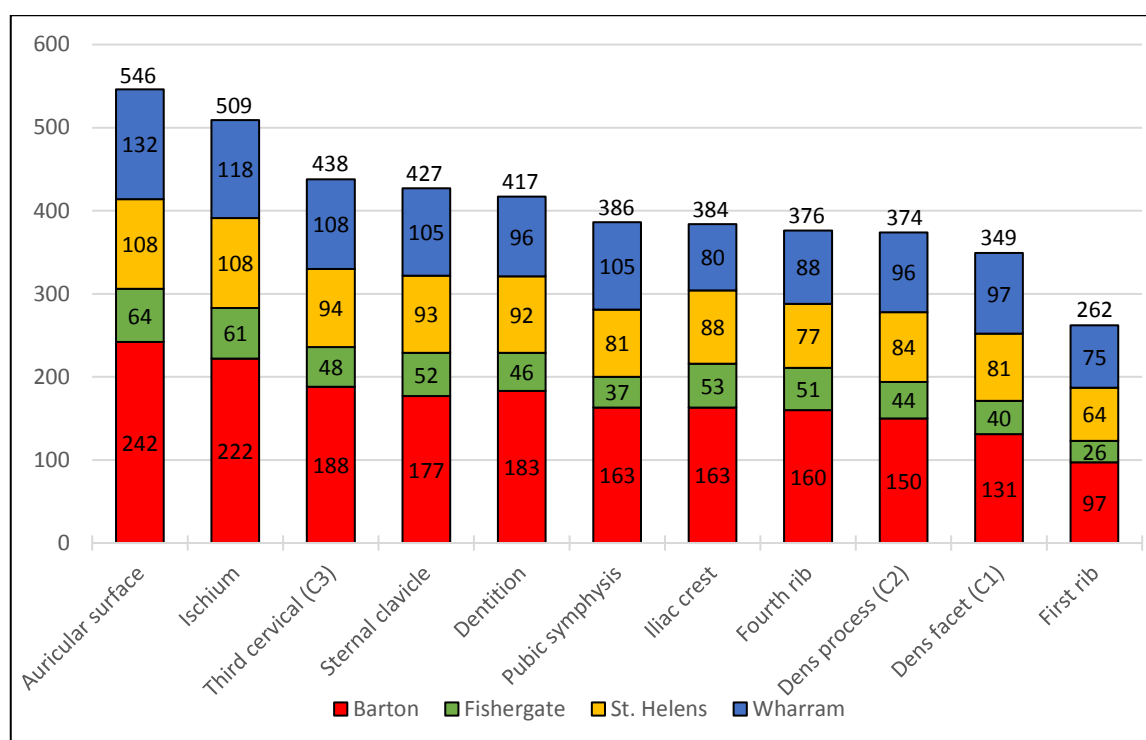


Figure 5.1. Number of each element by site, and number observed overall, arranged from most well preserved to least.

5.4 Sex distributions

When the sites were combined the study sample had a slightly greater number of males than females with a total of 314 (55.7%) males (M) and probable males (M?) compared with 247 (43.8%) females (F) and probable females (F?). There were three individuals (or 0.5%) who could not be assigned a sex (U) (Table 5.4; Figure 5.2). The predominance of males in the combined sample is due to the significantly higher number of males recorded at Barton ($X^2=25.50$, 1.d.f.; $p=0.001$). This may be the result of sampling bias, as individuals assigned a numerical age category were predominantly selected for analysis (i.e. those in the 'adult' category were generally not included). A statistical comparison of the numbers of males ($n=246$) and females ($n=330$) within the 'adult' age cohort in the Barton site report (Waldron, 2007) showed there were significantly more females in this group than males ($X^2=24.50$, 1.d.f.; $p=0.001$). Males also predominated in both the St. Helens and Wharram study samples, while at Fishergate there was a higher number of females ($n=37$) than males ($n=27$), although none of these trends were significant.

Table 5.4. Number and percentage of individuals in each study sample, by sex. .

Site	Male (%)	M? (%)	U (%)	F? (%)	Female (%)	Total M (%)	Total F (%)
Barton	130 (52.2)	21 (8.4)	3 (1.2)	16 (6.4)	79 (31.7)	151 (60.6)	95 (38.2)
Fishergate	15 (23.4)	12 (18.8)	0	15 (23.4)	22 (34.4)	27 (42.2)	37 (57.8)
St. Helens	48 (43.2)	8 (7.2)	0	7 (6.3)	48 (43.2)	56 (50.5)	55 (49.5)
Wharram	39 (27.9)	41 (29.3)	0	20 (14.3)	40 (28.6)	80 (57.1)	60 (42.9)
TOTAL	232 (41.1)	82 (14.5)	3 (0.5)	58 (10.3)	189 (33.5)	314 (55.7)	247 (43.8)

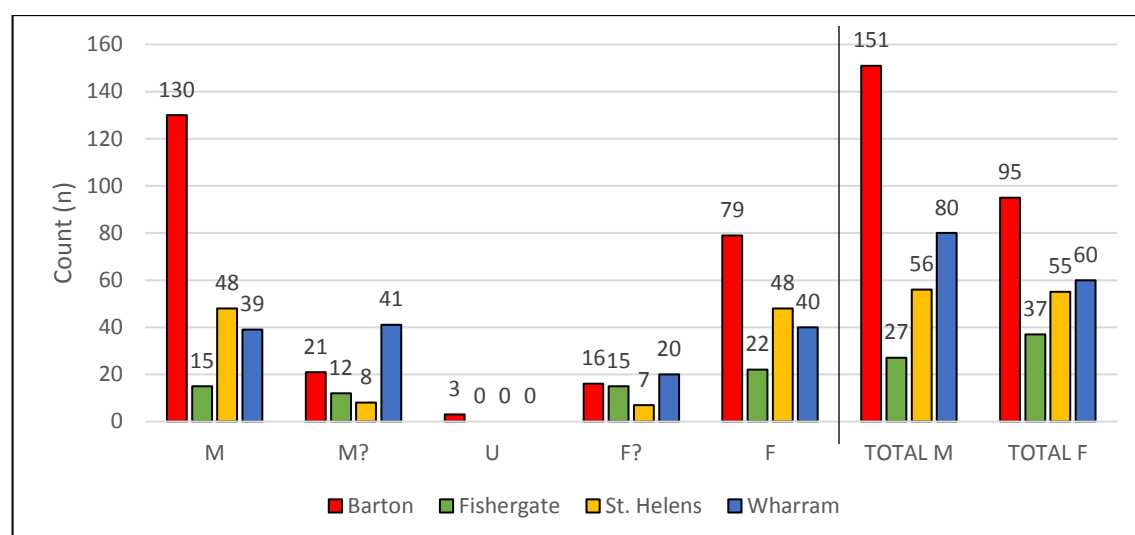


Figure 5.2. Number of individuals in each study sample , by sex (M=male; F=female).

To ensure the greatest sample size, possible males (M?) and possible females (F?) were combined with the male and female sex cohorts respectively. Individuals of unknown sex (U) were only considered for further analysis when the results were not dependent on sex.

5.5 Age distributions

Age distributions have been outlined below by site and sex, these allow for demographic comparisons to be made, and conclusions to be drawn by site location (rural/urban) and socio-economic status, and between males and females of differing ages. Raw data for age-at-death and mean age for each individual can be found in the appendices (Appendix 1).

5.5.1 Age distribution by site

Table 5.5 and Figure 5.3 present the age distribution of the study sample. Most individuals (55.9%, or n=315) fell into the 46-59 year age cohort, with the 70+ year age cohort having the fewest individuals (n=40, or 7.1%). Fishergate had significantly more individuals in the 35-45 year cohort (31.3% or n=20; $\chi^2=9.36$, 1.d.f.; $p=0.005$) and the lowest proportion of individuals in the 46-59

year cohort (39.1% or n=25; 46-59 cohort: $\chi^2=8.25$, 1.d.f.; $p=0.005$). Barton had significantly more individuals in the 46-59 year cohort (61.0%, or n=152; $\chi^2=4.88$, 1.d.f.; $p=0.05$) than the rest of the sites combined, and more individuals dying between 60 and 69 years (23.3%, or n=58). The higher percentage of individuals in the 70+ year cohort at Fishergate was not significant ($\chi^2=3.20$, 1.d.f.; $p=0.1$).

Table 5.5. Number and percentage (%) of individuals in each age cohort, by site.

Site	35-45 (%)	46-59 (%)	60-69 (%)	70+ (%)
Barton	23 (9.2)	152 (61.0)	58 (23.3)	16 (6.4)
Fishergate	20 (31.3)	25 (39.1)	11 (17.2)	8 (12.5)
St. Helens	20 (18.0)	62 (55.9)	21 (18.9)	8 (7.2)
Wharram	36 (25.7)	76 (54.3)	20 (14.3)	8 (5.7)
TOTAL	99 (17.6)	315 (55.9)	110 (19.5)	40 (7.1)

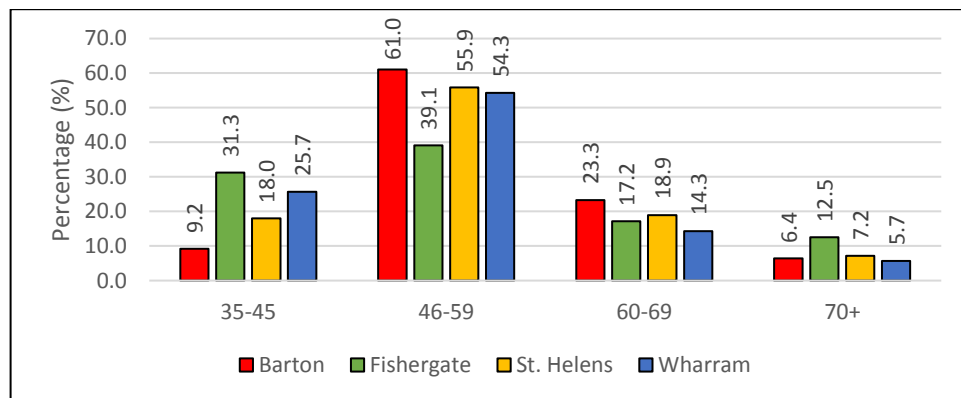


Figure 5.3. Percentage of individuals in each age cohort, by site.

5.5.1.1 'Adult' age distribution

In total, 60 individuals recorded as simply 'adult' in the site reports were included within the study sample. These were from Barton (n=27), St. Helens (n=6) and Wharram (n=27). All individuals were aged numerically during this study, despite having a lower number of elements available for study on average (Table 5.6). As per the requirements for this study, each individual possessed an auricular surface (n=56) and/or a pubic symphysis (n=31). The sex distribution between the 'adult' and numerically aged individuals was roughly equal (adult: male 55.0%, female 45.0%; numerically aged: male 56.9%, female 42.5%, indeterminate 0.6%). The 'adult' individuals had an inverse

relationship with the numerically aged individuals, when age distributions were calculated. A significantly higher proportion of individuals were aged 35-45 years ($\chi^2=26.98$, 1.d.f.; $p=0.001$), as well as 70+ years, although this was insignificant ($\chi^2=0.16$, 1.d.f.; $p=0.5$).

Table 5.6. Mean number of elements available for ageing per individual, and age distribution (%), when 'adults' and numerically aged individuals (according to the site reports) are separated.

Site report descriptor	Mean number of elements available	Age distribution (%) post-analysis			
		35-45	46-59	60-69	70+
'Adults'	4.6	41.7	38.3	11.7	8.3
Numerically aged	7.5	14.7	57.9	20.4	6.9
All individuals	7.2	17.6	55.9	19.5	7.1

5.5.2 Age distributions by sex

When the age cohorts were divided by sex, females (8.9%, or $n=50$) slightly exceeded males (8.5%, or $n=48$) in the 35-45 year cohort, while there were more males in the 46-59 and 60-69 year cohorts. Finally, there were equal proportions of males and females (3.5%, or $n=20$) in the 70+ cohort (Table 5.7; Figure 5.4). The higher prevalence of females in the 70+ year cohort at Barton was not significant ($\chi^2=1.22$, 1.d.f.; $p=0.5$), whereas the high prevalence of males was ($\chi^2=12.45$, 1.d.f.; $p=0.001$).

Table 5.7. Number and percentage of individuals in each age cohort by site and sex. Three unsexed individuals (1.2%) are excluded from the Barton data.

Site	35-45		46-59		60-69		70+	
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)
Barton	11 (4.4)	11 (4.4)	97 (39.0)	53 (21.3)	37 (14.9)	21 (8.4)	6 (2.4)	10 (4.0)
Fishergate	7 (10.9)	13 (20.3)	8 (12.5)	17 (26.6)	6 (9.4)	5 (7.8)	6 (9.4)	2 (3.1)
St. Helens	8 (7.2)	12 (10.8)	33 (29.7)	29 (26.1)	11 (9.9)	10 (9.0)	4 (3.6)	4 (3.6)
Wharram	22 (15.7)	14 (10.0)	42 (30.0)	34 (24.3)	12 (8.6)	8 (5.7)	4 (2.9)	4 (2.9)
TOTAL	48 (8.5)	50 (8.9)	180 (31.9)	133 (23.6)	66 (11.7)	44 (7.8)	20 (3.5)	20 (3.5)

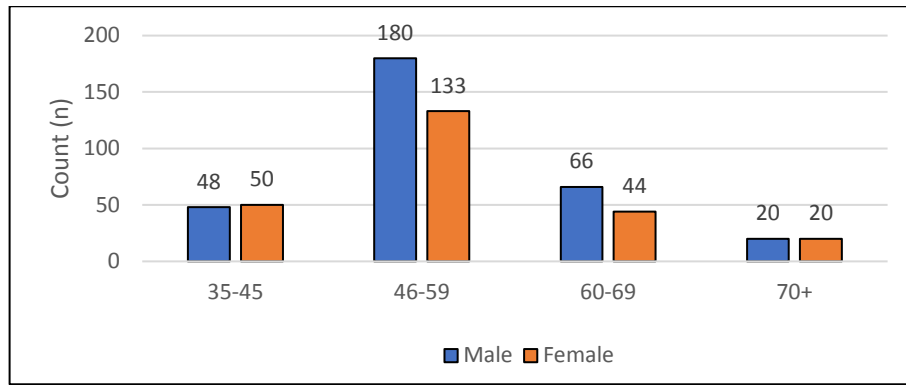


Figure 5.4. Number of males and females in each age cohort.

5.5.2.1 Cranial masculinisation in older females

To test if masculinisation of cranial features was an issue affecting older females, the variation across the spread of cranial traits recorded, for the different age cohorts, has been calculated (1. Female; 2. ?Female; 3. Indeterminate; 4. ?Male; 5. Male). From the 247 individuals with an estimated sex of female or ?female, a total of 827 sexually dimorphic cranial traits were recorded. The majority of these came from the 46-59 year cohort (55.1%) potentially indicating better preservation of these individuals, or simply that more individuals died within this age cohort. The predominant trait score recorded in each age cohort was 1. Female; with the majority declining continuously towards the more masculine traits. The exception was between the proportion of trait scores recorded as male (4.0%) in the 60-69 year cohort, which exceeded the proportion scored as ?male (3.4%). This demonstrates that in general, masculinisation of the skull does not affect sex estimation in old females, with similar proportions of more masculine traits recorded across the age cohorts.

Table 5.8. Number and percentage (%) of sexually dimorphic traits from the cranium recorded for estimated females, by age cohort.

Age cohort (years)	1. Female (%)	2. ?Female (%)	3. Indeterminate (%)	4. ?Male (%)	5. Male (%)	TOTAL (%)
35-45	57 (48.3)	38 (32.2)	13 (11.0)	7 (5.9)	3 (2.5)	118 (14.3)
46-59	211 (46.3)	146 (32.0)	55 (12.1)	29 (6.4)	15 (3.3)	456 (55.1)
60-69	73 (42.0)	55 (31.6)	33 (19.0)	6 (3.4)	7 (4.0)	174 (21.0)
70+	35 (44.3)	27 (34.2)	10 (12.7)	6 (7.6)	1 (1.3)	79 (9.6)
TOTAL	376 (45.5)	266 (32.2)	111 (13.4)	48 (5.8)	26 (3.1)	827 (100.0)

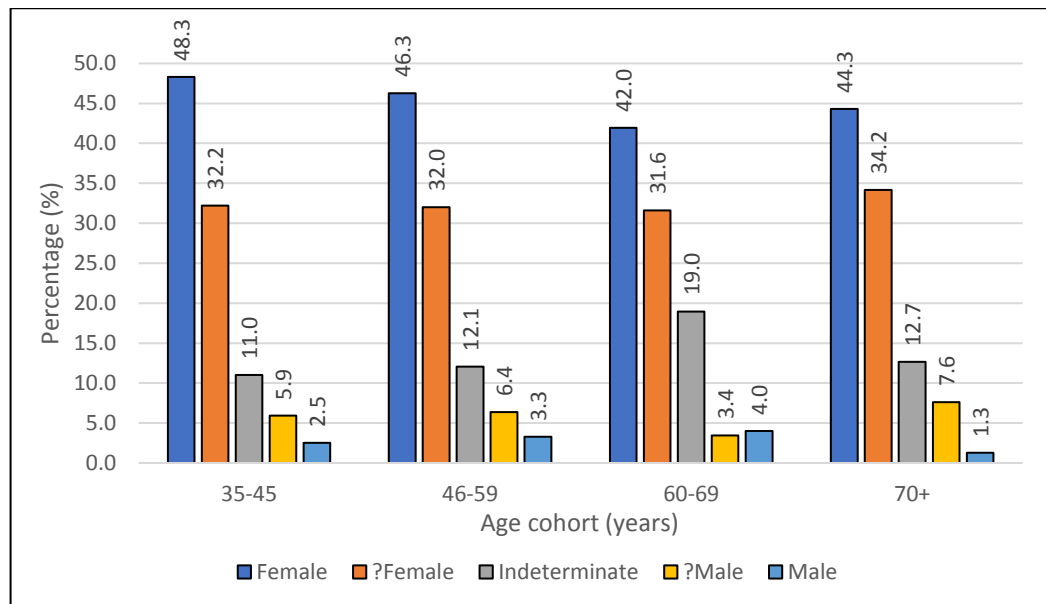


Figure 5.5. Proportion (%) of sexually dimorphic traits recorded for the cranium, for estimated females, by age cohort.

5.6 Evaluation of ageing methods

An objective of this study was to review standard and untested methods of age estimation for older individuals. The reasons for this were twofold, initially to assess if each method could identify individuals over 46 years at death, and their 'worth' in doing so. A methods worth is dictated by its ease of use, its usability across the adult life course, its consistency in ageing in comparison to other methods, its avoidance of age structure mimicry, and how it accounts for and incorporates increased degeneration on movable joints. These results are presented below; raw data for each method can be found in the appendices (Appendix 2 – 12).

5.6.1 Method ease of use

Five methods used composite scores to assign age ranges to individuals; these were the dens facet, dens process, third cervical vertebra, sternal clavicle and the auricular surface, meaning their resultant scores were singular, and consistent with no inconclusive results. The rest of the techniques (first and fourth ribs, iliac crest, pubic symphysis and ischium) used the scores directly generated by macroscopic examination of the skeletal traits, allowing for inconclusive results.

The pubic symphysis had the highest rate of inconclusive results at 76.2% (or n=294). The dentition (16.3%), fourth rib (14.9%) and ischium (1.6%) also produced a number of inconclusive

results. The only element which did not present any inconclusive results, despite not utilising a composite score was the first rib (Table 5.9).

Of the five methods that use composite scores, only the clavicle provided discrepancies between trait scores that make up the composite (n=5), but this did not alter the assigned age range. The only other element with discrepancies on an individual trait level was the pubic symphysis (n=3).

*Table 5.9. Number of decisive and inconclusive results for each method, arranged by most inconclusive to least. * = uses composite scores*

Method	No. observed	Decisive (%)	Inconclusive (%)
Pubic symphysis	386	92 (23.8)	294 (76.2)
Dentition	417	345 (82.7)	72 (17.3)
Fourth Rib	376	320 (85.1)	56 (14.9)
Ischium	509	501 (98.4)	8 (1.6)
Iliac crest	375	373 (99.5)	2 (0.5)
First Rib	262	262 (100.0)	0
Dens facet (C1)*	349	349 (100.0)	0
Dens process (C2)*	374	374 (100.0)	0
Third cervical (C3)*	438	438 (100.0)	0
Sternal clavicle*	427	427 (100.0)	0
Auricular surface*	543	543 (100.0)	0

5.6.2 Variability of age ranges

Accuracy and precision are crucial in age-at-death estimation, meaning methods must both incorporate the correct age-at-death and not produce impractical, large age ranges. To assess the variability in the age ranges derived by each method, the lowest and highest ages estimated by each method were recorded along with the number of years difference between them. The smallest and largest number of years within the age ranges provided by each method, as well as the minimum and maximum mean ages were also recorded (Table 5.10). Of all eleven methods, the highest estimated age was 97 years based on the sternal end of the clavicle, and the lowest was 12 years based on the first rib. The auricular surface produced age estimates from a low of 16 years to a high of 92 years, providing the biggest difference of 76 years, and the iliac crest and

dens facet (C1) provided the smallest difference at 25 years each, with age estimates from 57 to 82 years and 51 to 76 years respectively.

The dens facet (C1), as well as the C3, provided the smallest overall age range estimations, at only 3 years and the pubic symphysis provided the largest overall age range estimation of 72 years.

The minimum mean age for the combined sample was provided by the first rib at 12 years and the maximum mean age was provided by the clavicle at 87 years.

Table 5.10. Variability of age ranges and mean ages provided by the methods (years).

Method	Count (n)	Lowest age est.	Highest age est.	No. years difference	Smallest age range estimated	Largest age range estimated	Min. mean age	Max. mean age
Dentition	417	17	45+	28+	8	28	N/A	N/A
Dens facet (C1)	349	51	76	25	3	6	54.4	75.1
Dens process (C2)	374	51	77	26	4	8	55.1	75.1
Third cervical (C3)	438	44	81	37	3	12	50.3	78.1
Sternal clavicle	427	35	97	62	4	51	48.8	87.0
First rib	262	12	75	63	6	23	12.0	66.2
Fourth rib	376	20	82	62	4	28	22.6	76.4
Iliac crest	375	57	82	25	4	9	59.2	77.8
Auricular surface	543	16	92	76	17	59	29.3	72.3
Pubic symphysis	386	15	87	72	25	72	21.3	61.2
Ischium	509	38	93	55	16	50	45.8	78.9

5.6.3 Agreement between ageing methods

Using a multifactorial approach to ageing is regarded by many researchers as more accurate than using one technique on its own (Kemkes-grottenthaler, 2002), but some level of agreement is needed to be able to determine the correct age category for each individual. To explore this, the agreement between the mean ages provided by the ten skeletal ageing techniques was calculated, dental ageing was excluded due to its lack of means. This was done by tallying the means produced by every individual into one of four age cohorts to find their majority age cohort (Table 5.11). For example, if an individual was aged using four elements, and three produced mean ages between 35 and 45 years, with the final method producing a much higher or lower mean, that individuals' 'majority age cohort' would be 35-45 years. Alternatively, if two means fell

between 35 and 45 years, and two fell between 46 and 59 years, the individual was said to have a ‘wider’ majority age cohort, in this case 35-59 years.

Table 5.11. Number of individuals whose mean ages fell within one or more of the study’s age cohorts (wider = if an individual’s mean ages bridged more than one age cohort equally). NB. The mean ages for one individual placed it in a majority age cohort below 35 years, this individual was therefore excluded from further analysis.

Age Cohort	Count	Percentage (%)
35-45	25	4.4
46-59	225	40.0
60-69	59	10.5
70+	95	16.9
Subtotal	404	71.8
Wider	159	28.2
TOTAL	563	100.0

A total of 404 individuals (71.8%) had mean age estimates which fell into one of four age cohorts, with 159 individuals (or 28.2%) whose mean ages fell predominantly into more than one age cohort, this was therefore classed as a ‘wider’ age cohort (Table 5.12). Of the majority cohorts, 225 individuals (40.0%) had mean age estimates which fell principally into the 46-59 age cohort, with an additional 95 individuals (16.9%) whose mean ages predominantly fell into the 70+ age cohort. The high proportion of 70+ means will be further analysed below (Section 5.6.4).

Of the 159 individuals whose mean age estimates created a wider cohort, 119 (or 74.8%) fell into two age cohorts. Of those, 70 (or 58.8%) were consecutive cohorts, however 49 were non-consecutive, meaning they were separated by one or more age cohorts. For example, a wider, non-consecutive cohort of two primaries, could have an equal number of mean ages in both the 46-59 and 70+ age cohorts, with fewer mean ages in the 60-69 age cohort. This individual’s wider age cohort was therefore recorded as 46 to 70+ years.

Table 5.12. Number of individuals whose mean age estimates fell into wider majority age cohorts.

No. of age cohorts	Count (%)	Consecutive	Non-consecutive
2	119 (74.8)	70	49
3	34 (21.4)	27	7
4	5 (3.1)	3	2
5	1 (0.6)	1	0
TOTAL	159	101	58

5.6.4 High mean age

To assess why 16.9% of the sample were placed in the 70+ year age cohort using the means derived by the various ageing methods, the absolute mean age estimated by each skeletal technique was calculated (Figure 5.6). This was to test if the overall mean age for each individual was being influenced by age-structure mimicry (i.e. the age profile of the skeletal collection the methods were developed using). The results demonstrated that each of the techniques developed to age specifically over 45 years provided higher absolute means than the standard techniques. The only 45+ technique to have an average below 60 years was the ischium, at 59.1 years. By comparison the highest average for the standard methods was 56.4 years based on the auricular surface.

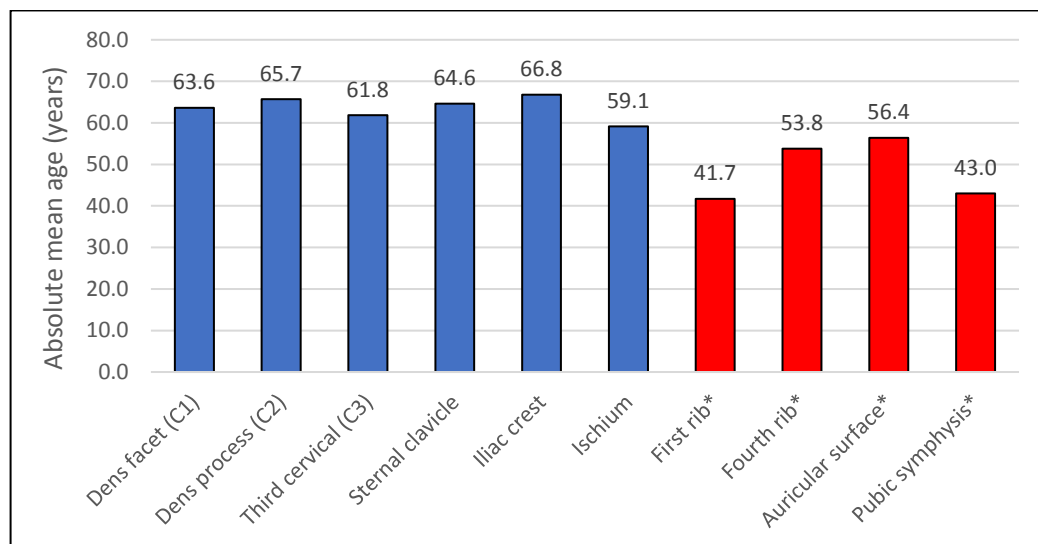


Figure 5.6. Absolute mean age for each skeletal ageing method used (* standard ageing techniques).

To explore this further, the number of times each method provided a mean over 70 years was calculated. Ageing using the iliac crest resulted in a mean age over 70 years in 47.5% of cases (n=178), whereas with the standard method using the pubic symphysis and first rib the mean age never reaches 70 years (n=0) (Table 5.13). Demonstrating that age-structure mimicry is definitely influencing the means of these techniques.

Table 5.13. Number and percentage (%) of times a mean age was recorded as above 70 years, for each of the skeletal ageing techniques. (* standard ageing techniques).

Method	Count (n)	70+ (%)
Dens facet (C1)	349	51 (14.6)
Dens process (C2)	374	126 (33.7)
Third cervical (C3)	433	147 (33.9)
Sternal clavicle	427	122 (28.6)
Iliac crest	375	178 (47.5)
Ischium	509	207 (40.7)
First rib*	262	0 (0.0)
Fourth rib*	376	39 (10.4)
Auricular surface*	543	46 (8.5)
Pubic symphysis*	386	0 (0.0)

5.6.5 Movable vs. static elements

Researchers have argued that assigning a chronological age, based on physiological changes, to moveable elements is less reliable. This is because they deteriorate more quickly than more static bones in individuals who carried out manual labour, or females who gave birth, providing an erroneously older age-at-death estimation (Augat and Schorlemmer, 2006:30; Bongiovanni, 2014; Márquez-Grant, 2015).

Of the 10 skeletal elements used to estimate age, four can be classed as movable and six as static (Table 5.14). A total of 2492 individual elements available for analysis were static and 1542 were moveable.

Table 5.14. Moveable and static elements.

Method	Moveable/static
Dens facet (C1)	Movable
Dens process (C2)	Movable
Third cervical (C3)	Movable
Pubic symphysis	Movable
Sternal clavicle	Static
First rib	Static
Fourth rib	Static
Iliac crest	Static
Auricular surface	Static
Ischium	Static

Of the moveable bones in the sample, the dens process (C2) had a distinct margin of mean age estimates above the majority age cohorts (n=144 above, n=22 below), both the dens facet (C1) and C3 follow this trend to a lesser degree (Figure 5.7). However, the pubic symphysis demonstrated a distinct majority of mean age estimates below the majority age cohort (n=272 below, n=2 above). This means that overall, out of the methods using movable bones, the dens process (C2) consistently placed individuals into older age cohorts, whereas the pubic symphysis consistently placed individuals into younger age cohorts.

Of the static bones, the first and fourth ribs, auricular surface and ischium all provided more mean ages that were lower than the majority age cohorts. However, the sternal clavicle and iliac crest both resulted in mean ages that were higher than the majority age cohorts (n=110 and 140 above, respectively). Hence, mean ages provided by the sternal end of the clavicle and iliac crest were often placing individuals into older age cohorts, despite being static bones.

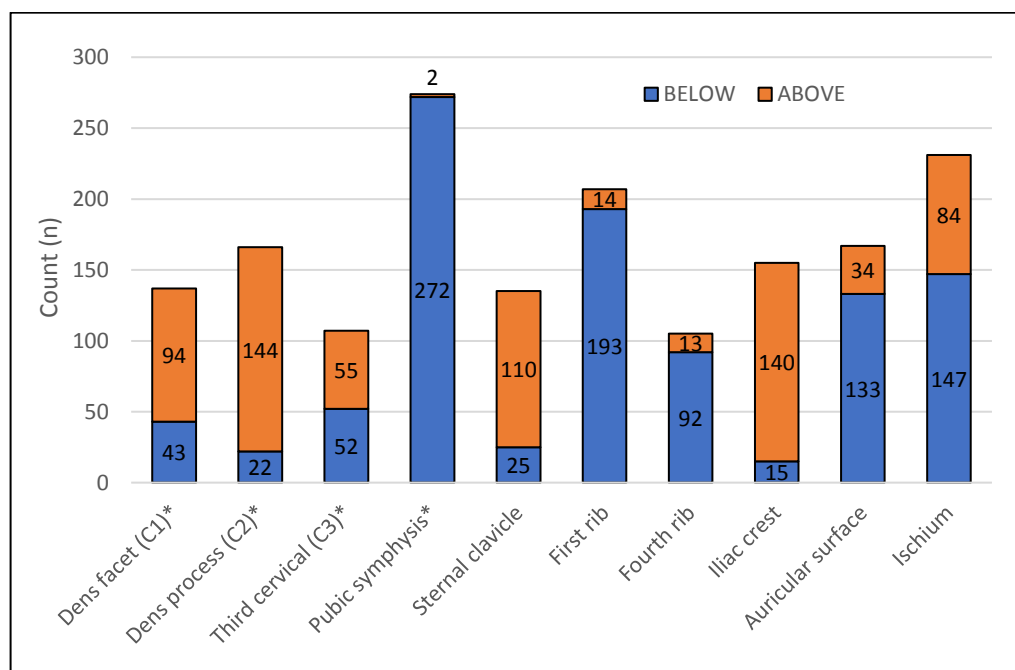


Figure 5.7. Number of mean age estimates that fall above or below the majority age cohorts (* - moveable elements).

When the age estimates for static and moveable elements were explored by sex the same trends apply overall (Figure 5.8).

However, the C3 aged significantly more females to below the majority cohort than above, in contrast to males, which follows the expected trend for moveable bones ($X^2 = 8.95$, 1.d.f.; $p=0.005$). The dens facet (C1) also provided significantly different results between the sexes, despite both having more individuals placed above the majority cohort than below it ($X^2 = 10.96$, 1.d.f.; $p=0.001$).

In summary, the pubic symphysis for both sexes, and the C3 for females, do not follow the expected trend for older age estimates in movable bones. In addition, the iliac crest in both sexes and the clavicle in males do not follow the expected trend of younger mean ages in static bones. However, all the other elements follow the expected trends.

The deviation from the expected could indicate age-structure mimicry in these techniques, or the variation in deterioration on both movable and static joints may be non-directional, meaning that it cannot be tracked, and therefore cannot be reflected by the means.

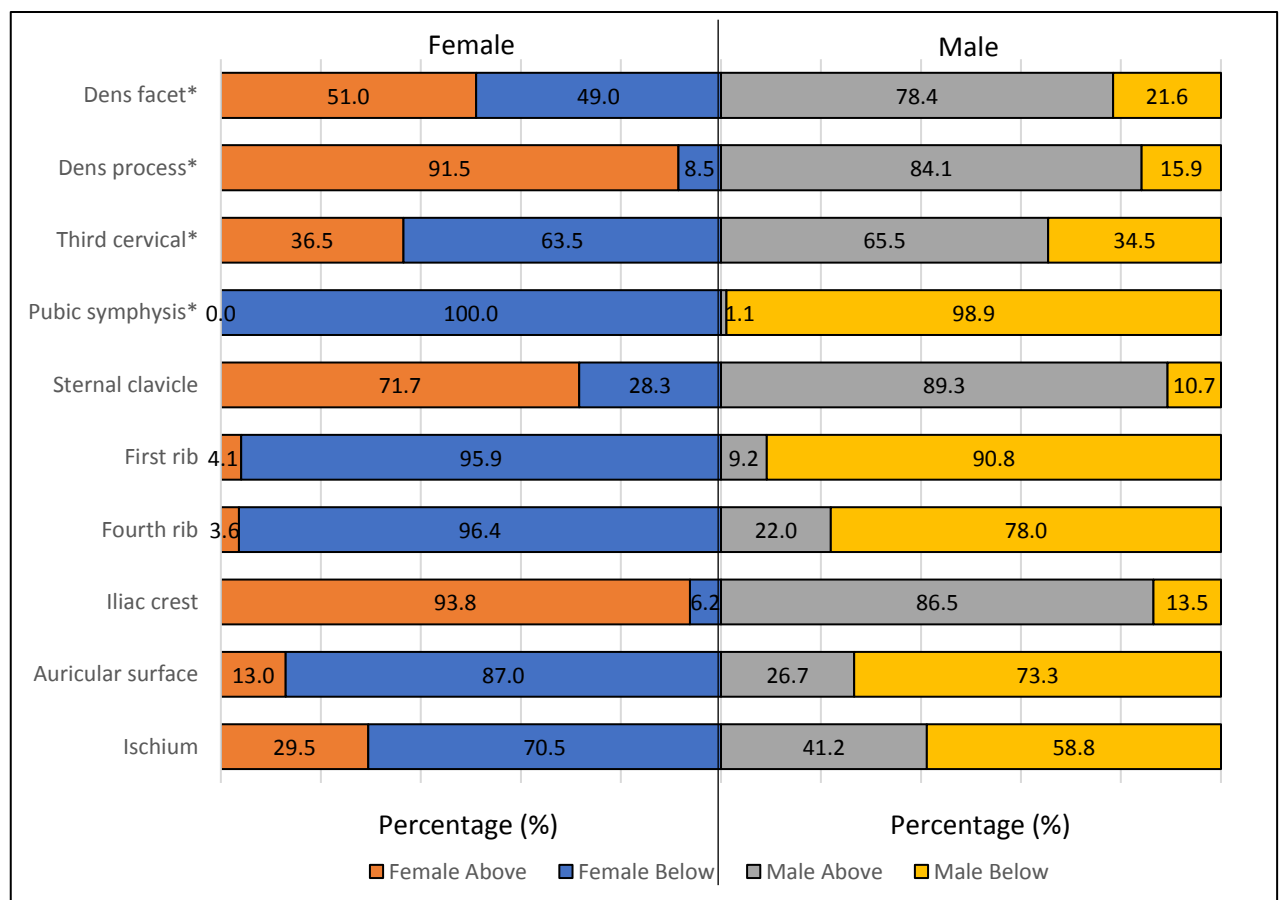


Figure 5.8. Percentage of mean age estimates that fell above and below the majority age cohort, by sex (* - moveable elements).

5.7 Frailty

Assessment of ability involves the calculation of morbidity in individuals, which are directly related entities although not equal, but inferences can be outlined. Marklein et al.'s (2016) Frailty Index, is considered below by age cohort, site and through pathology type. Nine frailty indices were used; dental disease, osteoarthritis, spondylosis, periostitis and/or osteomyelitis, malignant neoplasia, osteoporosis, cribra orbitalia, rickets/osteomalacia and fractures.

A frailty score for each individual in the combined sample was calculated, with a potential score available from zero to nine. The majority of individuals (n=158; 28.0%) exhibited two markers of frailty each (Table 5.15). A total of 97 individuals (17.2%) exhibited no markers of frailty, however this does not mean that they did not experience pathologies during life, simply that they were either not included within the frailty parameters or not recordable, due to preservation issues. No individuals exhibited more than six markers of frailty. The high prevalence of individuals with an SFI of 2 was significant, in comparison to the rest of the scores ($\chi^2=218.10$, 1.d.f.; $p=0.001$).

Table 5.15. Number and percentage (%) of individuals with each skeletal frailty index (SFI) score.

SFI score	Number individuals (%)
0	97 (17.2)
1	133 (23.6)
2	158 (28.0)
3	110 (19.5)
4	44 (7.8)
5	16 (2.8)
6	6 (1.1)
7	0
8	0
9	0

The prevalence of visible pathologies recorded on skeletal remains is dependent on preservation within the archaeological record. Low frailty scores on poorly preserved individuals does not necessarily mean that these individuals had low frailty, just that we lack the evidence for it. This is termed the 'osteological paradox' (Wood et al., 1992) and is evident if the number of individuals recorded with frailties is calculated against their preservation (Figure 5.9). This demonstrates that

frailties are recorded more often on better preserved individuals (very poor 25.0%, n=3; very good 92.5%, n=184).

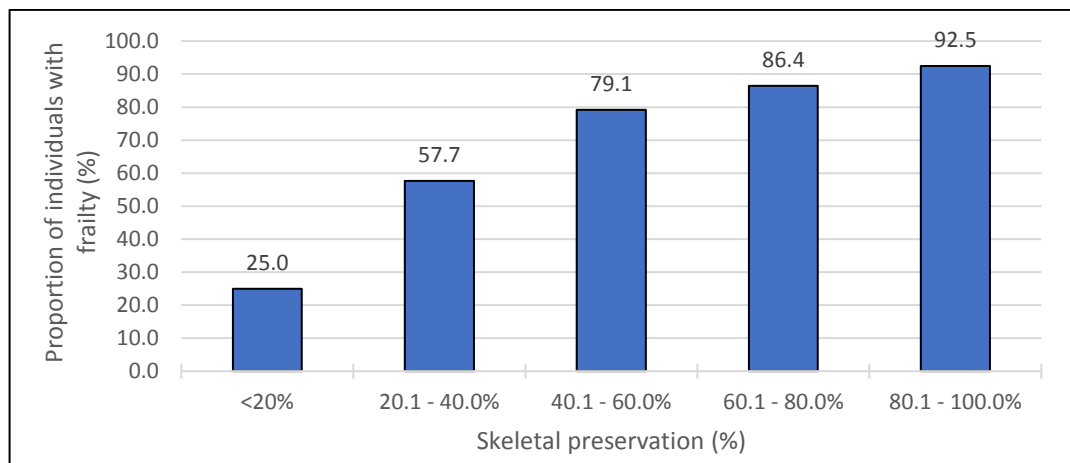


Figure 5.9. Proportion (%) of individuals with recorded frailties, by preservation.

5.7.1 Frailty by age cohort

The Frailty Index (Marklein et al., 2016) was applied to the study sample to calculate the mean morbidity by age cohort and to assess if ability was impacted by age (Table 5.16). The mean Skeletal Frailty Index (SFI) for the combined sample was 2.29. Mean SFI increased successively with age, from 1.83 in the 35-45 year cohort, to 3.15 in the 70+ year cohort (Figure 5.10). Following this trend, the prevalence of individuals in the combined sample who exhibited frailty, increased proportionally with advancing age, until the 70+ age cohort when 97.5% (n=39) of individuals exhibited some form of frailty. To test if there is an onset age for frailty, the number of frail individuals in each cohort was compared against the succeeding cohort. For males it was found to be most statistically significant that there are more frailties per individual in the 60-69 year cohort in comparison with the 46-59 year cohort ($\chi^2=10.07$, 1.d.f.; $p=0.005$). For females, the onset of frailty was statistically significant between the 35-45 year and 46-59 year cohorts ($\chi^2=7.39$, 1.d.f.; $p=0.01$).

Table 5.16. Number and percentage (%) of individuals with and without frailties, number of frailties recorded and mean SFI, by age cohort.

Age cohort	No. individuals w. frailties (%)	No. frailties recorded	Mean SFI	No. individuals without frailties (%)
35-45	65 (65.7)	119	1.83	34 (34.3)
46-59	258 (80.6)	541	2.10	57 (18.1)
60-69	105 (94.5)	288	2.74	5 (4.5)
70+	39 (97.5)	123	3.15	1 (2.5)
TOTAL	467 (81.9)	1071	2.29	97 (17.2)

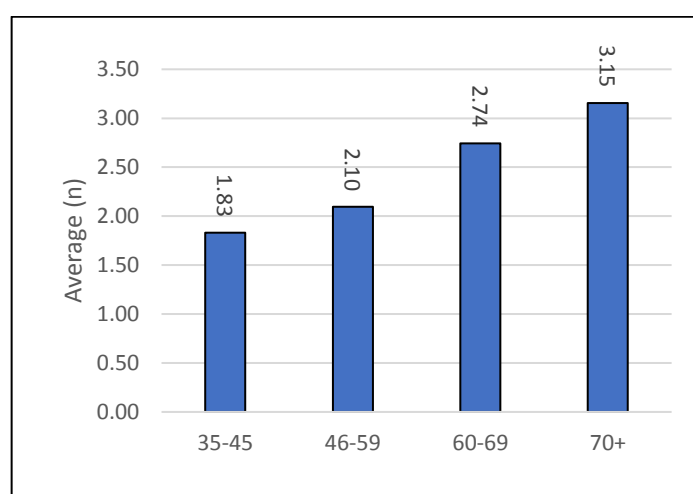


Figure 5.10. Mean SFI of pathologies, by age cohort.

Below, Figure 5.11 demonstrates the general decline of the lower SFI scores (i.e. 0 and 1) with increasing age, and the general increase of the higher scores (i.e. 2 to 6). These trends are clear for both sexes, although the female SFI of 6 peaks in the 60-69 year age cohort. Interestingly an SFI of 2 has a high percentage throughout the age cohorts for both sexes.

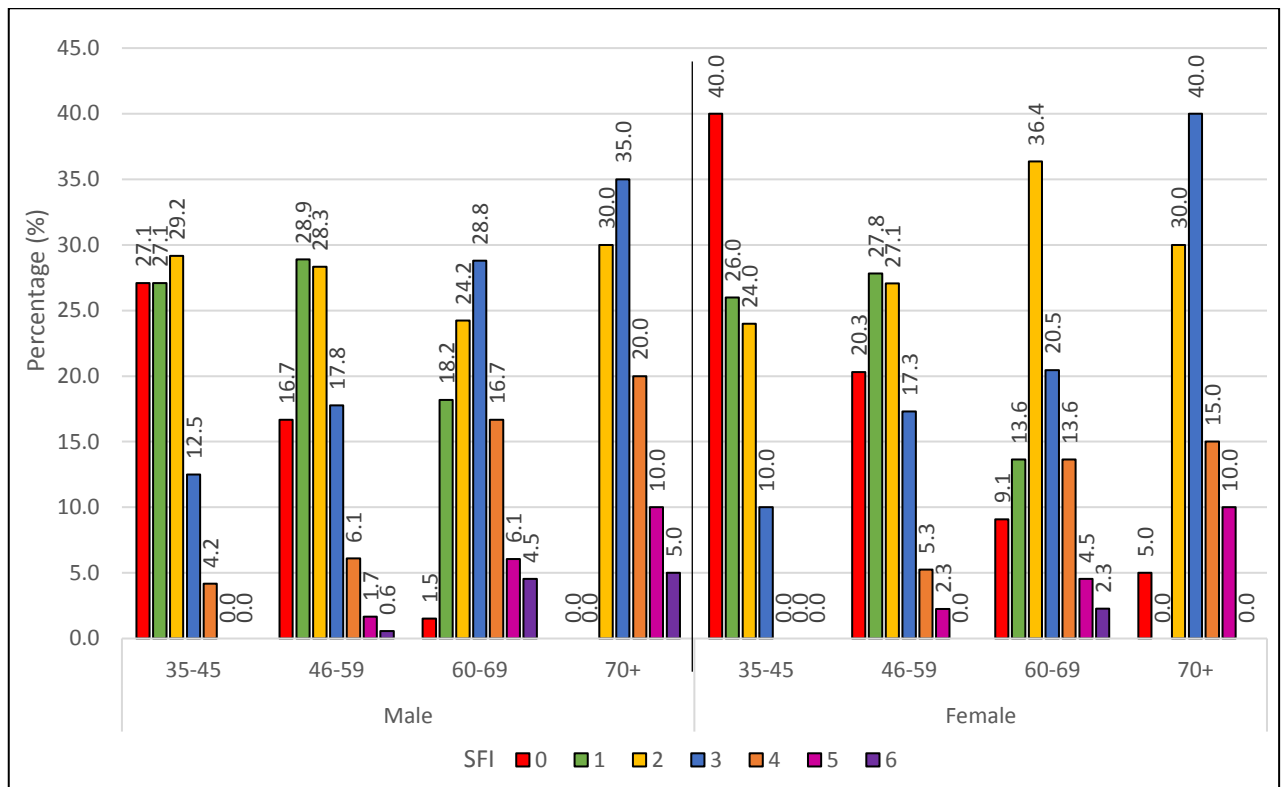


Figure 5.11. Percentage of individuals with each SFI score by sex and age.

5.7.2 Frailty by site

In order to assess whether site type lead to greater morbidity, the Frailty Index was calculated by site, sex, and age (Table 5.17; Figure 5.12; Figure 5.13). Fishergate had the highest mean SFI at 2.81, and Barton the lowest at 2.18. The higher SFI at Fishergate was not significant when compared with the other sites ($\chi^2=3.10$, 1.d.f.; $p=0.25$). The SFI increased with advancing age for both sexes, with females exhibiting a higher mean SFI at Barton and Wharram. Fishergate had the highest mean SFI for males at 3.64, with Wharram having the lowest at 2.14. The higher SFI for males at Fishergate compared to the other sites in the study was statistically significant ($\chi^2=4.53$, 1.d.f.; $p=0.05$). St. Helens had the lowest average SFI for females at 2.12, and Wharram the highest at 2.41. The higher total SFI for females at Wharram compared to the other sites was not statistically significant ($\chi^2=0.29$, 1.d.f.; $p=0.5$).

Table 5.17. Mean SFI by sex, age and site.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL
	M	F	M	F	M	F	M	F	M	F	
Barton	1.83	1.33	1.98	2.00	2.57	2.53	2.83	2.70	2.17	2.20	2.18
Fishergate	2.83	1.50	3.14	2.29	4.33	3.00	4.33	3.00	3.64	2.18	2.81
St. Helens	1.50	2.00	2.17	1.82	3.18	2.40	2.75	3.25	2.38	2.12	2.25
Wharram	1.76	1.91	2.15	2.29	2.45	2.88	2.75	3.75	2.14	2.41	2.26
TOTAL	1.91	1.73	2.10	2.08	2.82	2.63	3.25	3.05	2.33	2.24	2.29

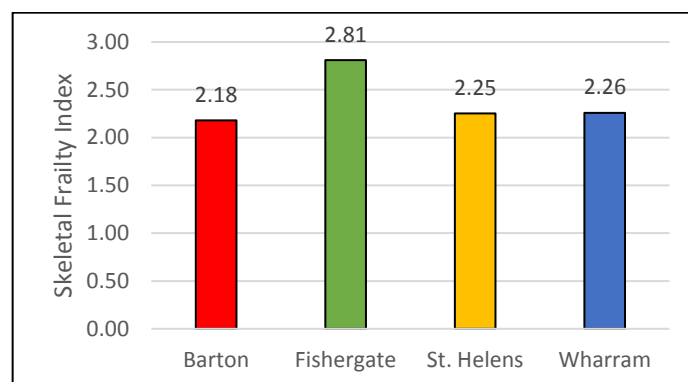


Figure 5.12. Mean SFI at each site.

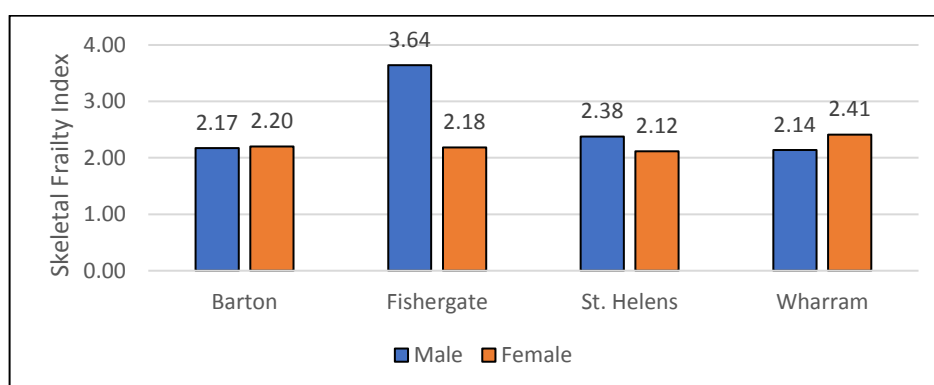


Figure 5.13. Mean SFI at each site, by sex.

5.7.3 Frailty by pathology

To assess which markers of frailty were most prevalent in the study samples the percentage of each was calculated by site (Figure 5.14). Spondylosis was the most prevalent frailty at Barton (54.1%), St. Helens (64.0%) and Wharram (55.7%). Whereas Fishergate had a higher proportion of osteoarthritis (62.5%), which was found to be significant against the rest of the sample ($\chi^2=25.27$, 1.d.f.; $p=0.001$). Fishergate also had the highest rate of fractures (39.1%), which was significant in

comparison to the rest of the sample ($X^2=6.53$, 1.d.f.; $p=0.025$), and the highest prevalence of infection (28.1%), but this was not statistically significant ($X^2=3.1$, 1.d.f.; $p=0.01$). Wharram had the highest prevalence rates of cribra orbitalia and periodontal disease, both of which were found to be significant in comparison to the rest of the sample (cribra: $X^2=13.22$, 1.d.f.; $p=0.001$; dental: $X^2=5.80$, 1.d.f.; $p=0.025$).

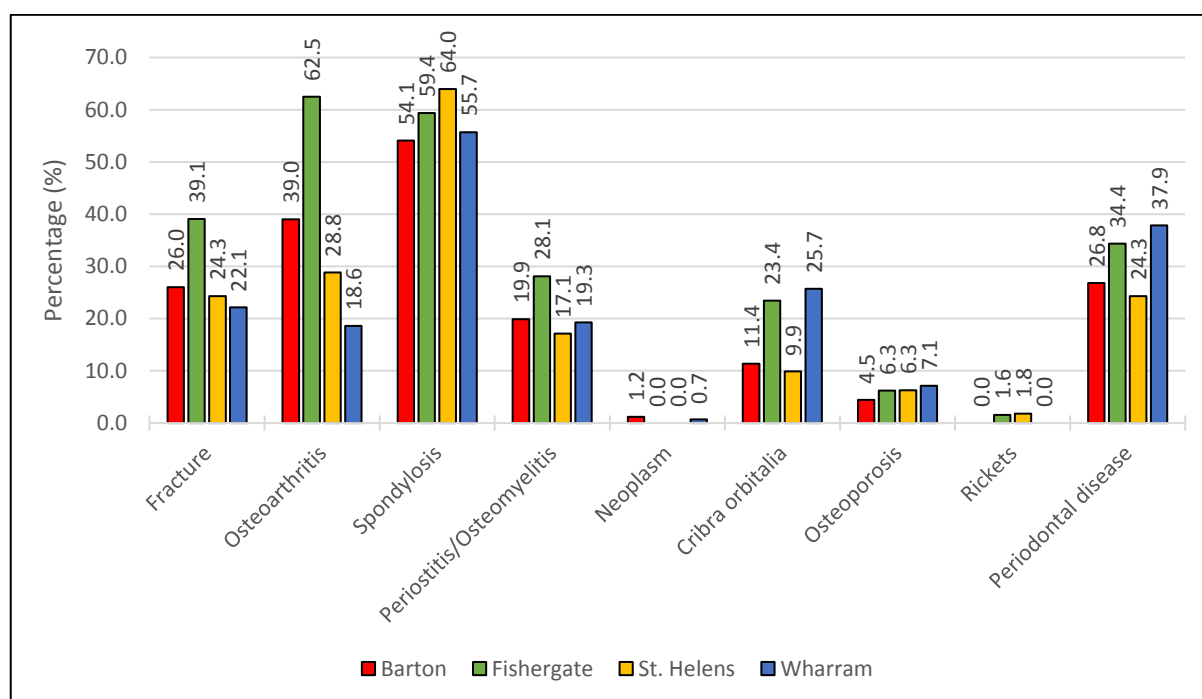


Figure 5.14. Prevalence (%) of each pathology used to calculate SFI, by site. Neoplasm = malignant only; Rickets = childhood rickets and osteomalacia.

Additionally, to assess if there was increase in disease prevalence with advancing age, the percentage of each was calculated by age cohort (Figure 5.15). The majority of markers for frailty were found to increase in prevalence with age, even those that are not age-related diseases, such as fractures and periodontal disease. The largest jump in prevalence occurs for osteoporosis between the 60-69 and 70+ year cohorts. When these cohorts were compared, the jump between them was found to be statistically significant ($X^2=8.02$, 1.d.f.; $p=0.005$). Another significant jump occurred between the 46-59 year and 60-69 year cohorts for osteoarthritis (OA) ($X^2=25.72$, 1.d.f.; $p=0.001$).

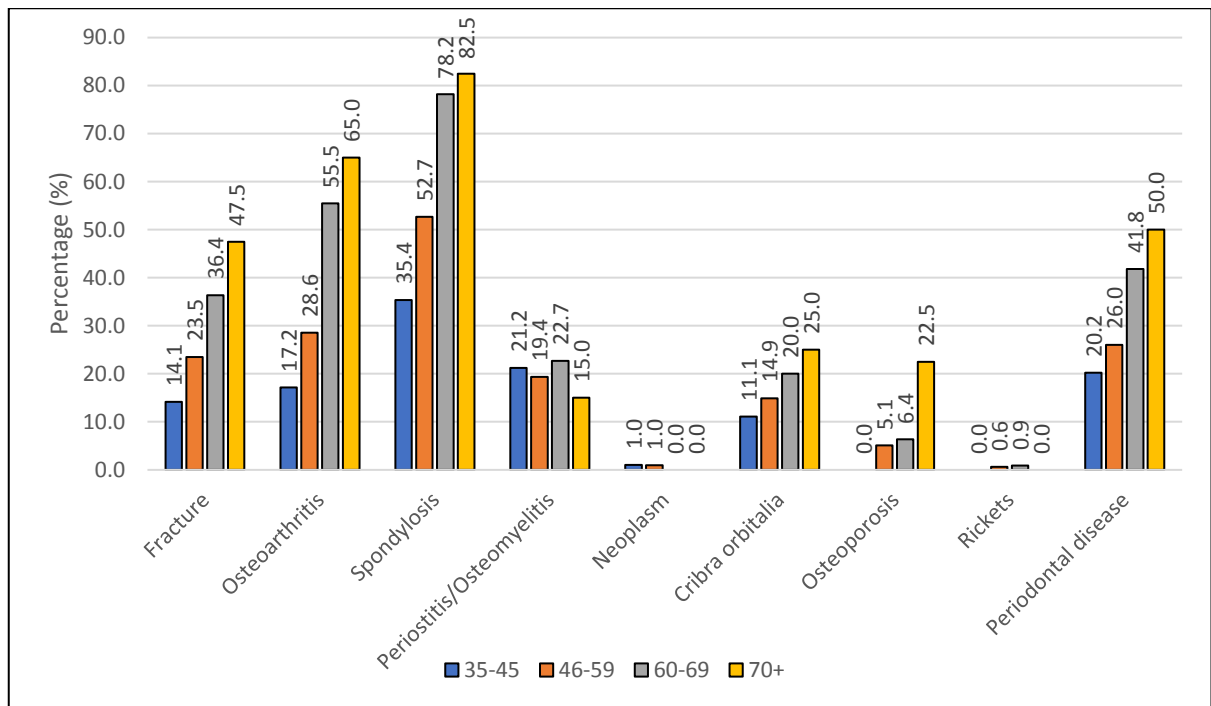


Figure 5.15. Prevalence (%) of each pathology used to calculate SFI, by age cohort. Neoplasm = malignant only; Rickets = childhood rickets and osteomalacia.

5.7.4 Frailty and ability

It has been demonstrated that frailty increases with age. Both in terms of the numbers of individuals recorded with frailties, and the number of frailties per individual. However lower SFI scores (SFI 2 or 3) predominate throughout, the scores were therefore explored to see if the oldest were also the frailest and therefore the least able.

Individuals from the 46-59, 60-69 and 70+ year cohorts were all observed to have an SFI of 6 (Figure 5.16). The majority (37.5%) of 70+ year individuals had an SFI of 3. With the preceding age cohorts having successively lower majority SFI scores (60-69 years = SFI 2, 29.1%; 46-59 years = SFI 1, 28.3%; 35-45 years = SFI 1, 33.3%). The 70+ year majority with an SFI of 3 was significant ($\chi^2=8.88$, 1.d.f.; $p=0.005$). The low prevalence of 35-45 year individuals with an SFI of 4 was significant ($\chi^2=5.58$, 1.d.f.; $p=0.025$).

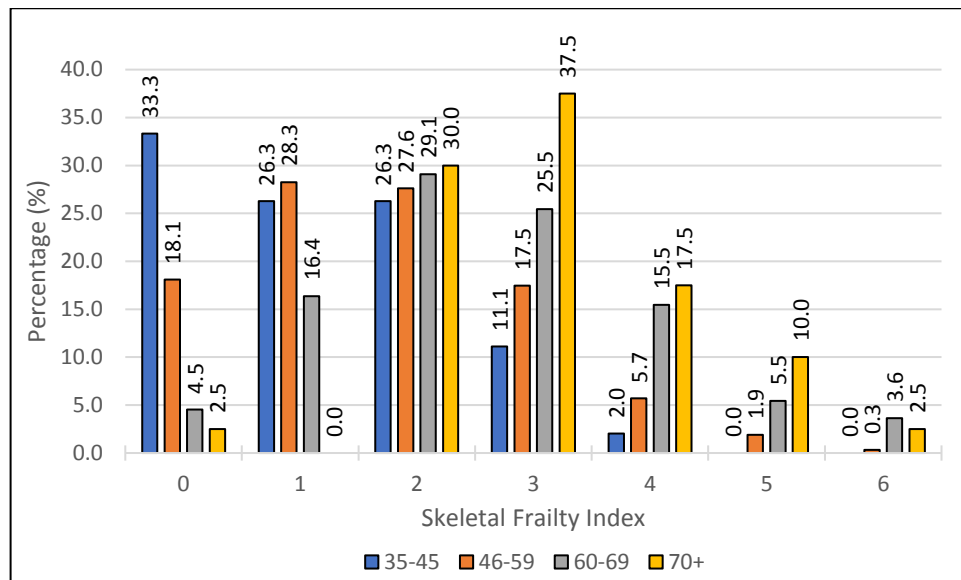


Figure 5.16. Results for the prevalence (%) of each SFI score 0-6, by age cohort.

When the frailest individuals (SFI 5 and 6) were considered separately (n=22; 3.9%), it was found that the number exhibiting markers of physical abuse (n=6) was significant in relation to the rest of the sample ($\chi^2=24.55$, 1.d.f.; $p=0.001$). This suggests that an increase in frailty is directly linked with a loss of ability through disease accumulation, resulting in a loss of societal worth and abuse.

5.8 Pathology

The results from the pathological assessment of each individual will be presented in the following section. Dental and skeletal pathology and trauma were assessed macroscopically for every individual and by radiograph where possible. The results are presented with an emphasis on accrual with advancing age. Finally, traumatic injuries caused through interpersonal violence and instances of physical abuse are highlighted. Each will be discussed drawing comparisons between age cohorts, each sex and between sites.

5.8.1 Dental pathology

Teeth generally survive well in the archaeological record and can contribute substantially to the total pathology recorded for each skeletal assemblage. However, the ante-mortem loss of dentition experienced by older individuals can also be used as an indicator of general health and possible dietary restrictions. Therefore, the presence or absence of teeth, as well as common dental diseases (caries, periapical lesions and periodontal disease) were recorded for each

individual. A total of 10,834 teeth (or 78.7%) were accounted for out of a potential 13,760 from 430 individuals recorded with a maxilla or mandible (or part thereof), with 5688 (or 52.6% of the accounted for teeth), available for study. The remaining teeth were either lost ante-mortem (AMTL – 25.1%), post-mortem (PMTL – 22.3%) or remained unerupted (0.1%).

St. Helens had the highest percentage of individuals with dentition available for study at 83.8% (n=93 individuals), however Fishergate had the highest percentage of teeth accounted for overall at 83.6% and the highest percentage of teeth physically present for analysis at 49.5% (n=728). Barton had the lowest percentage of teeth physically present for analysis overall at only 39.2% (n=2347), due to the remainder being lost either ante- or post-mortem (Table 5.18).

Table 5.18. Number and percentage of teeth available for study and accounted for at each site. NB. The percentage of teeth present, and percentage absent AMTL/PMTL is calculated against the potential maximum no. of teeth available, these numbers do not include teeth absent due to post-mortem loss of either the maxilla or mandible.

Site	No. ind.	No. w. teeth (%)	No. teeth potential	No. teeth present (%)	No. teeth AMTL (%)	No. teeth PMTL (%)	Total teeth accounted for (%)
Barton	249	187 (75.1)	5984	2347 (39.2)	963 (16.1)	1183 (19.8)	4493 (75.1)
Fishergate	64	46 (71.9)	1472	728 (49.5)	334 (22.7)	168 (11.4)	1230 (83.6)
St. Helens	111	93 (83.8)	2976	1183 (39.8)	780 (26.2)	483 (16.2)	2446 (82.2)
Wharram	140	104 (74.3)	3328	1430 (43.0)	627 (18.8)	582 (17.5)	2639 (79.3)
TOTAL	564	430 (76.2)	13,760	5688 (41.3)	2704 (19.7)	2416 (17.9)	10,808 (78.5)

The crude and true prevalence rates of dental pathology in the following sections, by age cohort and sex, were calculated using the numbers of individuals with a maxilla and/or mandible and the total number of teeth, as set out in Table 5.19.

Table 5.19. Number of individuals with a maxilla and/or mandible recorded and total number of teeth present at each site. NB, two individuals of unknown sex, from Barton, are excluded from this table.

Site	Age Cohort	No. individuals			No. of teeth		
		Male	Female	TOTAL	Male	Female	TOTAL
Barton	35-45	7	2	9	109	50	159
	46-59	70	44	114	926	576	1502
	60-69	32	17	49	340	192	532
	70+	5	8	13	47	80	127
	TOTAL	114	71	185	1422	898	2320
Fishergate	35-45	7	5	12	157	110	267
	46-59	6	10	16	99	163	262
	60-69	6	5	11	72	83	155
	70+	6	1	7	41	3	44
	TOTAL	25	21	46	369	359	728
St. Helens	35-45	7	8	15	110	162	272
	46-59	29	23	52	366	306	672
	60-69	10	8	18	107	57	164
	70+	4	4	8	23	52	75
	TOTAL	50	43	93	606	577	1183
Wharram	35-45	10	13	23	172	203	375
	46-59	33	26	59	465	395	860
	60-69	8	7	15	108	61	169
	70+	3	4	7	15	11	26
	TOTAL	54	50	104	760	670	1430
OVERALL TOTAL		243	185	428	3157	2504	5661

5.8.1.1 Caries

The true prevalence rate for caries at each site by age and sex is presented in Table 5.20.

Wharram had the highest prevalence rate for caries overall at 11.6% (n=74 individuals) and for each sex (male 12.2%, n=33 individuals; female 10.9%, n = 41 individuals). The higher prevalence of caries at Wharram was found to be statistically significant ($X^2=21.94$, 1.d.f.; $p=0.001$).

Interestingly, there was no clear trend of decreasing caries with age at any of the sites (Figure 5.17), which might be expected if caries were the major contributing factor of AMTL.

Table 5.20. Number and true prevalence rate (%) for caries at each site, by age and sex, calculated by number of teeth.

Site	Age cohort	Caries prevalence rate (%)		
		Male	Female	TOTAL
Barton	35-45	0 (0.0)	0 (0.0)	0 (0.0)
	46-59	29 (3.1)	25 (4.3)	54 (3.6)
	60-69	6 (1.8)	6 (3.1)	12 (2.3)
	70+	5 (10.6)	1 (1.3)	6 (4.7)
	TOTAL	40 (2.8)	32 (3.6)	72 (3.1)
Fishergate	35-45	1 (0.6)	0 (0.0)	1 (0.4)
	46-59	0 (0.0)	6 (3.7)	6 (2.3)
	60-69	8 (11.1)	5 (6.0)	13 (8.4)
	70+	1 (2.4)	1 (33.3)	2 (4.5)
	TOTAL	10 (2.7)	12 (3.3)	22 (3.0)
St. Helens	35-45	5 (4.5)	6 (3.7)	11 (4.0)
	46-59	31 (8.5)	11 (3.6)	42 (6.3)
	60-69	6 (5.6)	4 (7.0)	10 (6.1)
	70+	3 (13.0)	5 (9.6)	8 (10.7)
	TOTAL	45 (7.4)	26 (4.5)	71 (6.0)
Wharram	35-45	5 (2.9)	19 (9.4)	24 (6.4)
	46-59	77 (16.6)	39 (9.9)	116 (13.5)
	60-69	8 (7.4)	14 (23.0)	22 (13.0)
	70+	3 (20.0)	1 (9.1)	4 (15.4)
	TOTAL	93 (12.2)	73 (10.9)	166 (11.6)
OVERALL TOTAL		188 (3.6)	143 (2.9)	331 (3.3)

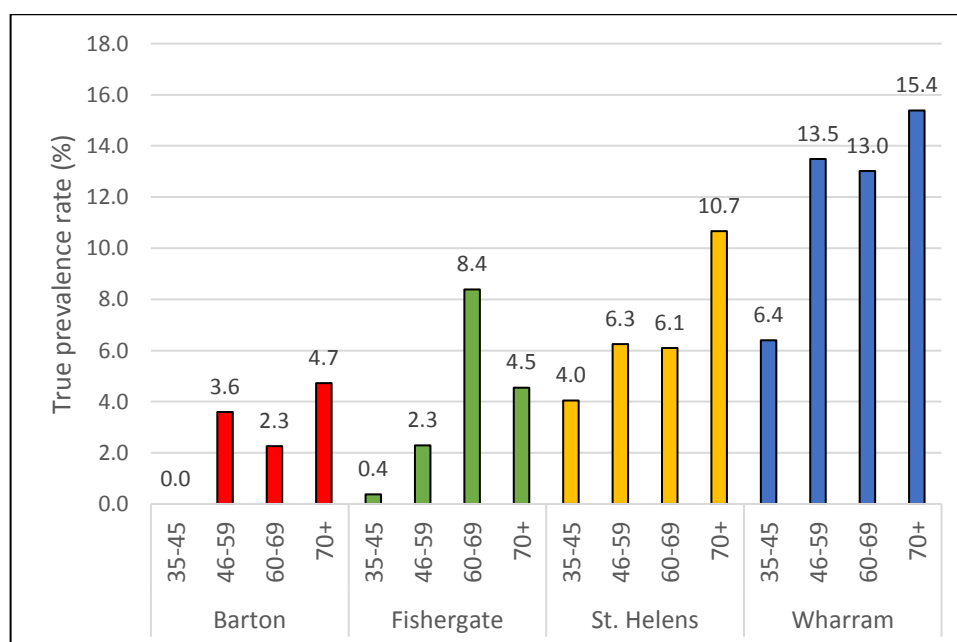


Figure 5.17. Total true prevalence rates (%) for caries, by age cohort from each site.

5.8.1.2 Periapical lesions

The true prevalence rates for periapical lesions is presented in Table 5.21. As with the caries, Wharram had the highest prevalence of periapical lesions overall, with a total prevalence rate of 18.2% (n=74 individuals), this was found to be statistically significant when compared to the rest of the combined sample ($\chi^2=27.34$, 1.d.f.; $p=0.001$). The three female individuals with dentition in the 70+ age cohort for Wharram had a 100.0% prevalence rate, with two individuals exhibiting multiple lesions in both the maxilla and mandible (Figure 5.18). For each site the total prevalence rates increased with advancing age, however this trend was less pronounced when the prevalence rate was considered by sex, particularly at St. Helens. The male total prevalence rate for periapical lesions at each site was consistently higher than the female rate, especially at St. Helens and Wharram.

Table 5.21. Number and true prevalence rate (%) for periapical lesions at each site, by age and sex, calculated by number of teeth.

Site	Age cohort	Periapical lesions prevalence rate (%)		
		Male	Female	TOTAL
Barton	35-45	2 (1.8)	0 (0.0)	2 (1.3)
	46-59	56 (6.0)	27 (4.7)	83 (5.5)
	60-69	25 (7.4)	17 (8.9)	42 (7.9)
	70+	8 (17.0)	9 (11.3)	17 (13.4)
	TOTAL	91 (6.4)	53 (5.9)	144 (6.2)
Fishergate	35-45	6 (3.8)	0 (0.0)	6 (2.2)
	46-59	1 (1.0)	11 (6.7)	12 (4.6)
	60-69	9 (12.5)	6 (7.2)	15 (9.7)
	70+	6 (14.6)	1 (33.3)	7 (15.9)
	TOTAL	22 (6.0)	18 (5.0)	40 (5.5)
St. Helens	35-45	1 (0.9)	0 (0.0)	1 (0.4)
	46-59	22 (6.0)	6 (2.0)	28 (4.2)
	60-69	5 (4.7)	4 (7.0)	9 (5.5)
	70+	5 (21.7)	0 (0.0)	5 (6.7)
	TOTAL	33 (5.4)	10 (1.7)	43 (3.6)
Wharram	35-45	10 (5.8)	11 (5.4)	21 (5.6)
	46-59	108 (23.2)	59 (14.9)	167 (19.4)
	60-69	27 (25.0)	19 (31.1)	46 (27.2)
	70+	13 (86.7)	11 (100.0)	24 (92.3)
	TOTAL	158 (20.8)	100 (14.9)	258 (18.0)
OVERALL TOTAL		304 (5.8)	181 (3.7)	485 (4.8)

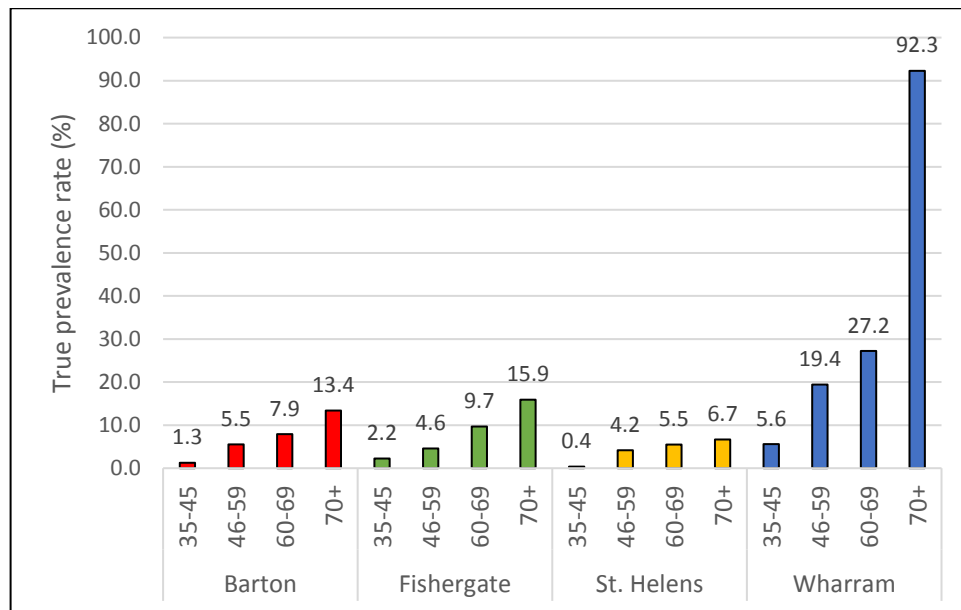


Figure 5.18. Total true prevalence rates (%) of periapical lesions at each site, by age cohort.

5.8.1.3 Periodontal disease

The true prevalence rate of periodontal disease is presented in Table 5.22. Wharram once again had the highest prevalence rate, at 51.0% (n=53 individuals) out of the four sites, and when the samples were divided by sex. This was significant ($X^2=8.15$, 1.d.f.; $p=0.005$). Barton and Fishergate showed a clear trend of increasing total prevalence with advancing age, however St. Helens and Wharram do not (Figure 5.19). Unlike with caries and periapical lesions, females have the highest rates of prevalence for periodontal disease at all sites except Wharram, which has roughly equal rates for males (51.9%) and females (50.0%).

Table 5.22. Number and true prevalence rates for periodontal disease at each site, by age and sex calculated per individual.

Site	Age cohort	Periodontal disease prevalence (%)		
		Male	Female	TOTAL
Barton	35-45	1 (14.3)	0 (0.00)	1 (11.1)
	46-59	22 (31.4)	12 (27.3)	34 (29.8)
	60-69	13 (40.6)	10 (58.8)	23 (46.9)
	70+	2 (40.0)	6 (75.0)	8 (61.5)
	TOTAL	38 (33.3)	28 (39.4)	66 (35.7)
Fishergate	35-45	2 (28.6)	2 (40.0)	4 (33.3)
	46-59	2 (33.3)	4 (40.0)	6 (37.5)
	60-69	3 (50.0)	4 (80.0)	7 (63.6)
	70+	4 (66.7)	1 (100.0)	5 (71.4)
	TOTAL	11 (44.0)	11 (52.4)	22 (47.8)
St. Helens	35-45	1 (14.3)	1 (12.5)	2 (13.3)
	46-59	8 (27.6)	7 (30.4)	15 (28.8)
	60-69	3 (30.0)	4 (50.0)	7 (38.9)
	70+	2 (50.0)	1 (25.0)	3 (37.5)
	TOTAL	14 (28.0)	13 (30.2)	27 (29.0)
Wharram	35-45	7 (70.0)	6 (46.2)	13 (56.5)
	46-59	14 (42.4)	13 (50.0)	27 (45.8)
	60-69	5 (62.5)	4 (57.1)	9 (60.0)
	70+	2 (66.7)	2 (50.0)	4 (57.1)
	TOTAL	28 (51.9)	25 (50.0)	53 (51.0)
OVERALL TOTAL		91 (1.7)	77 (1.6)	168 (1.7)

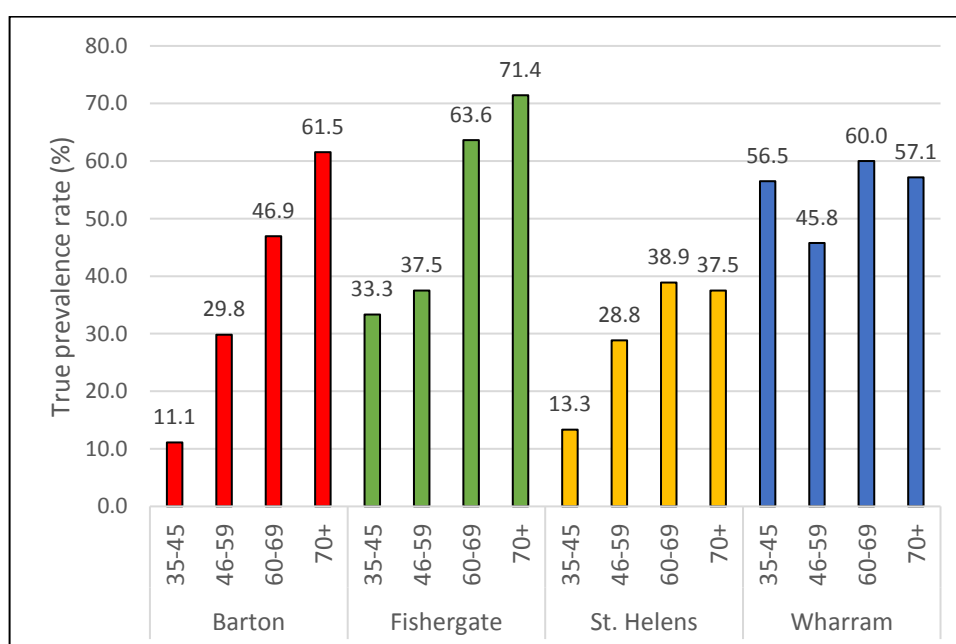


Figure 5.19. Total true prevalence rate (%) of periodontal disease at each site, by age cohort.

5.8.1.4 Ante-mortem tooth loss

The true prevalence rate of ante-mortem tooth loss (AMTL) is presented in Table 5.23. The general trend across all four sites was increasing prevalence of AMTL with advancing age (Figure 5.20). The only site to have a peak prevalence below 70+ years was at St. Helens, which had a peak prevalence for AMTL in the 60-69 year age cohort of 44.2% (n=18 individuals) for both sexes combined. St. Helens also had the highest prevalence rates for AMTL overall at 31.7% (n=86 individuals). Male AMTL was higher than female AMTL overall for all sites. Wharram had the lowest rates of AMTL across the age and sex cohorts at 22.4% (n=83 individuals), with females from Wharram and Barton having the lowest overall percentages at 21.8% (n=37 and 60 individuals respectively).

Table 5.23. Number and true prevalence rates (%) for ante-mortem tooth loss at all sites, by age and sex, calculated by numbers of teeth.

Site	Age cohort	Ante-mortem tooth loss prevalence (%)		
		Male	Female	TOTAL
Barton	35-45	4 (2.8)	0 (0.0)	4 (2.0)
	46-59	284 (35.3)	230 (21.0)	514 (27.1)
	60-69	231 (31.3)	105 (23.8)	336 (28.5)
	70+	47 (37.0)	55 (28.4)	102 (31.8)
	TOTAL	566 (31.3)	390 (21.8)	956 (26.6)
Fishergate	35-45	24 (12.3)	25 (16.9)	49 (14.3)
	46-59	37 (25.0)	62 (23.5)	99 (24.0)
	60-69	51 (31.5)	48 (32.7)	99 (32.0)
	70+	87 (48.9)	10 (62.5)	97 (50.0)
	TOTAL	199 (29.1)	145 (25.2)	344 (27.3)
St. Helens	35-45	33 (19.6)	19 (8.7)	52 (13.5)
	46-59	223 (30.0)	211 (32.5)	434 (31.2)
	60-69	124 (45.9)	82 (41.8)	206 (44.2)
	70+	47 (50.0)	41 (32.8)	88 (40.2)
	TOTAL	427 (33.5)	353 (29.7)	780 (31.7)
Wharram	35-45	11 (4.9)	22 (7.3)	33 (6.3)
	46-59	238 (24.8)	140 (19.4)	378 (22.5)
	60-69	58 (26.2)	55 (31.6)	113 (28.6)
	70+	33 (44.0)	70 (60.3)	103 (53.9)
	TOTAL	340 (23.0)	287 (21.8)	627 (22.4)
OVERALL TOTAL		1532 (29.2)	1175 (24.1)	2707 (26.8)

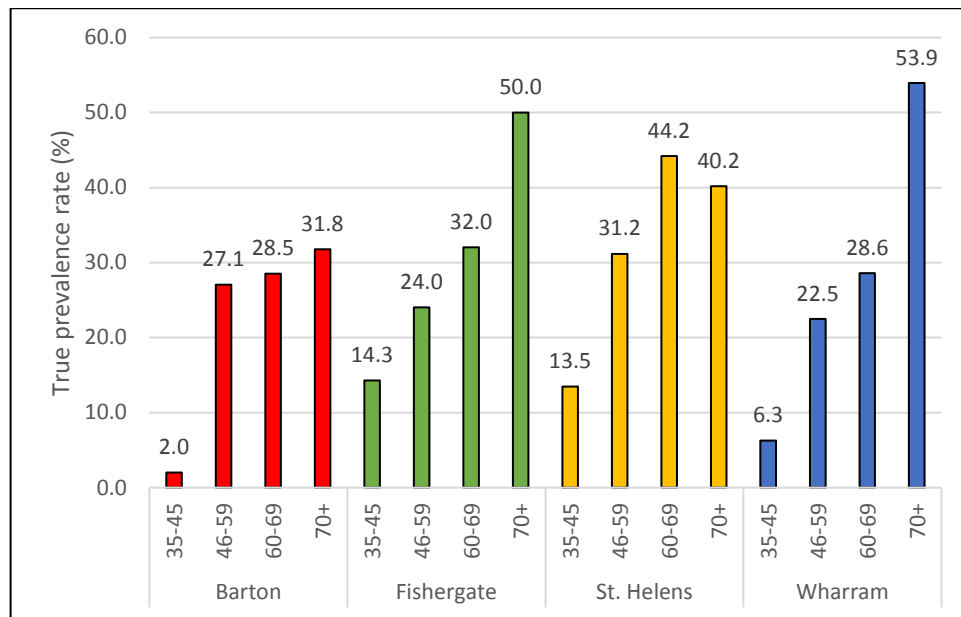


Figure 5.20. Total true prevalence rates (%) for AMTL, by age cohort from each site.

5.8.1.5 Edentulism

A total of eight individuals were recorded as apparently completely edentulous, which produced a crude prevalence of 1.9% from the individuals recorded with dentition in the combined sample (n=430). However only two (0.5%) of those had both the maxilla and mandible preserved, the remaining six retained the mandible only (Table 5.24). Female total crude prevalence at 2.2% in the combined sample, was slightly higher than male at 1.6%, however the total numbers of individuals observed with edentulism were equal between the sexes (n=4) (Table 5.25). Figure 5.21 demonstrates the slight increase in edentulism with advancing age in the combined sample. St. Helens had the highest number of edentulous individuals (n=4, or 4.3%) and Fishergate the lowest (n=0).

Table 5.24. Individuals recorded with edentulism.

Site	Skeleton number	Age cohort	Sex	Maxilla / Mandible
Barton	132	60-69	M?	Mandible only
Barton	1498	46-59	F	Mandible only
Barton	2612	60-69	M	Mandible only
St. Helens	5123	46-59	F	Maxilla and mandible
St. Helens	5402	46-59	M	Mandible only
St. Helens	5475	46-59	M?	Maxilla and mandible
St. Helens	6093	46-59	F	Mandible only
Wharram	WCO045	70+	F?	Mandible only

Table 5.25. Number and true prevalence (%) of individuals with edentulism in the combined sample, by age and sex.

Age cohort	M (%)	F (%)	TOTAL (%)
35-45	0 (0.0)	0 (0.0)	0 (0.0)
46-59	2 (1.4)	3 (2.9)	5 (2.1)
60-69	2 (3.6)	0 (0.0)	2 (2.2)
70+	0 (0.0)	1 (5.9)	1 (2.9)
TOTAL	4 (1.6)	4 (2.2)	8 (1.9)

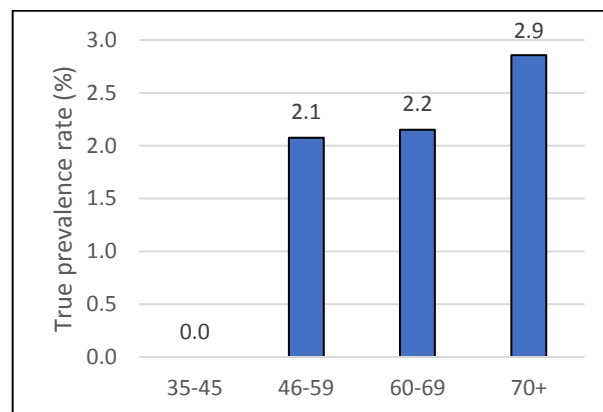


Figure 5.21. Total true prevalence of edentulism in the combined sample, by age cohort.

5.8.2 Skeletal pathology

Due to the nature of the study, requiring multiple bones for ageing, all individuals analysed were well preserved enough for skeletal pathology to be observed if it was present. A total of 503 individuals (or 89.2%) in the combined sample were recorded as having some form of skeletal pathology. Of those 289 (57.5%) were male, 211 (41.9%) were female and three (0.6%) were of unknown sex. There was no significant difference in crude pathology levels between the sites ($X^2 = 0.16$, 1.d.f.; $p=0.5$).

5.8.2.1 Disease prevalence

Arthropathies were the predominant pathology recorded in the total sample, with a crude prevalence rate of 82.4% ($n=465$). This was statistically significant when compared against the other classifications combined ($X^2=1318.58$, 1.d.f.; $p=0.001$). Arthropathies were also the most prevalent form of pathology recorded at each site. Specific infections and malignant cancers were the least frequently observed pathologies (Table 5.26).

Table 5.26. Number and crude prevalence rate (%) of diseases, by site.

Disease category	Barton (%)	Fishergate (%)	St. Helens (%)	Wharram (%)	TOTAL (%)
Non-specific infection	63 (25.3)	21 (32.8)	25 (22.5)	33 (23.6)	142 (25.2)
Specific infection	1 (0.4)	4 (6.3)	0	7 (5.0)	12 (2.1)
Arthropathies	205 (82.3)	56 (87.5)	89 (80.2)	115 (82.1)	465 (82.4)
Metabolic conditions	53 (21.3)	22 (34.4)	23 (20.7)	43 (30.7)	141 (25.0)
Benign neoplasm	7 (2.8)	5 (7.8)	3 (2.7)	12 (8.6)	27 (4.8)
Malignant neoplasm	3 (1.2)	0	0	1 (0.7)	4 (0.7)

5.8.2.2 Non-specific infection

Cases of non-specific infection in the combined sample (n=136 or 24.2%) were primarily in the form of sub-periosteal new bone formation (n=105, or 18.7%), with sinusitis (n=18), and osteomyelitis (n=13), also recorded. Fishergate had the highest CPR of non-specific infection at 43.8% (n=28) and Wharram the lowest at 21.4% (n=30) (Table 5.27).

Table 5.27. Total number and crude prevalence (%) of each type of non-specific infection recorded at each site. NB. Some individuals may have more than one type of non-specific infection.

Site	Sub-periosteal new bone formation (%)	Sinusitis (%)	Osteomyelitis (%)	TOTAL (%)
Barton	46 (18.7)	4 (1.6)	4 (1.6)	54 (22.0)
Fishergate	18 (28.1)	9 (14.1)	1 (1.6)	28 (43.8)
St. Helens	15 (13.5)	4 (3.6)	5 (4.5)	24 (21.6)
Wharram	26 (18.6)	1 (0.7)	3 (2.1)	30 (21.4)
TOTAL	105 (18.7)	18 (3.2)	13 (2.3)	136 (24.2)

5.8.2.2.1 Sub-periosteal new bone formation

The crude prevalence rate for sub-periosteal new bone formation in the combined sample was 18.5% or n=104 (Table 5.28). Fishergate had the highest CPR of sub-periosteal new bone formation at 28.1% (n=18), and St. Helens the lowest at 13.5% (n=15). The peak at Fishergate was statistically significant ($\chi^2=4.31$, 1.d.f.; $p=0.05$). The prevalence of sub-periosteal new bone formation in males was consistently higher than in females, when the total rates were considered by both site and age cohort, and overall. The peak prevalence for males was in the 60-69 year age

cohort at 30.3% (n=20), with the peak prevalence for females in the 35-45 year age cohort at 18.0% (n=9). There was no indication of increasing prevalence with advancing age.

Table 5.28. Number and crude prevalence (%) of individuals recorded with sub-periosteal new bone formation at each site, by age and sex. NB. One individual of unknown sex is excluded from this table.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	2 (18.2)	1 (9.1)	19 (19.6)	10 (18.9)	11 (29.7)	0	0	2 (20.0)	32 (21.2)	13 (13.7)	45 (18.3)
Fishergate	2 (28.6)	3 (23.1)	3 (37.5)	4 (23.5)	3 (50.0)	0	3 (50.0)	0	11 (40.7)	7 (18.9)	18 (28.1)
St. Helens	1 (12.5)	2 (16.7)	4 (12.1)	4 (13.8)	4 (36.4)	0	0	0	9 (16.1)	6 (10.9)	15 (13.5)
Wharram	6 (27.3)	3 (21.4)	10 (23.8)	2 (5.9)	2 (16.7)	2 (25.0)	1 (25.0)	0	19 (23.8)	7 (11.7)	26 (18.6)
TOTAL	11 (22.9)	9 (18.0)	36 (20.0)	20 (15.0)	20 (30.3)	2 (4.5)	4 (20.0)	2 (10.0)	71 (22.6)	33 (13.4)	104 (18.5)

When the true prevalence rate (TPR) of sub-periosteal new bone formation was calculated by the number of elements affected against the number of elements recorded, the fibula (n=69) was the most often affected bone across all sites at a TPR of 16.8%, closely followed by the tibia at 15.0% (n=63). Fishergate had the highest overall prevalence of sub-periosteal new bone formation across the skeleton, out of the four sites, at 5.0% (Figure 5.22).

Two individuals exhibited sub-periosteal new bone formation on the ilium, as well as across much of the rest of the skeleton, both appeared to be secondary formation due to a primary disease.

The individual from St. Helens, Sk. 5123 was differentially diagnosed with Paget's disease and the individual from Wharram, Sk. WCO200, was diagnosed with hypertrophic osteoarthropathy due to a non-pulmonary infection, or respiratory disease. Other individuals with sub-periosteal new bone formation on the visceral aspect of the ribs, at Barton (n=1), Fishergate (n=4) and Wharram (n=3) may also indicate the presence of respiratory disease.

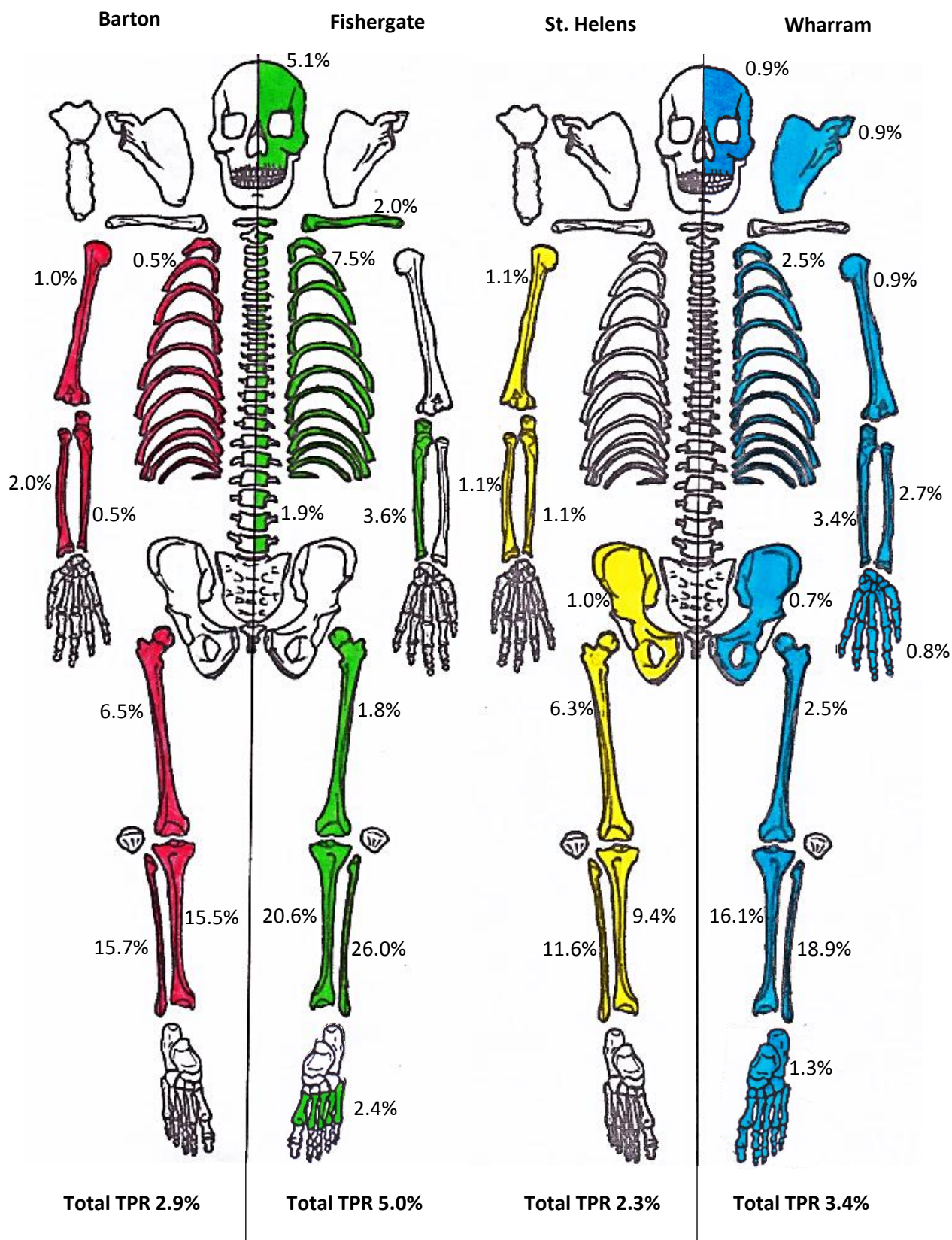


Figure 5.22. True prevalence (%) of sub-periosteal new bone formation at each site.

5.8.2.2.2 Osteomyelitis

The CPR for osteomyelitis is shown in Table 5.29. In the combined sample, 13 individuals (2.3%) had osteomyelitis, with males most frequently affected (males 3.5%; females 0.8%). There are no cases of osteomyelitis in individuals over the age of 70 years at any of the sites and there was no indication of osteomyelitis increasing with advancing chronological age. The high prevalence of osteomyelitis at St. Helens was not significant in comparison to the rest of the sample ($X^2=2.97$, 1.d.f.; $p=0.05$).

Table 5.29. Number and crude prevalence (%) of osteomyelitis at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	1 (9.1)	0	2 (2.1)	0	1 (2.7)	0	0	0	4 (2.6)	0	4 (1.6)
Fishergate	0	0	1 (12.5)	0	0	0	0	0	1 (3.7)	0	1 (1.6)
St. Helens	0	0	2 (6.1)	1 (3.4)	1 (9.1)	1 (10.0)	0	0	3 (5.4)	2 (3.6)	5 (4.5)
Wharram	2 (9.1)	0	0	0	1 (8.3)	0	0	0	3 (3.8)	0	3 (2.1)
TOTAL	3 (6.3)	0	5 (2.8)	1 (0.8)	3 (4.5)	1 (2.3)	0	0	11 (3.5)	2 (0.8)	13 (2.3)

The true prevalence rates (%) for skeletal elements affected by osteomyelitis are shown in Table 5.25. The impoverished urban parish of St. Helens has the largest variety of bones affected by osteomyelitis overall (n=6) and the highest total prevalence at 0.5%, and Fishergate the least at 0.1% (n=1). Most of the lesions occur on the long bones, with the tibia (1.0%, n=4) exhibiting the highest prevalence overall, followed by the femur (0.8%, n=4) in the combined sample.

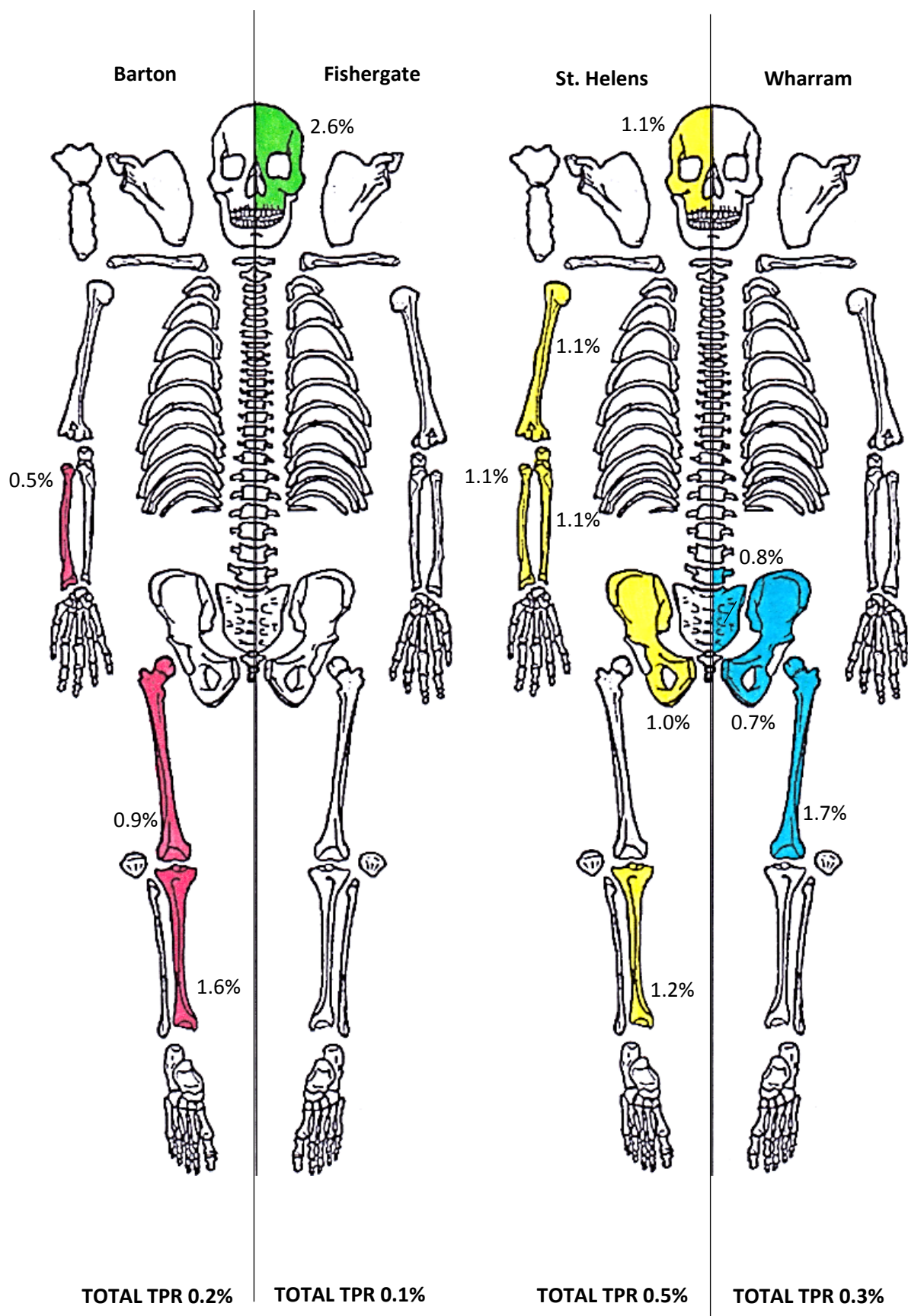


Figure 5.23. True prevalence (%) of elements exhibiting osteomyelitis by site.

5.8.2.2.3 Sinusitis

A total of eighteen individuals in the combined sample exhibited sinusitis (Table 5.30) with a CPR of 3.2%; however sinuses were only examined when they were visible due to post-mortem breaks meaning the true prevalence may be considerably higher. The highest CPR was at Fishergate at 14.1% (n=9) which was statistically significant ($\chi^2=27.61$, 1.d.f.; $p=0.001$), and the lowest was at Wharram at 0.7% (n=1). Sinusitis was more frequent in males (3.5%, n=11) than females (2.8%, n=7) but the rates in females exceeded the males in both the 35-45 year, and the 60-69 year age cohorts. An increase in the prevalence of sinusitis was apparent for both sexes with advancing age (Figure 5.24).

Table 5.30. Number and crude prevalence (%) of sinusitis at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	2 (2.1)	2 (3.8)	0	0	0	0	2 (1.3)	2 (2.1)	4 (1.6)
Fishergate	0	1 (7.7)	1 (12.5)	1 (5.9)	2 (33.3)	0	4 (66.7)	0	7 (25.9)	2 (5.4)	9 (14.1)
St. Helens	0	0	2 (6.1)	0	0	2 (20.0)	0	0	2 (3.6)	2 (3.6)	4 (3.6)
Wharram	0	0	0	0	0	0	0	1 (25.0)	0	1 (1.7)	1 (0.7)
TOTAL	0	1 (2.0)	5 (2.8)	3 (2.3)	2 (3.0)	2 (4.5)	4 (20.0)	1 (5.0)	11 (3.5)	7 (2.8)	18 (3.2)

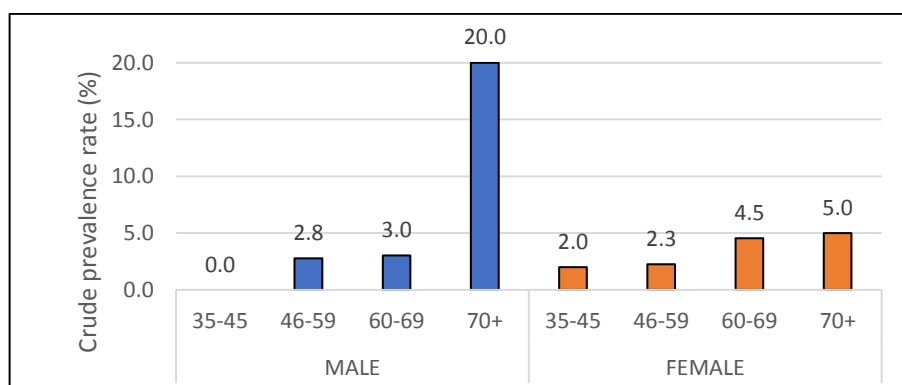


Figure 5.24. Crude prevalence (%) for sinusitis by sex in the combined sample, demonstrating their increase in prevalence with advancing age.

5.8.2.3 Specific infections

Specific infections were diagnosed at three of the four sites: Barton, Fishergate and Wharram.

Barton had a single individual; Barton 1409, M?, aged 46-59 years; exhibiting residual childhood poliomyelitis deformity, including coxa valga and shortening of the tibia and fibula (Grauer and

Roberts, 2019). Tuberculosis was diagnosed according to Roberts and Buikstra (2019), and recorded at Fishergate and Wharram (n=4 and n=7 respectively). It is possible that cases of diffuse sub-periosteal new bone formation at all sites may be the result of infectious diseases, however no indicative lesions were noted on these individuals. No instances of leprosy or treponemal disease were found in the combined sample (Roberts and Buikstra, 2019). The overall total CPR of tuberculosis in the combined sample was 2.0%, with Fishergate having the highest prevalence at 6.3%. Male prevalence was higher overall at 2.9%, in total for each site, and for each age cohort. There does not appear to be any increase in prevalence with advancing age, particularly for females, with no cases in the 60-69 year and 70+ year age cohorts (Table 5.31).

Table 5.31. Number and crude prevalence (%) of tuberculosis at Fishergate and Wharram, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Fishergate	2 (28.6)	0	0	0	1 (16.7)	0	1 (16.7)	0	4 (14.8)	0	4 (6.3)
Wharram	1 (4.5)	1 (7.1)	3 (7.1)	1 (2.9)	1 (8.3)	0	0	0	5 (6.3)	2 (3.3)	7 (5.0)
TOTAL	3 (6.3)	1 (2.0)	3 (1.7)	1 (0.8)	2 (3.0)	0	1 (5.0)	0	9 (2.9)	2 (0.8)	11 (2.0)

5.8.2.4 Arthropathies

5.8.2.4.1 Osteoarthritis

Osteoarthritis was recorded by the presence of eburnation or three combined degenerative traits on a single joint (porosity, loss of anatomical joint contour and osteophyte formation). The overall total crude prevalence is 34.4% (n=193), with Fishergate having the highest prevalence at 62.5% and Wharram the lowest at 18.6% (Table 5.32). Fishergate's high prevalence was significant ($\chi^2=25.65$, 1.d.f.; $p=0.001$). The total male CPR (37.3%) for osteoarthritis was higher than the female (30.8%), a trend which was followed at all sites except Wharram. Female cases (18.0%) also exceeded male at 16.7% in the 35-45 year age cohort. There was a very clear increase in osteoarthritis with advancing age for males, however the female peak was in the 60-69 year age cohort at 47.7%.

Table 5.32. Number and crude prevalence (%) of osteoarthritis at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	2 (18.2)	1 (9.1)	32 (33.0)	15 (28.3)	24 (64.9)	10 (47.6)	6 (100.0)	5 (50.0)	64 (42.4)	31 (32.6)	95 (38.6)
Fishergate	4 (57.1)	4 (30.8)	6 (75.0)	10 (58.8)	6 (100.0)	4 (80.0)	6 (100.0)	0	22 (81.5)	18 (48.6)	40 (62.5)
St. Helens	0	3 (25.0)	8 (24.2)	5 (17.2)	7 (63.6)	4 (40.0)	2 (50.0)	3 (75.0)	17 (30.4)	15 (27.3)	32 (28.8)
Wharram	2 (9.1)	1 (7.1)	6 (14.3)	7 (20.6)	3 (25.0)	3 (37.5)	3 (75.0)	1 (25.0)	14 (17.5)	12 (20.0)	26 (18.6)
TOTAL	8 (16.7)	9 (18.0)	52 (28.9)	37 (27.8)	40 (60.6)	21 (47.7)	17 (85.0)	9 (45.0)	117 (37.3)	76 (30.8)	193 (34.4)

The true prevalence rate (TPR) of osteoarthritic joints was calculated by counting the number of elements present for each joint and dividing by the number of elements that make up the joint (e.g. the elbow consists of the distal humerus, proximal ulna and proximal radius). Incidences of osteoarthritis involving the vertebral facets or costovertebral joints were counted as one occurrence despite the number of vertebrae or ribs involved.

The overall total TPR for osteoarthritis was 6.1% (n=364), with Fishergate having the highest prevalence overall at 9.5% and Wharram the lowest at 2.7% (Table 5.33). The low prevalence at Wharram was significant ($X^2=36.22$, 1d.f.; $p=0.001$). Male prevalence was significantly higher in total at 6.6% ($X^2=4.82$, 1.d.f.; $p=0.05$) and higher at each site, other than Wharram where the male and female totals were equal at 2.7%. Male prevalence was also higher in almost all the age cohorts, aside from the 35-45 year cohort in which the total female prevalence was higher at 2.9%. An increase in prevalence of osteoarthritis with advancing age was apparent for both sexes.

Table 5.33. True prevalence (%) of osteoarthritis at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	4 (3.8)	1 (1.2)	60 (5.9)	28 (5.5)	50 (11.7)	21 (9.4)	14 (19.7)	11 (11.0)	128 (7.9)	61 (6.6)	189 (7.4)
Fishergate	5 (5.5)	6 (5.1)	6 (6.8)	16 (9.9)	8 (10.9)	9 (15.3)	15 (19.5)	0	34 (10.3)	31 (8.7)	65 (9.5)
St. Helens	0	5 (4.2)	20 (5.5)	9 (3.1)	14 (10.5)	9 (7.7)	6 (12.5)	5 (10.8)	4 (6.4)	28 (4.9)	68 (5.7)
Wharram	4 (2.0)	2 (1.2)	10 (2.2)	12 (3.1)	4 (3.4)	5 (3.5)	4 (9.0)	1 (2.0)	22 (2.7)	20 (2.7)	42 (2.7)
TOTAL	13 (2.7)	14 (2.9)	96 (5.0)	65 (4.8)	76 (10.1)	44 (8.1)	39 (16.2)	17 (8.0)	224 (6.6)	140 (5.4)	364 (6.1)

Osteoarthritis was most prevalent at Barton in the male 70+ age cohort (19.7%), followed by the male 70+ age cohorts for Fishergate (19.5%) (Figure 5.25). No osteoarthritis was recorded for the two females in the 70+ year age cohort from Fishergate, or the male 35-45 year age cohort from St. Helens. Wharram had comparatively low rates of osteoarthritis overall when compared by sex and age.

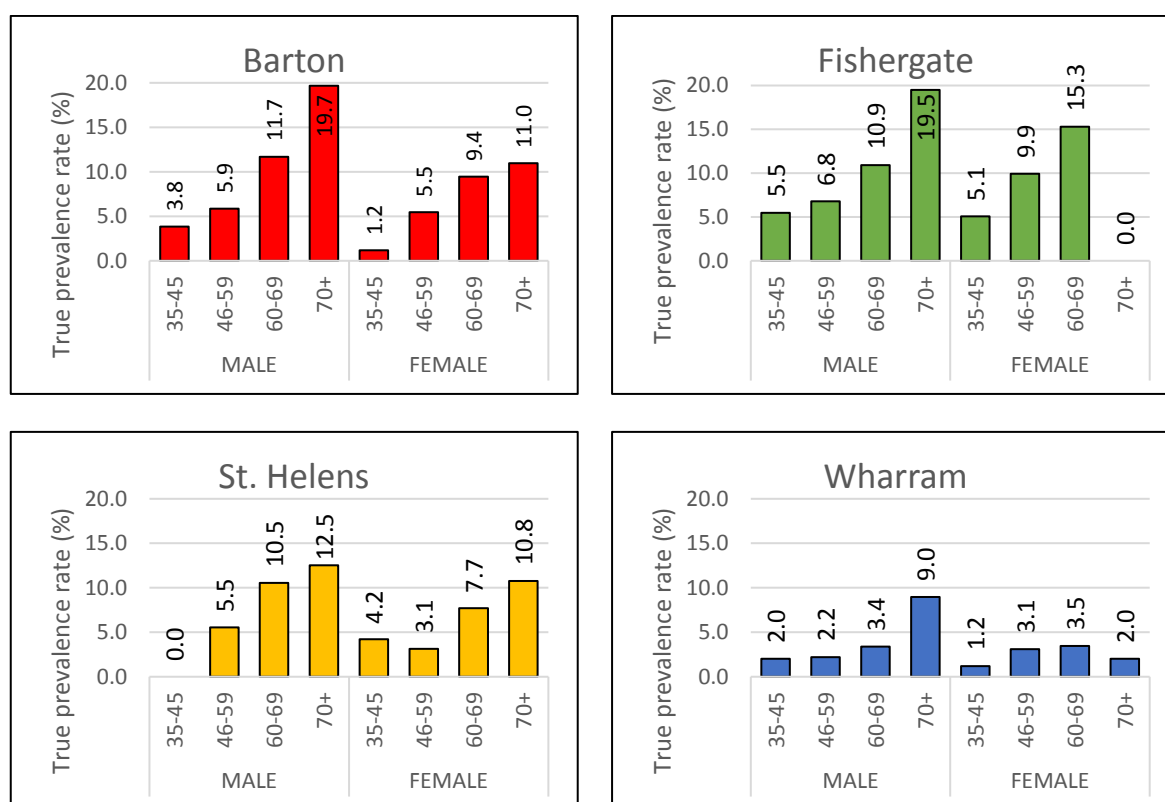


Figure 5.25. True prevalence rate (%) of osteoarthritis at each site, by sex and age cohort.

Osteoarthritis to the vertebral facets was the most prevalent form within the combined sample when the TPR was calculated by sex at 29.0% for males and 22.3% for females (Figure 5.26).

More males than females exhibited osteoarthritis for most joints, however females exhibited more on the costovertebral, hand, sacroiliac, knee and ankle joints. Each of the sites, except Wharram, had eleven different joints exhibiting osteoarthritic involvement over both sexes, with Wharram individuals exhibiting only seven affected joints. All sites had individuals who exhibited osteoarthritis of the vertebral facets, costovertebral joints, at the elbow, wrist and hand, as well as the hip and knee. St. Helens was the only site where osteoarthritis of the atlanto-occipital joint was recorded, with Barton being the only site with osteoarthritis of the sternoclavicular joint. The TPR of osteoarthritis on each joint by site and sex is presented in Figure 5.28.

When the different joints were compared by age cohort, the general trend of increasing prevalence of osteoarthritis with advancing age is followed in most cases (Figure 5.27). The most notable exception being the sacroiliac joint which peaks in the 35-45 year age cohort, potentially associated with trauma. Once again, the levels of osteoarthritis on the vertebral facets in the 35-45 and 46-59 year age cohorts were high, especially when compared to the prevalence rates of other joints in these age cohorts. Therefore, care must be taken when using osteoarthritis prevalence, to indicate senescence within a sample, particularly when including the vertebral facets.

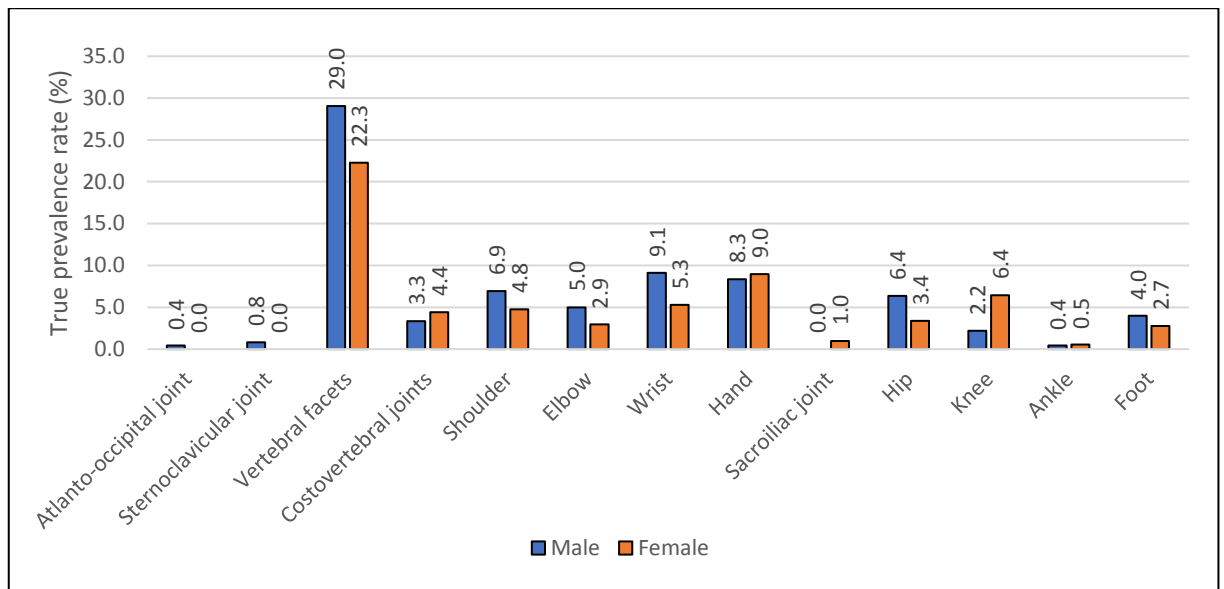


Figure 5.26. True prevalence rate (%) of osteoarthritic joints for the combined sample, by sex.

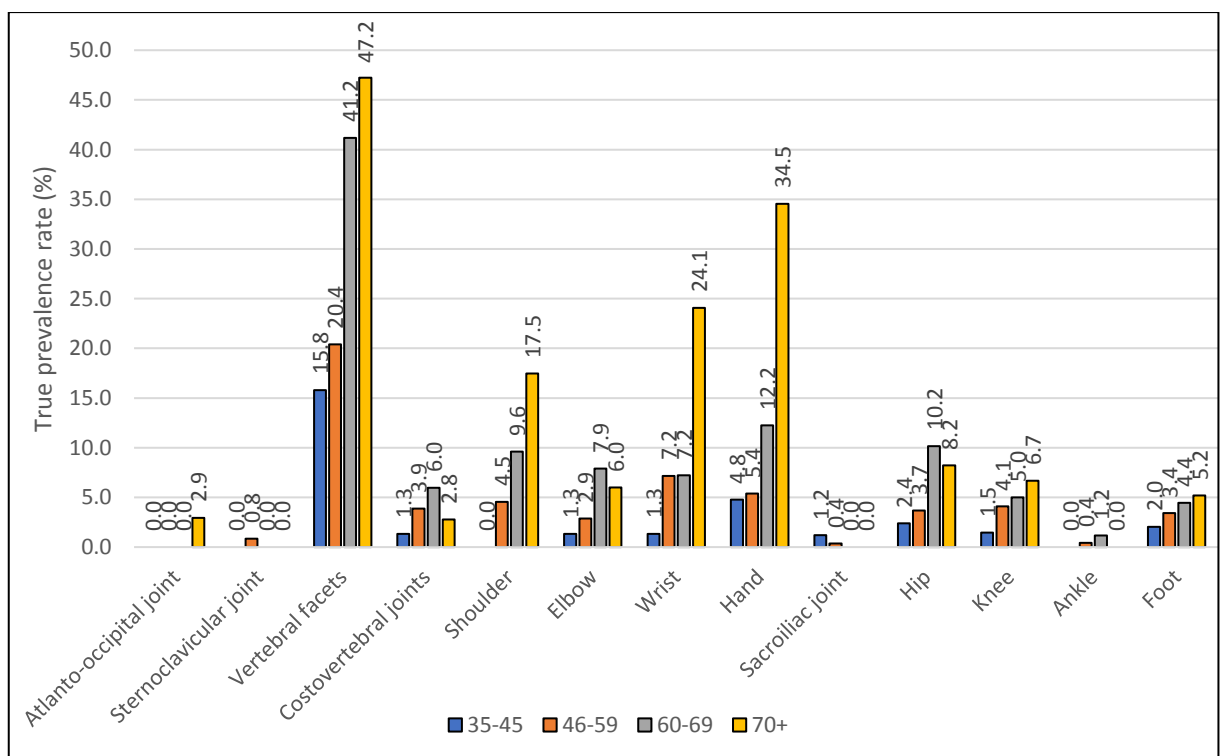


Figure 5.27. True prevalence rate (%) of osteoarthritic joints for the combined sample, by age cohort.

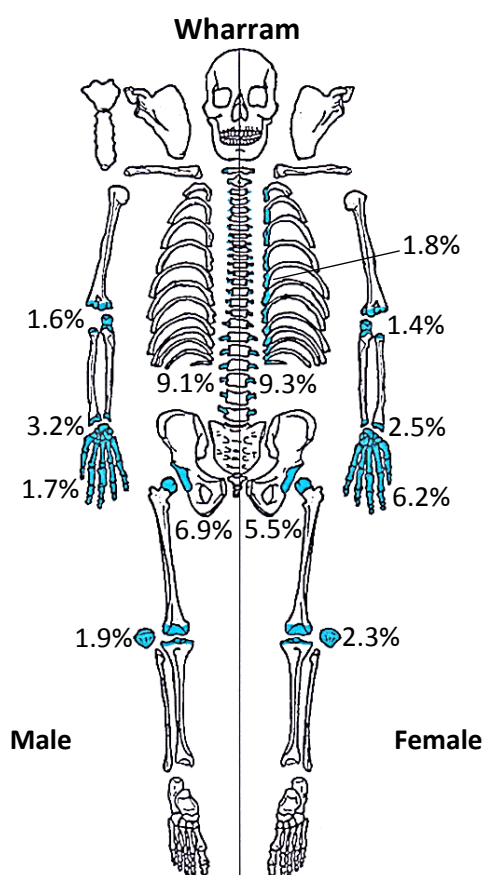
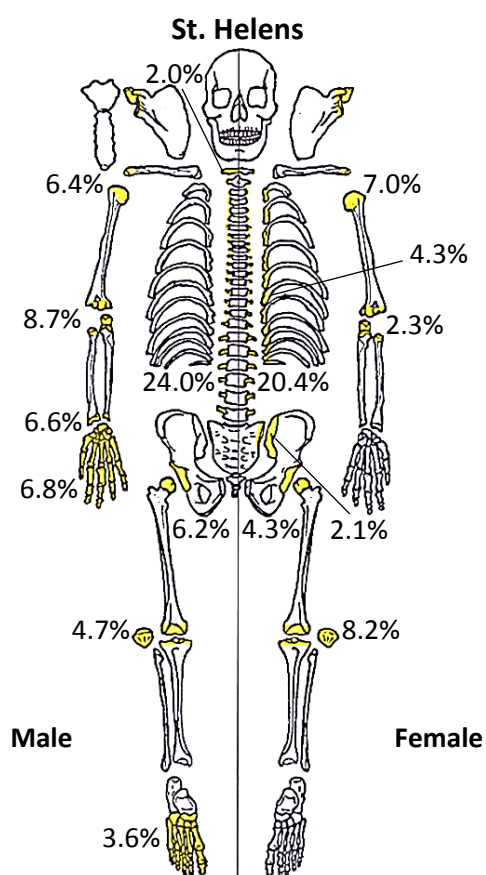
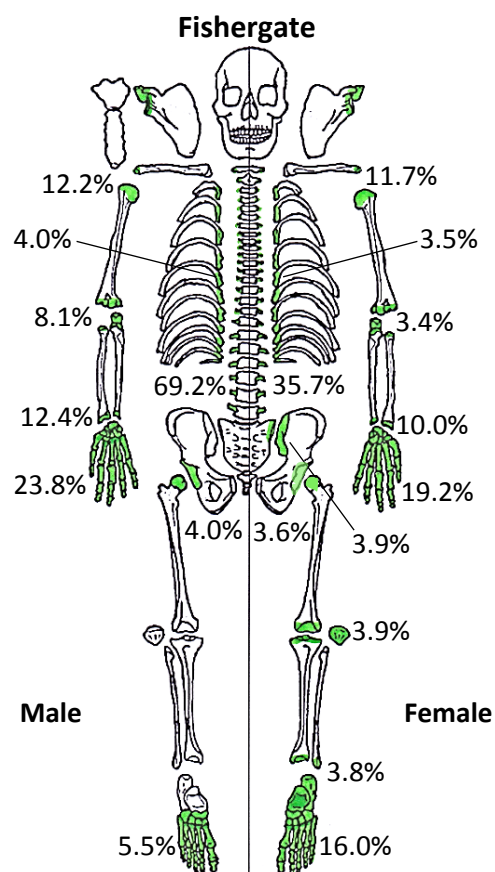
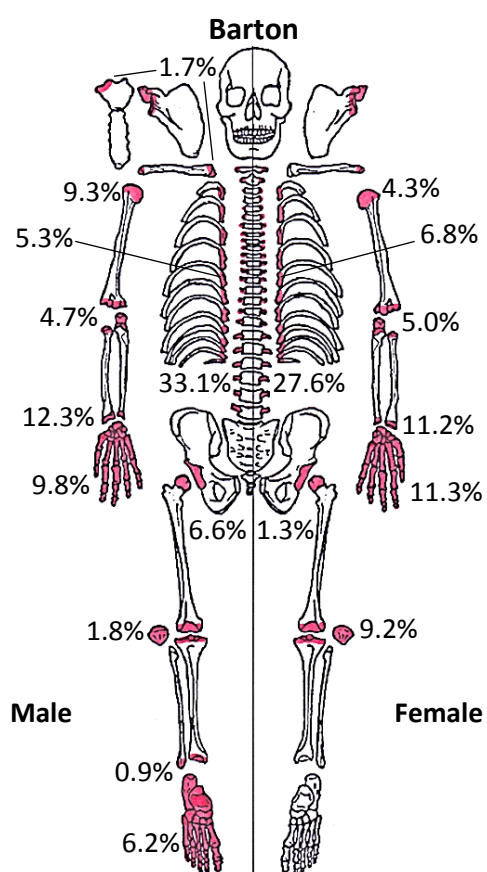


Figure 5.28. True prevalence rate (%) of osteoarthritic joints at each site, by sex.

5.8.2.4.2 Spondylosis

The overall total true prevalence of spondylosis in the combined sample was 66.5% (Table 5.34).

St. Helens had the highest total true prevalence of spondylosis at 71.0% and Barton the lowest at 64.1%. The distribution between males and females was almost equal at 67.6% and 65.0% respectively but female cases exceeded male cases at 46-59 years, and at both St. Helens and Wharram. An increase in cases of spondylosis was evident with advancing age for both sexes (Figure 5.29).

Table 5.34. Number and true prevalence (%) of spondylosis at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	3 (33.3)	1 (16.7)	55 (67.9)	22 (51.2)	25 (73.5)	14 (73.7)	6 (100.0)	6 (75.0)	89 (68.5)	43 (56.6)	132 (64.1)
Fishergate	4 (57.1)	5 (55.6)	4 (57.1)	9 (69.2)	6 (100.0)	4 (80.0)	5 (83.3)	1 (100.0)	19 (73.1)	19 (67.9)	38 (70.4)
St. Helens	3 (50.0)	3 (27.3)	17 (58.6)	19 (76.0)	11 (100.0)	10 (100.0)	4 (100.0)	4 (100.0)	35 (70.0)	36 (72.0)	71 (71.0)
Wharram	11 (73.3)	5 (38.5)	18 (47.4)	21 (73.3)	9 (90.0)	7 (87.5)	3 (100.0)	4 (100.0)	41 (62.1)	37 (68.9)	78 (65.2)
TOTAL	21 (56.8)	14 (35.9)	94 (60.6)	71 (64.7)	51 (83.6)	35 (83.3)	18 (94.7)	15 (88.2)	184 (67.6)	135 (65.0)	319 (66.5)

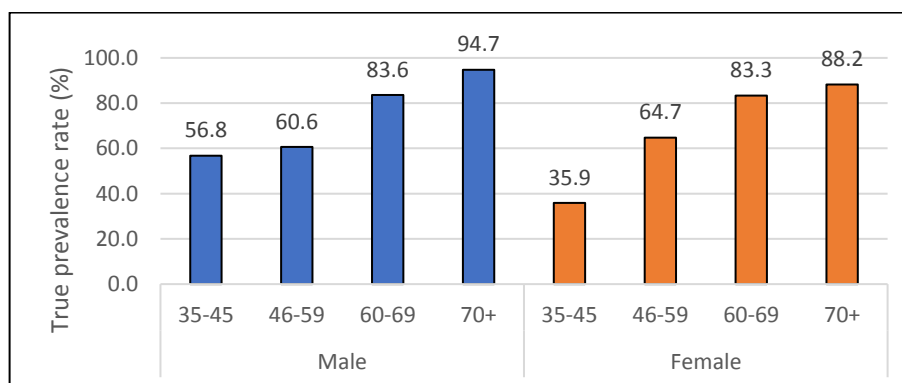


Figure 5.29. Total true prevalence (%) of spondylosis for each sex, demonstrating the incline with advancing age.

5.8.2.4.3 Schmorl's nodes

The true prevalence of Schmorl's nodes is presented in Table 5.35. The true prevalence rate (TPR), in the combined sample was 80.9%, with Barton having the highest TPR (83.5%), and St. Helens the lowest (74.0%), although this was still high. Males consistently exhibited more Schmorl's

nodes than females (87.5% and 72.2% respectively), which was statistically significant when the two were compared ($X^2=14.72$, 1.d.f.; $p=0.001$), this trend was maintained at each site and within each age cohort (Figure 5.30).

Table 5.35. Number and true prevalence (%) of Schmorl's nodes at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	7 (77.8)	4 (66.7)	73 (90.1)	28 (65.1)	31 (91.2)	16 (84.2)	6 (100.0)	7 (87.5)	117 (90.0)	55 (72.4)	172 (83.5)
Fishergate	6 (85.7)	5 (55.6)	7 (100.0)	9 (69.2)	6 (100.0)	5 (100.0)	6 (100.0)	1 (100.0)	25 (96.2)	20 (71.4)	45 (83.3)
St. Helens	5 (83.3)	7 (63.6)	25 (86.2)	18 (72.0)	8 (72.7)	6 (60.0)	3 (75.0)	2 (50.0)	41 (82.0)	33 (66.0)	74 (74.0)
Wharram	12 (80.0)	13 (100.0)	32 (84.2)	20 (69.8)	8 (80.0)	6 (75.0)	3 (100.0)	3 (75.0)	55 (83.3)	42 (78.3)	97 (81.1)
TOTAL	30 (81.1)	29 (74.4)	137 (88.4)	75 (68.4)	53 (86.9)	33 (78.6)	18 (94.7)	13 (76.5)	238 (87.5)	150 (72.2)	388 (80.9)

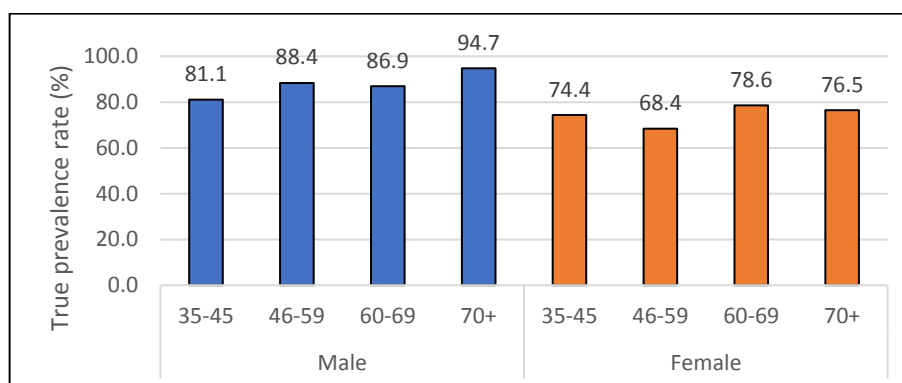


Figure 5.30. Total true prevalence by age cohort, for both sexes.

5.8.2.4.4 Diffuse idiopathic skeletal hyperostosis (DISH)

The true prevalence of DISH is presented in Table 5.36. Overall, 4.2% ($n=20$) of the sample had evidence for DISH, with Fishergate, significantly, having the highest TPR out of the four sites at 9.3% ($X^2=3.84$, 1.d.f.; $p=0.05$) and St. Helens the lowest at 2.0%. There was a significant male predominance for DISH throughout the sites overall at 6.6% ($X^2=9.74$, 1.d.f.; $p=0.005$), and by age cohort. Only two females were diagnosed with DISH. A male increase in prevalence with advancing age is apparent (Figure 5.31). The high prevalence of DISH in the 70+ cohort was statistically significant ($X^2=24.51$, 1.d.f.; $p=0.001$).

Table 5.36. Number and true prevalence (%) of DISH at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	1 (11.1)	0	4 (4.9)	0	3 (8.8)	0	1 (16.7)	0	9 (6.9)	0	9 (4.4)
Fishergate	0	0	0	1 (7.7)	0	0	4 (66.7)	0	4 (15.4)	1 (3.6)	5 (9.3)
St. Helens	0	0	0	0	2 (18.2)	0	1 (25.0)	0	3 (6.0)	0	3 (2.5)
Wharram	0	0	1 (2.6)	1 (3.5)	0	0	1 (33.3)	0	2 (3.0)	1 (1.9)	3 (2.5)
TOTAL	1 (2.7)	0	5 (3.2)	2 (1.8)	5 (8.2)	0	7 (36.8)	0	18 (6.6)	2 (1.0)	20 (4.2)

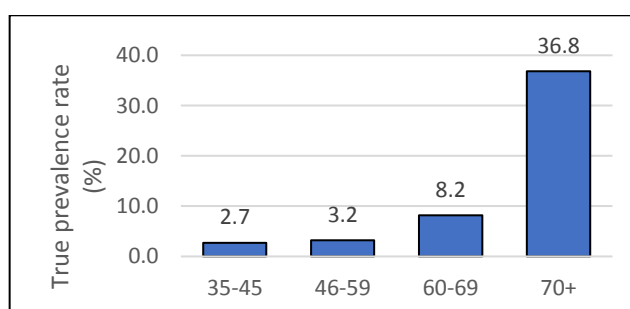


Figure 5.31. Male total true prevalence (%) showing an incline with advancing age.

5.8.2.4.5 Gout

Three individuals in the combined sample exhibited lesions consistent with gout (Table 5.37). No examples of gouty lesions were recorded at either Fishergate or Wharram. There was no apparent increase in prevalence with advancing age, aside from the fact that no individuals under the age of 45 years at death were recorded with gout. Twice as many males (n=2) than females (n=1) exhibited lesions, but the sample of affected individuals was so small this cannot be considered indicative of a male predominance.

Table 5.37. Individuals exhibiting lesions consistent with gout.

Site	Skeleton No.	Age	Sex	Element
Barton	499	70+	F	Both hand, R wrist
Barton	1047	46-59	M	Both hands and feet, R ankle
St. Helens	5453	46-59	M	Left foot

5.8.2.5 Metabolic conditions

Metabolic conditions recorded in the combined sample included osteoporosis, Paget's disease, cribra orbitalia and hyperostosis frontalis interna (HFI). Overall metabolic conditions were recorded for 26.0% of the combined sample and were most prevalent at Fishergate at 35.9%, and least prevalent at Barton with 22.0% (Table 5.38). More females (30.0%) than males (22.9%) had metabolic conditions in total, with Barton and Wharram following this trend. There is a clear increase in the crude prevalence of metabolic conditions with advancing age for females, and a general incline for males with the peak prevalence (37.9%) in the 60-69 year age cohort (Figure 5.32).

Table 5.38. Number and crude prevalence (%) of metabolic conditions recorded at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	1 (9.1)	14 (14.4)	12 (22.6)	14 (37.8)	7 (33.3)	2 (33.3)	4 (40.0)	30 (19.9)	24 (25.3)	54 (22.0)
Fishergate	3 (42.9)	0	3 (37.5)	6 (35.3)	3 (50.0)	4 (80.0)	3 (50.0)	1 (50.0)	12 (44.4)	11 (29.7)	23 (35.9)
St. Helens	2 (25.0)	1 (8.3)	5 (15.2)	5 (17.2)	6 (54.5)	3 (30.0)	1 (25.0)	3 (75.0)	14 (25.0)	12 (21.8)	26 (23.4)
Wharram	2 (9.1)	5 (35.7)	11 (26.2)	15 (44.1)	2 (16.7)	3 (37.5)	1 (25.0)	4 (100.0)	16 (20.0)	27 (45.0)	43 (30.7)
TOTAL	7 (14.6)	7 (14.0)	33 (18.3)	38 (28.6)	25 (37.9)	17 (38.6)	7 (35.0)	12 (60.0)	72 (22.9)	74 (30.0)	146 (26.0)

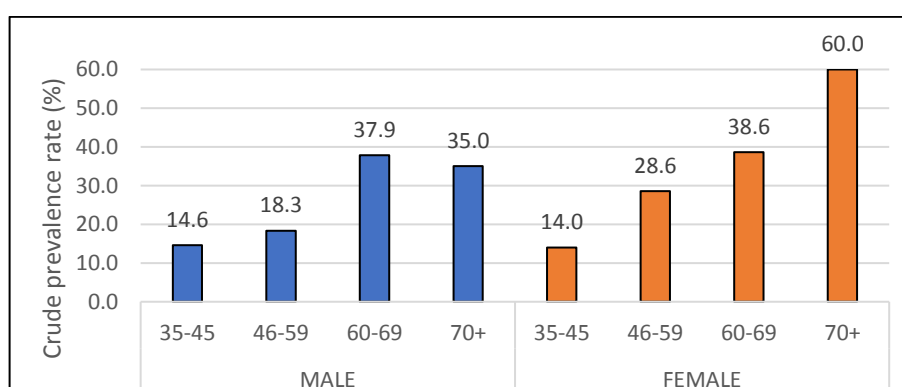


Figure 5.32. Crude prevalence (%) of metabolic conditions by age and sex.

5.8.2.5.1 Osteoporosis

Osteoporosis was only recorded through the presence of vertebral compression fractures, and/or the presence of sparse trabeculae in the vertebral bodies. The overall total true prevalence, using the number of spines recorded in the combined sample was 6.9% (n=33), with Wharram exhibiting the highest true prevalence at 8.4% and Barton the lowest at 5.3% (Table 5.39). The predominance of osteoporosis at Wharram was found to be statistically insignificant ($X^2=1.01$, 1.d.f.; $p=0.05$). As would be expected, the total female true prevalence (8.7%) is higher than the male (5.1%), this trend follows for each site, except Fishergate which has a higher male true prevalence at 7.7% (n=2). Total female true prevalence increases with advancing age to 47.1% in the 70+ age cohort, however male prevalence fluctuates throughout the age cohorts. Figure 5.33 demonstrates the clear increasing female prevalence with age at Barton, St. Helens and Wharram and the fluctuation in prevalence with age for males at all sites.

Table 5.39. Number and true prevalence of osteoporosis at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	5 (6.2)	1 (2.3)	0	1 (5.3)	1 (16.7)	3 (37.5)	6 (4.6)	5 (6.6)	11 (5.3)
Fishergate	0	0	0	1 (7.7)	2 (33.3)	0	0	1 (100.0)	2 (7.7)	2 (7.1)	4 (7.4)
St. Helens	0	0	2 (6.9)	1 (4.0)	1 (9.1)	1 (10.0)	0	2 (50.0)	3 (6.0)	4 (8.0)	7 (7.0)
Wharram	0	0	3 (7.9)	3 (10.5)	0	2 (25.0)	0	2 (50.0)	3 (4.5)	7 (13.0)	10 (8.4)
TOTAL	0	0	10 (6.5)	6 (5.5)	3 (4.9)	4 (9.5)	1 (5.3)	8 (47.1)	14 (5.1)	18 (8.7)	32 (6.7)

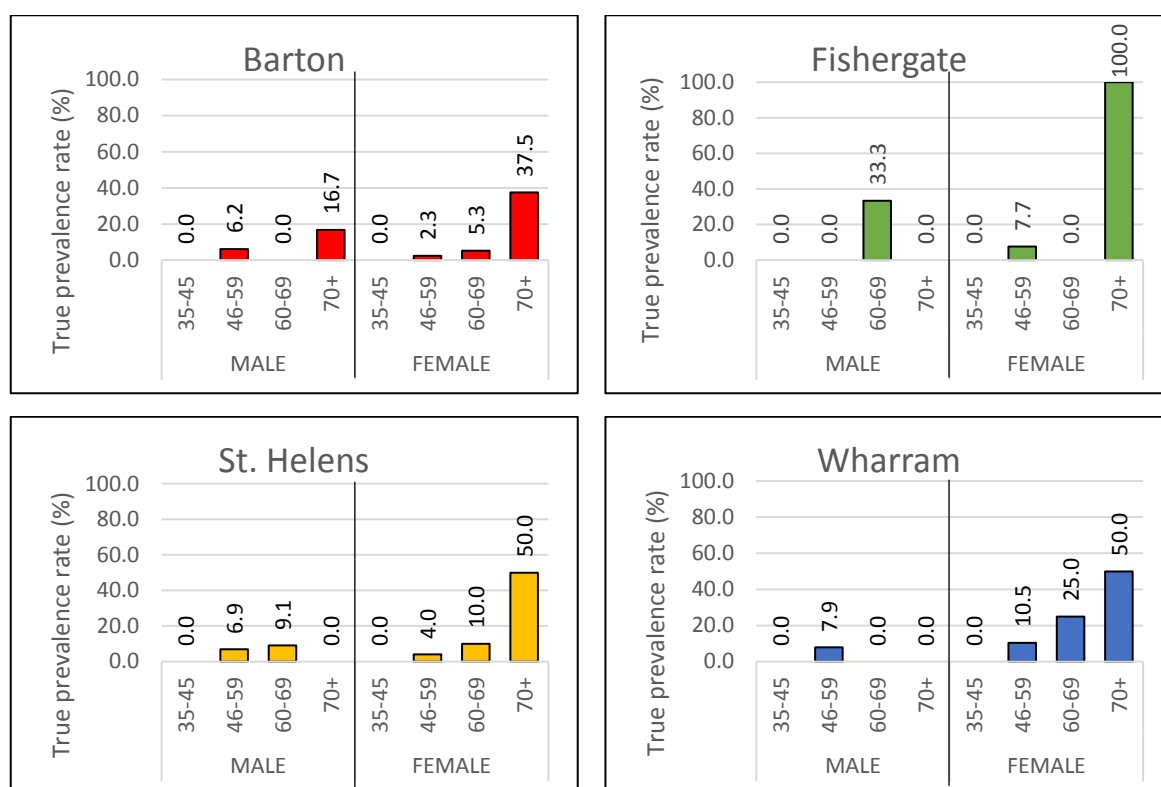


Figure 5.33. True prevalence of osteoporosis for males and females at each site, by age.

5.8.2.5.2 Paget's disease

The overall total crude prevalence of Paget's disease in the combined sample was 1.1% (n=6), with Barton having the highest prevalence at 1.6% (n=4), and Fishergate the lowest with no cases (Table 5.40). As would be expected, there was a higher total male prevalence at 1.3% (n=4), a trend which was followed at Barton and Wharram. St. Helens, in contrast had a higher female prevalence at 1.8% (n=1). There was no apparent increase in prevalence with advancing age, other than the fact that all the individuals exhibiting Pagetic traits were over 45 years at age of death, however they were all also under 70 years at death.

Table 5.40. Number and crude prevalence of Paget's disease at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	1 (1.0)	0	2 (5.4)	1 (4.8)	0	0	3 (2.0)	1 (1.1)	4 (1.6)
Fishergate	0	0	0	0	0	0	0	0	0	0	0
St. Helens	0	0	0	1 (3.4)	0	0	0	0	0	1 (1.8)	1 (0.9)
Wharram	0	0	1 (2.4)	0	0	0	0	0	1 (1.3)	0	1 (0.7)
TOTAL	0	0	2 (1.1)	1 (0.8)	2 (3.0)	1 (2.3)	0	0	4 (1.3)	2 (0.8)	6 (1.1)

5.8.2.5.3 Cribra orbitalia

Cribra orbitalia, in the combined sample had an overall prevalence of 16.0% (n=90) (Table 5.41).

Wharram had the highest prevalence with 25.7% (n=36) of individuals exhibiting active or healing lesions, and St. Helens had the lowest at 9.9% (n=11). The total female prevalence was higher at 20.2% (n=50) than the male at 12.7% (n=40). Barton and Wharram followed this trend, whereas Fishergate and St. Helens did not. In each age cohort the total female prevalence for cribra orbitalia was higher than the male. Overall, there was an incline in crude prevalence with advancing age, however this fluctuated slightly for both sexes (Figure 5.34). Wharram's high female prevalence (40.0%) was found to be statistically significant ($\chi^2=19.35$, 1.d.f.; $p=0.001$) in comparison with the rest of the female sample; as was Fishergate's high male prevalence ($\chi^2=7.58$, 1.d.f.; $p=0.01$), in comparison with the rest of the male sample.

Table 5.41. Number and crude prevalence of cribra orbitalia at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	1 (9.1)	5 (5.2)	10 (18.9)	7 (18.9)	4 (19.0)	0	1 (10.0)	12 (7.9)	16 (16.8)	28 (11.4)
Fishergate	2 (28.6)	0	3 (37.5)	5 (29.4)	0	2 (40.0)	3 (50.0)	0	8 (29.6)	7 (18.9)	15 (23.4)
St. Helens	1 (12.5)	1 (8.3)	3 (9.1)	0	4 (36.4)	0	0	2 (50.0)	8 (14.3)	3 (5.5)	11 (9.9)
Wharram	2 (9.1)	4 (28.6)	7 (16.7)	14 (41.2)	2 (16.7)	3 (37.5)	1 (25.0)	3 (75.0)	12 (15.0)	24 (40.0)	36 (25.7)
TOTAL	5 (10.4)	6 (12.0)	18 (10.0)	29 (21.8)	13 (19.7)	9 (20.5)	4 (20.0)	6 (30.0)	40 (12.7)	50 (20.2)	90 (16.0)

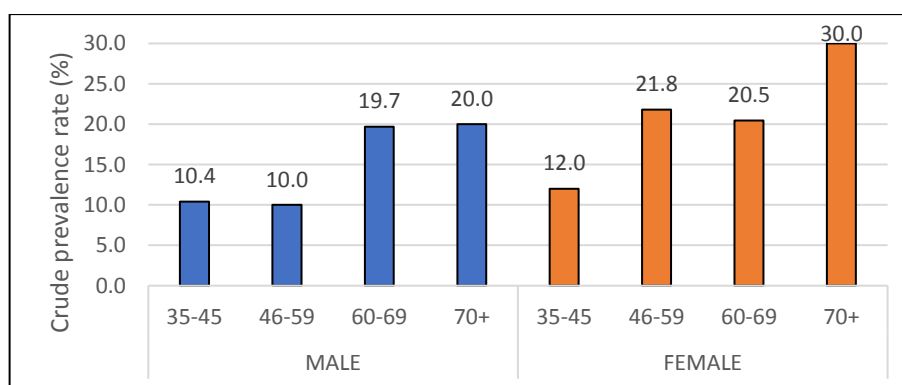


Figure 5.34. Crude prevalence of cribra orbitalia in the combined sample, by age cohort and sex.

5.8.2.5.4 Hyperostosis frontalis Interna

The overall total true prevalence of hyperostosis frontalis interna (HFI) based on those with frontal bones preserved, in the combined sample was 8.1% (n=31), with Fishergate having the highest true prevalence at 14.6% (n=6) and Wharram the lowest at 2.2% (n=2) (Table 5.42). As expected, the total female true prevalence (11.4%) was higher than the male (5.6%), this was the case at all sites, other than Barton, which had a slightly higher total male prevalence (9.8%), this was not found to be significant ($X^2=0.01$, 1.d.f.; $p=0.5$). The overall higher female prevalence was not statistically significant when compared with the male ($X^2=2.88$, 1.d.f.; $p=0.1$). Within the age cohort totals, female prevalence exceeded male in all but the 70+ age cohort. There was a significant increase in male prevalence with advancing age ($X^2=9.45$, 1.d.f.; $p=0.005$), however the female prevalence peaks in the 60-69 year age cohort at 22.9% (n=8) (Figure 5.35). A link to urbanisation as a cause was explored, with a significant relationship found between the higher levels of HFI at urban St. Helens than rural Wharram Percy ($X^2=5.40$, 1.d.f.; $p=0.025$).

Table 5.42. Number and true prevalence (%) of hyperostosis frontalis interna at each site by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	4 (7.0)	3 (7.9)	4 (14.8)	3 (20.0)	1 (25.0)	0	9 (9.8)	6 (9.5)	15 (9.7)
Fishergate	1 (14.3)	0	0	0	0	2 (50.0)	2 (33.3)	1 (100.0)	3 (12.0)	3 (18.8)	6 (14.6)
St. Helens	0	0	0	3 (13.0)	0	2 (25.0)	1 (25.0)	2 (50.0)	1 (2.0)	7 (16.3)	8 (8.7)
Wharram	0	1 (10.0)	0	0	0	1 (12.5)	0	0	0	2 (4.5)	2 (2.2)
TOTAL	1 (4.0)	1 (4.0)	4 (3.3)	6 (6.7)	4 (7.8)	8 (22.9)	4 (23.5)	3 (18.8)	13 (6.0)	18 (10.8)	31 (8.1)

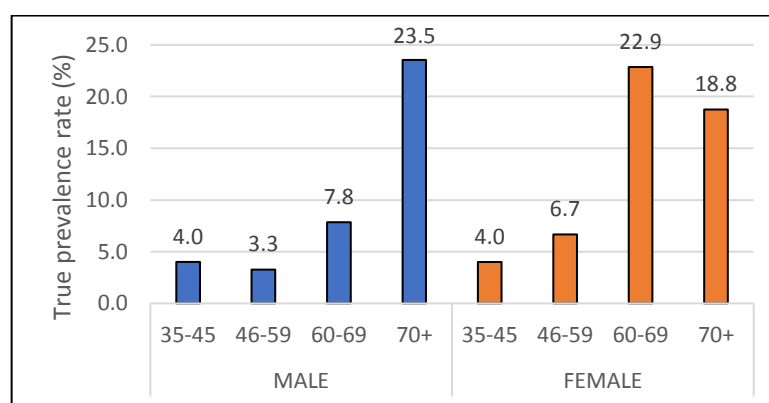


Figure 5.35. True prevalence (%) of HFI in the combined sample, by age cohort and sex.

5.8.2.6 Neoplasia

5.8.2.6.1 Benign neoplasms

Benign neoplasms recorded in the combined sample included, osteomas, button osteomas, osteoid osteomas and osteochondromas, and occurred in an overall total of 4.8% (n=27) of the individuals observed. Wharram had the highest prevalence at 8.6% (n=12) and St. Helens the lowest at 2.7% (n=3) (Table 5.43). Female prevalence was higher at 6.1%, and at each site, other than St. Helens. There was a male increase in prevalence with advancing age, but not a corresponding one for females (Figure 5.36).

Table 5.43. Number and crude prevalence of benign neoplasms at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	3 (3.1)	1 (1.9)	1 (2.7)	2 (9.5)	0	0	4 (2.6)	3 (3.2)	7 (2.8)
Fishergate	0	1 (7.7)	0	1 (5.9)	0	1 (20.0)	2 (33.3)	0	2 (7.4)	3 (8.1)	5 (7.8)
St. Helens	0	0	1 (3.0)	1 (3.4)	1 (9.1)	0	0	0	2 (3.6)	1 (1.8)	3 (2.7)
Wharram	1 (4.5)	4 (28.6)	2 (4.8)	3 (8.8)	1 (8.3)	1 (12.5)	0	0	4 (5.0)	8 (13.3)	12 (8.6)
TOTAL	1 (2.1)	5 (10.0)	6 (3.3)	6 (4.5)	3 (4.5)	4 (9.1)	2 (10.0)	0	12 (3.8)	15 (6.1)	27 (4.8)

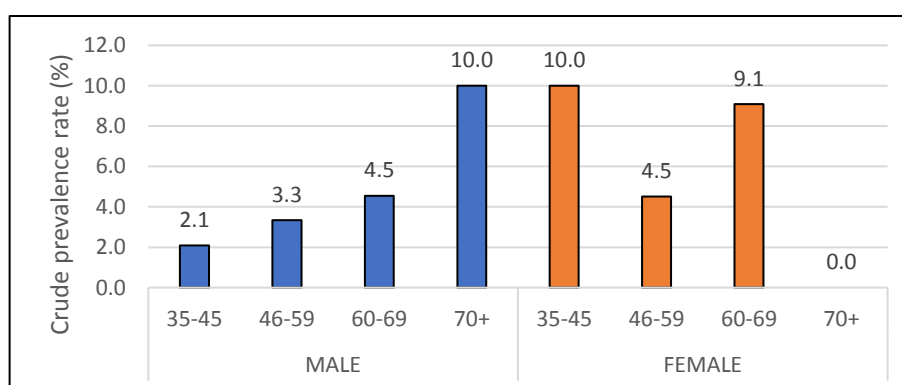


Figure 5.36. Crude prevalence of benign neoplasms in the combined sample, by age cohort and sex.

5.8.2.6.2 Malignant neoplasms

Four individuals were diagnosed with malignant neoplastic lesions, accounting for 0.7% of the combined sample. All exhibited lesions consistent with secondary metastases, from epithelial carcinomas of the lung (n=2), prostate (n=1) and breast (n=1). Three individuals (1.2%) observed were from Barton, with the single other individual from Wharram (0.7%) (Table 5.44). There was no apparent increase in prevalence with advancing age and although the female crude prevalence (0.8%, n=2) slightly exceed the male (0.6%, n=2), the number of cases were split evenly between the sexes.

Table 5.44. Number and crude prevalence at Barton and Wharram, and number and crude prevalence totals in the combined sample, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	2 (2.1)	1 (1.9)	0	0	0	0	2 (1.3)	1 (1.1)	3 (1.2)
Wharram	0	1 (7.1)	0	0	0	0	0	0	0	1 (1.7)	1 (0.7)
TOTAL	0	1 (2.0)	2 (1.1)	1 (0.8)	0	0	0	0	2 (0.6)	2 (0.8)	4 (0.7)

5.8.2.7 Diseases of old age

To explore which diseases were most associated with advancing age in the combined sample, the number and crude prevalence of each disease typically associated with advancing age was calculated (Table 5.45). Schmorl's nodes had the highest crude prevalence in the combined sample at 69.1% in total, and throughout the age cohorts, however their high presence in the 35-45 year age cohort (66.7%) indicates many were formed in adolescence due to congenital weaknesses in the vertebral body, rather than due to weaknesses caused by senescence. Instances of age-related increase in disease occurred for osteoarthritis, spondylosis, DISH, osteoporosis and HFI. Osteoarthritis exhibited a sharp increase in prevalence after 59 years of age (Figure 5.37), which was statistically significant ($X^2=25.72$, 1.d.f.; $p=0.001$). Spondylosis exhibited a continuous increase in prevalence from 35 years (28.9%) to over 70 years (57.5%), as did DISH (1.1% - 15.0%) and HFI (2.2% - 17.5%). Osteoporosis increased sharply in prevalence over 69 years of age, which was statistically significant ($X^2=8.85$, 1.d.f.; $p=0.005$).

Table 5.45. Number and crude prevalence (%) of age-related diseases in the combined sample, by age cohort.

	35-45 (%)	46-59 (%)	60-69 (%)	70+ (%)	TOTAL (%)
Osteoarthritis	17 (18.9)	90 (27.8)	61 (55.5)	26 (65.0)	194 (34.4)
Spondylosis	35 (38.9)	166 (51.2)	86 (78.2)	33 (82.5)	320 (56.7)
Schmorl's nodes	60 (66.7)	213 (65.7)	86 (78.2)	31 (77.5)	390 (69.1)
DISH	1 (1.1)	7 (2.2)	5 (4.5)	6 (15.0)	19 (3.4)
Osteoporosis	0	16 (4.9)	7 (6.4)	10 (25.0)	33 (5.9)
Paget's disease	0	3 (0.9)	3 (2.7)	0 (0.0)	6 (1.1)
HFI	2 (2.2)	10 (3.1)	12 (10.9)	7 (17.5)	31 (5.5)
Malignant neoplasm	1 (1.1)	3 (0.9)	0	0	4 (0.7)

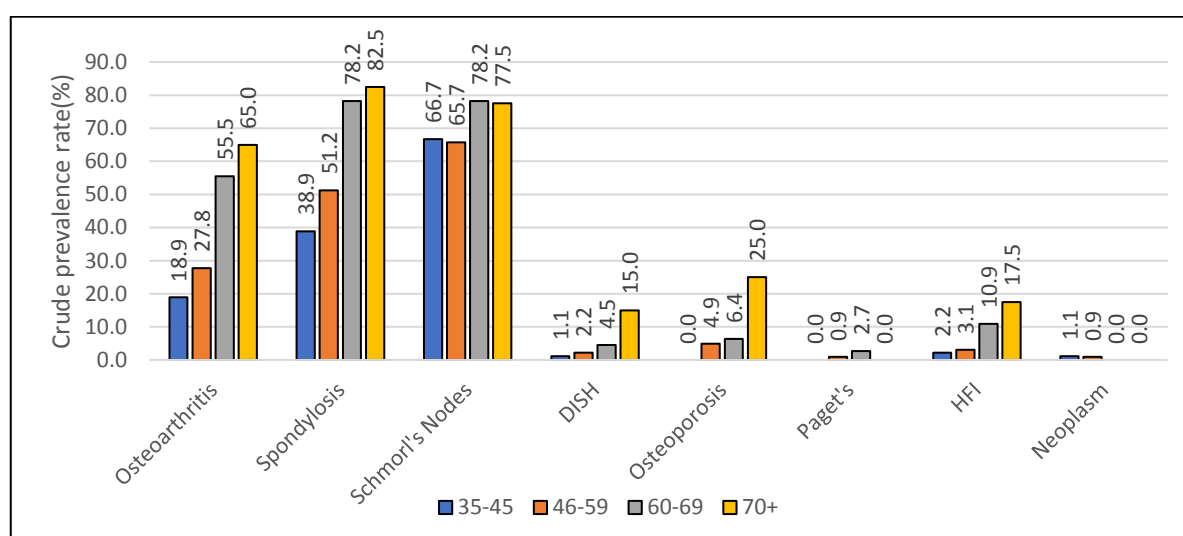


Figure 5.37. Crude prevalence rate (%) of individuals with age-related disease, by age cohort.

When the true prevalence rate was calculated for HFI (using the number of frontal's observed) and spondylosis, Schmorl's nodes, DISH and osteoporosis (using the number of spines observed), the increasing prevalence of each with age was clearly observable (Figure 5.38). The sharp increase in prevalence between the 60-69 year and 70+ year age cohorts for DISH and osteoporosis was statistically significant (DISH: $\chi^2=7.60$, 1.d.f.; $p=0.05$; osteoporosis: $\chi^2=16.13$, 1.d.f.; $p=0.001$).

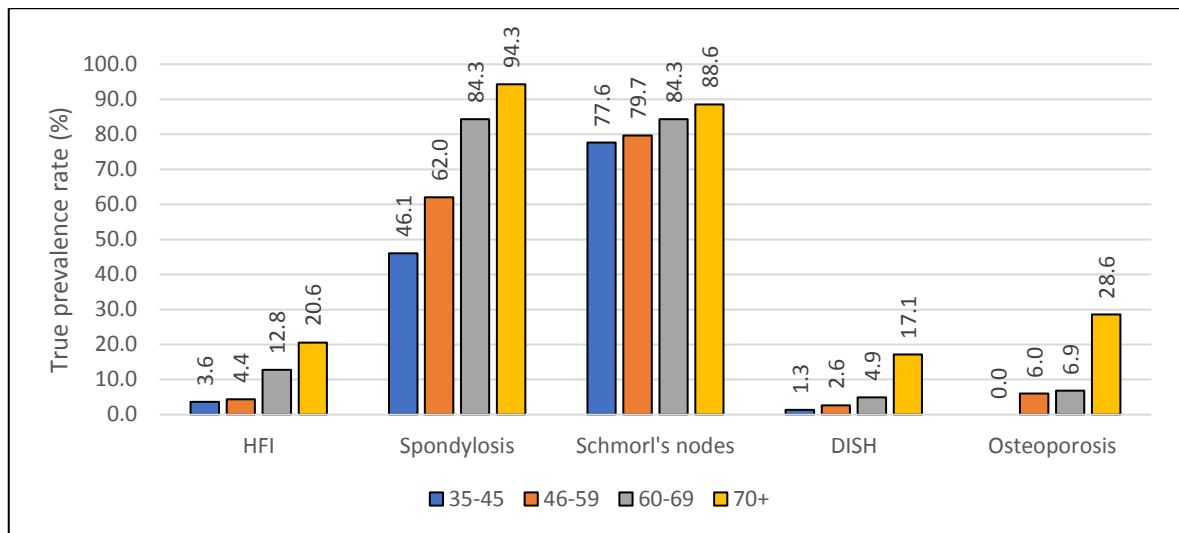


Figure 5.38. True prevalence rate (%) of each age-related disease in the combined sample, by age cohort.

When the true prevalence rate was calculated for the combined sample by sex, spondylosis, Schmorl's nodes and DISH came out more prevalent for males, whereas HFI and osteoporosis were more prevalent for females (Figure 5.39). All of which follow general trends for prevalence for these diseases (see section 2.5).

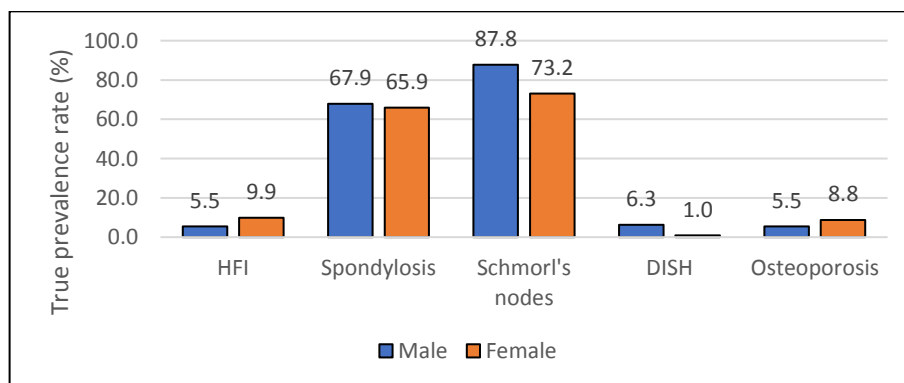


Figure 5.39. True prevalence rate (%) of each age-related disease in the combined sample, by sex.

5.8.3 Trauma

Trauma comprises skeletal injuries which occur either deliberately or accidentally throughout life, with fractures being the most common form of trauma found within the archaeological record (Waldron, 2007). Trauma was recorded within the combined sample when it was visible, and true prevalence rates for specific traumas were calculated by element, using the total number of each

element observed. The crude prevalence rate for trauma in the combined sample was 40.1%, with a total of 226 individuals exhibiting with some form of injury (Table 5.46). Trauma was most prevalent at Barton (45.0%; n=112), and least prevalent at Wharram (27.1%; n=38). The higher rate of trauma at Barton was found to be statistically significant ($X^2=4.47$, 1.d.f.; $p=0.05$) in comparison to the combined sample. Additionally, the low rate of trauma at Wharram was also found to be statistically significant ($X^2=12.96$, 1.d.f.; $p=0.001$) when compared to the rest of the combined sample.

Table 5.46. Number and crude prevalence rate (%) of individuals exhibiting trauma, by site.

Site	No. observed	No. w. trauma	Crude prevalence (%)
Barton	249	112	45.0
Fishergate	64	29	45.3
St. Helens	111	47	42.3
Wharram	140	38	27.1
TOTAL	564	226	40.1

5.8.3.1 Trauma categorisation

Trauma was categorised into fractures, spondylolysis, dislocation, sharp and blunt force trauma, osteochondritis dissecans and soft tissue trauma (Table 5.47). Fractures were the most common trauma type in total at 26.2%, and at each site. Dislocations were the least common form of trauma observed at 0.9% in total. By sex (Table 5.48) a male predominance in almost all trauma categories was demonstrated, except for in cases of dislocation (CPR female 1.2; CPR male 0.6%). The high prevalence of spondylolysis for the St. Helens females (10.9%), was found to be statistically significant in comparison with the rest of the combined females ($X^2=5.60$, 1.d.f.; $p=0.025$). The high prevalence of osteochondritis dissecans at Barton was statistically significant ($X^2=26.28$, 1.d.f.; $p=0.001$). Fishergate's prevalence for sharp and blunt force trauma were not significant (sharp: $X^2=0.90$, 1.d.f.; $p=0.5$; blunt: $X^2=1.50$, 1.d.f.; $p=0.25$). Male prevalence for sharp force trauma was significant ($X^2=12.96$, 1.d.f.; $p=0.001$), but was not significant for blunt force trauma ($X^2=0.14$, 1.d.f.; $p=0.5$).

Table 5.47. Number and crude prevalence of each trauma category, by site

	Barton (%)	Fishergate (%)	St. Helens (%)	Wharram (%)	TOTAL (%)
Fracture	64 (26.0)	25 (39.1)	27 (24.3)	31 (22.1)	147 (26.2)
Spondylolysis	22 (8.9)	3 (4.7)	10 (9.0)	9 (6.4)	44 (7.8)
Dislocation	3 (1.2)	1 (1.6)	1 (0.9)	0	5 (0.9)
Sharp force trauma	7 (2.8)	3 (4.7)	3 (2.7)	3 (2.1)	16 (2.9)
Blunt force trauma	2 (0.8)	2 (3.1)	3 (2.7)	1 (0.7)	8 (1.4)
Osteochondritis dissecans	48 (19.5)	2 (3.1)	12 (10.8)	3 (2.1)	65 (11.6)
Soft tissue trauma	5 (2.0)	0	1 (0.9)	3 (2.1)	9 (1.6)

Table 5.48. Number and crude prevalence of each trauma category, by site and sex

	Barton (%)		Fishergate (%)		St. Helens (%)		Wharram (%)		TOTAL (%)	
	M	F	M	F	M	F	M	F	M	F
Fracture	47 (31.1)	17 (17.9)	17 (63.0)	8 (21.6)	18 (32.1)	9 (16.4)	21 (26.3)	10 (16.7)	103 (32.8)	44 (17.8)
Spondylolysis	19 (12.6)	3 (3.2)	1 (3.7)	2 (5.4)	4 (7.1)	6 (10.9)	8 (10.0)	1 (1.7)	32 (10.2)	12 (4.9)
Dislocation	2 (1.3)	1 (1.1)	0	1 (2.7)	0	1 (1.8)	0	0	2 (0.6)	3 (1.2)
Sharp force trauma	7 (4.6)	0	3 (11.1)	0	3 (5.4)	0	3 (3.8)	0	16 (5.1)	0
Blunt force trauma	1 (0.7)	1 (1.1)	1 (3.7)	1 (2.7)	2 (3.6)	1 (1.8)	1 (1.3)	0	5 (1.6)	3 (1.2)
Osteochondritis dissecans	30 (19.9)	18 (18.9)	1 (3.7)	1 (2.7)	6 (10.7)	6 (10.9)	2 (2.5)	1 (1.7)	39 (12.4)	26 (10.5)
Soft tissue trauma	3 (2.0)	2 (2.1)	0	0	1 (1.8)	0	3 (3.8)	0	7 (2.2)	2 (0.8)

5.8.3.2 Trauma distribution

To explore if age or sex affected the rates of trauma at each site, the crude prevalence was calculated (Table 5.49). More males than females exhibited trauma in total at 47.8% and at each site, with Fishergate having the highest total male prevalence (70.4%). The higher total crude prevalence for Fishergate males was found to be statistically significant ($X^2=14.13$, 1.d.f.; $p=0.001$). St. Helens had the highest female prevalence at 36.4%, and Wharram had the lowest prevalence for both males (32.5%) and females (20.0%) (Figure 5.40). Trauma prevalence increased with advancing age for both sexes (Figure 5.41).

Table 5.49. Number and crude prevalence (%) of individuals exhibiting trauma at each site, by age and sex. NB. This table excludes one individual of unknown sex from Barton.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	3 (27.3)	0	50 (51.5)	16 (30.2)	20 (54.1)	11 (52.4)	5 (83.3)	6 (60.0)	78 (51.7)	33 (34.7)	111 (45.1)
Fishergate	4 (57.1)	1 (7.7)	5 (62.5)	7 (41.2)	5 (83.3)	2 (40.0)	5 (83.3)	0	19 (70.4)	10 (27.0)	29 (45.3)
St. Helens	5 (62.5)	3 (25.0)	11 (33.3)	9 (31.0)	7 (63.6)	6 (60.0)	4 (100.0)	2 (50.0)	27 (48.2)	20 (36.4)	47 (42.3)
Wharram	4 (18.2)	1 (7.1)	15 (35.7)	6 (17.6)	5 (41.7)	2 (25.0)	2 (50.0)	3 (75.0)	26 (32.5)	12 (20.0)	38 (27.1)
TOTAL	16 (33.3)	5 (10.0)	81 (45.0)	38 (28.6)	37 (56.1)	21 (47.7)	16 (80.0)	11 (55.0)	150 (47.8)	75 (30.4)	225 (40.1)

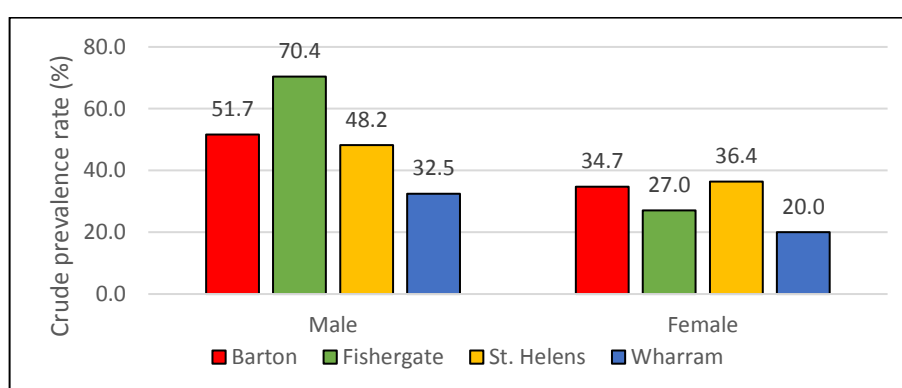


Figure 5.40. Percent prevalence of trauma in males and females, by site.

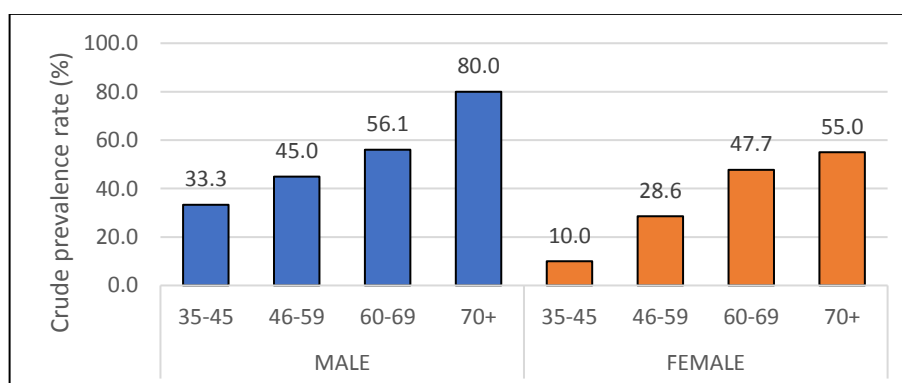


Figure 5.41. Percent prevalence of trauma, by age cohort and sex.

5.8.3.3 Fractures

The true prevalence rates of fractures within the combined sample, were calculated with each element regarded as one, for example, the ribs and spine were each recorded as a single element. Multiple fractures to each element were also recorded as one, regardless of the number of

instances. Fractures to the spine recorded included both pathological compression fractures due to osteoporosis, and instances of spondylolysis. In the skull, secondary fractures from sharp or blunt force trauma were included. Both healed and healing fractures were included in analysis; additionally, the proportions for healed and healing fractures were evaluated by age cohort to highlight any differences.

The TPR for fractures in the combined sample was 3.4%, with a male total of 4.4%, more than double that of the female total at 2.1% (Table 5.50). The male predominance for fractures was significant ($\chi^2=17.02$, 1.d.f.; $p=0.001$), and the high prevalence was maintained throughout the totals for each site and in each age cohort, up to the 70+ individuals where the prevalence rates were equal at 5.7%. A female increase in true prevalence with advancing age was clear, however the male prevalence peaked in the 60-69 year age cohort at 6.1% (Figure 5.42). The high prevalence of fractures at Fishergate was significant ($\chi^2=6.33$, 1.d.f.; $p=0.025$).

Table 5.50. Total number and true prevalence rate (%) of fractures at each site by age and sex. NB. This table excludes one individual of unknown sex from Barton who exhibited a fracture to the left ulna, and another to the left MT5.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	2 (1.6)	0	53 (4.2)	10 (1.6)	30 (5.7)	7 (2.6)	5 (5.6)	5 (4.1)	90 (4.5)	22 (2.0)	112 (3.6)
Fishergate	5 (4.2)	1 (0.6)	7 (6.0)	8 (3.7)	9 (9.9)	1 (1.3)	8 (8.2)	0	28 (6.8)	10 (2.1)	39 (4.3)
St. Helens	4 (3.5)	3 (2.1)	13 (2.9)	6 (1.8)	8 (4.9)	8 (5.6)	3 (5.5)	5 (8.7)	28 (3.6)	22 (3.2)	50 (3.4)
Wharram	6 (2.4)	1 (0.5)	24 (4.1)	5 (1.0)	9 (6.1)	3 (1.7)	1 (1.7)	5 (8.5)	40 (3.8)	14 (1.5)	54 (2.7)
TOTAL	17 (2.8)	5 (0.8)	96 (4.0)	29 (1.7)	56 (6.1)	19 (2.9)	17 (5.7)	15 (5.7)	186 (4.4)	68 (2.1)	255 (3.4)

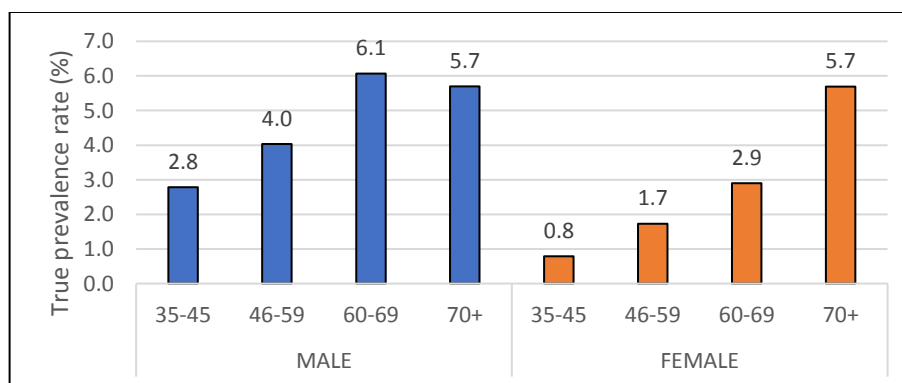


Figure 5.42 True prevalence (%) of fractures in the combined sample, by age cohort and sex.

The true prevalence for fractures across the skeleton in males and females, for each site, can be seen in Figure 5.44. Rib fractures for males at Wharram had the highest true prevalence overall at 50.7%, followed by males from Fishergate at 44.0%. Fractures to the ribs and spine were the most prevalent form of fractures at each site, and for both sexes. Parry fractures of the ulna, at Barton (5.7%), St. Helens (9.4%) and Wharram (1.8%) were more prevalent in females, and at Fishergate (8.0%) more prevalent in males. Barton had the largest distribution of fractures across the skeleton in both sexes, and Fishergate the smallest, with fractures mostly confined to the upper body.

Healed and healing fractures (Table 5.51; Figure 5.43), followed similar trends, with individuals in the 46-59 year cohort demonstrating the highest percentage of both (healed: 40.1%; healing 6.8%). Proportionally, the individuals in the 60-69 and 70+ year cohorts demonstrate fewer healing, than healed fractures, in comparison to individuals in the 46-59 year cohort. Interestingly, the percentage of individuals in the 60-69 year cohort, exhibiting both healed and healing fractures (4.1%), exceeds all other cohorts.

Table 5.51. Number and percentage (%) of individuals exhibited healed, or healing fractures, or both, by age cohort.

Age cohort	Healed (%)	Healing (%)	Both (%)	TOTAL (%)
35-45	10 (6.8)	2 (1.4)	2 (1.4)	14 (9.5)
46-59	59 (40.1)	10 (6.8)	5 (3.4)	74 (50.3)
60-69	31 (21.1)	3 (2.0)	6 (4.1)	40 (27.2)
70+	15 (10.2)	2 (1.4)	2 (1.4)	19 (12.9)
TOTAL	115 (78.2)	17 (11.6)	15 (10.2)	147 (100.0)

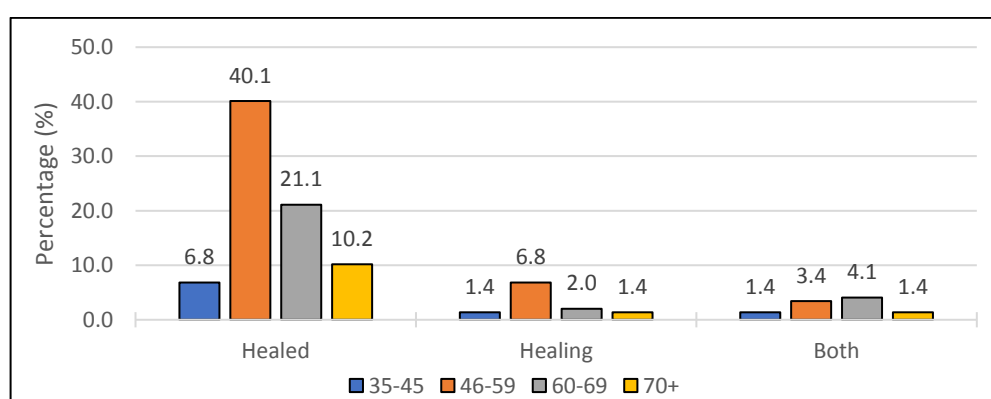


Figure 5.43. Percentage (%) of individuals recorded with healed or healing fractures, or both, by age cohort.

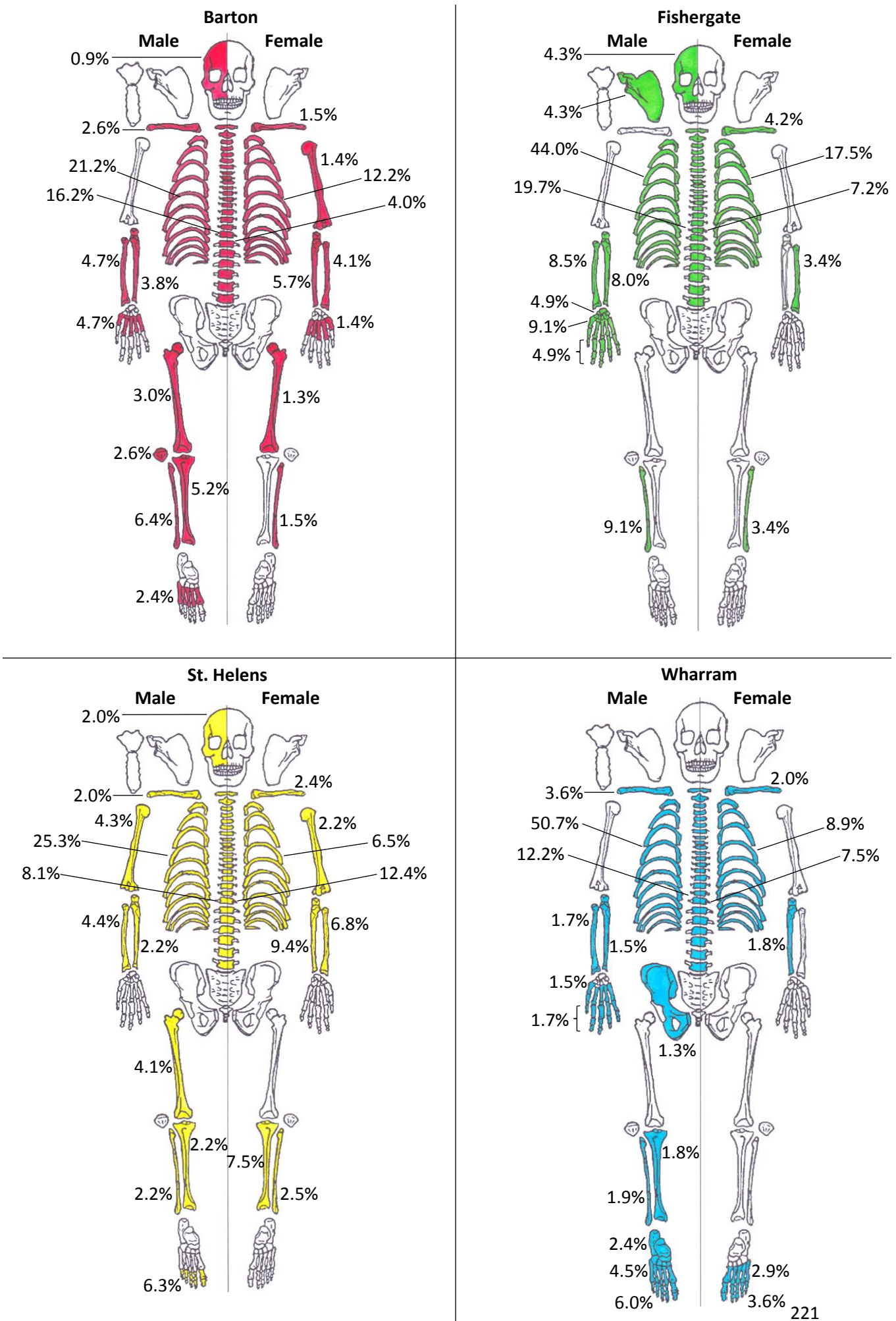


Figure 5.44. True prevalence rate for fractures at each site, by sex.

5.8.3.4 Interpersonal violence

Interpersonal violence (IPV) can represent isolated incidents, such as battles, or alternatively it can signify exposure to physical abuse. Other forms of abuse, such as psychological or financial, are archaeologically invisible. Incidences of violence as opposed to accidental injury were decided according to the type and location of the trauma, for example blade wounds and defensive injuries, as well as the number and state of healing and healed fractures. Evidence suggests that multiple fractures at different stages of healing can be indicative of prolonged exposure to abuse (Gowland, 2015). This study considered all combinations of healed and healing fractures, including defensive (parry fractures) and combative (metacarpal or punching fractures), sharp and blunt force trauma, additional traumatic lesions and underlying skeletal pathologies, as well as age and sex, to assess for interpersonal violence, and further abuse or neglect, within the combined sample. Spinal trauma was considered when present, but only included if it was obviously inflicted damage, rather than pathological fracture due to osteoporosis. An example is Fishergate 1486 (male, 46-59 years) who exhibited unhealed blade injuries to several vertebrae.

A total of 42 individuals exhibited some form of potential interpersonal violence within the combined sample, providing an overall total crude prevalence of 7.5% (Table 5.52). Fishergate had the highest crude prevalence overall at 14.1% and Wharram the lowest at 5.0%. It was found to be significant that Fishergate had a higher rate of interpersonal violence, when compared with the rest of the sample ($\chi^2=4.58$, 1.d.f.; $p=0.05$). Male crude prevalence exceeded female in total, at each site and in each age cohort. Again, the Fishergate males demonstrated significantly more IPV when compared with the rest of the males in the study sample ($\chi^2=10.81$, 1.d.f.; $p=0.005$). An increase in prevalence with advancing age was evident for both sexes (Figure 5.45). The female majority for IPV over 60 years of age ($n=6$) was significant ($\chi^2=9.38$, 1.d.f.; $p=0.005$).

Table 5.52. Crude prevalence (%) of interpersonal violence at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	9 (9.3)	1 (1.9)	6 (16.2)	1 (4.8)	1 (16.7)	2 (20.0)	16 (10.6)	4 (4.2)	20 (8.1)
Fishergate	0	0	5 (62.5)	1 (5.9)	1 (16.7)	0	2 (33.3)	0	8 (29.6)	1 (2.7)	9 (14.1)
St. Helens	1 (12.5)	0	3 (9.1)	0	0	1 (10.0)	1 (25.0)	0	5 (8.9)	1 (1.8)	6 (5.4)
Wharram	0	0	4 (9.5)	0	1 (8.3)	1 (12.5)	0	1 (25.0)	5 (6.3)	2 (3.3)	7 (5.0)
TOTAL	1 (2.1)	0	21 (11.7)	2 (1.5)	8 (12.1)	3 (6.8)	4 (20.0)	3 (15.0)	34 (10.8)	8 (3.2)	42 (7.5)

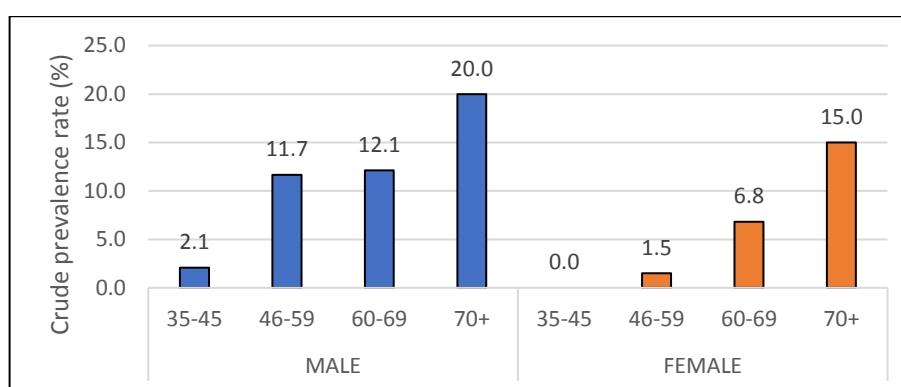


Figure 5.45. Crude prevalence (%) of interpersonal violence in the combined sample, by age cohort and sex.

Figure 5.46 presents the numbers of each trauma potentially related to interpersonal violence recorded within the combined sample, by sex. Each individual is only represented once within each IPV category, irrespective of the number of similar IPV traumas recorded, however individuals may be represented in more than one category if they exhibited multiple different forms of IPV trauma. All fractures recorded as IPV were either multiple instances on a single individual; in locations suggesting IPV on the skeleton (rib, metacarpal, distal ulna and skull fractures); or associated with other lesions, suggesting IPV. Male numbers exceed female in every category, particularly regarding sharp force trauma, the majority of which presented as blade injuries. It is interesting that one female exhibited a metacarpal fracture, which can be indicative of punching with a closed fist, especially when the fracture occurs to the 5th metacarpal (Jeanmonod et al., 2011).

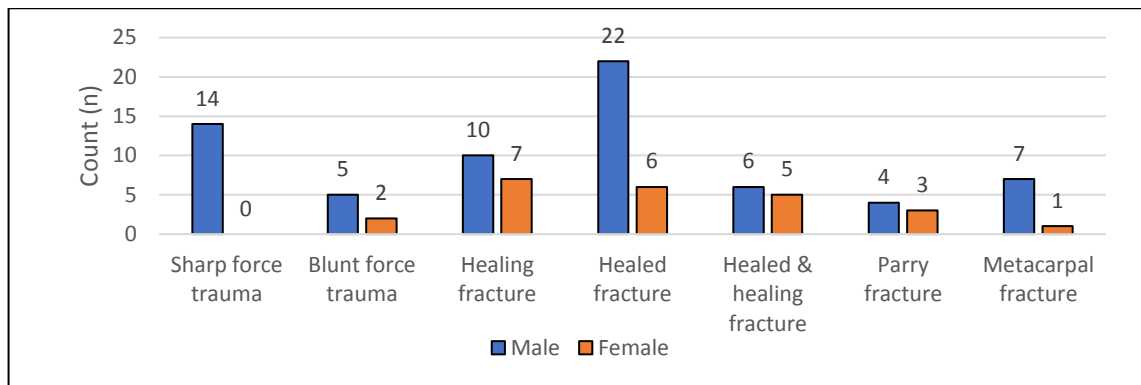


Figure 5.46. Number of traumas recorded related to potential interpersonal violence in the combined sample, by sex.

When IPV categories were divided by age cohort (Figure 5.47), only two categories, sharp force trauma and healing fracture, have trauma recorded below 46 years (this was a single 35-45 year old individual exhibiting a healing blade injury, and associated healing fractures as well as secondary infection to the skull). Overall, each IPV category is most common in the 46-59 age cohort, with a general decline in instances towards the 70+ age cohort.

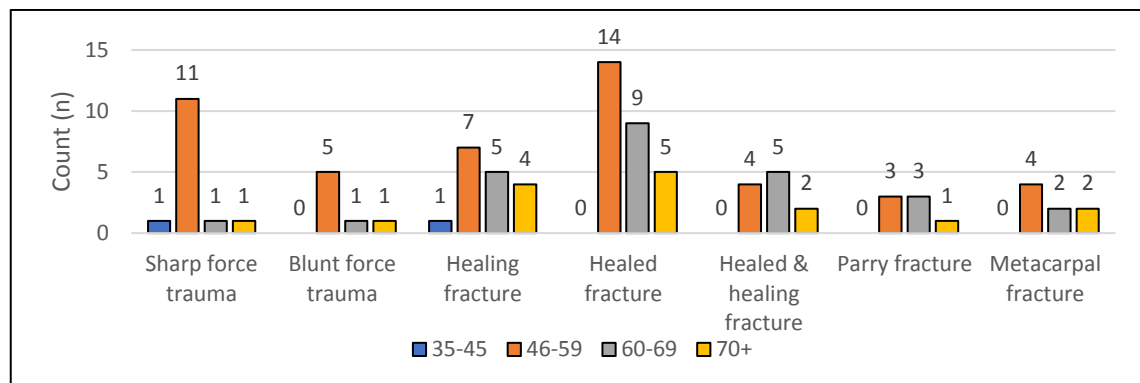


Figure 5.47. Number of traumas recorded related to potential interpersonal violence in the combined sample, by age cohort.

To explore this apparent decline in IPV with age by IPV category, despite a recorded crude increase in IPV with age. Each IPV injury recorded was assessed to see if it occurred while the individual was younger, or while they were within the same age cohort that they were in when they died. This was accomplished by assessing the level of healing exhibited, in conjunction with the absolute mean age calculated for the individual, to evaluate if the injury occurred within, or prior to, the age cohort the individual died within. Individuals that demonstrated both past and recent trauma, were collated into a separate category (Table 5.53; Figure 5.48).

The results (Figure 5.48) demonstrate that the majority of IPV observed on those above 60 years (60-69 year and 70+ year cohorts) occurred prior to the age cohort they died in, while the majority of those younger than 60 (35-45 year and 46-59 year cohorts) experienced IPV related trauma within the age cohort they died in. Indicating that although the crude prevalence of IPV increases with age, it is due to the accumulation of trauma over a lifetime rather than specific events of violence towards older people. Although this does not mean that these instances of violence did not occur. It is interesting to note that very few individuals (n=1, 2.4%) that died within the 35-45 year cohort exhibited IPV, suggesting that either, age does have a role in violent interactions, or more likely, that those individuals that engaged in IPV may have been more hardy, and therefore lived longer to accrue more evidence for trauma.

Table 5.53. Number and percentage (%) of individuals exhibiting IPV divided by trauma occurrence prior to, or within, the age cohort at death or both, by age.

Age cohort	Prior to Age Cohort (%)	Within Age Cohort (%)	Both (%)	TOTAL (%)
35-45	0	1 (2.4)	0	1 (2.4)
46-59	6 (14.3)	12 (28.6)	5 (11.9)	23 (54.8)
60-69	6 (14.3)	3 (7.1)	2 (4.8)	11 (26.2)
70+	3 (7.1)	2 (4.8)	2 (4.8)	7 (16.7)
TOTAL	15 (35.7)	18 (42.9)	9 (21.4)	42 (100.0)

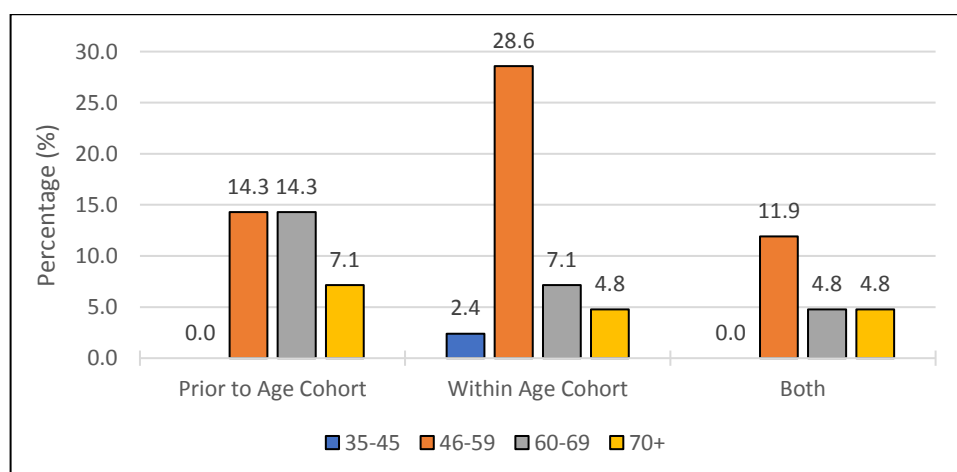


Figure 5.48. Percentage (%) of individuals who exhibited trauma consistent with IPV, divided by occurrence prior to, or within, the age cohort at death, or both, by age.

5.8.3.4.1 Abuse and neglect

Of the 42 individuals who exhibited signs of interpersonal violence, 20 individuals exhibited trauma apparently associated with a single incident or single injury (e.g. healed blade wound) and

were therefore not considered further for potential abuse. Four types of potential physical abuse were visible in the combined sample. These were, prolonged exposure (n=9), evidenced by multiple fractures at different stages of healing; past exposure (n=6), evidenced by multiple healed traumas including multiple and/or defensive fractures and blade wounds. Traumatic event around death (n=4) evidenced by multiple concurrent fractures either unhealed or at a very early stage of healing; and finally disease associated (n=3) evidenced by trauma more in line with conflict (for example, sharp force trauma and 5th metacarpal fractures), on individuals suffering from debilitating conditions, suggesting the trauma suffered may have in fact been the result of abuse and defence (Table 5.54). There were no individuals who exhibited obvious signs of neglect, and no evidence of decubiti was found in this study.

The overall total crude prevalence of physical abuse in the combined sample was 3.9% (n=22), with Fishergate having the highest prevalence overall at 7.8% (although this was not significant $\chi^2=2.95$, 1.d.f.; $p=0.1$) and St. Helens the lowest at 0.9%. In total, the male prevalence exceeded the female (4.8%, and 2.8% respectively), a trend which was followed at Barton and Fishergate and in the 46-59 year age cohort. A higher female prevalence was recorded at St. Helens and Wharram, as well as in the 60-69 year and 70+ year age cohorts. There were no individuals in the 35-45 year age cohort exhibiting potential abuse. An increase in the prevalence of abuse with advancing age was apparent for both sexes (Figure 5.49).

Table 5.54. Number and crude prevalence of potential physical abuse at each site, by age and sex.

Site	35-45		46-59		60-69		70+		TOTAL		OVERALL TOTAL (%)
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	
Barton	0	0	6 (6.2)	1 (1.9)	2 (5.4)	1 (4.8)	1 (16.7)	1 (10.0)	9 (6.0)	3 (3.2)	12 (4.9)
Fishergate	0	0	1 (12.5)	1 (5.9)	1 (16.7)	0	2 (33.3)	0	4 (14.8)	1 (2.7)	5 (7.8)
St. Helens	0	0	0	0	0	1 (10.0)	0	0	0 (0.0)	1 (1.8)	1 (0.9)
Wharram	0	0	1 (2.4)	0	1 (8.30)	1 (12.5)	0	1 (25.0)	2 (2.5)	2 (3.3)	4 (2.9)
TOTAL	0	0	8 (4.4)	2 (1.5)	4 (6.1)	3 (6.8)	3 (15.0)	2 (10.0)	15 (4.8)	7 (2.8)	22 (3.9)

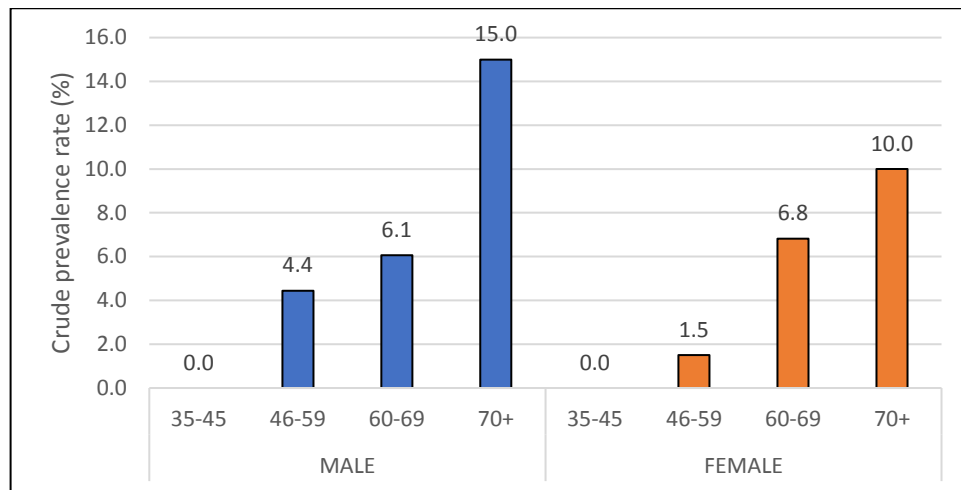


Figure 5.49. Crude prevalence (%) of potential physical abuse in the combined sample, by age cohort and sex.

5.8.3.4.1.1 Prolonged exposure

An individual from St. Helens exhibits injuries consistent with prolonged exposure to physical abuse, over a several year period, at least. This was St. Helens 5508, a female in the 60-69 year cohort, with an absolute mean age at death of 65.7 years. This individual demonstrated seven recordable fractures, six to the ribs, and one to the right ulna (Figure 5.50). The fracture locations, and differing healing stages are consistent with abuse (ribs) and defence (parry fracture to the ulna) (Gowland, 2015). A single mid-cage rib fragment appeared well healed, with remodelling complete, however some malalignment was evident; this fracture occurred some years prior to death. The ulna, and the left 12th rib, exhibited healed fractures, with partially complete remodelling of the primary woven bone, indicating that the fracture events occurred between several months and several years prior to death (Loi et al., 2016). The remaining four rib fractures, observable on mid-cage fragments, all occurred within several months of death. Two demonstrated considerable woven bone or 'callus' development, indicating more advanced healing; another exhibited some lesser callus development, and the final demonstrated flaring at the fracture site, and some minor callus formation, indicating minimal healing, suggesting it occurred within weeks of death (Loi et al., 2016; Lovell, 1997). Additionally, the individual was almost entirely edentulous, exhibited signs of dental disease, displayed new bone formation consistent with sinusitis, and demonstrated eburnation indicative of osteoarthritis to the right

shoulder (humeral head, lateral clavicle and scapular facet), and the articular facets of the cervical vertebrae, as well as spondylosis. The timing of the fractures, over a several year period, increasing in volume towards death, in conjunction with the other pathologies exhibited, indicates that the abuse may have been related to the individuals decline in ability with increasing age.



Figure 5.50. Fractures associated with prolonged exposure to physical abuse on St. Helens 5508. Left: four ribs with different rates of healing, exhibiting callus development (left), lesser callus (upper right) and minimal callus (lower right). Right: parry fracture to the right ulna, exhibiting remodelling woven bone.

5.8.3.4.1.2 Past exposure

An individual from Barton exhibited trauma in line with past exposure to at least one physically abusive event; this was individual Barton 1315, a male in the 46-59 year cohort. The joint degeneration and cartilage ossification exhibited by Barton 1315 indicates that they were probably towards the upper end of the 46-59 year cohort. This individual exhibited a total of seven mid-cage rib fractures; four left, one right and two unsided fragments. All of the fractures were well healed, and fully remodelled, indicating that they occurred when the individual was younger (Figure 5.51). Although they may have occurred while the individual was still within the 46-59 year cohort. Once a fracture is fully remodelled it is difficult to differentiate between their occurrence in a single, or multiple events. However, the presence of multiple fractures, particularly to both sides of the rib-cage, indicates that abuse, or at the very least interpersonal violence, is more likely than an accident (Gowland, 2015). Barton 1315 exhibited various age

related pathologies, such as osteoarthritis, spondylosis, and partial edentulism; but no clear indications of why they may have been subjected to physical abuse at a younger age.



Figure 5.51. Well remodelled rib fractures associated with past exposure to physical abuse on Barton 1315.

5.8.3.4.1.3 Traumatic event

An individual from Wharram Percy exhibited injuries consistent with a traumatic event, which occurred within two months of the death of the individual, according to the healing present (Loi et al., 2016). This was individual EE015, an old adult female, estimated to be aged between 60-69 years at death. The trauma encompassed 19 separate fractures, one to the left third metatarsal and the remaining 18 to the ribs. Nine left ribs, two right ribs and five unsided rib fragments demonstrated fractures, with two of the left ribs exhibiting two fractures each. Additionally, the individual suffered from osteoporosis, osteoarthritis to both hip joints (Figure 5.52) differential diagnosis was osteonecrosis, or avascular necrosis (Konarski et al., 2022) but no trauma was evident. They were also suffering from periodontal disease which left them almost entirely edentulous, and demonstrated evidence of past malnutrition in the form of healed cribra orbitalia. This traumatic event was considered as a potential isolated abusive event, due to the fracture locations and the individuals advanced age and poor health status. It is unlikely that an older female, suffering from potentially debilitating degenerative joint disease in both hip joints would be involved in heavy manual labour, meaning traumatic accidents are more unlikely. In a rural farming community like Wharram, an individual unable to contribute would have placed

considerable pressure on resources, which exacerbates IPV towards weaker individuals (Minois, 1989).



Figure 5.52. Pathology observed on Wharram EE015. Left: degeneration to both femoral heads, representing either severe osteoarthritis or avascular necrosis. Right: left first rib demonstrating a fracture united by minimal callus distal to the tubercle facet.

5.8.3.4.1.4 Disease associated

An individual from Barton exhibited evidence of physical abuse and defence, associated with a potentially debilitating disease. Barton 327, a male aged into the 46-59 year cohort displayed atrophy or ‘withering’ of the long bones from the right hand side of the body. This is consistent with a neuromuscular disorder, for example, poliomyelitis (Iolascon et al., 2019), although no definitive diagnosis could be made. This individual exhibited three healed mid-cage rib fractures, and two left metacarpal fractures (MC2 and MC5). Although the rib fractures were all healed, one, to a left mid-cage rib appeared less well remodelled than the other two mid-cage fragments, indicating that it may have occurred later (Figure 5.53). Metacarpal fractures, particularly to the 5th, are indicative of punching injuries, and can demonstrate defence (Jeanmonod et al., 2011). Additionally, both metacarpal fractures exhibited malalignment upon healing, which can be indicative of lack of care of an injured person, signalling abuse (Gowland, 2015). These, in conjunction with the long bone atrophy, indicate that this individual may have experienced disease related abuse at some stage in their life. They also exhibited spondylolysis, periodontal

disease, spondylosis, fusion of the first proximal and distal phalanges of the left foot and general joint decline across the body.



Figure 5.53. Fractures exhibited by Barton 327 associated with disease related physical abuse. Left: the left MC2 and MC5 demonstrating potential punching injuries. Right: a healed fracture to a left mid-cage rib exhibiting slightly less remodelling than the metacarpal fractures.

5.9 Funerary archaeology

Veneration, meaning respect or high regard of the dead, by the living; or contrastingly a lack thereof; may be visible through funerary archaeology (Parker Pearson, 1999:3). Assessment of this through burial location, grave goods and even body position was explored across the study samples, where the records allowed, to reveal trends, with particular focus on those of advanced age or increased frailty. It must be noted that by AD 900, Christian burial rites dictated that grave goods and furnishings should not be included in burials, however this does not mean that they did not occur, particularly in wealthy burials, but does account for the limited findings (Daniell, 1998). The raw data is presented in the appendices (Appendix 13).

5.9.1 Barton-upon-Humber

The comprehensive nature of the burial plans by phase from Barton (Waldron, 2007), have allowed for assessment of burial location for all phased individuals used in the study sample (n=2 unphased). No burial plan could be included within this study due to the overlapping nature of the

burials stratigraphically. Phases E (AD 950-1150) and D (AD 1150-1300) incorporate more than one church development stage and no clear information was obtainable about which individuals were buried outside and then incorporated by the later church additions. Individuals inside the earlier church for these phases, have therefore been regarded as inside, and those inside the later church have been classed as originally outside. This is because many of the graves are cut by the later church walls (Phase E) and are in distinct clusters along the line of the external earlier church walls (Phase D).

By age, a significant proportion of 70+ year olds were buried inside the church (18.2%; $X^2=5.46$, 1.d.f.; $p=0.025$), as well as the greatest proportion of 60-69 years olds (36.4%), although this was not significant ($X^2=2.23$, 1.d.f.; $p=0.25$). A significantly lower proportion of 46-59 year olds (40.9%, $X^2=3.98$, 1.d.f.; $p=0.05$) were buried within the church than outside (Figure 5.54). This suggests some form of veneration of older individuals at Barton, which may be due to its status as a wealthier site, meaning older individuals could retain their wealth and standing in society into old age.

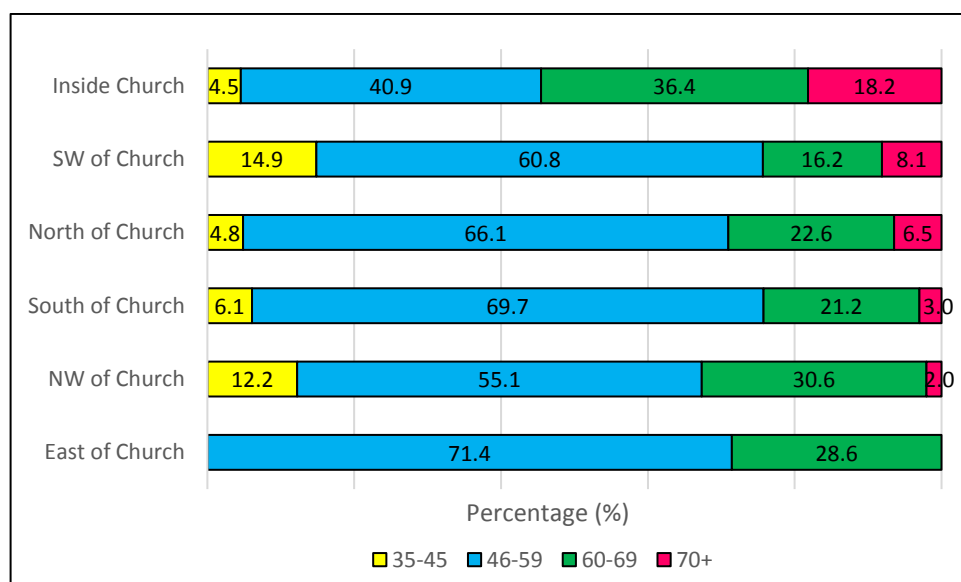


Figure 5.54. Proportion (%) of individuals buried within each section of the churchyard at Barton.

A secondary cluster of those 70+ at death was revealed to the south-west of the church, again this area particularly near the entrance, was similarly favourable to burial within the church, if this

latter location could not be achieved (Parker Pearson, 1999:14). However, it must be noted that this area was very heavily populated by individuals of all ages and phases.

By sex, the same trends apply (Figure 5.55). A high proportion of 70+ year females (33.3%) was buried within the church in comparison to the males, however this was due to the low numbers of females buried within the church overall (n=6).

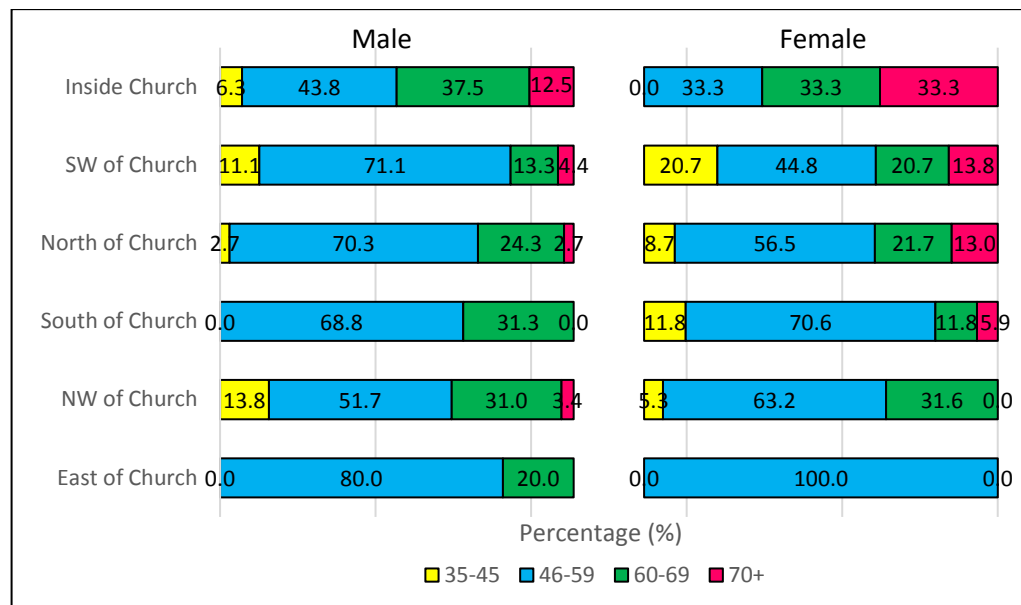


Figure 5.55. Proportion (%) of individuals buried within each section of the churchyard at Barton, by sex.

In total 43.8% (n=7) of the 70+ cohort exhibited evidence of confined burial, more than at all other sites combined, indicating the wealth status of the site, although only one was associated with grave goods. Individual Barton 187, a 70+ year female, buried by the south wall of the phase D church had a bone die located between her ribs and left elbow (Figure 5.56), however it has been suggested that this may have been a tool utilised by the clergy to make decisions, rather than a true grave inclusion (Rodwell, 2011b:631).

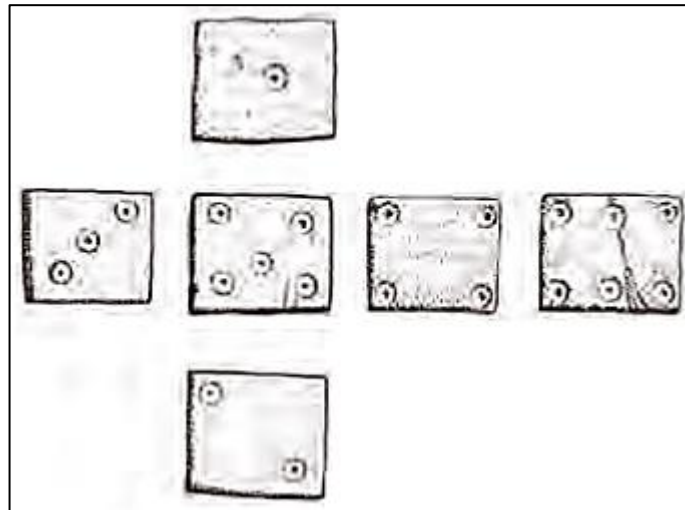


Figure 5.56. Diagram of the bone die from the grave of Barton 187, a 70+ female buried immediately to the south of the Church of St. Peter, Barton-upon-Humber (Rodwell, 2011b:626).

5.9.2 Fishergate House

As the location of the church associated with the cemetery at Fishergate is unknown, assessing importance to society by burial location is impossible. However, using the suggested location of the church from Spall and Toop (2005b), it can be surmised that all of the individuals excavated were buried to the east of the church (Figure 5.57). All individuals in the 70+ cohort were clustered in the main area of Intervention 1, indicating potential preference in burial location for older individuals. The true extent of the cemetery is unknown however, meaning any clusters cannot be deemed reliable, and when tested the 70+ cluster was not significant ($X^2=2.80$, 1.d.f.; $p=0.1$). All interments in the study sample appear to have been shroud burials, placed supine and extended, without grave goods (Holst, 2005; Spall and Toop, 2005c), this fits with Fishergate being the most deprived site of the four. There were no patterns visible by sex.

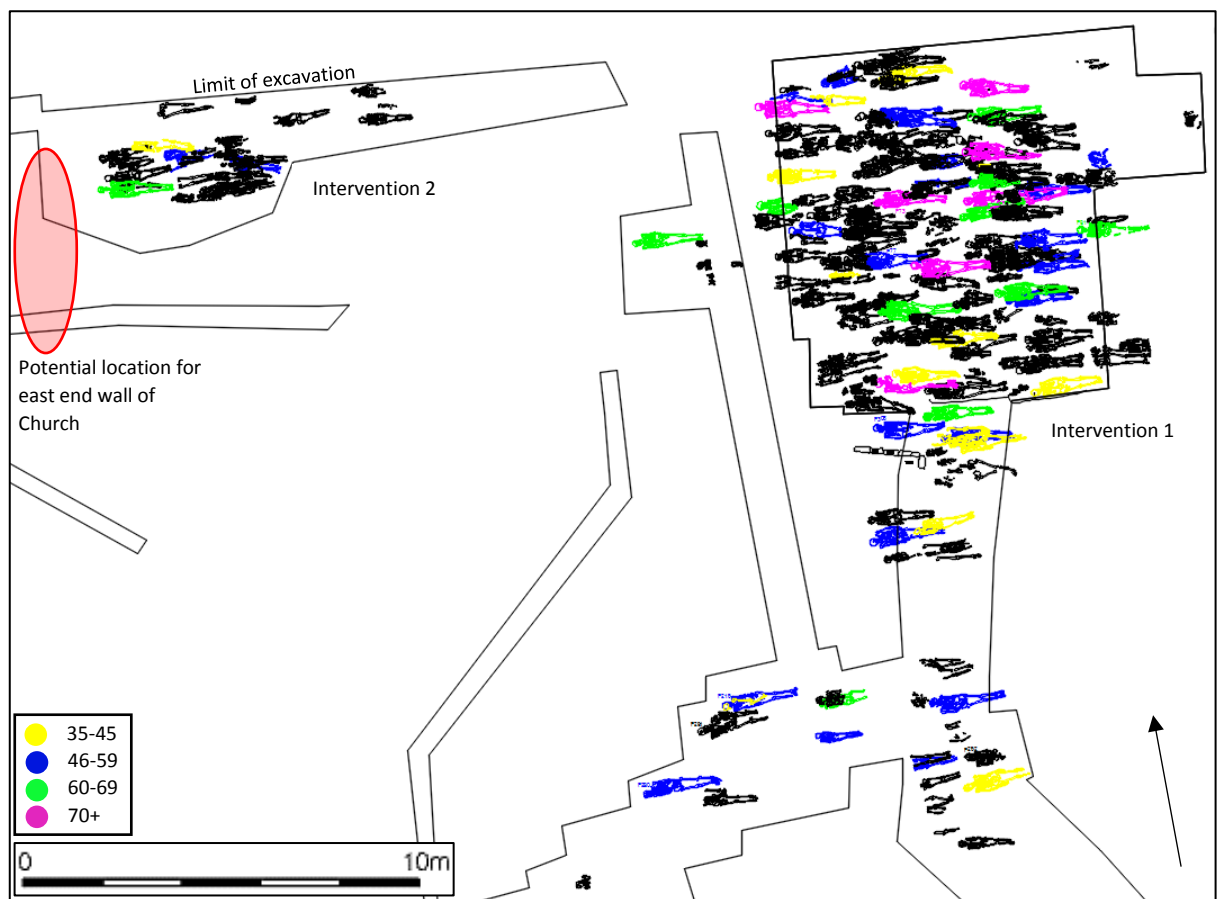


Figure 5.57. Burial plan for Fishergate House, York (Spall and Toop, 2005a).

5.9.3 St. Helen-on-the-Walls

Limited evidence is available about the funerary archaeology at St. Helens, with the information available being extracted from Dawes and Magilton (1980). The burial plan (Figure 5.58) suggests that older individuals were mostly concentrated within and to the north of the church. The identifiable individuals (outlined with boxes) from the 60-69 and 70+ cohorts appear to follow this trend, but the sample is small enough to be negligible ($n=6$). No clear information on which individuals may have been initially buried outside, and later incorporated by the extended church is available. It is important to note that 'elderly' according to this site report, is any individual over the age of 45 years; and that the many individuals depicted in green have been aged as either 'intermediate', presumably between roughly 18 and 45 years, or 'indeterminate', meaning no age was assigned. The combination of these age categories means reliance cannot be placed on the age of death of these individuals, or the supposed concentrations of older individuals in the cemetery.

There was no deviation from supine interment, other than in hand positioning; and alignment was generally consistent, but more in relation to the nearest straight line, rather than true west-east. Grave goods were minimal, with none of the 70+ cohort exhibiting evidence of their presence. Evidence for coffins was limited, however one individual, St. Helens 5501, a 70+ female, was buried in a cross-braced coffin in the heart of the early church (Dawes and Magilton, 1980:14), suggesting some form of veneration. Additionally, two other individuals (St. Helens 5159 and 5207) exhibited evidence for coffins, these individuals were aged into the 60-69 year cohort and were buried within the 5th church. Of the identified individuals roughly equal numbers of males and females were buried within (n=6 males; n=5 females), and outside the church (n=5 males; n=4 females).

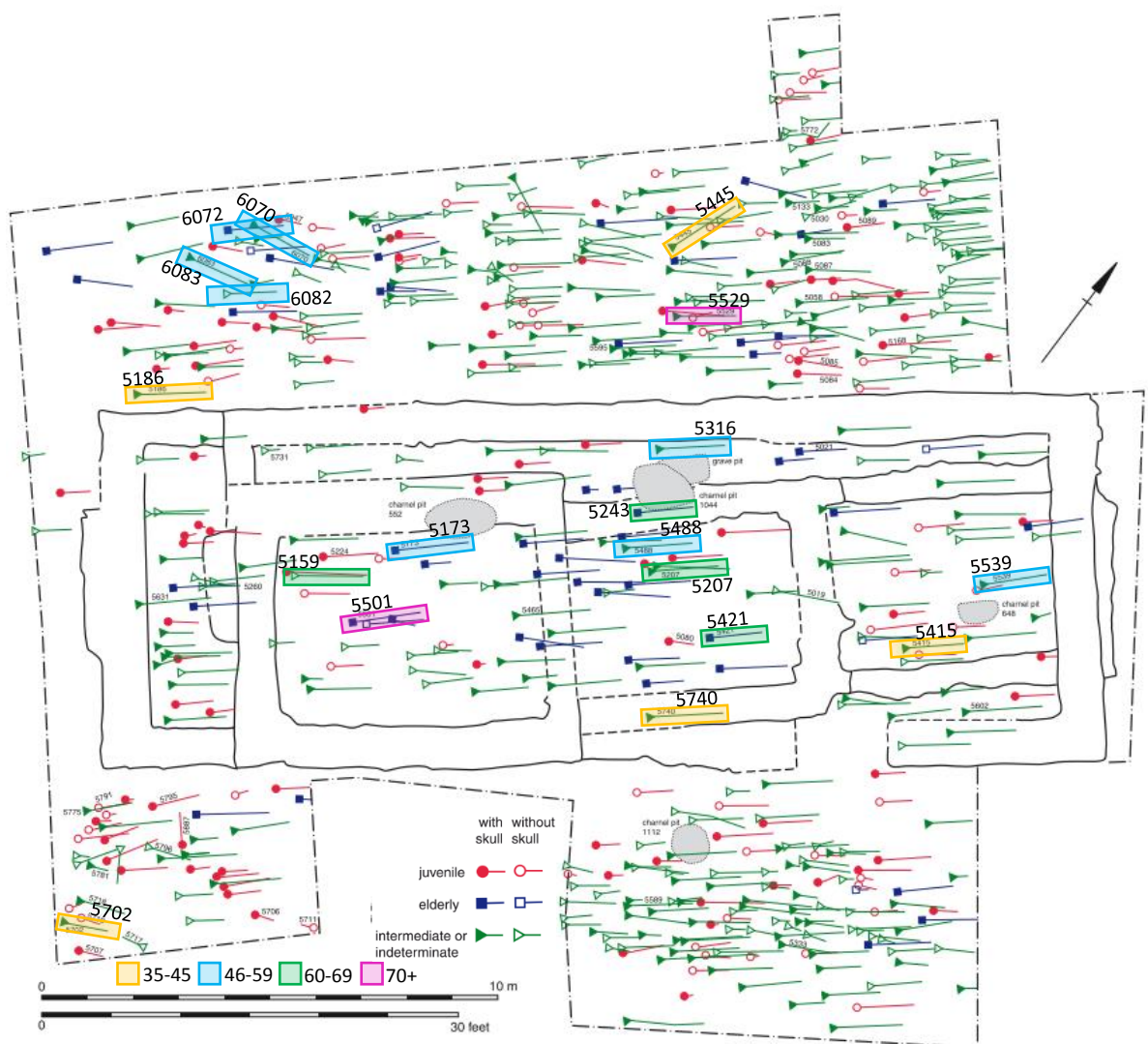


Figure 5.58. Burial plan for St. Helen on the Walls, York (Dawes and Magilton, 1980:11).

5.9.4 Wharram Percy

Precise assessment of burial location is more limited at Wharram Percy due to lack of a comprehensive burial plan, however the individuals are coded with the area of the cemetery that they were excavated from (Mays et al., 2007). There was no evidence for coffined burial or grave goods within the study sample, however this does not mean they were not present at time of burial, just that nothing remains of them. Burial location for the 70+ cohort is to the west, north and east of the church, with no individuals over the age of 59 years buried to the south, this was significant ($X^2=5.66$, 1.d.f., $p=0.025$) (Figure 5.59). This does suggest some form of preference for location of older individuals, as the Vestry is also to the south and contains no 70+ year individuals either; the South Aisle also has the highest prevalence of 35-45 year burials. Site 26 is located at a distance from the church, north of the North Aisle area. No individuals in the study sample were buried within the church, as all these burials were of a later date (Mays et al., 2007:337).

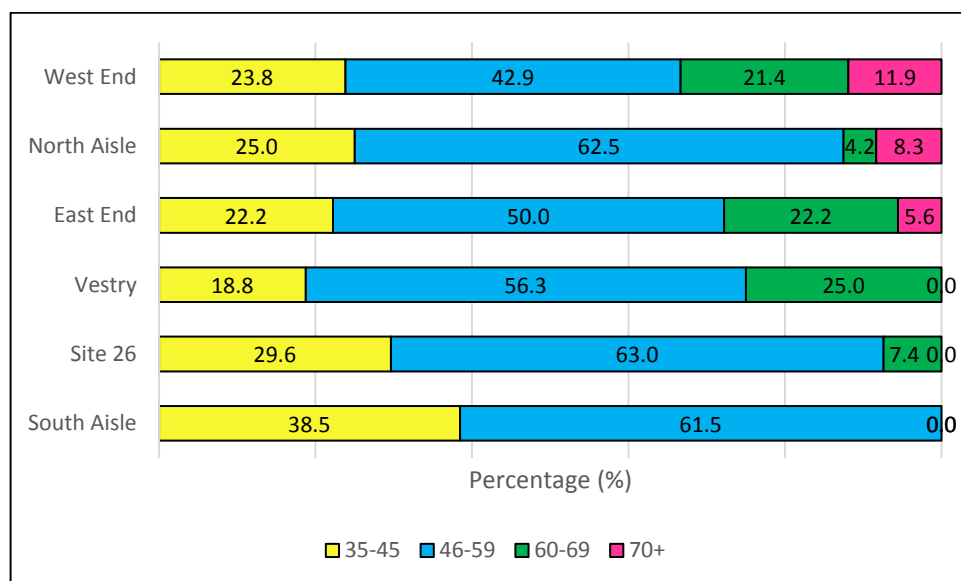


Figure 5.59. Percentage of individuals buried in each excavation area, by age cohort (Mays et al., 2007).

By sex, similar trends apply (Figure 5.60). Although, 70+ year females were concentrated in the west end and the north aisle, while 70+ year males were also present at the east end of the churchyard.

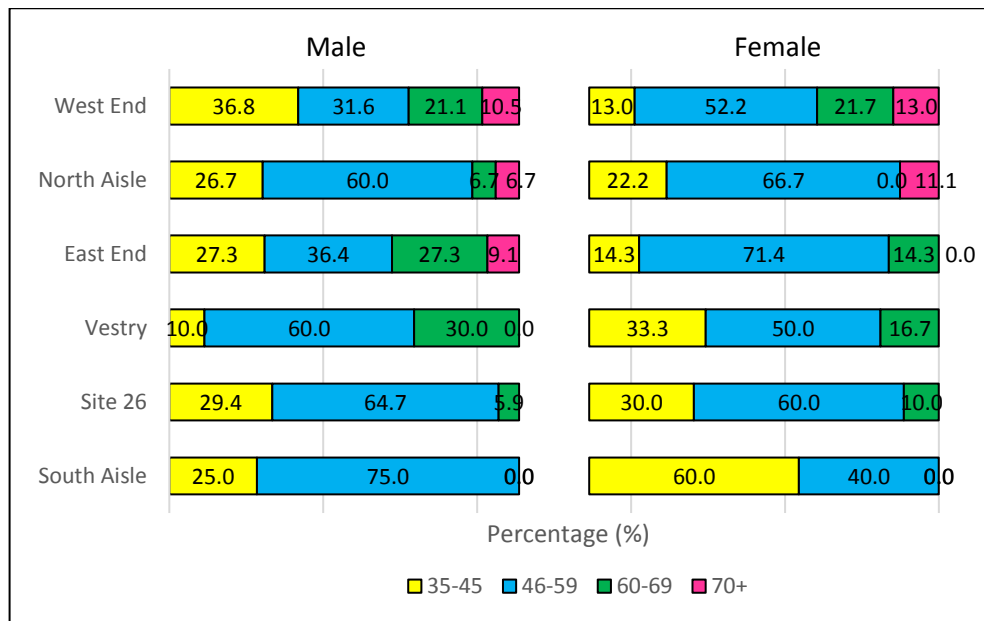


Figure 5.60. Percentage of individuals buried in each excavation area, by age cohort and sex (Mays et al., 2007).

Chapter 6 - Ageing methods

6.1 Introduction

This initial discussion encompasses a review of the eleven ageing methods used in this study. The focus is on their worth in age-at-death estimation for older adults, in order to answer the first aim of this study, whether it is possible to identify older individuals (over 46 years) within the archaeological record, as it has been demonstrated using contemporaneous records (Chapter 3), that typically more than 20% of the population did exceed this age at death. All of the ageing methods used in this study were developed on individuals of known age-at-death; six of which were specifically designed to age mature adults (Falys, 2012; Falys and Prangle, 2015). All have been statistically tested for their accuracy in age-at-death estimation on individuals of both known and unknown age-at-death (Brooks and Suchey, 1990; Brothwell, 1981; Buckberry and Chamberlain, 2002; DiGangi et al., 2009; Falys, 2012; İşcan et al., 1984a, 1985; Mills, 2013; Molleson and Cohen, 1990).

6.1.1 Limitations of the study

Conceptually, this study proves that an upper age limit of 46+ years for age-at-death estimation in bioarchaeology is as erroneous as it is inaccurate. As with the majority of archaeological samples, the true age of the individuals when they died is unknown, therefore an evaluation of the accuracy and precision of the ageing methods used in the study could not be truly tested. To overcome this limitation, a comparison of the age ranges, and mean ages provided by each method for every individual, was conducted. This was to highlight trends between ageing methods; including consistently providing older or younger age estimates, or impractically large or small age ranges.

Using prescribed means and age ranges to assess for accuracy and precision, on a distinct sample, has its own implications. Age structure mimicry cannot be avoided with the methods that utilised younger or older individuals during their development; and using the means derived from large

age ranges has a standardising effect, merging individuals of potentially diverse ages. However, the use of multiple techniques for age estimation, developed across a variety of known-age-at-death samples, means that bias is highlighted and can be evaluated, as has been demonstrated below.

6.2 Ageing methods

Age estimation is a crucial element in the study of demography and the life course. Techniques used to estimate age-at-death therefore need to be both accurate and precise, incorporating the correct age-at-death, but without unrealistically large or small age ranges that hinder analysis. They also need to produce low levels of inter- and intra- observer error, meaning they need to be easy to understand and replicate by many researchers of differing levels of experience. Finally, a high rate of preservation of the element is important, as even the best techniques fail if the element used is not preserved. Therefore, each ageing method utilised within this study has been reviewed below in relation to these outlined requirements, as well as their ability to age individuals into older age cohorts.

The results (Table 6.1) present the preservation (%) of each element, the lowest and highest ages achievable by each technique, and the smallest and largest number of years spanned by the age ranges produced. As well as the minimum and maximum mean ages achievable by each method, and the absolute mean age, which is the average age produced by combining all the means for each technique. Inconclusive results occur when skeletal traits could be represented by more than one score (a single score is a decisive result).

Table 6.1. Results for each method, presented in years, unless otherwise stated. Count (n) = number of elements observed; Pres. (%) = preservation rate; Low age = lowest age achievable; High age = highest age achievable; small range = smallest age range span; Large range = largest age range span; Min. mean = minimum mean age; Max. mean = maximum mean age; Ab. mean = absolute mean age; Inc. (%) = inconclusive results. *- standard methods.

Method	Count (n)	Pres. (%)	Low age	High age	Small range	Large range	Min. mean	Max. mean	Ab. mean	Inc. (%)
Dentition*	417	73.9	17	45+	8	28	N/A	N/A	N/A	17.3
Dens facet (C1)	349	61.9	51	76	3	6	54.4	75.1	63.6	0
Dens process (C2)	374	66.3	51	77	4	8	55.1	75.1	65.7	0
Third cervical (C3)	438	77.7	44	81	3	12	50.3	78.1	61.8	0
Sternal clavicle	427	75.7	35	97	4	51	48.8	87.0	64.6	0
First rib*	262	46.5	12	75	6	23	12.0	66.2	41.7	0
Fourth rib*	376	66.7	20	82	4	28	22.6	76.4	53.8	14.9
Iliac crest	375	68.1	57	82	4	9	59.2	77.8	66.8	0.5
Auricular surface*	543	96.8	16	92	17	59	29.3	72.3	56.4	0
Pubic symphysis*	386	68.4	15	87	25	72	21.3	61.2	43.0	76.2
Ischium	509	90.2	38	93	16	50	45.8	78.9	59.1	1.6

Additionally, each individuals' mean age estimates were collated, to find their 'majority cohort'. This was the age cohort which the greatest number of means fell into, per individual, (Table 6.2), and was used to explore the potential consistency of the ageing methods. Methods with a higher majority percentage were deemed to be more consistent; they had more means falling into the same age cohort as other methods. Outliers, providing mean ages above or below the majority, indicates that these methods are providing different results to the majority, and may potentially be over or under ageing. Finally, the proportion of individuals aged to over 70 years at death by each technique's means are presented. The proportions (%) of each method are presented ensuring their comparability, however some elements (e.g. first rib) were observable considerably less often than others due to preservation issues (see Table 6.1; Pres %). This has the potential to bias the results for these elements, because the true spread of means cannot be known.

Table 6.2. Results from the mean ages for each method. *- standard methods. NB. This analysis could not be carried out for the dentition, as the method does not provide mean ages.

Method	Count (n)	Majority (%)	Above (%)	Below (%)	Male (%)		Female (%)		70+ (%)
					Above	Below	Above	Below	
Dens facet (C1)	349	56.4	26.9	12.3	33.7	9.3	17.4	16.7	14.6
Dens process (C2)	374	52.1	38.5	5.9	41.7	7.9	34.2	3.2	33.7
Third cervical (C3)	433	73.7	12.7	12.0	14.3	7.6	10.6	18.3	33.9
Sternal clavicle	427	66.3	25.8	5.9	27.3	3.3	23.8	9.4	28.6
First rib*	262	20.6	5.3	73.7	6.5	64.3	3.8	88.7	0.0
Fourth rib*	376	70.2	3.5	24.5	5.0	17.6	1.3	34.6	10.4
Iliac crest	375	58.4	37.3	4.0	29.8	4.7	47.8	3.1	47.5
Auricular surface*	543	68.3	6.3	24.5	8.1	22.2	4.1	27.6	8.5
Pubic symphysis*	386	28.8	0.5	70.5	0.8	73.1	0.0	66.4	0.0
Ischium	509	54.2	16.5	28.9	19.7	28.2	12.5	29.9	40.7

6.2.1 Dentition

Using dental wear to age adult individuals, particularly those past 45 years at death, is contentious, however it is a method which is regularly used within commercial bioarchaeology (Falys and Lewis, 2011). Molar wear or AMTL was observable in 73.9% of individuals in the study sample. This was lower than expected as the dentition is meant to be one of the areas of the skeleton that preserves the best in the archaeological record (Kendall et al., 2018), and it was exceeded by other skeletal elements. However, a preservation rate of roughly three quarters is still useful. Initially it was planned to only use left mandibular molars for ageing to provide consistency across groups, however this proved impossible due to poor preservation levels and so the whole dentition was recorded, as is standard practice in many bioarchaeological studies. This poses problems in itself as it has been found that mandibular and maxillary molars wear at different rates (Benazzi et al., 2008; Mays, 2002), but looking at all available teeth may provide more realistic 'average' dental age-at-death.

Where Brothwell's (1981) method is concerned, the diagram is clear and concise, but it was often found that three consecutive molars did not wear in a regular way, that is according to the length of time they have been in occlusion. In addition, wear on the left side provided a different age

estimation to that of the right side, and in 17.3% of cases (n=72) the results were inconclusive, providing a result encompassing more than one age category.

Aside from variation in wear, the main issue with ageing using the dentition is that the maximum age estimate assignable using this technique is 45+ years (Brothwell, 1981). As no mean ages are provided, no direct comparison of the method's consistency or reliability could be undertaken.

Although, regularly observable, popular and easy to use, Brothwell's (1981) dental ageing method severely curtails older age estimates and limits demographic study. It is also difficult to implement when partial AMTL has occurred, especially as the effects of AMTL on adjacent teeth are not currently understood (Mays, 2010:76), meaning any age estimations produced may be unreliable, as well as erroneously low.

6.2.2 Cervical vertebrae

The cervical vertebrae are highly movable, weightbearing bones (bearing the weight of the skull), that have an emphasis on flexion and torsion, in comparison to the rest of the spine (Knüsel et al., 1997). It follows therefore, that occupational stresses, due to excessive movement or abnormal loading, may have an effect on the degeneration exhibited by individuals. Archaeological and ethnographic research evidence suggests that manual labour, and lifting or carrying heavy or frequent loads, particularly on the head or back, increases the risk of injury to, or degeneration experienced by, the cervical spine (Porter et al., 2013; Sofaer Derevenski, 2000). Although, it has also been noted that these loads need to be considerable, or for injury to occur, to increase wear outside the normal range for adults of any age or sex (Ezra et al., 2019; Knüsel et al., 1997; Porter et al., 2013; Quispe and Williams, 2019). Therefore, a correlation has been found between advancing age and the degeneration of the vertebral joints (Falys, 2012:258; Sager, 1969:85). Collation of the results into a decisive composite score, as well as clear, concise descriptions and depictions means age estimation using the cervical vertebrae is highly replicable and expected to produce low rates of inter- or intra-observer error. However, certain areas of the cervical vertebrae produced varying results.

The method on the C3 is replicated through C4 to 7 (Falys, 2012:65), and the results between the C3 and lower cervical vertebrae were found to be consistent when tested, with similarity existing in the levels of degeneration throughout the lower cervical spine (i.e. if severe degeneration had occurred, it had generally occurred throughout C3 to C7). If the C3 was absent a lower cervical vertebra was used in its stead.

Each vertebra is provided with a series of 95% confidence interval age ranges for age estimation. However, the span of these is narrow, from 3-6 years for the dens facet, 4-8 years for the dens process and 3-12 years for the C3. These are mostly too narrow to be considered accurate (i.e. encompass the true age-at-death) particularly as the score, or degradation exhibited increases, due to the greater variation in degeneration between individuals with advancing age. To overcome this Falys (2012) has developed 'age phases', however these were not used in this study because they are open ended and overlap considerably. An alternative would be to use the means, with their standard deviations (SD) as age ranges. These would be broad enough for accuracy yet retain the precision of a delimited age range.

6.2.2.1 Dens facet (C1) and dens process (C2)

The methods using the dens facet and dens process have been grouped in review due to the similarity in their results, and because they constitute two halves of a single joint. Preservation of the dens facet and process was among the lowest of all elements at 61.9% and 66.3% respectively, demonstrating it may be an issue. The lowest and highest ages achievable using the dens facet and process were 51-76 and 51-77 years respectively, and although the upper age estimates are beyond 45 years the span between the highest and lowest ages are the narrowest out of all the methods (15 and 16 years respectively), with the highest age estimates (76 and 77 years) some of the lowermost of all used in this study. This was not the case with the maximum mean age which was 75.1 years for both the dens facet and process. However, the minimum means were among the uppermost out of all used in this study at 54.4 and 55.1 years respectively. This suggests that these methods consistently provided older ages for younger

individuals and younger ages for older ones. Particularly considering that the individuals were aged from 35 years at death.

The majority cohort incorporated 56.4% and 52.1% of the means for the dens facet and process, indicating that just over half of individuals had mean ages that placed them into the most common age cohort using these methods. This is a moderately low consistency rate and was one of the lowermost of all the methods used. Both the dens facet and process were among the elements that consistently provided older age estimates (26.9 and 38.5% respectively). The dens process provided a correspondingly low proportion of younger age estimates (5.9%), whereas the dens facet provided a larger proportion (12.3%). By sex, older age estimates predominated using both the dens facet and process. The proportion of males with age estimates older or younger than their majority using the dens facet was roughly equal (17.4% above, 16.7% below), and unlike the prevailing trend for most methods tested, the proportion of males with younger age estimates exceeded the proportion of females. This suggests large variation in degeneration of the dens *facet* in females and the dens *process* in males.

The over estimation of age-at-death may be curtailed by excluding the lowest composite score of 3 or 'no change', which currently results in an age estimate of 50+ years for both the dens facet and process. It is merely describing completed fusion for both elements, which occurs from around 6 years for the C1 and from 20 years for the C2 (Schaefer et al., 2009). It will therefore considerably overage any younger individuals. Falys (2012:104) found that a score of 3 could be assigned to individuals up to 90 years of age, for both joint halves, once again demonstrating the variation in degeneration experienced on the dens facet and process.

Advanced age-at-death (70+ years) was recorded for 14.6% of individuals by the dens facet, and 33.7% of individuals by the dens process. This suggests that any degeneration appears first and in greater abundance on the dens process than the dens facet.

6.2.2.2 C3

The third cervical vertebra (C3), or an alternative lower cervical vertebra, was preserved for study in over three quarters of the study sample (77.7%). Good preservation of elements is essential for age-at-death studies. A lower cervical vertebra (from C4 to C7) was used in 8.7% (n=49) of cases. The ability to use any cervical vertebrae (C3 to C7) when estimating age-at-death with this technique makes it a very useful method. No facets were available for study in 25 cases (4.4%), due to poor preservation, and therefore age-at-death was estimated simply using the body of the vertebrae (Falys, 2012:129).

The lowest and highest ages achievable using this method (44-81 years) capture the full expression of degeneration on the C3. This is mirrored by the minimum and maximum mean ages of 50.3 and 78.1 years. These values suggest the techniques worth as an ageing method for older individuals. In total 33.9% of individuals were aged to 70+ years at death by this method. Which is among the higher proportions out of all the techniques used. However, the absolute mean age estimated is 61.8 years, demonstrating that high age-at-death estimations were not all-encompassing. This is demonstrated further, by the high proportion of individuals aged to within their majority cohorts by this method (73.7%), indicating its consistency. As well as the almost equal, and low proportions of individuals aged older or younger than the majority (12.7% and 12.0% respectively) by the C3. By sex, the method provided older ages for greater proportion of males (14.3%; 7.6% younger) and younger ages for a greater proportion of females (18.3%; 10.6% older), suggesting that degeneration is enhanced in males. As this element is a movable, weight-bearing bone, it is possible to conclude that the male peak is due to greater physical stress during life, from occupations such as hard manual labour.

6.2.3 Sternal clavicle

The ageing technique developed by Falys (2012) and Falys and Prangle (2015) using the degeneration of the sternal end of the clavicle is a useful continuation of the method marking the timing of the fusion of the epiphysis. The sternal clavicle was available for study in over 70% of

cases at each site, with a combined preservation rate of 75.7%. It is important for the utilisation of the method, that roughly three quarters of a sample possesses the required element. The method is easy to use (0% inconclusive results), employing a composite score, as well as clear written and photographic trait descriptions.

The span of the method's achievable ages (35-97 years) and mean ages (48.8-87.0 years) fully capture the extent of degeneration on the sternal clavicle, with 28.6% of individuals aged to 70+ years at death. The absolute mean age (64.6 years) is mid-way between the minimum and maximum mean ages, demonstrating that the spread around the mean is even across the sample. The consistency of the method was good with 66.3% of individuals having means that fell into their majority cohorts. Degeneration of the joint was exhibited by 25.8% of individuals providing older age estimates, as opposed to 5.9% providing younger estimates. By sex, a higher proportion of both sexes were aged older than their majorities (27.3% males and 23.8% females).

The age ranges assignable by this method are very variable, spanning between 4 and 51 years. The narrowest age range is 85-89 years (mean age 87 years) assigned to females exhibiting the highest levels of degeneration across all scorable traits (score 13-16). This was developed on a small sample of only four females (Falys and Prangle, 2015), and is overlapped by the preceding age ranges (scores 9-10 and 11-12) which have upper limits of 91 and 96 years respectively. However, despite these drawbacks, the degeneration exhibited does indicate a more advanced age (i.e. 80+ years).

The largest age range spanning 51 years (estimated age 37-88 years) was assigned to a single individual of unknown sex. This was achieved by combining the lowest and highest male and female age estimates for the appropriate phase. The unrealistically wide age range demonstrates that caution should be utilised when using this method on individuals of unknown sex, as with any technique where male and female results are divided.

6.2.4 First rib

Ageing on the first rib has been suggested to be superior to that on the fourth rib, primarily due to its ease of identification and higher rate of preservation (DiGangi et al., 2009; Kunos et al., 1999; Kurki, 2005:343). However, this study found that the first rib (DiGangi et al., 2009) had the worst preservation of all the methods used at just 46.5%. Loss of either the costal face or tubercle facet was common, meaning ageing could not be carried out, as neither can be utilised independently. There is no option to substitute a lower rib for the first, if the first rib was absent or incomplete; unlike with the method on the fourth rib.

The first rib is a static element, articulating with the transverse process of T1 at the tubercle facet and with cartilage joining it to the manubrium at the costal face (White and Folkens, 2005). This indicates that degeneration experienced should be age related rather than due to excessive movement or weightbearing stresses. It was therefore not entirely unexpected that a proportion of individuals would have younger age estimates than their majority. What was unexpected however, was how high this proportion would be. In total 73.7% of individuals were aged younger by their means, with only 20.6% of individuals having means which fell into their majority cohorts. By sex, 64.3% of males and 88.7% of females were estimated to be younger than their majority, demonstrating the first rib's high inconsistency in ageing older individuals, and the large variation in degeneration exhibited with advancing age. This is reinforced by the lowest and highest ages (12-75 years) and means (12.0-66.2 years) achievable using this method, which should represent the full expression of degeneration on the first rib. The fact they do not, is demonstrated by no individuals being aged to over 70 years at death by the means. This is supported by the absolute mean which was only 41.7 years, the lowermost mean out of all the methods used in this study.

The lowest age estimate and mean of 12 years is perplexing; rib growth and fusion does not complete until around 25 years of age (Schaefer et al., 2009:138); it is therefore erroneous to be able to produce age estimates this low for fully formed adults. The highest age estimated (75 years) is considerably in advance of the maximum mean age (66.2 years), which suggests a low

number of older individuals were used when developing this technique, however no clarity on this is provided (DiGangi et al., 2009).

The method was developed using males only, although it is regarded as being also applicable to females (DiGangi et al., 2009:170). The current study also suggests that there are no large inconsistencies between the sexes, with large proportions of both sexes providing considerably younger age estimates than their majorities.

Regarding ease of use, while there was no difficulty assigning trait scores (0% inconclusive), the descriptive changes for the tubercle facet particularly, were cumbersome and difficult to interpret. The assigning of an age range or mean age, using the scoring table could also cause confusion when combined with lack of familiarity with the technique.

In summary, this method is not useful for ageing individuals over 45 years at death, primarily due to its low mean ages but also due to the first ribs poor preservation within the archaeological record.

6.2.5 Fourth rib

The usefulness of the technique developed on the fourth rib by İşcan et al. (1984a, 1984b, 1985), has been called into question due to preservation issues, including high levels of fragmentation and similarity of rib ends in the burial environment (Kurki, 2005:343). However the option of using a higher or lower rib end (preferably either the third or fifth), somewhat negates this loss or mis-identification (İşcan et al., 1984b). Despite this, an appropriate rib end was only observable in 66.7% of cases in the study sample, which was among the lowest preservation out of all the elements used.

The sternal end of the rib is a static element, and it does not articulate with another bone, however it does connect anteriorly with the sternum via costal cartilage. This enables complex and regular movement (Graeber and Nazim, 2007), although it does not apparently affect rates of ossification, outside of pathological changes (Semine and Damon, 1975).

The lowest and highest ages (20-82 years) and means (22.6-76.4 years) achievable using this method encompass the full expression of degeneration to the rib end. It has been documented that costal cartilage can begin to ossify from roughly the twentieth year of age (Schaefer et al., 2009:138), so the low starting age is accounted for and acceptable.

The consistency of the method was among the highest of all the techniques used, with 70.2% of individuals aged to within their majority cohorts. Younger ages were estimated for 24.5% of individuals, which was an expected issue, as with many standard methods when ageing older individuals (Molleson and Cox, 1993). By sex, 17.6% of males and 34.6% of females were aged younger than their majority, suggesting that female expression of degeneration on the rib ends is more limited than male. However, the absolute mean age using the fourth rib was 53.8 years, with 10.4% of individuals aged to over 70 years at death. Both are among the uppermost values out of the standard methods.

The smallest and largest age spans (4-28 years) incorporate more limited variation at younger ages (age range 20-24 years), as well as accounting for increased variation in degeneration in older adults (age range 43-71 years). The largest age span occurred by combining age ranges due to an inconclusive result. In total 14.9% of the results were inconclusive using this method, across all scores, suggesting that degeneration of the traits scored varies considerably with age. Although not by more than one score in this study.

6.2.6 Iliac crest

As with the other methods developed by Falys (2012) this technique, using osteophyte formation on the iliac crest was developed on individuals from 40 years of age (40-96 years) specifically to age those past 45 years at death. Preservation was relatively low at 68.1%, this was more due to poor surface preservation, hindering analysis, than absence of the element.

The lowest and highest achievable ages (57-82 years) and means (59.2-77.8 years) are among the narrowest of all the methods. This suggests that the onset of degeneration on the iliac crest occurs rapidly at older chronological ages. In total 47.5% of individuals were aged to over 70 years

at death by this method, and the absolute mean was 66.8 years, these are both the highest out of all methods, resulting in consistently older age estimations. In total 58.4% of individuals were aged to within their majority cohorts suggesting relatively low consistency. Older age estimates were recorded for 37.3% of the sample, which again is among the uppermost values from all methods. By sex, 29.8% of males and 47.8% of females had older age estimates produced by the iliac crest than the majority of the rest of the methods. The primary reason for this is the inclusion of a mean age for a score of 0 indicating 'no change' (59.2 years for males and 60.4 years for females) (Falys, 2012:211). Considering the iliac crest normally completes union between 20-25 years in both sexes (Schaefer et al., 2009:253) this is perplexing. It is suggested that individuals with a score of 0 be excluded from study, as they exhibit no age-related degeneration to the iliac crest.

The smallest and largest age spans of 4 and 9 years are too narrow to be considered accurate (i.e. encompass the true age-at-death), particularly in older individuals with more varied degeneration. Falys (2012:211) developed 'age phases' to overcome this issue, but these were not used in this study as they overlap considerably and are open ended. It is suggested that this method be used to simply identify old individuals in the archaeological record, due to the late onset of degenerative changes to the iliac crest. Although caution must be exercised, as not all individuals exhibited these changes even at advanced ages.

The method was easy to use (0.5% inconclusive results), however no written description was provided, aside from a single word naming the score (e.g. 0=none, 4=severe), this meant the entire reliance was on images. Some further written guidance would have been useful, particularly between 'minimal' (Score 1) and 'slight' (Score 2), as well as when the line was drawn between 'severe' (Score 4) and 'pathological'.

6.2.7 Auricular surface

This technique was developed by Buckberry and Chamberlain (2002), in response to a review of Lovejoy et al.'s (1985) method, and is accepted as a standard ageing method in bioarchaeology

(Falys and Lewis, 2011). The auricular surface was available for study in 96.8% of cases, meaning it exhibited the highest preservation of all the elements used. This is an important factor when considering the usability of an ageing method, as using the same technique on as many individuals as possible will provide the most accurate and reliable results across the sample. The method scores a variety of macroscopic traits across the auricular surface resulting in a composite score from 5 to 19 (Buckberry and Chamberlain, 2002), meaning there were no inconclusive results. In bioarchaeology the sacroiliac joint is generally accepted to be static (Mays, 2010:59), suggesting any degeneration exhibited will be age related. Although how static the joint actually is, has been long debated in medical literature (Frigerio et al., 1974).

The lowest and highest ages (16-92 years) and means (29.3-72.3 years) achievable using the auricular surface encompass the full range of degeneration on the joint. However, the largest age range estimated spanned 59 years (16-65 years), overlapping and incorporating the preceding ranges estimated by the method (16-19 and 21-38 years). The large age ranges are maintained throughout, demonstrating that the variability in degeneration of the auricular surface commences at a young age.

Despite this, 68.3% of individuals were aged by this method into their majority cohorts, demonstrating its consistency. Although as with the other standard methods a preponderance for younger age estimates was an issue, with 24.5% of individuals providing younger ages than their majorities (22.2% males, 27.6% females). In total 8.5% of individuals were aged to over 70 years at death by this method, and the absolute mean age was 56.4 years. These values are necessarily low due to the small number of individuals over 70 years used in development of the technique (17 males and 25 females) (Buckberry and Chamberlain, 2002), this is also borne out by the maximum mean (72.3 years) being considerably lower than the highest age achievable (92 years).

6.2.8 Pubic symphysis

The ageing technique developed by Brooks and Suchey (1990), from Todd's (1920) method, using morphological alterations to the symphyseal face with increasing age, has long been accepted as a standard method for age estimation in bioarchaeology (Falys and Lewis, 2011). This is despite reviews suggesting its lack of precision, and frequent under ageing of individuals past 40 years of age (Berg, 2008; Savall et al., 2016). Due to its location on the body, and therefore in the grave, preservation of the pubic symphysis is not always good, however in this study, it was present in 68.4% of the study sample.

In bioarchaeology the pubic symphysis is generally accepted to be a static element (Mays, 2010:59), however, it is widely acknowledged that pregnancy can cause quite significant movement, and even morphological changes to the symphyseal face of the pubis (Becker et al., 2010; Bongiovanni, 2014; Maass and Friedling, 2016; Waltenberger et al., 2022). Research suggests that this movement is also experienced on a day to day basis, and involves complex weight-bearing stresses in both males and females (Becker et al., 2010; Bongiovanni, 2014; Waltenberger et al., 2022). It is for this reason that the pubic symphysis has been deemed a moveable element within this study. It would therefore be expected that the degeneration demonstrated by the pubic symphysis could be amplified by these movement and weight-bearing stresses, providing more advanced age estimations for both sexes. This was not the case however, with the absolute mean age being only 43.0 years in the study sample. This was among the lowermost values out of all the methods.

The lowest and highest ages (15-87 years) achievable do not reflect this limited mean age. This range is also the largest age assigned by the method (spanning 72 years) which demonstrates the large and unrealistic nature of the age ranges produced by the pubic symphysis. The means are therefore particularly important in this method, with the minimum and maximum mean ages (21.3 – 61.2 years) achievable more clearly reflecting the low absolute mean. Only 28.8% of individuals had means that fell into their majority cohorts, demonstrating this methods' low

consistency, in fact the pubic symphysis provided younger ages for 70.5% of individuals, in comparison to the majority of the other methods. By sex, 73.1% of males and 66.4% of females were estimated to be aged younger than the majority, and 0.8% and 0.0% were estimated to be older, respectively. These values were among the uppermost for younger ages, and the lowermost for older ages out of all the methods. Due to the low means no individuals were aged to over 70 years at death using this method.

The difference between the highest age achievable (87 years) and the maximum means (61.2 years) reveals that the sample used in creation of the method, did not include many individuals over 60 years of age, although exactly how many were used is unclear (Brooks and Suchey, 1990). This therefore limits its use in the reliable ageing of individuals past 45 years. The unreliably large age ranges produced by the pubic symphysis are due primarily to the plethora of inconclusive results (76.2%) that it produced. This is due to the variation in degeneration of different traits on the pubic symphysis, without the benefit of a composite score to align them.

6.2.9 Ischium

The ischium (Falys, 2012) was available for study in 90.2% of cases demonstrating that the element survives extremely well in the archaeological record making it an ideal element to use in age estimation. It is a static, non-weightbearing element, and is not a joint, meaning that degeneration exhibited should be entirely related to advancing age (Augat and Schorlemmer, 2006).

The lowest and highest ages (38-93 years) and means (45.8-78.9 years) achievable are representative of the complete span of degenerative variation with age. The absolute mean (59.1 years) is mid-way between the minimum and maximum means demonstrating that the spread around the mean is even across the sample. It is therefore interesting that the consistency of the method is relatively low, only 54.2% of individuals had means that fell within their majority cohorts. Unlike the other methods developed to age past 45 years at death, a greater proportion of individuals were estimated to be younger than their majorities by this method (28.9% younger,

16.5% older). Both sexes follow this trend (28.2% males and 29.9% females aged younger).

Despite this 40.7% of individuals were aged to over 70 years at death by the ischium, potentially demonstrating how many older individuals are missed by standard methods. Inconclusive results occurred in 1.6% of the sample, creating the largest age span recorded on the ischium (50 years), however overall, the method was very simple to understand and easy to implement.

6.2.10 Summary

Standard osteological techniques consistently underage older individuals in comparison to the newer methods developed for older ages. This is particularly true for the dentition, first rib and pubic symphysis. The auricular surface and fourth rib, while providing younger age estimates, are a useful tool in the multifactorial ageing of older adults. Of the new methods developed specifically to age individuals to over 45 years at death, the iliac crest consistently provided older age estimates, however it is a good method to simply distinguish old adults in samples. The dens facet and dens process are either inaccurate or imprecise, depending on which age formats are utilised (age ranges or age phases), and tend to provide older age estimates for individuals due to this. Suggested alterations to the age ranges, using standard deviations would aid this considerably. The C3, clavicle and ischium all age individuals well over 45 years at death, and up to (or over) 80 years at death, maintaining the necessary balance of consistency and precision. They are therefore an advantageous addition to the repertoire of adult ageing techniques. Although these ageing methods, as with most techniques, should be used in conjunction with others. A greater proportion of males, than females, were consistently provided older age estimates across almost all methods. The only exceptions occurring on the iliac crest, which provided older ages for a greater proportion of females. The inverse was true for younger age estimates, with a greater proportion of females providing younger ages across almost all methods. The only exceptions occur on the dens process, iliac crest and pubic symphysis. This suggests that overall males exhibited more advanced degeneration than females across the body, potentially linked to higher rates of movement and loading during life (e.g. during manual labour). It is unclear why the dens process and iliac crest present the opposite trend, but it may again be linked to occupation during

life. The lower rate of younger age estimates for females on the pubic symphysis, is potentially linked to parturition.

Chapter 7 - Lived experiences

7.1 Introduction

This chapter explores whether an individual's social role altered with age, and if this differed by biological sex or site type. The lived experience of old age will be explored through discussion of age related pathologies and trauma; before osteobiographies of some of the very oldest and most frail are presented to demonstrate frailty and ability at an individual level. A total of 40 individuals were aged into the 70+ year cohort (20 males and 20 females). High skeletal frailty (SFI 6) was recorded for six individuals, five males and one female, ranging from the 46-59 year to the 70+ year cohort. It is these individuals that this chapter will consider primarily.

7.1.1 Limitations

Demographic comparisons are dependent upon the individuals excavated and studied; and cemetery age distributions predominantly reflect fertility not mortality (DeWitte, 2014; McFadden et al., 2019; Sattenspiel and Harpending, 1983). Not all the sites studied were fully excavated, and contemporaneous cutting of graves due to overcrowding or poor cemetery planning was an issue. The preservation of those excavated also affected the study sample. These factors have been argued to result in a loss of more elderly people in the archaeological record, due to greater bone frailty (Gowland, 2007).

Out of the complete adult population from the cemetery, the most individuals were studied from Fishergate (69.9%) and the least from St. Helens (22.5%), which could impact the results obtained from these sites. Despite this, an advancement to the upper limit for age estimation was established at each site (i.e. 70+ years), demonstrating the benefit to demographic studies. A total of 4.6% of individuals analysed in this study were aged to simply 'adult' in the site reports. These individuals were aged into the study age cohorts, although a significant majority were aged into

the 35-45 year cohort (41.7%). It was expected that most of these individuals would be older, with poorer preservation, hence the reasoning for their lack of numerical age. This demonstrates that further research is needed into the demography of 'adult' samples, and the worth of including them within wider analysis.

7.2 Chronological vs. biological age

Exact chronological age at death is something that is unobtainable for archaeological populations, particularly for older individuals. Ageing methods, whether macroscopic, microscopic, digital or statistical, provide age estimates and narrow the potential age bracket an individual may have died within. All of these methods are inherently flawed in that they attempt to quantify biological alteration of the skeleton into a chronological age at death estimation. Biological variation is limitless and dependent on a plethora of diverse factors, such as genetics, diet and occupation (see Chapter 2), meaning that obtaining exact chronological age is impossible. This raises the question, why do bioarchaeologists do it? The answer is threefold. First, chronological age is a fundamental aspect of modern life, which naturally means emphasis by modern researchers is placed on age in the past too. Second, study of past population demographics provides investigators with a greater understanding of past lifeways and societal structures. Finally, chronological age estimation derived from biological alteration is the best form of archaeological age estimation technique that has been developed, to date.

The concept of chronological age was more fluid in the medieval period (see Chapter 3). This is evidenced through 'age heaping' of contemporaneous medieval records, which rarely document birth year accurately, even for royal bloodlines, with record keepers preferentially using round decades (Cummins, 2017). In court or church records the preference for documenting age as a range for example, '50 and more', evidences the fluidity with which chronological age was regarded (Rosenthal, 1996). Chronological age was a tool, to be roughly aware of and to be used to one's advantage, to gain inheritance or petition for retirement dispensations from the court, without acknowledgement of the importance of accuracy (Beam, 2006; Shahar, 1997). Far more

crucial in medieval society was an individual's ability to contribute, particularly within poorer communities. Broadly, those that could work and participate actively in society were respected, or had social worth, while those that could not were marginalised (Johnson, 1998:7). The emphasis on contribution, particularly into old age, is demonstrated through the provision of specific employment roles for those that could no longer work in other ways. For men, these roles included road mending, or caring for the churchyard; for women they included childcare, washing and cleaning (Thane, 2003). All arguably still labour intensive roles.

The demarcation of 'old age', differed for men and women; men were not considered old until they could no longer contribute, women in contrast were regarded as old at the onset of the menopause, although they were still required to contribute until incapacity prevented them (Johnson, 1998; Roberts, 2011; Rosenthal, 1996). This is evidenced by the lack of institutional or church provision for individuals purely on the basis of advanced age; which was reserved for the sick and destitute (Jones, 2011; Shahar, 1997:165); categories which many older individuals will have fallen into. This places emphasis directly away from chronological age and on to biological age and ability levels.

Biological ageing has been defined as "the physical development and subsequent degeneration of the body and mind" (Gowland, 2002:10). It's central role in day to day life in the medieval period has been demonstrated, but it is interlinked with ability. Ability levels are distinct from biological age, in that they quantify morbidity accrual (frailty), and through them researchers can infer an individuals' ability to function as an active member of community (Marklein et al., 2016). Once again, the balance between ability and social worth has been demonstrated by the historical data summarised above. However, it can be further evidenced, somewhat starkly, by the archaeological data. The frailest individuals recorded within the combined sample (n=6, 1.1%), with SFI scores of six, exhibited a significantly higher rate of physical abuse related trauma than the rest of the sample. Although the number is small 66.6% (n=4) of these individuals exhibited markers of physical abuse, with three demonstrating healing fractures linked to abuse at the time

of death. This is a physical representation of the loss of social worth of an individual in conjunction with a decline in ability. The distinction between biological age and ability level arises, when the biological age of the individuals is considered. Twelve (30.0%) of the individuals placed in the oldest 70+ year cohort have an SFI of 2. This indicates that advanced biological age did not independently impact an individuals' ability to contribute to society. This is supported by the findings that trauma related to interpersonal violence on the majority of these individuals was fully healed and remodelled at death (n=5; 71.4%), meaning it occurred when the individuals were younger.

These results validate the approach of assessing an individual's biological age, before translating it into a quantifiable chronological age at death estimation. This not only ensures data can be compared between sites, and with other studies, but also honours the more fluid medieval perception of age.

7.3 Lived experience

The largest proportion of individuals aged over 70 years were recovered from Fishergate (12.5%) and St. Helens, in York (7.2%), this is in contrast to the wealthier site of Barton (6.4%) and rural Wharram Percy (5.7%). This might suggest that wealth and a rural lifestyle did not promote longevity, but it could also be interpreted as illustrating a more physically challenging existence in urban centres that accelerated the biological ageing process in these individuals. This seems to be the case at Fishergate where the males exhibited the highest mean frailty score (SFI 3.64), and had the highest prevalence of skeletal pathology as well as significantly more evidence for interpersonal violence. Advanced degeneration may also be evidenced at St. Helens, where individuals exhibited a high prevalence of activity related trauma, such as spondylolysis (9.0%) and osteochondritis dissecans (10.8%). At Wharram, the seemingly lower age at death (reduced longevity) may actually signal the health benefits of living in a rural environment (less pollution, less crowding, family/community orientated). Evidenced by minimal pollution related pathology (Lewis et al., 1995) observed at Wharram (sinusitis 0.7%; HFI 2.2%), due to distinct living and

working spaces (Dyer, 2012b). Comparatively, at Fishergate a lack of separation in zones of domesticity or industry (Rowland, 2005) is reflected by a significantly high rate of sinusitis (14.1%) and HFI (14.6%).

Additionally, the robusticity of many of the Wharram individuals could indicate that they retained their health into old age, and therefore appear chronologically younger. But this picture is complex. Females at Wharram had significantly higher rates of nutritional stress markers (cribra orbitalia 40.0%; periodontal disease 50.0%); and rural communities, particularly those in more secluded locations, would have been almost entirely reliant on a successful crop yield, and possessed few skills to earn a wage outside of the rural sector if this crop failed (Dyer, 2012a). Hence, the reliance on a good crop yield could exacerbate hidden heterogeneity in frailty and selective mortality at the site, resulting in apparently healthy people entering the archaeological record, due to starvation or related disease events that left few signs on their bones (Pinhasi and Bourbou, 2008; Wood et al., 1992). An example is the crop failures and spread of cattle diseases causing famine and death between AD 1315 and 1325, or the 1348 onset of the Black Death (Schofield, 2000:286). Conversely, the individuals from Barton, may have benefitted from their relative affluence and retained their health for a longer period, resulting in lower chronological age estimations, due to less biological degeneration. In modern society it is accepted that greater wealth equals better health (Semyonov et al., 2013), and in turn longer life spans. This is due to access to better living conditions, healthcare and education (Cockerham, 2021; Hendi, 2015), all of which would have also been more readily available to the more affluent of medieval society. However, flawed medieval knowledge and mistaken beliefs about hygiene, diet, medicine, as well as many other daily practices may not have aided in longevity for the more affluent (Horden, 2011). The use of lead glazed cooking ware in more affluent areas such as Barton (Hayfield, 1982), could have caused lead toxicity leading to ill health and death (Rasmussen et al., 2015), in contrast to the plainer cheaper ware used by people of lower social status.

Prior to AD 1240, living standards at St. Helens may not have differed substantially to other areas in central York, where “filth and dirt” abounded (Raine, 1955:xiii). After AD 1240 the people moving into the street grew successively poorer, and living conditions would have declined drastically. Despite having one of the oldest age profiles, individuals from St. Helens had less evidence for chronic disease in each category than at any other site. This might be interpreted as the result of the rural poor migrating into the city for work and succumbing quickly to diseases they had not come into contact with in rural areas, which left no traces on the skeleton (Walter and DeWitte, 2017). However, it may also reflect the ‘salmon hypothesis’ wherein migrants leave urban areas and return to their rural homes when they become old or infirm (Di Napoli et al., 2021), leaving the more robust older individuals within the community and workforce. Although, also in York, the picture at Fishergate is different. The high mean frailty score of the males (3.64), high prevalence of infections and interpersonal violence suggest life was hard. The relationship between poverty and poor health is cyclical, as poor individuals have a greater propensity to morbidity; and morbidity contributes to an inability to work and the further depletion of economic resources (Cockerham, 2021; Semyonov et al., 2013), which may account for the significantly higher number of individuals that died younger at this site (35-45 year cohort = 31.3%).

As a farming community the Wharram individuals were expected to demonstrate higher levels of trauma related to farming accidents (Judd and Roberts, 1999); however these individuals exhibited significantly less trauma overall (CPR 27.1%) than the rest of the sites. Research (Krakowka, 2017ab) suggests that rather than a low prevalence at Wharram, the other more urban sites have particularly high levels of trauma. Which is evidenced by the higher rates of interpersonal violence recorded at these sites. It demonstrates differences in the lived experience between urban and rural communities and variation in outlook regarding old age, which may be related to closer knit family groupings in rural communities.

Another consideration is the concept of bone formers or bone losers (Mays, 2016). The individuals from Fishergate are bone formers, demonstrated by the high prevalence of bone forming pathologies (DISH 9.3%; OA 62.5%). In comparison, Wharram's population appear to have an increased propensity to bone losing; with a high prevalence of osteoporosis 8.4%. In terms of biological age, this means that the Fishergate individuals could be presenting with advanced degeneration related to bone formation (i.e. osteophytes), in comparison to the other sites, skewing their age at death estimations. Nevertheless, their propensity to form bone and develop degenerative diseases (Rogers et al., 1997) would have negatively impacted their lived experience, and hence their feeling of 'old age'.

7.4 Ability and frailty

Ability can be inferred through frailty, which is distinct from either biological or chronological age. Ability, incorporating personal agency and societal contribution was the key to retaining social worth in the medieval period (Rosenthal, 1996; Shahar, 1997). A potential nine frailty indices were scorable in this study. No individuals exhibited a higher SFI than 6 (1.1%), demonstrating that according to the frailty index, no individuals experienced long lasting and disabling pathology, requiring constant care. In fact, a significant majority of individuals (28.0%) had an SFI of 2, with an additional 17.2% with an SFI of 0 (meaning they demonstrated no pathologies linked with frailty), suggesting that high frailty and low ability was a rarer occurrence. Preservation does affect SFI scores, only 25.0% of the poorly preserved individuals (<20.0%) exhibited frailties, in contrast 92.5% of the individuals with very good preservation (80.1-100.0%) had frailties recorded. Evidencing that frailties are lost due to poor preservation, and that care must be taken when assessing health and ability on these individuals.

Despite this many frailty trends were visible in the study sample. Instances of frailty were demonstrated to increase with age, with 97.5% of the 70+ year cohort exhibiting two or more. The number of frailties observed per individual also increased with age, for both sexes. Onset of frailty differed by sex. Male frailty was most prevalent over 60 years of age, demonstrated by a

significant jump in frailty levels observed between the 46-59 and 60-69 year cohorts. Meanwhile for females this significant jump occurred between the 35-45 and 46-59 year cohorts. Suggesting females experienced an earlier onset of frailty accrual. However, advancing age did not guarantee increased frailty. A significant majority of individuals in the 70+ year cohort had an SFI of 3 (37.5%). Although, relative youth (35-45 years) was also demonstrated to act as some protection against frailty, with significantly less individuals in this age cohort exhibiting an SFI of 4, and none a higher SFI than this. This suggests that many older individuals retained their agency and ability into advanced age, and may have been more able than some other younger individuals. Site type did not impact frailty accrual, with no significant differences observed overall. This suggests that on the whole frailty was experienced similarly across rural and urban communities and between populations of high and low socioeconomic status. By sex, only the Fishergate males stood out, with their significant high SFI (3.64).

7.5 Male and female experiences

The numbers of males and females aged 70+ years in the study sample were equal (n=20; 3.5% each). This uniformity was reflected in the youngest cohort, 35-45 years (male 8.5%; female 8.9%), demonstrating that biological sex did not have an effect on longevity. While the picture was similar for St. Helens and Wharram, indicating urban or rural settlement did not impact longevity; the results suggest social status may have played a greater part in gender mortality. At Fishergate significantly more males reached 70+ years (9.4%; females 3.1%), whereas females exhibited less differences between the sites, although at Barton more females obtained this age (4.0%; males 2.4%). This suggests males are less likely to succumb early due to poverty, while females may benefit from better living conditions. This is reflected by Fishergate's 70+ year males, having a significantly higher mean frailty score (4.33) overall, demonstrating they accrued and lived with significant morbidities.

Mean male frailty (3.25) was higher than female frailty (3.05) in the 70+ year cohort, a trend that was reflected across the age cohorts. However, this was not consistent by site. The 70+ year St.

Helens females (3.25; males 2.75), and the 70+ year Wharram females (3.75, males 2.75) had considerably higher mean SFI scores than the males. Interestingly, with age cohorts combined, the St. Helens females had the lowest mean SFI score (2.14) while the females from Wharram retained their high mean (2.41). This demonstrates that frailty at St. Helens increased considerably in very old age. This tallies with the low prevalence of pathologies recorded at St. Helens in comparison with the rest of the study sample. Conversely, Wharram's females developed and retained frailties throughout life. Demonstrating the differences in lived experience between urban and rural women.

Lived experience can also be demonstrated through interpersonal violence. Male prevalence exceeded female at all sites, however the patterns of occurrence differed, with only the Fishergate males demonstrating significantly more IPV than the females from the same site. Female IPV (n=8) was almost exclusively abuse related (87.5%), the final instances of which occurred close to the death of the individual, demonstrated by their lack of complete healing. Additionally, significantly more females observed with IPV were over 60 years at death (75.0%), suggesting that female interpersonal violence was age and ability related. Male IPV in contrast, occurred predominantly while individuals were younger (75.0%), demonstrated by the well healed trauma observed on those over 60 years of age. Additionally, only 26.4% of males observed with IPV had healing trauma related to abuse at death, suggesting that male IPV was not wholly related to age or ability. By site, the Fishergate males exhibited significantly more IPV (29.6%), suggesting that low socioeconomic status increased the likelihood of male violence. No significant variations were revealed between the females, suggesting that age and ability alone affect violence towards women.

7.6 Burial

Prevailing funerary rights in the medieval period were relatively simple (Parker Pearson, 1999). Individuals were to be buried in a west-east orientation, with the head at the western end. Body positioning was supine, with legs and arms extended. Coffins and burial shrouds were equally

used, and often dependent on wealth. No grave goods were to be included within the grave, although this did occur, usually in more affluent burials. Burial within the church was the most prestigious location, followed by proximity to the south-west door, or on the south side of the church. The least prestigious location for burial was on the north side of the church. It is likely that the cemeteries at Barton, Fishergate and Wharram present a good cross section of the people living in the community (Mays, 2007; Rodwell, 2007a; Spall and Toop, 2005b). While St. Helens cemetery was initially more likely to have incorporated the servants of the more well to do, the church being smaller and less grandiose than either of the two adjacent churches St. Andrews and St. Cuthbert's; before representing a more accurate cross section of the population once the area had declined (Rees Jones, 1988). At Barton significantly more older individuals (60-69 years = 36.4%; 70+ years = 18.2%) were buried within the church in coffins, suggesting that wealthier individuals were more likely to reach old age and were more able to afford prestigious burials. This theory is somewhat retained at St. Helens, by the majority of older individuals included within the church, and by burial evidence for coffins for several of them (n=2). However, it is likely that many of these individuals were initially buried outside the church (to the east) and later incorporated by the expanding church (Dawes and Magilton, 1980). By contrast, at Fishergate there was a cluster of 70+ year individuals located to the east of the church. The majority have been interpreted as shroud burials due to their body positions, signifying their relative poverty. At Wharram, old and frail individuals also appear to have been clustered, but to the north of the church, with individuals under 59 years located in more favourable conditions. These apparent clusters of individuals dying in older age or increased frailty may suggest a loss of worth in the eyes of the community, or a loss of family to bury them. These results highlight the need for future research in this area.

7.7 The life course

The following section will focus on the experiences and resilience of old age for the individuals from the combined sample. Exploring how specific pathologies related to advancing age, trauma, and increasing frailty, would have impacted the daily lives of the individuals they affected.

7.7.1 Age related palaeopathology

The pathological conditions found to correlate strongly with advancing age in this study, were edentulism, osteoporosis, osteoarthritis, DISH and HFI (see Section 5.8.2.7). Each of these has varying impacts on quality of life and frailty of sufferers. HFI is not a debilitating condition, with the main symptom if it occurs, being a persistent headache (Western and Bekvalac, 2017). HFI has been linked to the conditions of virilism and hirsutism in postmenopausal women, as well as instances of neuropsychiatric disorder, meaning that although the disease itself has little impact on biological age, it may affect the sufferer's appearance and hence social attitudes (Szeniczey et al., 2019). Although the exact aetiology of HFI is currently unknown, a link to urbanisation and air pollution has been suggested (Szeniczey et al., 2019; Western and Bekvalac, 2020). In the current study, there was a significantly higher prevalence of HFI at St. Helens when compared to Wharram, adding some weight to this theory. Interestingly, while often seen as an elderly female condition, it was observed in males at every site, with the exception of Wharram Percy. This may suggest that, while women in any environment may be expected to develop HFI after a certain age, the influence of urban air pollution is best seen through HFI in males.

DISH is another pathology which may remain asymptomatic for years, or presents with mild symptoms, such as stiffness in the affected areas, numbness and tingling in the extremities (due to nerve compression) or musculoskeletal pain (Resnick et al., 1978). No severe cases were observed in the combined sample. It has been noted to be related to higher status, and linked to consumption of richer foods (Waldron, 2019:731). However, in this study, the poorest site Fishergate House, had significantly more DISH than the rest of the sample combined (9.3%). This appears to be related to Fishergate's population having a propensity to bone formation (Mays, 2016; Rogers et al., 1997).

Edentulism, total or partial, can have a large influence on general health and nutrition as it impacts an individual's ability to masticate foods that have not been pureed or at least processed into small bites (Cichero, 2018). Critically, evidence suggests that edentulism has a direct link to

increased risk of mortality (Gil-Montoya et al., 2015). The individuals from St. Helens had significantly higher levels of AMTL (31.7%) in comparison with the other sites, and significantly lower rates of periodontal disease (29.0%), potentially indicating that these individuals are losing their teeth for another reason, such as trauma or removal; or simply that AMTL, as the final result of periodontal disease, masks previous afflictions caused by periodontal degeneration (Al-Shammari et al., 2005; Waldron, 2009:238). Contemporaneous records suggest the presence of sex workers inhabiting the tenements of Aldwark (Rees Jones, 1988), an occupation prone to violence (Karras, 1998). Alternatively, leatherworking, an occupation also recorded to have occurred in the area of St. Helens (Rees Jones, 1988), can result in lingual surface attrition of the maxillary anterior teeth (Monaco et al., 2022), potentially indicating that advanced use wear lead to loss of these teeth. However, a lack of evidence for this type of use wear on individuals that have retained their anterior maxillary teeth somewhat belies this theory. In comparison, Wharram's population had the lowest rate of AMTL (22.4%), but significantly higher rates of caries (11.6%), periapical lesions (18.0%) and periodontal disease (51.0%) overall. Further demonstrating the inverse relationship between periodontal disease and edentulism, and a variation in dental health between urban and rural sites. Total edentulism was only recorded in two individuals, one male and one female, both 46-59 years at death, from St. Helens, indicating that old age is not necessarily a causal reason for loss of dentition, however levels of AMTL overall did increase with age.

Osteoporosis is a metabolic disease primarily associated with post-menopausal women, however it can, and does also affect older men. It is also a key factor when considering frailty (Marklein et al., 2016). Onset age for osteoporosis across the sample was calculated to be over 70 years of age, evidenced by a significant jump in prevalence between the 60-69 and 70+ year cohorts. The Wharram females exhibited the highest prevalence of osteoporosis (13.0%), but it was prevalent for females across the sites. In contrast, the Wharram males exhibited the lowest prevalence (4.5%), suggesting that their active agricultural lifestyle prevented bone loss into old age.

Considering the females would have lead similarly active lifestyles to their male counterparts, this

divergence is unusual (Agarwal et al., 2004; Sofaer Derevenski, 2000). Research suggests it may be linked to malnutrition in childhood or young adulthood (Curate, 2014), and is borne out by the Wharram females exhibiting significantly higher levels of healing and healed cribra orbitalia (40.0%) across the sites. Alternatively higher rates of parity and breast feeding has been suggested as a causal factor for the large difference between male and female bone loss at Wharram Percy (Agarwal et al., 2004). Interestingly, the males that exhibited the highest rates of osteoporosis (Fishergate, 7.7%), also displayed significantly higher levels of healing and healed cribra orbitalia (29.6%), suggesting that malnutrition in youth does play a considerable role in bone mass in older adulthood. Despite this, no severe cases were observed in the study sample, meaning osteoporosis had a limited impact overall.

Osteoarthritis is one of the most common old age pathologies recorded at archaeological sites (Robb et al., 2021); this was reflected in the combined sample by over one third (34.4%) of individuals exhibiting either eburnation, or three combined degenerative traits to a single joint. Onset age for osteoarthritis in the combined sample was around 60 years, with a significant jump in prevalence observed between the 46-59 and 60-69 year cohorts. Fishergate's individuals exhibited a significant high prevalence of osteoarthritis (TPR 9.5%). This is in line with Fishergate's population being bone formers (Im and Kim, 2014; Mays, 2016). In contrast, at Wharram, significantly less osteoarthritis was observed (TPR 2.7%), in keeping with their status as bone losers. Male osteoarthritis (TPR 6.6%) was significantly higher than female, suggesting elevated levels of male joint usage and potentially trauma. Pain associated with osteoarthritis is frequently recorded in modernity (Hu et al., 2021), however its effects vary by joint and individual, and therefore its impact is difficult to assess on archaeological populations. Severe osteoarthritis, involving considerable sclerosis and loss of anatomical joint contour was observed on 4.4% of the study sample. This would have both caused pain and impacted quality of life. Interestingly, Wharram's individuals exhibited the highest prevalence of severe osteoarthritis (CPR 5.7%) and Fishergate the least (CPR 3.1%), suggesting that when osteoarthritis occurred at Wharram it had a considerable impact.

These results demonstrate how diseases of old age vary between rural and urban populations, between communities of high and low socioeconomic status and between the sexes. Barton's individuals never exhibited considerably more or less of any age related pathology, suggesting that wealthier individuals did experience the hardships related to diseases of old age, but they were protected from the worst effects of them. In contrast, Fishergate's low socioeconomic individuals demonstrated significantly higher prevalence's of the majority of the diseases related to age (HFI, DISH, osteoarthritis). Overall, these individuals show the greatest morbidity related to old age diseases, which are potentially linked to their status as bone formers. Urban and rural age related decline were both associated with malnutrition (edentulism and osteoporosis, respectively). Edentulism at St. Helens suggests malnutrition as a causal factor for tooth loss and as a consequence after. Similarly, osteoporosis at Wharram was most closely associated with malnutrition in younger life. By sex, males and females followed the expected trends for HFI, osteoporosis and DISH, although both sexes did exhibit all pathologies. A high male prevalence for osteoarthritis and AMTL suggests elevates levels of usage, and potential trauma in comparison to the females. The males from Fishergate consistently demonstrated a greater morbidity, in comparison to both the other males and the females. Suggesting that socioeconomic status was one of the biggest factors affecting health for males in the medieval period.

7.7.2 Trauma

Trauma can occur at any stage of life, and its effects can have a large impact on frailty (Marklein et al., 2016), evidenced by all individuals in the highest two frailty cohorts (SFI 5 and 6) exhibiting one or more forms of trauma. Joint dislocation (CPR 0.9%) and soft tissue trauma (CPR 1.6%) were the only types not recorded across all four sites, and are also the most invisible archaeologically. For dislocation to be detected, it must not have undergone reduction, and it has to have happened long enough prior to death for bony alteration to occur. Reduction methods for resetting dislocated joints are recorded from c. 430 BC (Bennike, 2008), meaning effective methods of treatment would have existed in the medieval period, and only in circumstances where it was not, or could not, be reduced would it impact an individual.

Soft tissue trauma is only visible on skeletal remains when an inflammatory response occurs causing extraskeletal ossification, commonly known as heterotopic ossification (Meyers et al., 2019). Wharram males exhibited the highest rates of soft tissue trauma (3.8%) linked to repetitive strenuous activity, likely due to their occupation as farm labourers, carrying out physically demanding work on a daily basis, with a higher potential for injuries to occur (Dyer, 2012b).

Osteochondritis dissecans was considerably more prevalent within the study sample (CPR 11.6%). It is related to vigorous activity and repetitive stress to the primarily appendicular joints and commonly occurs in youth (Lewis, 2018:110); however adult lesions can and do occur, often due to injury (Waldron, 2009). Symptoms include persistent pain, and subsequent development of osteoarthritis in the affected joint (Hevesi et al., 2020). A TPR of 7.7% was demonstrated in the study sample for osteoarthritis related to osteochondritis dissecans. Osteochondritis dissecans was significantly more prevalent at Barton (19.5%), suggesting these wealthier individuals were involved in regular strenuous activity. All age cohorts demonstrated osteochondritis dissecans across the joints of the body, and its prevalence was not influenced by sex.

Spondylolysis had a CPR of 7.8%, with two individuals exhibiting evidence for subsequent spondylolisthesis, although this was not severe. It occurs most commonly in youth, and is linked to mechanical stresses in the lumbar region (Lewis, 2018; Pope and Smith, 2006). The St. Helens females had significantly more spondylolysis observed, suggesting they carried out higher levels of physical activity, potentially in youth.

Blunt (CPR 1.4%) and sharp (CPR 2.9%) force trauma can both be indicative of accidents or instances of interpersonal violence and can be difficult to differentiate (Krakowka, 2017a). Both forms were prevalent across the study sample. A significantly high male prevalence (5.1%) contrasted with no females exhibiting sharp force trauma. As with previous studies (Krakowka, 2015), this type of trauma was predominantly recorded on the skull, indicating that this was the target during conflict. For blunt force trauma, males (3.7%) and females (2.7%) demonstrated a similar prevalence. The females (Barton 2283; Fishergate 1579; both 46-59 years) both exhibited

additional lesions indicating physical abuse. The prevalence of sharp and blunt force trauma indicates that in general, objects, such as weapons, were used more frequently against men, while instances of interpersonal violence against women may be more invisible in the archaeological record; being rarely fatal and more likely to have been carried out using the fists, or feet (Krakowka, 2017ab).

Long term survival post-fracture was not a rare occurrence in the medieval period; evidenced by the fractures observed in the study sample, the majority of which (78.2%) were well healed at time of death. Additionally the low level of observed instances of malunion or severe deformity upon healing, demonstrates that effective treatment methods were available regardless of social or economic status or sex (Grauer and Roberts, 1996; Russcher and Bremmer, 2012). Male fracture prevalence (4.4%) significantly exceeds female, suggesting males generally undertook more diverse labour intensive activities than females and were injured more often. Once again, the high prevalence at Fishergate was significant (4.3%), suggesting low socioeconomic status promotes injury.

Fractures occurring in old age can be more traumatic, due to extended healing times and loss of ability (Clark et al., 2017). However, less than half (47.5%) of the individuals in the 70+ year cohort exhibited fractures, and only four of them (10.0%) had healing fractures at death (all related to interpersonal violence).

These results demonstrate that trauma is accrued throughout life, and can impact all individuals, no matter if they are wealthy or poor, or live in urban or rural communities. However, sex and low socioeconomic status does impact prevalence, with males, particularly from Fishergate exhibiting a greater frequency of trauma overall.

7.8 Osteobiographies

Osteobiographies will illustrate the variation in lived experience between urban and rural populations, communities of high and low socioeconomic status and between males and females. Seven individuals, representing each site, with a range of frailty scores (0-6) and age at death

estimations, will be discussed to demonstrate the range of ability, agency, and social treatment visible in the archaeological record.

7.8.1 Fishergate 1104, female, 70+ years

A single individual in the 70+ year cohort had an SFI score of zero, meaning they exhibited no frailty, this was Fishergate 1104. This individual exhibited low preservation, consisting of one innominate and both legs. Despite this, the degeneration to the pubic symphysis, auricular surface, ischium and iliac crest was considerable enough to place this individual into the 70+ year cohort. This individual highlights the osteological paradox when analysing human remains, as they may have retained their health into old age as the remaining elements suggest; conversely evidence for considerable pathology may have been lost with the upper skeleton (Wood et al., 1992). The only apparent pathology experienced by this individual occurred to the hip joint, in the form of porosity and osteophyte formation to the acetabulum and femoral head, which is indicative of developing degenerative joint disease. The remaining skeletal material suggests this female retained their health and ability level into old age, potentially experiencing minor discomfort due to advancing degeneration in the hip, and would therefore have been able to contribute at almost all levels of community. Despite their apparent health into old age this individual's burial treatment was uniform with the rest of the individuals at Fishergate. They were buried to the east of the church, within the 70+ year cluster. No other burial treatment was evident; however, their body position suggests a shroud burial which demonstrates their poverty.

7.8.2 St. Helens 5501, female, 70+ years

St. Helens 5501 had an SFI of 2, however their ability was impacted by other disease factors. They demonstrated osteoarthritis to the left hip joint (eburnation, macroporosity, osteophyte formation, some loss of anatomical joint contour), which would have caused considerable discomfort, stiffness and affected mobility (Rydevik et al., 2010). Degenerative joint disease was observed on the articular facets of the thoracic and lumbar vertebrae, presenting as macroporosity, osteophyte formation, loss of anatomical joint contour and fusion; their spine also

exhibited spondylosis and Schmorl's nodes. These, however, would have paled in comparison to the chronic inflammatory disorder, rheumatoid arthritis, which was destroying and ankylosing the joints of the hands and feet (Figure 7.1). This disease would have considerably impacted the quality of life of the sufferer, causing pain and a severe decline in physical function, including deformity and disability, reducing capacity for work and isolating the individual socially (Smolen et al., 2016). A link to environmental pollution, as well as low socioeconomic status has been reported in the risk factors for development of rheumatoid arthritis, which is cognisant with living conditions in the area surrounding St. Helens (Rees Jones, 1988; Smolen et al., 2016). Despite this debilitating disease, this individual did not exhibit any signs of trauma, specifically trauma related to IPV, indicating that they may have retained their agency throughout, and that some form of care structure may have been in place. This supposition is corroborated by their burial treatment. They were interred in a coffin within St. Helens church, suggesting their relative affluence or importance within the community. This individual clearly demonstrates that debilitating diseases which are not considered by the Frailty Index do impact ability.



Figure 7.1. Pathology observed on St. Helens 5501. Left: complete destruction of the distal first metatarsals consistent with rheumatoid arthritis. Right: osteoarthritis presenting as eburnation, porosity, osteophyte formation and some loss of anatomical joint contour to the left femoral head.

7.8.3 Barton 771, female, 70+ years

Barton 771 also had an SFI of 2 and exhibited relatively little decline. Some spondylosis, and minor Schmorl's nodes were observed on the spine, with some general microporosity and osteophyte formation to the joints across the body, as expected of a 70+ year old individual. They also exhibited three well healed rib fractures (occurred well before death) and a healing midshaft fracture to the right ulna and radius, which occurred within a year of death (Figure 7.2). Their midshaft location indicates that they are likely associated with a fall. However, the difference in healing, could indicate prolonged exposure to interpersonal violence and abuse. This is compounded by a slight malalignment in the healing of the ulna (and to a lesser extent the radius), which can indicate a lack of care post injury (Gowland, 2015). Interpersonal violence on this individual indicates that ability does not always act as protection, or that public affluence also does not equate to private lack of abuse. They were buried in a favourable location near the south-west entrance of St. Peter's church. In conjunction with the evidence from St. Helens 5501, the health, potential abuse and burial treatment of these individuals may demonstrate that wealth promotes longevity and hinders frailty accrual, but it does not halt adverse life experiences.



Figure 7.2. Pathology observed on Barton 771. Left: a midshaft fracture to the right ulna, demonstrating continued remodelling and malalignment in healing. Right: a well remodelled rib fracture to a mid-cage rib fragment.

7.8.4 Wharram WCO017, female, 46-59 years

This individual exhibited an SFI of 5. They demonstrate the prevalence for malnutrition related pathology at Wharram through presentation of osteoporosis, healed cribra orbitalia and periodontal disease (Figure 7.3). A healed osteoporotic compression fracture was evident on a lumbar vertebra, along with sparse trabeculae noted in other vertebral body fragments. This individual also had a well healed fracture to the distal epiphysis of the left MC2, which occurred during adolescence; as well as spondylosis, Schmorl's nodes, and some general osteophyte formation to the joints across the body. They were interred to the west of St. Martins church, with no evidence for a coffin (although this does not mean they were not buried within one). They are a good example of the hidden heterogeneity in frailty and selective mortality, which was postulated to occur at Wharram due to crop and livestock failures (Pinhasi and Bourbou, 2008; Wood et al., 1992).

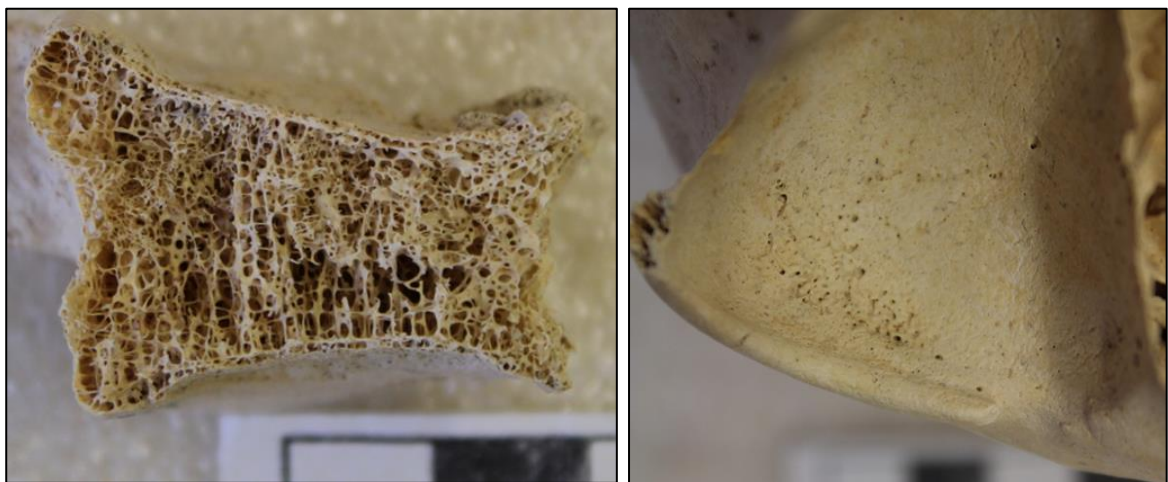


Figure 7.3. Pathology observed on Wharram WCO017. Right: healed compression fracture to a lumbar vertebra indicating osteoporosis. Left: remodelled orbital lesions consistent with cribra orbitalia to the left orbit.

7.8.5 Fishergate 1163, Male, 70+ years

Fishergate 1163 is the only individual in the 70+ year cohort to have an SFI of 6. This clearly demonstrates that high frailty is not dependant on advanced chronological and biological age. This individual appears to have experienced adversity from a young age, evidenced by remodelling evident in both orbits, indicating healed cribra orbitalia as well as Harris lines to the left femur (identified radiographically). Both of these demonstrate some form of stress, usually

related to malnutrition or illness, occurred during youth (Brickley, 2018; Lewis, 2018). They exhibited widespread periosteal reactions, to the ribs (both active and remodelled), left femur and left fibula, with active osteitis observed on the left tibia (Figure 7.4). This, in addition to severe spondylosis particularly to the cervical vertebrae, indicates that this individual may have been suffering from pulmonary tuberculosis at their time of death (Roberts and Buikstra, 2019). It may be expected that an older individual suffering from a debilitating disease, may show clear signs of physical abuse or neglect, however this was not the case, demonstrating their continued agency throughout illness and old age. Although it does not mean that this individual did not suffer from archaeologically invisible forms of abuse. Three healed rib fractures were recorded, all mid-cage, from both the left (n=1) and right (n=2) sides, however these do not appear to have been violence related; or if they were, to a single event which occurred at least a year prior to death (Loi et al., 2016). HFI was evidenced by some early endosteal new bone on the inner table of the frontal (Barber, 1997). Periodontal disease and a periapical lesion in the location of the lower left M2 (lost antemortem) were observed, in addition to total AMTL of the left dentition of both the maxilla and mandible (right dentition retained). Considerable alveolar remodelling indicated that this happened some time prior to death. The one sidedness of this loss could indicate occupational use of these teeth, or loss due to interpersonal violence (Lovell and Grauer, 2019; Redfern and Roberts, 2019). As male IPV was significantly more prevalent at Fishergate than at any other site, this is very probable, and may be linked to the rib fractures also exhibited by this individual. Additionally, they suffered from minor osteoarthritis exhibited through eburnation to a thoracic vertebral facet and Schmorl's nodes. Once again, diseases such as TB are not considered by the Frailty Index therefore their impact on ability level must be highlighted separately. This individual experienced a typical burial for those from Fishergate, east of the church, in the 70+ year cluster, in a shroud. This demonstrates their poverty, which would have been linked to, and exacerbated by their poor health status and inability to continue in employment.



Figure 7.4. Pathology observed on Fishergate 1163. Left: maxilla, demonstrating complete AMTL of the left dentition and considerable post-loss remodelling to the alveolar bone. Right: active osteitis on the midshaft left tibia and associated periosteal reaction evident on the left midshaft fibula, both likely associated with TB.

7.8.6 Barton 619, Male, 60-69 years

This individual exhibited a wealth of pathological lesions. In addition to Schmorl's nodes, periodontal disease, and spondylosis, they showed remodelling to both orbits signalling past cribra orbitalia, and adversity in youth. They also exhibited bilateral separation of the pars interarticularis of the L5, spondylolysis, which again most likely occurred in youth; as well as a well healed fracture to the right femoral head, which exhibits a malalignment of approximately two centimetres (Figure 7.5), with an associated necrotic lesion, osteochondritis dissecans. These fractures may have occurred in the same traumatic event, and would have altered the gait of the individual. The left femoral head exhibits considerable osteoarthritis expressed as eburnation, macroporosity and osteophyte formation, a likely response to the pressure placed on this joint by a shortened and potentially painful right leg. They also exhibit advanced DISH, diagnosed through the complete fusion of four vertebral bodies (T10-L1) and one rib, by 'candle wax' like osteophytes, with the retention of intervertebral spaces (Mader et al., 2017). Additional associated bone formation had occurred to the iliac crests, and patellae; potentially also to the tibiae, fibulae, humeri and radii which all demonstrated periosteal new bone formation. The metatarsals and foot phalanges of this individual demonstrated destruction and ankylosis

consistent with rheumatoid arthritis, further affecting their mobility (Smolen et al., 2016). The fact this individual does not exhibit signs of IPV may be due to the community they lived and died in, and their own social status. Evidence for this is found in their burial environment. They were interred in a coffin, within the church at Barton, suggesting they may have been a more affluent individual. Although this did not stop them from experiencing hardship throughout life including malnutrition and disability.



Figure 7.5. Pathology observed on Barton 619. Left: T10-L1, as well as the 10th right rib, fused by 'candle wax' like osteophyte formation, representing DISH. Right: well healed fracture to the right femoral head, exhibiting an approximately 2cm malalignment.

7.8.7 Fishergate 1184, Male, 46-59 years

The youngest individual biologically with an SFI of 6. This individual exhibited severe sinusitis in the maxillary sinuses, caused by a periapical lesion on the maxillary plate which had perforated upwards (Figure 7.6). This would have resulted in debilitating pain and affected the individual's ability to function in society. This loss of ability is expressed by the healing parry fracture to the left distal ulna, which occurred between two months and one year prior to death. It was associated with a periosteal reaction indicating infection had occurred, potentially due to a lack of care post injury, which also indicates abuse (Gowland, 2015). Additionally, fractures were observed to seven right and four left ribs, with the same level of healing as the ulna, indicating they occurred concurrently. Another fracture to the left scapula was not IPV related, and had occurred when this individual was younger. Evidence for healed cribra orbitalia and active periodontal disease indicates prolonged episodes of malnutrition which can be linked to their low

socioeconomic status. Expressed, not only by the site they were associated with, but also their burial in a shroud, demonstrating their poverty. Finally, this individual exhibited osteoarthritis (eburnation) to the C3 to C4 vertebral facets and left first metacarpal and trapezium, as well as spondylosis and Schmorl's nodes. The abuse and lack of care experienced by this individual, perfectly demonstrates a loss of social worth in association with declined ability to contribute to society.



Figure 7.6. Pathology observed on Fishergate 1184. Right: maxilla demonstrating periapical cloaca to the hard plate, which was associated with considerable sinusitis as it also perforated upwards. Left: 10th and 11th right ribs demonstrating multiple healed fractures to both.

Chapter 8 - Conclusions

The primary aim of this thesis was to assess whether individuals of very old age could be identified within the archaeological record. Initially, contemporaneous historical documents which directly recorded the presence of older individuals (over 45 years at death) were collated, proving the existence of people living into old age in the medieval period. Identification of the aged within the archaeological record was accomplished using a combination of standard and recently developed skeletal ageing techniques that all aged over 45 years at death, to provide a more precise age-at-death than the 45+ category common in osteological reports. A total of 700 individuals were re-aged, with 315 (45.0%) individuals aged between 46 and 59 years, 110 (15.7%) individuals aged between 60 and 69 years and 40 (5.7%) individuals aged over 70 years at death. Demonstrating that it is not only possible to identify older people in archaeology, but that they can be distinguished from those who had shorter life spans, when previously they would have

been assigned the same age-at-death estimation (45+ years). It has been demonstrated that biological decline varies between individuals, which impacts age-at-death estimation. Each technique used was developed on a range of known-age-death individuals, which would account for much of this variation. This, in conjunction with a multifactorial approach using joints across the body, further accounting for variation; meant individuals were placed into the age cohort which was most closely linked with their level of decline and therefore chronological age-at-death. As a consequence of this analysis, a systematic review of each utilised ageing method could be undertaken to assess their worth in contributing to the progression of the study of old age in archaeology. It was established that of the newly developed methods, the C3, clavicle and ischium techniques are the most valuable additions to the catalogue of adult ageing techniques, while the standard methods using the auricular surface and fourth rib can be used with some confidence in the multifactorial age estimation of older adults. The standard methods using the dentition, pubic symphysis and first rib should not be used when attempting to age older adults, as they have a propensity for providing a younger age when compared to the other methods. Of the final newly developed methods, the iliac crest may be used as a good indicator of advanced age, due to the late development of degeneration in this area. The dens facet and dens process have a tendency towards providing older age estimates compared to other methods, although using their standard deviations as age ranges would considerably negate this.

The second aim was to evaluate how an individual's role within medieval English society altered with advancing age, and if this was affected by sex. Firstly, contemporaneous literature on senescence and longevity was assessed for medieval views on old age and the ageing process. It was found that the concept of ageing in the medieval period was twofold, with both chronological and biological age impacting lived experience, somewhat independently; and lived experience was based upon the level of input an individual could provide to society. The literature suggests males would have been more impacted by an alteration in role in later life, based upon their health, while 'old age' for females was signalled by the menopause; after which female identity is lost, with postmenopausal women being regarded as sexless beings (Shahar, 1997:151). In reality,

medieval records demonstrate that males and females continued to contribute to society so long as they were able, with specific roles provided for the aged, such as road-mending for males, and cleaning or washing for females (Thane, 2003).

To assess if an alteration in lived experience could be discerned in the archaeological record, the Skeletal Frailty Index (Marklein et al., 2016) was used to calculate levels of ability or decline by individual; in conjunction with indicators for physical abuse or care. This revealed that, as suggested in the medieval literature, ability level was the key to social decline. However, this was not limited to the very old. Any individual exhibiting high frailty, equating to low ability level, was found to be significantly more likely to have suffered from physical abuse. Females were significantly more likely to suffer from abuse in old age and infirmity. Whereas indicators for male interpersonal violence occurred at younger ages and were less linked with decline. By site, the Fishergate males exhibited significantly higher frailty, more pathology overall and greater interpersonal violence. Whereas the Wharram females exhibited significantly higher levels of nutritional stress and morbidity accrual throughout life.

The final aim of this thesis explored agency and social treatment of those with advanced chronological ages, and low ability levels at the disparate study sites. In order to assess if it varied between individuals of high or low socioeconomic status or in urban and rural settlements. This was undertaken by comparison of skeletal pathology, frailty, trauma and abuse markers at each site, in relation to prevalent occupation and living conditions; as well as through osteobiographies of the oldest and frailest. It was revealed that low socioeconomic status played the largest role in morbidity accrual. This was applicable to Fishergate, St. Helens and Wharram, with each demonstrating significant levels. It was particularly evidenced by the Fishergate males. In contrast, Barton's more affluent individuals appeared to be more protected from morbidity accrual, potentially due to better ability to absorb resource pressures created by the old and infirm. Demonstrated by Barton's frailest individual (Barton 619) being buried with veneration.

Resource stress and marginalisation at rural Wharram was evidenced by burial of older and infirm individuals in less favourable locations.

Agency, into old age at all sites and for both sexes, was demonstrated through a significant proportion of 70+ year individuals having low frailty scores. However, frailty should be assessed at an individual level to highlight any ability impacting diseases not considered by the Frailty Index.

8.1 Future research

There are various avenues for further or future research that could be undertaken to enhance and broaden the results presented in this study. These are as follows:

- Additional analysis of known age-at-death individuals, to enhance the accuracy of conclusions drawn.
- Testing of inter- and intra- observer error to assess the true usability of the methods.
- Extending analysis to include individuals younger than 35 years to assess the full range of degeneration exhibited by each element used in age-at-death estimation.
- Further consideration of the contemporaneous medieval literature in conjunction with the study sites, to assess if changes in the agency and treatment of the old and frail are visible over the time period.
- Wider research into burial treatment of older and frail individuals, in comparison to younger hale individuals of all ages, to assess if age and/or frailty impacted burial treatment.

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Appendices

The following is the raw data used within this study.

Appendix 1 – Age-at-death

The observed sex, age (cohort) and mean age (years) calculated by the author and used throughout the study. Sk. No. = Skeleton number; BAR = Barton-upon-Humber; FGH = Fishergate House, SHOW = St. Helen-on-the-Walls; WP = Wharram Percy.

Barton-upon-Humber				
Site	Sk. No.	Sex	Cohort	Mean
BAR	7	F	70+	65.0
BAR	18	F	46-59	57.0
BAR	99	M	35-45	48.0
BAR	126	M	60-69	66.0
BAR	127	M?	60-69	61.6
BAR	128	M	60-69	61.6
BAR	132	M?	60-69	59.3
BAR	179	M	46-59	60.0
BAR	187	F	70+	64.0
BAR	204	F	46-59	56.6
BAR	208	M	35-45	46.4
BAR	241	M	46-59	56.7
BAR	266	M	46-59	60.5
BAR	269	M	60-69	67.1
BAR	272	M	70+	67.5
BAR	276	F	35-45	52.5
BAR	308	M	46-59	57.9
BAR	309	F	60-69	64.8
BAR	311	F?	35-45	55.8
BAR	326	F	46-59	50.8
BAR	327	M	46-59	59.2
BAR	363	M	46-59	59.7
BAR	380	?	46-59	48.6
BAR	425	M	70+	68.2
BAR	427	M	46-59	56.6
BAR	428	F	46-59	63.3
BAR	431	F	70+	65.3
BAR	446	M	46-59	55.9
BAR	488	M	46-59	54.2
BAR	499	F	70+	67.2
BAR	513	F?	70+	72.2
BAR	539	F	46-59	63.2
BAR	548	M?	46-59	57.7
BAR	550	F	46-59	64.3

Site	Sk. No.	Sex	Cohort	Mean
BAR	552	F	60-69	62.5
BAR	558	M?	46-59	59.0
BAR	578	F?	46-59	48.3
BAR	582	M	46-59	59.7
BAR	588	M	46-59	49.7
BAR	591	M?	60-69	64.9
BAR	594	M?	46-59	55.7
BAR	597	M	60-69	64.4
BAR	598	M	60-69	67.0
BAR	605	M	46-59	53.5
BAR	606	F	70+	66.9
BAR	607	F	46-59	55.9
BAR	613	F	46-59	47.0
BAR	619	M	60-69	67.8
BAR	624	M	46-59	60.5
BAR	650	M	60-69	64.6
BAR	675	F	46-59	50.2
BAR	706	M	60-69	63.1
BAR	717	F	46-59	64.7
BAR	737	M	46-59	56.7
BAR	748	F	60-69	61.8
BAR	749	F	60-69	59.3
BAR	750	F?	46-59	58.9
BAR	765	M	46-59	54.4
BAR	771	F	70+	64.2
BAR	778	M	46-59	53.5
BAR	788	F	46-59	59.9
BAR	834	M	60-69	60.6
BAR	850	F	46-59	62.0
BAR	854	F	46-59	63.7
BAR	867	M	46-59	61.1
BAR	870	M	46-59	61.4
BAR	894	F?	46-59	54.6
BAR	918	M	60-69	61.2
BAR	947	M	46-59	54.1

Site	Sk. No.	Sex	Cohort	Mean
BAR	948	F	46-59	64.6
BAR	950	M?	46-59	58.7
BAR	971	F	60-69	66.8
BAR	975	M?	46-59	49.0
BAR	976	M	46-59	54.8
BAR	981	M?	46-59	47.5
BAR	989	M	60-69	62.9
BAR	1015	M	46-59	54.6
BAR	1020	M	46-59	60.8
BAR	1022	M	46-59	62.7
BAR	1028	F	46-59	59.1
BAR	1030	F?	35-45	52.0
BAR	1039	F	35-45	50.8
BAR	1043	M	46-59	54.7
BAR	1047	M	46-59	53.6
BAR	1049	F	70+	72.0
BAR	1062	F	60-69	67.4
BAR	1063	M	70+	71.0
BAR	1064	F	46-59	56.6
BAR	1068	F	60-69	65.3
BAR	1071	F	46-59	56.1
BAR	1085	M?	46-59	55.4
BAR	1096	F	46-59	62.4
BAR	1100	M	46-59	57.7
BAR	1103	M	60-69	60.7
BAR	1104	M	46-59	50.7
BAR	1106	M	46-59	53.8
BAR	1120	F	46-59	62.9
BAR	1122	M	46-59	52.3
BAR	1133	F	46-59	58.4
BAR	1134	M	46-59	46.6
BAR	1139	M	60-69	71.3
BAR	1144	F	60-69	66.2
BAR	1146	M?	46-59	61.3
BAR	1148	F	46-59	62.0
BAR	1149	M	46-59	55.1
BAR	1151	F	46-59	59.2
BAR	1162	M	60-69	65.1
BAR	1169	M	35-45	55.2
BAR	1176	M	46-59	60.3
BAR	1183	M?	46-59	51.6
BAR	1197	F	46-59	54.4
BAR	1202	F	46-59	62.3
BAR	1204	M	46-59	59.8
BAR	1214	M	60-69	60.2

Site	Sk. No.	Sex	Cohort	Mean
BAR	1220	F?	46-59	57.9
BAR	1235	F	35-45	55.8
BAR	1236	F	46-59	63.4
BAR	1251	M	35-45	54.0
BAR	1254	F	60-69	60.9
BAR	1255	F	46-59	49.9
BAR	1263	M?	46-59	48.5
BAR	1268	M	46-59	60.7
BAR	1291	M?	60-69	61.0
BAR	1297	M	46-59	61.7
BAR	1299	F?	46-59	62.5
BAR	1307	M	46-59	52.6
BAR	1315	M	46-59	62.9
BAR	1316	M	46-59	54.9
BAR	1324	M	35-45	47.1
BAR	1409	M?	46-59	56.9
BAR	1438	M	46-59	54.4
BAR	1498	F	46-59	62.8
BAR	1538	F	46-59	50.8
BAR	1542	F	46-59	55.5
BAR	1548	M	46-59	60.9
BAR	1556	M	46-59	48.5
BAR	1566	M	46-59	59.0
BAR	1571	F	46-59	60.9
BAR	1615	M	46-59	51.4
BAR	1655	F	35-45	51.0
BAR	1691	M	46-59	50.0
BAR	1695	F?	46-59	61.3
BAR	1707	M	70+	63.2
BAR	1723	M	46-59	47.2
BAR	1750	F	46-59	61.2
BAR	1756	M?	46-59	48.6
BAR	1765	F	46-59	64.7
BAR	1769	M	70+	63.8
BAR	1775	M	46-59	61.3
BAR	1788	M	46-59	53.9
BAR	1805	M	46-59	59.4
BAR	1824	M	46-59	57.2
BAR	1843	M	46-59	54.7
BAR	1849	M	60-69	57.7
BAR	1856	?	35-45	47.3
BAR	1863	M	60-69	60.7
BAR	1869	M?	60-69	72.0
BAR	1871	M	46-59	57.1
BAR	1875	F	46-59	52.1

Site	Sk. No.	Sex	Cohort	Mean
BAR	1889	F?	70+	65.3
BAR	1892	F	46-59	50.6
BAR	1897	M	46-59	60.1
BAR	1910	M	46-59	60.1
BAR	1911	M	46-59	50.7
BAR	1920	M	46-59	61.0
BAR	1922	M	46-59	58.9
BAR	1926	M	46-59	58.3
BAR	1993	M	60-69	58.7
BAR	1995	M	60-69	63.1
BAR	2027	M	46-59	58.4
BAR	2064	F	35-45	54.9
BAR	2130	F	60-69	61.2
BAR	2142	F	60-69	60.3
BAR	2176	F	46-59	53.4
BAR	2187	F	46-59	56.1
BAR	2193	M	60-69	59.3
BAR	2200	M	46-59	49.6
BAR	2206	M	60-69	59.7
BAR	2216	F	46-59	58.3
BAR	2219	M	46-59	59.6
BAR	2236	F	60-69	68.5
BAR	2244	M	46-59	55.0
BAR	2248	M	60-69	61.7
BAR	2251	M	46-59	60.1
BAR	2259	F	46-59	47.4
BAR	2274	M	46-59	63.3
BAR	2283	F	46-59	57.9
BAR	2284	F?	46-59	61.7
BAR	2289	M	35-45	50.1
BAR	2294	M	46-59	51.1
BAR	2297	F?	70+	64.8
BAR	2298	M	46-59	61.2
BAR	2304	M	35-45	36.5
BAR	2309	M	60-69	62.3
BAR	2320	M	60-69	65.0
BAR	2327	M	46-59	48.8
BAR	2337	M	60-69	60.0
BAR	2338	M	60-69	62.1
BAR	2345	M	46-59	57.5
BAR	2348	F	60-69	57.0
BAR	2356	F	60-69	58.4
BAR	2376	M	60-69	58.9
BAR	2386	F	60-69	62.0
BAR	2408	F	46-59	51.4

Site	Sk. No.	Sex	Cohort	Mean
BAR	2411	F?	60-69	65.1
BAR	2413	M?	46-59	65.0
BAR	2428	F	35-45	57.3
BAR	2436	F?	46-59	52.2
BAR	2451	M?	35-45	51.8
BAR	2452	M	46-59	58.0
BAR	2457	F	60-69	65.1
BAR	2465	F	46-59	56.7
BAR	2466	M	46-59	60.4
BAR	2469	M	46-59	46.6
BAR	2471	M	46-59	56.7
BAR	2485	M	35-45	52.1
BAR	2491	M?	60-69	61.7
BAR	2495	M	46-59	52.8
BAR	2499	M	60-69	62.8
BAR	2503	F	46-59	50.8
BAR	2514	M	46-59	54.4
BAR	2520	F?	60-69	65.4
BAR	2583	M	60-69	67.3
BAR	2603	M	46-59	56.3
BAR	2612	M	60-69	62.2
BAR	2616	?	46-59	62.8
BAR	2666	F?	35-45	54.2
BAR	2684	M	46-59	55.2
BAR	2700	M	46-59	50.6
BAR	2714	M	70+	66.5
BAR	2718	F	35-45	45.7
BAR	2720	M	46-59	50.6
BAR	2721	M	46-59	53.7
BAR	2722	F	46-59	47.0
BAR	2727	F	46-59	57.4
BAR	2730	M	46-59	53.6
BAR	2731	M	35-45	49.3
BAR	2732	F	60-69	64.0
BAR	2739	M	46-59	49.7
BAR	2751	F	60-69	60.2
BAR	2758	M	60-69	63.1
BAR	2766	F	35-45	52.9
BAR	2775	F	60-69	64.2
BAR	2780	F	46-59	52.9
BAR	2783	M	46-59	51.4
BAR	2784	M	46-59	58.8
BAR	2786	M	46-59	51.9
BAR	2798	M?	46-59	63.9
BAR	2799	M	35-45	58.8

Fishergate House				
Site	Sk. No.	Sex	Cohort	Mean
FGH	1021	M?	35-45	60.1
FGH	1037	F	46-59	45.3
FGH	1047	F	46-59	61.1
FGH	1049	F?	60-69	66.2
FGH	1051	M	70+	70.7
FGH	1053	F?	35-45	49.4
FGH	1057	F	70+	68.6
FGH	1063	M	60-69	59.3
FGH	1075	M	70+	72.0
FGH	1079	F	46-59	63.2
FGH	1081	M?	35-45	53.9
FGH	1091	F?	46-59	68.3
FGH	1097	F?	60-69	69.7
FGH	1099	F?	46-59	64.9
FGH	1101	F	46-59	56.8
FGH	1104	F	70+	74.5
FGH	1110	F	46-59	61.8
FGH	1113	M	35-45	52.6
FGH	1115	F	60-69	67.4
FGH	1117	M	60-69	64.0
FGH	1130	M	60-69	63.1
FGH	1139	M?	70+	68.2
FGH	1147	M	46-59	58.1
FGH	1150	F	46-59	67.3
FGH	1163	M?	70+	68.5
FGH	1171	M?	35-45	58.6
FGH	1180	F	35-45	43.9
FGH	1184	M	46-59	51.7
FGH	1188	M	35-45	60.1
FGH	1190	F	46-59	57.7
FGH	1208	F?	46-59	65.6
FGH	1228	M	70+	70.2
FGH	1230	F?	35-45	61.2
FGH	1237	M?	46-59	60.2
FGH	1255	F?	35-45	54.2
FGH	1257	F	35-45	60.9
FGH	1280	M?	46-59	63.7
FGH	1284	F?	35-45	44.9
FGH	1286	F	35-45	62.2
FGH	1297	F?	35-45	55.3
FGH	1305	F?	46-59	62.1
FGH	1312	F	35-45	51.5
FGH	1313	M?	70+	67.0
FGH	1327	M?	60-69	64.6

Site	Sk. No.	Sex	Cohort	Mean
FGH	1354	M	46-59	51.9
FGH	1385	M	60-69	65.8
FGH	1391	F	46-59	53.9
FGH	1412	M	46-59	57.8
FGH	1441	M?	60-69	67.1
FGH	1455	F	35-45	41.8
FGH	1469	F	46-59	57.5
FGH	1471	F	35-45	57.9
FGH	1484	F	60-69	66.7
FGH	1486	M	46-59	52.8
FGH	1521	F	46-59	56.2
FGH	1525	F?	46-59	55.1
FGH	1553	M?	35-45	57.0
FGH	1560	M?	35-45	56.8
FGH	1569	F?	46-59	60.1
FGH	1579	F?	46-59	61.1
FGH	1581	F?	60-69	64.8
FGH	1583	M	46-59	55.3
FGH	1589	F	35-45	48.0
FGH	1597	F	35-45	54.8
St. Helen-on-the-Walls				
Site	Sk. No.	Sex	Cohort	Mean
SHOW	5010a	F	46-59	56.8
SHOW	5066	M	46-59	59.5
SHOW	5091	F	35-45	48.7
SHOW	5098	F	35-45	57.5
SHOW	5103	F	46-59	60.8
SHOW	5105	F	60-69	70.1
SHOW	5110	F	46-59	58.9
SHOW	5123	F	46-59	59.1
SHOW	5159	M	60-69	65.2
SHOW	5172	M	46-59	42.1
SHOW	5173	M	46-59	53.4
SHOW	5186	M?	35-45	53.6
SHOW	5190	F	46-59	57.2
SHOW	5203	M	46-59	61.9
SHOW	5204	M	35-45	51.1
SHOW	5207	M	60-69	60.6
SHOW	5208	M?	46-59	56.4
SHOW	5211	F	60-69	62.6
SHOW	5218	F?	46-59	54.9
SHOW	5222	M	46-59	59.7
SHOW	5225	F	46-59	57.4
SHOW	5228	F?	60-69	67.1
SHOW	5233	M	46-59	56.4

Site	Sk. No.	Sex	Cohort	Mean
SHOW	5237	M	46-59	57.9
SHOW	5241	F	35-45	45.3
SHOW	5243	M	60-69	62.5
SHOW	5244	M?	46-59	57.2
SHOW	5254	F	60-69	65.0
SHOW	5258	F	35-45	50.0
SHOW	5267	F	46-59	53.1
SHOW	5269	M	46-59	63.7
SHOW	5270	F?	35-45	53.3
SHOW	5283	M	35-45	51.1
SHOW	5290	F?	46-59	60.2
SHOW	5292	F	46-59	56.2
SHOW	5298	F	46-59	57.8
SHOW	5302	F	35-45	47.3
SHOW	5311	F?	46-59	60.7
SHOW	5316	F?	46-59	55.4
SHOW	5320	F	35-45	52.0
SHOW	5323	M	46-59	56.1
SHOW	5329	M	46-59	53.1
SHOW	5347	M	60-69	67.3
SHOW	5350	F	46-59	55.5
SHOW	5364	F	46-59	53.6
SHOW	5384	M	60-69	60.5
SHOW	5393	F	46-59	51.5
SHOW	5402	M	46-59	57.4
SHOW	5415	F	35-45	52.0
SHOW	5421	M?	60-69	59.5
SHOW	5438	M	46-59	58.4
SHOW	5445	M	35-45	49.2
SHOW	5451	M	46-59	58.0
SHOW	5453	M	46-59	56.1
SHOW	5457	M	35-45	46.8
SHOW	5461	M?	60-69	60.6
SHOW	5463	M?	46-59	52.8
SHOW	5475	M?	46-59	61.4
SHOW	5488	F	46-59	52.8
SHOW	5492	F	35-45	58.9
SHOW	5494	F	70+	68.3
SHOW	5501	F	70+	64.6
SHOW	5507	F?	46-59	59.2
SHOW	5508	F	60-69	65.7
SHOW	5529	F	70+	67.1
SHOW	5534	F	46-59	49.4
SHOW	5539	M	46-59	53.1
SHOW	5544	M	46-59	55.5

Site	Sk. No.	Sex	Cohort	Mean
SHOW	5562	F	60-69	62.1
SHOW	5563	M	46-59	53.7
SHOW	5588	F	46-59	57.7
SHOW	5601	F	46-59	61.8
SHOW	5603	M	46-59	54.0
SHOW	5617	M	46-59	58.9
SHOW	5632	F	70+	68.1
SHOW	5644	M	60-69	61.8
SHOW	5657	F	35-45	47.7
SHOW	5671	M	46-59	57.6
SHOW	5680	M	70+	71.4
SHOW	5699	F	46-59	66.0
SHOW	5702	M	35-45	42.0
SHOW	5710	M	46-59	50.4
SHOW	5740	F	35-45	52.5
SHOW	5773	M	46-59	60.2
SHOW	5774	F	60-69	65.9
SHOW	5794	M	60-69	61.6
SHOW	5835	F	46-59	50.4
SHOW	5845	M	46-59	56.4
SHOW	5884	F	35-45	52.2
SHOW	5909	F	46-59	58.3
SHOW	5977	M?	46-59	61.1
SHOW	6003	F	60-69	60.9
SHOW	6026	M	35-45	44.8
SHOW	6027	F	46-59	59.0
SHOW	6029	M	46-59	57.9
SHOW	6030	F	60-69	64.2
SHOW	6042	M	35-45	49.2
SHOW	6043	F	60-69	59.4
SHOW	6048	M	46-59	57.8
SHOW	6060	M	60-69	67.6
SHOW	6070	F	46-59	57.8
SHOW	6072	M	46-59	54.8
SHOW	6074	F	46-59	58.7
SHOW	6081	M	60-69	65.2
SHOW	6082	F	46-59	56.3
SHOW	6083	M	46-59	52.3
SHOW	6088	M	70+	59.7
SHOW	6093	F	46-59	53.1
SHOW	6098	M	46-59	55.9
SHOW	6103	M	70+	63.4
SHOW	6105	M	70+	63.8

Wharram Percy				
Site	Sk. No.	Sex	Cohort	Mean
WP	EE004	M?	60-69	63.0
WP	EE013	M	35-45	54.2
WP	EE015	F	60-69	72.2
WP	EE019	F	35-45	58.3
WP	EE022	F	46-59	56.7
WP	EE024	M?	35-45	59.0
WP	EE025	M?	60-69	67.5
WP	EE026	M	46-59	58.3
WP	EE037	M	46-59	58.5
WP	EE056	F	46-59	53.7
WP	EE062	M	46-59	48.7
WP	EE070	F	46-59	53.9
WP	EE079	M?	60-69	68.6
WP	EE080	M	35-45	54.5
WP	EE089	M	46-59	57.4
WP	EE097	F?	46-59	61.6
WP	EE098	M?	70+	72.3
WP	EE099	F	46-59	57.8
WP	G251	F	46-59	49.2
WP	G265	M	35-45	56.0
WP	G278	M?	46-59	63.6
WP	G279	M?	60-69	61.5
WP	G296	F?	35-45	59.3
WP	G297	M?	46-59	58.3
WP	G303	M	35-45	58.1
WP	G310	M	35-45	49.9
WP	G361	F?	35-45	57.4
WP	G377	F?	46-59	57.3
WP	G379	M	46-59	59.6
WP	G381	M?	46-59	51.6
WP	G385	F?	35-45	55.8
WP	G406	M?	46-59	54.5
WP	G411	M	46-59	43.6
WP	G419	F?	46-59	61.7
WP	G451	F	60-69	62.9
WP	G474	F	46-59	62.0
WP	G482	M	46-59	58.2
WP	G516	M	46-59	50.1
WP	G561	M	46-59	55.8
WP	G565	M?	35-45	49.1
WP	G571	F?	46-59	53.3
WP	G587	M?	35-45	48.8
WP	G601	M?	46-59	58.5
WP	G607	M	46-59	50.3

Site	Sk. No.	Sex	Cohort	Mean
WP	G628	F?	46-59	57.4
WP	NA046	M	46-59	61.9
WP	NA047	F	35-45	54.8
WP	NA059	F?	46-59	57.3
WP	NA075	M?	35-45	55.1
WP	NA078	M?	46-59	57.5
WP	NA080	M	35-45	48.7
WP	NA084	F	35-45	49.7
WP	NA088	F	46-59	56.8
WP	NA100	F	46-59	60.3
WP	NA166	M	35-45	45.6
WP	NA168	F	46-59	59.9
WP	NA171	M?	46-59	56.6
WP	NA181	M?	46-59	62.8
WP	NA183	M	46-59	50.1
WP	NA190	M?	35-45	56.3
WP	NA197	M	60-69	64.1
WP	NA199	M	46-59	53.4
WP	NA202	F	70+	70.9
WP	NA203	F	46-59	56.5
WP	NA217	M	70+	74.9
WP	NA218	M	46-59	59.6
WP	NA224	M	46-59	50.8
WP	NA233	F	46-59	56.0
WP	NA234	M	46-59	38.7
WP	SA003	M?	46-59	56.6
WP	SA012	M	35-45	51.6
WP	SA013	F?	35-45	59.1
WP	SA015	M	46-59	57.3
WP	SA021	M	46-59	52.5
WP	SA033	M?	35-45	66.7
WP	SA034	M	46-59	57.0
WP	SA047	F?	35-45	52.0
WP	SA050	F	46-59	52.1
WP	SA052	M?	46-59	57.1
WP	SA053	F?	46-59	63.8
WP	SA054	F	35-45	47.8
WP	SA056	M?	46-59	51.7
WP	V11	M?	60-69	61.7
WP	V14	F?	46-59	61.2
WP	V15	M?	46-59	60.6
WP	V18	M?	60-69	62.6
WP	V19	M?	46-59	54.0
WP	V26	F	60-69	60.3
WP	V27	M?	60-69	60.2

Site	Sk. No.	Sex	Cohort	Mean
WP	V29	F	46-59	49.4
WP	V33	F	35-45	53.2
WP	V38	M?	46-59	55.2
WP	V39	M	46-59	50.8
WP	V40	M	35-45	27.7
WP	V45	M?	46-59	55.2
WP	V46	F	46-59	54.3
WP	V51	M?	46-59	53.6
WP	V61	F	35-45	52.1
WP	WCO009	F	35-45	36.9
WP	WCO012	M?	35-45	38.6
WP	WCO013	F?	46-59	62.8
WP	WCO015	M	46-59	51.1
WP	WCO017	F?	46-59	58.0
WP	WCO018	M	35-45	52.0
WP	WCO022	F	46-59	49.6
WP	WCO026	F?	60-69	65.0
WP	WCO028	F	46-59	60.9
WP	WCO029	F	46-59	63.9
WP	WCO036	F	46-59	56.2
WP	WCO037	M?	60-69	52.1
WP	WCO041	M	35-45	40.0
WP	WCO045	F?	70+	62.4
WP	WCO056	F	35-45	54.9
WP	WCO057	M?	60-69	52.4
WP	WCO059	M?	70+	58.0
WP	WCO109	F	46-59	56.5
WP	WCO115	M?	35-45	65.3
WP	WCO117	M	46-59	53.6
WP	WCO124	F	46-59	56.7
WP	WCO130	F	60-69	67.4
WP	WCO131	M?	70+	61.2
WP	WCO137	M?	46-59	50.5
WP	WCO142	M?	35-45	61.2
WP	WCO146	M	46-59	59.3
WP	WCO153	M?	60-69	66.1
WP	WCO162	F?	70+	60.4
WP	WCO164A	M	60-69	60.4
WP	WCO165	F?	60-69	66.5
WP	WCO165A	M	46-59	56.2
WP	WCO167	F	46-59	51.8
WP	WCO169	M	35-45	38.7
WP	WCO170	F	70+	70.7
WP	WCO173	F	46-59	53.6
WP	WCO179	F?	60-69	66.2

Site	Sk. No.	Sex	Cohort	Mean
WP	WCO184	F	35-45	51.3
WP	WCO187	F	46-59	54.8
WP	WCO199	F	60-69	60.3
WP	WCO200	M?	46-59	57.9
WP	WCO203	M?	35-45	57.8
WP	WCO204	F	46-59	56.8

Appendix 2 – Dentition

Raw data from age estimation using tooth wear analysis (Brothwell, 1981). Sk. No. = Skeleton number; Stage = dental wear stage; Est. Age = estimated age at death using this method. BAR = Barton-upon-Humber; FGH = Fishergate House, SHOW = St. Helen-on-the-Walls; WP = Wharram Percy.

Site	Sk. No.	Sex	Stage	Est. Age
BAR	7	F	D	45+
BAR	18	F	D	45+
BAR	99	M	ABSENT	ABSENT
BAR	126	M	D	45+
BAR	127	M?	D	45+
BAR	128	M	C3/D	33-45+
BAR	132	M?	D	45+
BAR	179	M	C1	33-45
BAR	187	F	C3	33-45
BAR	204	F	C2	33-45
BAR	208	M	ABSENT	ABSENT
BAR	241	M	D	45+
BAR	266	M	ABSENT	ABSENT
BAR	269	M	C1/D	33-45+
BAR	272	M	C3/D	33-45+
BAR	276	F	ABSENT	ABSENT
BAR	308	M	D	45+
BAR	309	F	C3/D	33-45+
BAR	311	F?	ABSENT	ABSENT
BAR	326	F	C3	33-45
BAR	327	M	C2	33-45
BAR	363	M	D	45+
BAR	380	?	C1/D	33-45+
BAR	425	M	D	45+
BAR	427	M	D	45+
BAR	428	F	C3	33-45
BAR	431	F	D	45+
BAR	446	M	ABSENT	ABSENT
BAR	488	M	ABSENT	ABSENT
BAR	499	F	D	45+
BAR	513	F?	ABSENT	ABSENT
BAR	539	F	C3	33-45
BAR	548	M?	ABSENT	ABSENT
BAR	550	F	D	45+
BAR	552	F	C3	33-45
BAR	558	M?	C2	33-45
BAR	578	F?	B3/C1	25-45
BAR	582	M	C3	33-45
BAR	588	M	ABSENT	ABSENT
BAR	591	M?	ABSENT	ABSENT
BAR	594	M?	C2	33-45
BAR	597	M	D	45+
BAR	598	M	D	45+
BAR	605	M	ABSENT	ABSENT
BAR	606	F	D	45+

Site	Sk. No.	Sex	Stage	Est. Age
BAR	607	F	C1	33-45
BAR	613	F	C1/D	33-45+
BAR	619	M	C1/D	33-45+
BAR	624	M	B3	25-35
BAR	650	M	ABSENT	ABSENT
BAR	675	F	D	45+
BAR	706	M	ABSENT	ABSENT
BAR	717	F	D	45+
BAR	737	M	ABSENT	ABSENT
BAR	748	F	D	45+
BAR	749	F	D	45+
BAR	750	F?	ABSENT	ABSENT
BAR	765	M	ABSENT	ABSENT
BAR	771	F	D	45+
BAR	778	M	ABSENT	ABSENT
BAR	788	F	D	45+
BAR	834	M	C3/D	33-45+
BAR	850	F	C3/D	33-45+
BAR	854	F	D	45+
BAR	867	M	D	45+
BAR	870	M	C3/D	33-45+
BAR	894	F?	B3	25-35
BAR	918	M	C2	33-45
BAR	947	M	D	45+
BAR	948	F	D	45+
BAR	950	M?	D	45+
BAR	971	F	D	45+
BAR	975	M?	C1	33-45
BAR	976	M	C3	33-45
BAR	981	M?	ABSENT	ABSENT
BAR	989	M	D	45+
BAR	1015	M	B3/C1	25-45
BAR	1020	M	C2	33-45
BAR	1022	M	C2	33-45
BAR	1028	F	D	45+
BAR	1030	F?	ABSENT	ABSENT
BAR	1039	F	ABSENT	ABSENT
BAR	1043	M	D	45+
BAR	1047	M	C3	33-45
BAR	1049	F	ABSENT	ABSENT
BAR	1062	F	ABSENT	ABSENT
BAR	1063	M	D	45+
BAR	1064	F	C3	33-45
BAR	1068	F	D	45+
BAR	1071	F	C3	33-45
BAR	1085	M?	ABSENT	ABSENT
BAR	1096	F	D	45+
BAR	1100	M	C3	33-45
BAR	1103	M	D	45+
BAR	1104	M	D	45+
BAR	1106	M	D	45+
BAR	1120	F	D	45+
BAR	1122	M	ABSENT	ABSENT
BAR	1133	F	ABSENT	ABSENT
BAR	1134	M	C1	33-45
BAR	1139	M	D	45+

Site	Sk. No.	Sex	Stage	Est. Age
BAR	1144	F	D	45+
BAR	1146	M?	B3	25-35
BAR	1148	F	C1	33-45
BAR	1149	M	ABSENT	ABSENT
BAR	1151	F	ABSENT	ABSENT
BAR	1162	M	C1	33-45
BAR	1169	M	C2	33-45
BAR	1176	M	C3/D	33-45+
BAR	1183	M?	ABSENT	ABSENT
BAR	1197	F	C1	33-45
BAR	1202	F	C2	33-45
BAR	1204	M	C2	33-45
BAR	1214	M	C3	33-45
BAR	1220	F?	C3	33-45
BAR	1235	F	ABSENT	ABSENT
BAR	1236	F	A1	17-25
BAR	1251	M	C1	33-45
BAR	1254	F	D	45+
BAR	1255	F	D	45+
BAR	1263	M?	ABSENT	ABSENT
BAR	1268	M	C2	33-45
BAR	1291	M?	C2	33-45
BAR	1297	M	D	45+
BAR	1299	F?	D	45+
BAR	1307	M	ABSENT	ABSENT
BAR	1315	M	D	45+
BAR	1316	M	B1	25-35
BAR	1324	M	B1	25-35
BAR	1409	M?	C3/D	33-45+
BAR	1438	M	ABSENT	ABSENT
BAR	1498	F	D	45+
BAR	1538	F	ABSENT	ABSENT
BAR	1542	F	D	45+
BAR	1548	M	D	45+
BAR	1556	M	ABSENT	ABSENT
BAR	1566	M	D	45+
BAR	1571	F	ABSENT	ABSENT
BAR	1615	M	ABSENT	ABSENT
BAR	1655	F	ABSENT	ABSENT
BAR	1691	M	C2	33-45
BAR	1695	F?	C3	33-45
BAR	1707	M	ABSENT	ABSENT
BAR	1723	M	ABSENT	ABSENT
BAR	1750	F	ABSENT	ABSENT
BAR	1756	M?	C3	33-45
BAR	1765	F	C2	33-45
BAR	1769	M	D	45+
BAR	1775	M	D	45+
BAR	1788	M	C3	33-45
BAR	1805	M	D	45+
BAR	1824	M	C2	33-45
BAR	1843	M	C2	33-45
BAR	1849	M	D	45+
BAR	1856	?	C1	33-45
BAR	1863	M	D	45+
BAR	1869	M?	C3	33-45

Site	Sk. No.	Sex	Stage	Est. Age
BAR	1871	M	C2	33-45
BAR	1875	F	C3/D	33-45+
BAR	1889	F?	B2	25-35
BAR	1892	F	C1	33-45
BAR	1897	M	C3	33-45
BAR	1910	M	D	45+
BAR	1911	M	C2	33-45
BAR	1920	M	C3	33-45
BAR	1922	M	C1	33-45
BAR	1926	M	D	45+
BAR	1993	M	D	45+
BAR	1995	M	C3	33-45
BAR	2027	M	D	45+
BAR	2064	F	ABSENT	ABSENT
BAR	2130	F	ABSENT	ABSENT
BAR	2142	F	C1	33-45
BAR	2176	F	C3/D	33-45+
BAR	2187	F	C3/D	33-45+
BAR	2193	M	ABSENT	ABSENT
BAR	2200	M	C2	33-45
BAR	2206	M	ABSENT	ABSENT
BAR	2216	F	D	45+
BAR	2219	M	C3/D	33-45+
BAR	2236	F	ABSENT	ABSENT
BAR	2244	M	ABSENT	ABSENT
BAR	2248	M	ABSENT	ABSENT
BAR	2251	M	D	45+
BAR	2259	F	A1	17-25
BAR	2274	M	D	45+
BAR	2283	F	D	45+
BAR	2284	F?	C3/D	33-45+
BAR	2289	M	ABSENT	ABSENT
BAR	2294	M	B3/C1	25-45
BAR	2297	F?	D	45+
BAR	2298	M	C3	33-45
BAR	2304	M	ABSENT	ABSENT
BAR	2309	M	C3	33-45
BAR	2320	M	C1	33-45
BAR	2327	M	ABSENT	ABSENT
BAR	2337	M	D	45+
BAR	2338	M	ABSENT	ABSENT
BAR	2345	M	ABSENT	ABSENT
BAR	2348	F	ABSENT	ABSENT
BAR	2356	F	D	45+
BAR	2376	M	D	45+
BAR	2386	F	D	45+
BAR	2408	F	D	45+
BAR	2411	F?	D	45+
BAR	2413	M?	D	45+
BAR	2428	F	C1	33-45
BAR	2436	F?	C2/D	33-45+
BAR	2451	M?	B3/C1	25-45
BAR	2452	M	ABSENT	ABSENT
BAR	2457	F	D	45+
BAR	2465	F	C3	33-45
BAR	2466	M	D	45+

Site	Sk. No.	Sex	Stage	Est. Age
BAR	2469	M	ABSENT	ABSENT
BAR	2471	M	D	45+
BAR	2485	M	C3/D	33-45+
BAR	2491	M?	C3	33-45
BAR	2495	M	ABSENT	ABSENT
BAR	2499	M	C3/D	33-45+
BAR	2503	F	ABSENT	ABSENT
BAR	2514	M	D	45+
BAR	2520	F?	C3/D	33-45+
BAR	2583	M	D	45+
BAR	2603	M	C3	33-45
BAR	2612	M	D	45+
BAR	2616	?	ABSENT	ABSENT
BAR	2666	F?	ABSENT	ABSENT
BAR	2684	M	B2	25-35
BAR	2700	M	D	45+
BAR	2714	M	D	45+
BAR	2718	F	C3	33-45
BAR	2720	M	B2	25-35
BAR	2721	M	ABSENT	ABSENT
BAR	2722	F	ABSENT	ABSENT
BAR	2727	F	D	45+
BAR	2730	M	C2	33-45
BAR	2731	M	ABSENT	ABSENT
BAR	2732	F	D	45+
BAR	2739	M	B1	25-35
BAR	2751	F	D	45+
BAR	2758	M	C2/3	33-45
BAR	2766	F	ABSENT	ABSENT
BAR	2775	F	D	45+
BAR	2780	F	ABSENT	ABSENT
BAR	2783	M	ABSENT	ABSENT
BAR	2784	M	D	45+
BAR	2786	M	C2	33-45
BAR	2798	M?	D	45+
BAR	2799	M	C2	33-45
FGH	1021	M?	C3	33-45
FGH	1037	F	ABSENT	ABSENT
FGH	1047	F	B2	25-35
FGH	1049	F?	B1	25-35
FGH	1051	M	C3	33-45
FGH	1053	F?	ABSENT	ABSENT
FGH	1057	F	C3	33-45
FGH	1063	M	C3	33-45
FGH	1075	M	D	45+
FGH	1079	F	ABSENT	ABSENT
FGH	1081	M?	C2	33-45
FGH	1091	F?	B3	25-35
FGH	1097	F?	B2	25-35
FGH	1099	F?	ABSENT	ABSENT
FGH	1101	F	C3	33-45
FGH	1104	F	ABSENT	ABSENT
FGH	1110	F	D	45+
FGH	1113	M	B1	25-35
FGH	1115	F	C2	33-45
FGH	1117	M	C3	33-45

Site	Sk. No.	Sex	Stage	Est. Age
FGH	1130	M	C3	33-45
FGH	1139	M?	D	45+
FGH	1147	M	B1	25-35
FGH	1150	F	ABSENT	ABSENT
FGH	1163	M?	B1	25-35
FGH	1171	M?	C3	33-45
FGH	1180	F	ABSENT	ABSENT
FGH	1184	M	C3	33-45
FGH	1188	M	C3	33-45
FGH	1190	F	ABSENT	ABSENT
FGH	1208	F?	C2	33-45
FGH	1228	M	C3	33-45
FGH	1230	F?	C3	33-45
FGH	1237	M?	ABSENT	ABSENT
FGH	1255	F?	ABSENT	ABSENT
FGH	1257	F	ABSENT	ABSENT
FGH	1280	M?	C3	33-45
FGH	1284	F?	C2	33-45
FGH	1286	F	C1	33-45
FGH	1297	F?	C2	33-45
FGH	1305	F?	C1/2	33-45
FGH	1312	F	A1	17-25
FGH	1313	M?	C2	33-45
FGH	1327	M?	C2	33-45
FGH	1354	M	ABSENT	ABSENT
FGH	1385	M	D	45+
FGH	1391	F	ABSENT	ABSENT
FGH	1412	M	C2	33-45
FGH	1441	M?	C3	33-45
FGH	1455	F	ABSENT	ABSENT
FGH	1469	F	C3	33-45
FGH	1471	F	ABSENT	ABSENT
FGH	1484	F	C3	33-45
FGH	1486	M	C1	33-45
FGH	1521	F	ABSENT	ABSENT
FGH	1525	F?	B1	25-35
FGH	1553	M?	C2	33-45
FGH	1560	M?	C1/2	33-45
FGH	1569	F?	C3	33-45
FGH	1579	F?	C2	33-45
FGH	1581	F?	D	45+
FGH	1583	M	B1	25-35
FGH	1589	F	ABSENT	ABSENT
FGH	1597	F	ABSENT	ABSENT
SHOW	5010a	F	ABSENT	ABSENT
SHOW	5066	M	D	45+
SHOW	5091	F	C3/D	33-45+
SHOW	5098	F	B3	25-35
SHOW	5103	F	ABSENT	ABSENT
SHOW	5105	F	D	45+
SHOW	5110	F	D	45+
SHOW	5123	F	D	45+
SHOW	5159	M	ABSENT	ABSENT
SHOW	5172	M	D	45+
SHOW	5173	M	D	45+
SHOW	5186	M?	D	45+

Site	Sk. No.	Sex	Stage	Est. Age
SHOW	5190	F	D	45+
SHOW	5203	M	C3/D	33-45+
SHOW	5204	M	C3	33-45
SHOW	5207	M	D	45+
SHOW	5208	M?	C3/D	33-45+
SHOW	5211	F	C1	33-45
SHOW	5218	F?	C3/D	33-45+
SHOW	5222	M	B1	25-35
SHOW	5225	F	B3	25-35
SHOW	5228	F?	D	45+
SHOW	5233	M	B3/D	25-45+
SHOW	5237	M	D	45+
SHOW	5241	F	B1	25-35
SHOW	5243	M	C3	33-45
SHOW	5244	M?	C1	33-45
SHOW	5254	F	D	45+
SHOW	5258	F	ABSENT	ABSENT
SHOW	5267	F	D	45+
SHOW	5269	M	D	45+
SHOW	5270	F?	B3	25-35
SHOW	5283	M	ABSENT	ABSENT
SHOW	5290	F?	ABSENT	ABSENT
SHOW	5292	F	ABSENT	ABSENT
SHOW	5298	F	C3/D	33-45+
SHOW	5302	F	ABSENT	ABSENT
SHOW	5311	F?	C3	33-45
SHOW	5316	F?	B2	25-35
SHOW	5320	F	ABSENT	ABSENT
SHOW	5323	M	ABSENT	ABSENT
SHOW	5329	M	B3	25-35
SHOW	5347	M	D	45+
SHOW	5350	F	D	45+
SHOW	5364	F	ABSENT	ABSENT
SHOW	5384	M	C3	33-45
SHOW	5393	F	D	45+
SHOW	5402	M	D	45+
SHOW	5415	F	C2	33-45
SHOW	5421	M?	D	45+
SHOW	5438	M	C3/D	33-45+
SHOW	5445	M	B2	25-35
SHOW	5451	M	D	45+
SHOW	5453	M	C1	33-45
SHOW	5457	M	C3	33-45
SHOW	5461	M?	D	45+
SHOW	5463	M?	C1/D	33-45+
SHOW	5475	M?	D	45+
SHOW	5488	F	C3/D	33-45+
SHOW	5492	F	C1	33-45
SHOW	5494	F	B3	25-35
SHOW	5501	F	C3/D	33-45+
SHOW	5507	F?	C3/D	33-45+
SHOW	5508	F	D	45+
SHOW	5529	F	D	45+
SHOW	5534	F	D	45+
SHOW	5539	M	C2	33-45
SHOW	5544	M	C3	33-45

Site	Sk. No.	Sex	Stage	Est. Age
SHOW	5562	F	ABSENT	ABSENT
SHOW	5563	M	D	45+
SHOW	5588	F	A3	17-25
SHOW	5601	F	D	45+
SHOW	5603	M	B1	25-35
SHOW	5617	M	B3/D	25-45+
SHOW	5632	F	D	45+
SHOW	5644	M	D	45+
SHOW	5657	F	B1	25-35
SHOW	5671	M	D	45+
SHOW	5680	M	C3/D	33-45+
SHOW	5699	F	A2/D	17-45+
SHOW	5702	M	C3/D	33-45+
SHOW	5710	M	B3	25-35
SHOW	5740	F	A3	17-25
SHOW	5773	M	ABSENT	ABSENT
SHOW	5774	F	D	45+
SHOW	5794	M	D	45+
SHOW	5835	F	D	45+
SHOW	5845	M	D	45+
SHOW	5884	F	B2	25-35
SHOW	5909	F	D	45+
SHOW	5977	M?	C1/D	33-45+
SHOW	6003	F	C3/D	33-45+
SHOW	6026	M	A3	17-25
SHOW	6027	F	ABSENT	ABSENT
SHOW	6029	M	C2	33-45
SHOW	6030	F	D	45+
SHOW	6042	M	A3	17-25
SHOW	6043	F	ABSENT	ABSENT
SHOW	6048	M	ABSENT	ABSENT
SHOW	6060	M	C3/D	33-45+
SHOW	6070	F	ABSENT	ABSENT
SHOW	6072	M	ABSENT	ABSENT
SHOW	6074	F	D	45+
SHOW	6081	M	D	45+
SHOW	6082	F	B3	25-35
SHOW	6083	M	D	45+
SHOW	6088	M	ABSENT	ABSENT
SHOW	6093	F	D	45+
SHOW	6098	M	D	45+
SHOW	6103	M	D	45+
SHOW	6105	M	D	45+
WP	EE004	M?	ABSENT	ABSENT
WP	EE013	M	ABSENT	ABSENT
WP	EE015	F	D	45+
WP	EE019	F	C3	33-45
WP	EE022	F	B3/C1	25-45
WP	EE024	M?	B3/C1	25-45
WP	EE025	M?	C2	33-45
WP	EE026	M	C3	33-45
WP	EE037	M	C3+	33-45
WP	EE056	F	C1	33-45
WP	EE062	M	B2	25-35
WP	EE070	F	C2	33-45
WP	EE079	M?	ABSENT	ABSENT

Site	Sk. No.	Sex	Stage	Est. Age
WP	EE080	M	B3	25-35
WP	EE089	M	ABSENT	ABSENT
WP	EE097	F?	D	45+
WP	EE098	M?	ABSENT	ABSENT
WP	EE099	F	B3/C1	25-45
WP	G251	F	ABSENT	ABSENT
WP	G265	M	C2	33-45
WP	G278	M?	ABSENT	ABSENT
WP	G279	M?	C3	33-45
WP	G296	F?	C2	33-45
WP	G297	M?	C3	33-45
WP	G303	M	B1	25-35
WP	G310	M	B3/C1	25-45
WP	G361	F?	C2	33-45
WP	G377	F?	C3	33-45
WP	G379	M	C3	33-45
WP	G381	M?	C3	33-45
WP	G385	F?	C3	33-45
WP	G406	M?	B1	25-35
WP	G411	M	C1	33-45
WP	G419	F?	C1	33-45
WP	G451	F	ABSENT	ABSENT
WP	G474	F	C1	33-45
WP	G482	M	C3+ / D	45+
WP	G516	M	B3/C1	25-45
WP	G561	M	D	45+
WP	G565	M?	ABSENT	ABSENT
WP	G571	F?	C1	33-45
WP	G587	M?	C1	33-45
WP	G601	M?	C2	33-45
WP	G607	M	ABSENT	ABSENT
WP	G628	F?	B3	25-35
WP	NA046	M	B1/D	25-45+
WP	NA047	F	B3/C1	25-45
WP	NA059	F?	B3/C1	25-45
WP	NA075	M?	ABSENT	ABSENT
WP	NA078	M?	ABSENT	ABSENT
WP	NA080	M	C1	33-45
WP	NA084	F	ABSENT	ABSENT
WP	NA088	F	C3	33-45
WP	NA100	F	C2	33-45
WP	NA166	M	ABSENT	ABSENT
WP	NA168	F	C3	33-45
WP	NA171	M?	C2	33-45
WP	NA181	M?	B1/D	25-45+
WP	NA183	M	ABSENT	ABSENT
WP	NA190	M?	B3/C1	25-45
WP	NA197	M	B1/D	25-45+
WP	NA199	M	D	45+
WP	NA202	F	D	45+
WP	NA203	F	ABSENT	ABSENT
WP	NA217	M	ABSENT	ABSENT
WP	NA218	M	C3	33-45
WP	NA224	M	ABSENT	ABSENT
WP	NA233	F	ABSENT	ABSENT
WP	NA234	M	ABSENT	ABSENT

Site	Sk. No.	Sex	Stage	Est. Age
WP	SA003	M?	C3/D	33-45+
WP	SA012	M	B1/2	25-35
WP	SA013	F?	B2	25-35
WP	SA015	M	D	45+
WP	SA021	M	D	45+
WP	SA033	M?	ABSENT	ABSENT
WP	SA034	M	C3/D	33-45+
WP	SA047	F?	B3/C1	25-45
WP	SA050	F	ABSENT	ABSENT
WP	SA052	M?	C2/D	33-45+
WP	SA053	F?	D	45+
WP	SA054	F	ABSENT	ABSENT
WP	SA056	M?	D	45+
WP	V11	M?	B2	25-35
WP	V14	F?	ABSENT	ABSENT
WP	V15	M?	B3/C1	25-45
WP	V18	M?	B1/C2	25-45
WP	V19	M?	ABSENT	ABSENT
WP	V26	F	D	45+
WP	V27	M?	C2	33-45
WP	V29	F	ABSENT	ABSENT
WP	V33	F	ABSENT	ABSENT
WP	V38	M?	D	45+
WP	V39	M	ABSENT	ABSENT
WP	V40	M	ABSENT	ABSENT
WP	V45	M?	B1/D	25-45+
WP	V46	F	B1/D	25-45+
WP	V51	M?	C2/D	33-45+
WP	V61	F	C2	33-45
WP	WCO009	F	ABSENT	ABSENT
WP	WCO012	M?	ABSENT	ABSENT
WP	WCO013	F?	C3	33-45
WP	WCO015	M	C1	33-45
WP	WCO017	F?	C1	33-45
WP	WCO018	M	ABSENT	ABSENT
WP	WCO022	F	D	45+
WP	WCO026	F?	C3	33-45
WP	WCO028	F	C2	33-45
WP	WCO029	F	C3/D	33-45+
WP	WCO036	F	ABSENT	ABSENT
WP	WCO037	M?	D	45+
WP	WCO041	M	ABSENT	ABSENT
WP	WCO045	F?	D	45+
WP	WCO056	F	B3	25-35
WP	WCO057	M?	D	45+
WP	WCO059	M?	D	45+
WP	WCO109	F	D	45+
WP	WCO115	M?	ABSENT	ABSENT
WP	WCO117	M	C2/D	33-45+
WP	WCO124	F	B1/D	25-45+
WP	WCO130	F	D	45+
WP	WCO131	M?	D	45+
WP	WCO137	M?	D	45+
WP	WCO142	M?	ABSENT	ABSENT
WP	WCO146	M	D	45+
WP	WCO153	M?	ABSENT	ABSENT

Site	Sk. No.	Sex	Stage	Est. Age
WP	WCO162	F?	C2/D	33-45+
WP	WCO164A	M	ABSENT	ABSENT
WP	WCO165	F?	C2	33-45
WP	WCO165A	M	ABSENT	ABSENT
WP	WCO167	F	ABSENT	ABSENT
WP	WCO169	M	ABSENT	ABSENT
WP	WCO170	F	D	45+
WP	WCO173	F	C3	33-45
WP	WCO179	F?	ABSENT	ABSENT
WP	WCO184	F	C3	33-45

WP	WCO187	F	ABSENT	ABSENT
WP	WCO199	F	C3	33-45
WP	WCO200	M?	C3	33-45
WP	WCO203	M?	ABSENT	ABSENT
WP	WCO204	F	D	45+

Appendix 3 – Dens facet (C1)

Raw data from age estimation using the dens facet of the atlas (Falys, 2012).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	7	F	3	3	1	7	73-76	75.1
BAR	18	F	1	2	1	4	62-65	63.9
BAR	99	M	1	1	1	3	51-57	54.4
BAR	126	M	A	A	A	0	A	A
BAR	127	M?	A	A	A	0	A	A
BAR	128	M	2	1	1	4	62-65	63.9
BAR	132	M?	1	3	1	5	62-65	63.9
BAR	179	M	1	3	1	5	62-65	63.9
BAR	187	F	A	A	A	0	A	A
BAR	204	F	1	2	1	4	62-65	63.9
BAR	208	M	A	A	A	0	A	A
BAR	241	M	1	1	1	3	51-57	54.4
BAR	266	M	A	A	A	0	A	A
BAR	269	M	1	3	2	6	73-76	75.1
BAR	272	M	1	3	1	5	62-65	63.9
BAR	276	F	A	A	A	0	A	A
BAR	308	M	1	2	1	4	62-65	63.9
BAR	309	F	3	3	2	8	73-76	75.1
BAR	311	F?	1	1	1	3	51-57	54.4
BAR	326	F	A	A	A	0	A	A
BAR	327	M	1	2	1	4	62-65	63.9
BAR	363	M	2	3	2	7	73-76	75.1
BAR	380	?	A	A	A	0	A	A
BAR	425	M	2	3	2	7	73-76	75.1
BAR	427	M	1	1	1	3	51-57	54.4
BAR	428	F	1	2	1	4	62-65	63.9
BAR	431	F	1	1	1	3	51-57	54.4
BAR	446	M	1	2	1	4	62-65	63.9
BAR	488	M	A	A	A	0	A	A
BAR	499	F	A	A	A	0	A	A
BAR	513	F?	A	A	A	0	A	A
BAR	539	F	2	3	1	6	73-76	75.1
BAR	548	M?	A	A	A	0	A	A
BAR	550	F	1	2	1	4	62-65	63.9
BAR	552	F	1	2	1	4	62-65	63.9
BAR	558	M?	1	2	1	4	62-65	63.9
BAR	578	F?	1	1	1	3	51-57	54.4
BAR	582	M	1	3	1	5	62-65	63.9
BAR	588	M	A	A	A	0	A	A
BAR	591	M?	A	A	A	0	A	A

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	594	M?	A	A	A	0	A	A
BAR	597	M	2	3	1	6	73-76	75.1
BAR	598	M	1	3	1	5	62-65	63.9
BAR	605	M	A	A	A	0	A	A
BAR	606	F	A	A	A	0	A	A
BAR	607	F	1	1	1	3	51-57	54.4
BAR	613	F	A	A	A	0	A	A
BAR	619	M	3	3	2	8	73-76	75.1
BAR	624	M	2	3	1	6	73-76	75.1
BAR	650	M	2	3	2	7	73-76	75.1
BAR	675	F	A	A	A	0	A	A
BAR	706	M	A	A	A	0	A	A
BAR	717	F	A	A	A	0	A	A
BAR	737	M	A	A	A	0	A	A
BAR	748	F	2	3	1	6	73-76	75.1
BAR	749	F	A	A	A	0	A	A
BAR	750	F?	A	A	A	0	A	A
BAR	765	M	1	3	1	5	62-65	63.9
BAR	771	F	2	3	2	7	73-76	75.1
BAR	778	M	A	A	A	0	A	A
BAR	788	F	A	A	A	0	A	A
BAR	834	M	2	3	1	6	73-76	75.1
BAR	850	F	2	3	2	7	73-76	75.1
BAR	854	F	A	A	A	0	A	A
BAR	867	M	A	A	A	0	A	A
BAR	870	M	1	1	1	3	51-57	54.4
BAR	894	F?	A	A	A	0	A	A
BAR	918	M	A	A	A	0	A	A
BAR	947	M	1	2	1	4	62-65	63.9
BAR	948	F	1	2	1	4	62-65	63.9
BAR	950	M?	A	A	A	0	A	A
BAR	971	F	2	2	2	6	73-76	75.1
BAR	975	M?	1	2	1	4	62-65	63.9
BAR	976	M	2	2	1	5	62-65	63.9
BAR	981	M?	A	A	A	0	A	A
BAR	989	M	2	3	1	6	73-76	75.1
BAR	1015	M	1	2	1	4	62-65	63.9
BAR	1020	M	1	3	1	5	62-65	63.9
BAR	1022	M	1	2	1	4	62-65	63.9
BAR	1028	F	1	2	1	4	62-65	63.9
BAR	1030	F?	A	A	A	0	A	A
BAR	1039	F	A	A	A	0	A	A
BAR	1043	M	1	2	1	4	62-65	63.9
BAR	1047	M	1	2	1	4	62-65	63.9
BAR	1049	F	A	A	A	0	A	A
BAR	1062	F	A	A	A	0	A	A
BAR	1063	M	2	2	2	6	73-76	75.1
BAR	1064	F	A	A	A	0	A	A
BAR	1068	F	A	A	A	0	A	A
BAR	1071	F	1	2	1	4	62-65	63.9
BAR	1085	M?	A	A	A	0	A	A
BAR	1096	F	A	A	A	0	A	A
BAR	1100	M	1	2	1	4	62-65	63.9
BAR	1103	M	1	3	1	5	62-65	63.9
BAR	1104	M	A	A	A	0	A	A
BAR	1106	M	1	2	1	4	62-65	63.9

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	1120	F	2	2	1	5	62-65	63.9
BAR	1122	M	A	A	A	0	A	A
BAR	1133	F	A	A	A	0	A	A
BAR	1134	M	A	A	A	0	A	A
BAR	1139	M	2	3	1	6	73-76	75.1
BAR	1144	F	2	3	1	6	73-76	75.1
BAR	1146	M?	A	A	A	0	A	A
BAR	1148	F	A	A	A	0	A	A
BAR	1149	M	1	2	1	4	62-65	63.9
BAR	1151	F	1	3	2	6	73-76	75.1
BAR	1162	M	A	A	A	0	A	A
BAR	1169	M	A	A	A	0	A	A
BAR	1176	M	2	3	1	6	73-76	75.1
BAR	1183	M?	A	A	A	0	A	A
BAR	1197	F	1	1	1	3	51-57	54.4
BAR	1202	F	A	A	A	0	A	A
BAR	1204	M	1	3	2	6	73-76	75.1
BAR	1214	M	2	3	1	6	73-76	75.1
BAR	1220	F?	1	2	1	4	62-65	63.9
BAR	1235	F	1	3	1	5	62-65	63.9
BAR	1236	F	A	A	A	0	A	A
BAR	1251	M	1	2	1	4	62-65	63.9
BAR	1254	F	2	3	1	6	73-76	75.1
BAR	1255	F	A	A	A	0	A	A
BAR	1263	M?	A	A	A	0	A	A
BAR	1268	M	1	2	1	4	62-65	63.9
BAR	1291	M?	1	1	1	3	51-57	54.4
BAR	1297	M	2	2	1	5	62-65	63.9
BAR	1299	F?	1	2	1	4	62-65	63.9
BAR	1307	M	A	A	A	0	A	A
BAR	1315	M	A	A	A	0	A	A
BAR	1316	M	1	1	1	3	51-57	54.4
BAR	1324	M	1	2	1	4	62-65	63.9
BAR	1409	M?	1	3	1	5	62-65	63.9
BAR	1438	M	A	A	A	0	A	A
BAR	1498	F	A	A	A	0	A	A
BAR	1538	F	A	A	A	0	A	A
BAR	1542	F	A	A	A	0	A	A
BAR	1548	M	1	2	1	4	62-65	63.9
BAR	1556	M	A	A	A	0	A	A
BAR	1566	M	A	A	A	0	A	A
BAR	1571	F	A	A	A	0	A	A
BAR	1615	M	A	A	A	0	A	A
BAR	1655	F	A	A	A	0	A	A
BAR	1691	M	1	1	1	3	51-57	54.4
BAR	1695	F?	1	2	1	4	62-65	63.9
BAR	1707	M	A	A	A	0	A	A
BAR	1723	M	A	A	A	0	A	A
BAR	1750	F	A	A	A	0	A	A
BAR	1756	M?	A	A	A	0	A	A
BAR	1765	F	2	3	1	6	73-76	75.1
BAR	1769	M	A	A	A	0	A	A
BAR	1775	M	1	3	1	5	62-65	63.9
BAR	1788	M	A	A	A	0	A	A
BAR	1805	M	A	A	A	0	A	A
BAR	1824	M	2	3	2	7	73-76	75.1

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	1843	M	1	2	1	4	62-65	63.9
BAR	1849	M	1	1	1	3	51-57	54.4
BAR	1856	?	A	A	A	0	A	A
BAR	1863	M	2	2	1	5	62-65	63.9
BAR	1869	M?	1	3	2	6	73-76	75.1
BAR	1871	M	A	A	A	0	A	A
BAR	1875	F	1	2	1	4	62-65	63.9
BAR	1889	F?	3	1	1	5	62-65	63.9
BAR	1892	F	1	2	1	4	62-65	63.9
BAR	1897	M	1	2	1	4	62-65	63.9
BAR	1910	M	1	1	1	3	51-57	54.4
BAR	1911	M	A	A	A	0	A	A
BAR	1920	M	2	3	2	7	73-76	75.1
BAR	1922	M	1	3	1	5	62-65	63.9
BAR	1926	M	1	2	1	4	62-65	63.9
BAR	1993	M	1	3	1	5	62-65	63.9
BAR	1995	M	1	2	1	4	62-65	63.9
BAR	2027	M	A	A	A	0	A	A
BAR	2064	F	A	A	A	0	A	A
BAR	2130	F	A	A	A	0	A	A
BAR	2142	F	A	A	A	0	A	A
BAR	2176	F	1	2	1	4	62-65	63.9
BAR	2187	F	A	A	A	0	A	A
BAR	2193	M	1	2	1	4	62-65	63.9
BAR	2200	M	A	A	A	0	A	A
BAR	2206	M	A	A	A	0	A	A
BAR	2216	F	1	3	1	5	62-65	63.9
BAR	2219	M	1	2	1	4	62-65	63.9
BAR	2236	F	A	A	A	0	A	A
BAR	2244	M	A	A	A	0	A	A
BAR	2248	M	1	3	1	5	62-65	63.9
BAR	2251	M	1	2	1	4	62-65	63.9
BAR	2259	F	A	A	A	0	A	A
BAR	2274	M	2	2	1	5	62-65	63.9
BAR	2283	F	A	A	A	0	A	A
BAR	2284	F?	A	A	A	0	A	A
BAR	2289	M	1	1	1	3	51-57	54.4
BAR	2294	M	1	1	1	3	51-57	54.4
BAR	2297	F?	A	A	A	0	A	A
BAR	2298	M	1	3	1	5	62-65	63.9
BAR	2304	M	A	A	A	0	A	A
BAR	2309	M	2	3	2	7	73-76	75.1
BAR	2320	M	A	A	A	0	A	A
BAR	2327	M	A	A	A	0	A	A
BAR	2337	M	1	2	1	4	62-65	63.9
BAR	2338	M	A	A	A	0	A	A
BAR	2345	M	A	A	A	0	A	A
BAR	2348	F	A	A	A	0	A	A
BAR	2356	F	1	2	2	5	62-65	63.9
BAR	2376	M	1	1	1	3	51-57	54.4
BAR	2386	F	A	A	A	0	A	A
BAR	2408	F	A	A	A	0	A	A
BAR	2411	F?	1	3	1	5	62-65	63.9
BAR	2413	M?	1	3	1	5	62-65	63.9
BAR	2428	F	1	2	1	4	62-65	63.9
BAR	2436	F?	A	A	A	0	A	A

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	2451	M?	1	2	1	4	62-65	63.9
BAR	2452	M	A	A	A	0	A	A
BAR	2457	F	A	A	A	0	A	A
BAR	2465	F	1	3	1	5	62-65	63.9
BAR	2466	M	A	A	A	0	A	A
BAR	2469	M	A	A	A	0	A	A
BAR	2471	M	1	2	1	4	62-65	63.9
BAR	2485	M	A	A	A	0	A	A
BAR	2491	M?	A	A	A	0	A	A
BAR	2495	M	1	2	1	4	62-65	63.9
BAR	2499	M	1	3	1	5	62-65	63.9
BAR	2503	F	A	A	A	0	A	A
BAR	2514	M	A	A	A	0	A	A
BAR	2520	F?	1	2	1	4	62-65	63.9
BAR	2583	M	2	3	2	7	73-76	75.1
BAR	2603	M	A	A	A	0	A	A
BAR	2612	M	2	3	2	7	73-76	75.1
BAR	2616	?	A	A	A	0	A	A
BAR	2666	F?	A	A	A	0	A	A
BAR	2684	M	2	3	1	6	73-76	75.1
BAR	2700	M	A	A	A	0	A	A
BAR	2714	M	2	3	1	6	73-76	75.1
BAR	2718	F	1	1	1	3	51-57	54.4
BAR	2720	M	A	A	A	0	A	A
BAR	2721	M	A	A	A	0	A	A
BAR	2722	F	A	A	A	0	A	A
BAR	2727	F	1	1	1	3	51-57	54.4
BAR	2730	M	1	2	1	4	62-65	63.9
BAR	2731	M	A	A	A	0	A	A
BAR	2732	F	3	3	2	8	73-76	75.1
BAR	2739	M	1	1	1	3	51-57	54.4
BAR	2751	F	A	A	A	0	A	A
BAR	2758	M	A	A	A	0	A	A
BAR	2766	F	A	A	A	0	A	A
BAR	2775	F	1	3	1	5	62-65	63.9
BAR	2780	F	A	A	A	0	A	A
BAR	2783	M	A	A	A	0	A	A
BAR	2784	M	1	3	1	5	62-65	63.9
BAR	2786	M	A	A	A	0	A	A
BAR	2798	M?	1	2	1	4	62-65	63.9
BAR	2799	M	1	2	1	4	62-65	63.9
FGH	1021	M?	2	1	1	4	62-65	63.9
FGH	1037	F	A	A	A	A	A	A
FGH	1047	F	1	1	1	3	51-57	54.4
FGH	1049	F?	2	2	1	5	62-65	63.9
FGH	1051	M	2	2	1	5	62-65	63.9
FGH	1053	F?	A	A	A	A	A	A
FGH	1057	F	A	A	A	A	A	A
FGH	1063	M	A	A	A	A	A	A
FGH	1075	M	3	3	1	7	73-76	75.1
FGH	1079	F	1	1	1	3	51-57	54.4
FGH	1081	M?	1	1	1	3	51-57	54.4
FGH	1091	F?	A	A	A	A	A	A
FGH	1097	F?	2	2	1	5	62-65	63.9
FGH	1099	F?	A	A	A	A	A	A
FGH	1101	F	1	1	1	3	51-57	54.4

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
FGH	1104	F	A	A	A	A	A	A
FGH	1110	F	2	2	2	6	73-76	75.1
FGH	1113	M	1	1	1	3	51-57	54.4
FGH	1115	F	2	2	1	5	62-65	63.9
FGH	1117	M	A	A	A	0	A	A
FGH	1130	M	2	1	1	4	62-65	63.9
FGH	1139	M?	2	2	1	5	62-65	63.9
FGH	1147	M	1	1	1	3	51-57	54.4
FGH	1150	F	A	A	A	A	A	A
FGH	1163	M?	2	2	1	5	62-65	63.9
FGH	1171	M?	2	2	1	5	62-65	63.9
FGH	1180	F	A	A	A	A	A	A
FGH	1184	M	1	1	1	3	51-57	54.4
FGH	1188	M	2	2	1	5	62-65	63.9
FGH	1190	F	A	A	A	A	A	A
FGH	1208	F?	2	2	1	5	62-65	63.9
FGH	1228	M	2	2	1	5	62-65	63.9
FGH	1230	F?	2	2	1	5	62-65	63.9
FGH	1237	M?	A	A	A	A	A	A
FGH	1255	F?	A	A	A	A	A	A
FGH	1257	F	A	A	A	A	A	A
FGH	1280	M?	2	2	1	5	62-65	63.9
FGH	1284	F?	A	A	A	A	A	A
FGH	1286	F	2	2	1	5	62-65	63.9
FGH	1297	F?	2	2	1	5	62-65	63.9
FGH	1305	F?	2	2	1	5	62-65	63.9
FGH	1312	F	1	2	1	4	62-65	63.9
FGH	1313	M?	2	2	1	5	62-65	63.9
FGH	1327	M?	2	2	1	5	62-65	63.9
FGH	1354	M	A	A	A	A	A	A
FGH	1385	M	2	2	1	5	62-65	63.9
FGH	1391	F	A	A	A	A	A	A
FGH	1412	M	2	2	1	5	62-65	63.9
FGH	1441	M?	2	2	1	5	62-65	63.9
FGH	1455	F	A	A	A	A	A	A
FGH	1469	F	A	A	A	0	A	A
FGH	1471	F	A	A	A	A	A	A
FGH	1484	F	3	2	1	6	73-76	75.1
FGH	1486	M	2	2	1	5	62-65	63.9
FGH	1521	F	A	A	A	A	A	A
FGH	1525	F?	2	2	1	5	62-65	63.9
FGH	1553	M?	2	2	1	5	62-65	63.9
FGH	1560	M?	2	2	1	5	62-65	63.9
FGH	1569	F?	0	0	0	0	A	A
FGH	1579	F?	2	2	1	5	62-65	63.9
FGH	1581	F?	2	2	1	5	62-65	63.9
FGH	1583	M	2	2	1	5	62-65	63.9
FGH	1589	F	A	A	A	A	A	A
FGH	1597	F	A	A	A	A	A	A
SHOW	5010a	F	1	1	1	3	51-57	54.4
SHOW	5066	M	1	2	1	4	62-65	63.9
SHOW	5091	F	1	1	1	3	51-57	54.4
SHOW	5098	F	2	2	1	5	62-65	63.9
SHOW	5103	F	2	3	1	6	73-76	75.1
SHOW	5105	F	2	1	1	4	62-65	63.9
SHOW	5110	F	1	2	1	4	62-65	63.9

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
SHOW	5123	F	1	1	1	3	51-57	54.4
SHOW	5159	M	A	A	A	0	A	A
SHOW	5172	M	A	A	A	0	A	A
SHOW	5173	M	1	2	1	4	62-65	63.9
SHOW	5186	M?	1	1	1	3	51-57	54.4
SHOW	5190	F	1	1	1	3	51-57	54.4
SHOW	5203	M	1	1	1	3	51-57	54.4
SHOW	5204	M	1	1	1	3	51-57	54.4
SHOW	5207	M	1	2	1	4	62-65	63.9
SHOW	5208	M?	2	3	1	6	73-76	75.1
SHOW	5211	F	1	2	1	4	62-65	63.9
SHOW	5218	F?	A	A	A	0	A	A
SHOW	5222	M	1	1	1	3	51-57	54.4
SHOW	5225	F	A	A	A	0	A	A
SHOW	5228	F?	2	2	1	5	62-65	63.9
SHOW	5233	M	1	1	1	3	51-57	54.4
SHOW	5237	M	1	2	1	4	62-65	63.9
SHOW	5241	F	A	A	A	0	A	A
SHOW	5243	M	1	2	1	4	62-65	63.9
SHOW	5244	M?	1	1	1	3	51-57	54.4
SHOW	5254	F	1	2	1	4	62-65	63.9
SHOW	5258	F	A	A	A	0	A	A
SHOW	5267	F	1	2	1	4	62-65	63.9
SHOW	5269	M	A	A	A	0	A	A
SHOW	5270	F?	1	2	1	4	62-65	63.9
SHOW	5283	M	A	A	A	0	A	A
SHOW	5290	F?	A	A	A	0	A	A
SHOW	5292	F	A	A	A	0	A	A
SHOW	5298	F	1	2	1	4	62-65	63.9
SHOW	5302	F	A	A	A	0	A	A
SHOW	5311	F?	1	3	1	5	62-65	63.9
SHOW	5316	F?	A	A	A	0	A	A
SHOW	5320	F	A	A	A	0	A	A
SHOW	5323	M	1	2	1	4	62-65	63.9
SHOW	5329	M	1	1	1	3	51-57	54.4
SHOW	5347	M	2	3	2	7	73-76	75.1
SHOW	5350	F	2	1	1	4	62-65	63.9
SHOW	5364	F	A	A	A	0	A	A
SHOW	5384	M	1	3	1	5	62-65	63.9
SHOW	5393	F	1	1	1	3	51-57	54.4
SHOW	5402	M	A	A	A	0	A	A
SHOW	5415	F	1	3	1	5	62-65	63.9
SHOW	5421	M?	1	2	1	4	62-65	63.9
SHOW	5438	M	1	3	1	5	62-65	63.9
SHOW	5445	M	1	2	1	4	62-65	63.9
SHOW	5451	M	1	2	2	5	62-65	63.9
SHOW	5453	M	A	A	A	0	A	A
SHOW	5457	M	A	A	A	0	A	A
SHOW	5461	M?	1	3	1	5	62-65	63.9
SHOW	5463	M?	1	1	1	3	51-57	54.4
SHOW	5475	M?	1	3	1	5	62-65	63.9
SHOW	5488	F	A	A	A	0	A	A
SHOW	5492	F	1	1	1	3	51-57	54.4
SHOW	5494	F	2	2	1	5	62-65	63.9
SHOW	5501	F	1	2	1	4	62-65	63.9
SHOW	5507	F?	1	1	1	3	51-57	54.4

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
SHOW	5508	F	1	2	1	4	62-65	63.9
SHOW	5529	F	2	3	1	6	73-76	75.1
SHOW	5534	F	1	1	1	3	51-57	54.4
SHOW	5539	M	1	2	1	4	62-65	63.9
SHOW	5544	M	A	A	A	0	A	A
SHOW	5562	F	1	2	1	4	62-65	63.9
SHOW	5563	M	1	1	1	3	51-57	54.4
SHOW	5588	F	1	2	1	4	62-65	63.9
SHOW	5601	F	1	2	1	4	62-65	63.9
SHOW	5603	M	1	1	1	3	51-57	54.4
SHOW	5617	M	1	2	1	4	62-65	63.9
SHOW	5632	F	2	2	1	5	62-65	63.9
SHOW	5644	M	1	2	1	4	62-65	63.9
SHOW	5657	F	1	1	1	3	51-57	54.4
SHOW	5671	M	1	2	1	4	62-65	63.9
SHOW	5680	M	1	3	1	5	62-65	63.9
SHOW	5699	F	2	3	1	6	73-76	75.1
SHOW	5702	M	A	A	A	0	A	A
SHOW	5710	M	1	2	1	4	62-65	63.9
SHOW	5740	F	A	A	A	0	A	A
SHOW	5773	M	1	2	1	4	62-65	63.9
SHOW	5774	F	1	3	1	5	62-65	63.9
SHOW	5794	M	1	2	1	4	62-65	63.9
SHOW	5835	F	A	A	A	0	A	A
SHOW	5845	M	A	A	A	0	A	A
SHOW	5884	F	1	2	1	4	62-65	63.9
SHOW	5909	F	A	A	A	0	A	A
SHOW	5977	M?	A	A	A	0	A	A
SHOW	6003	F	1	2	1	4	62-65	63.9
SHOW	6026	M	A	A	A	0	A	A
SHOW	6027	F	A	A	A	0	A	A
SHOW	6029	M	A	A	A	0	A	A
SHOW	6030	F	1	3	1	5	62-65	63.9
SHOW	6042	M	1	1	1	3	51-57	54.4
SHOW	6043	F	1	3	1	5	62-65	63.9
SHOW	6048	M	1	2	1	4	62-65	63.9
SHOW	6060	M	1	2	1	4	62-65	63.9
SHOW	6070	F	3	3	2	8	73-76	75.1
SHOW	6072	M	A	A	A	0	A	A
SHOW	6074	F	1	2	1	4	62-65	63.9
SHOW	6081	M	3	2	2	7	73-76	75.1
SHOW	6082	F	1	3	1	5	62-65	63.9
SHOW	6083	M	1	3	1	5	62-65	63.9
SHOW	6088	M	1	3	1	5	62-65	63.9
SHOW	6093	F	A	A	A	0	A	A
SHOW	6098	M	1	2	1	4	62-65	63.9
SHOW	6103	M	1	3	1	5	62-65	63.9
SHOW	6105	M	1	2	1	4	62-65	63.9
WP	EE004	M?	2	2	1	5	62-65	63.9
WP	EE013	M	A	A	A	0	A	A
WP	EE015	F	2	2	1	5	62-65	63.9
WP	EE019	F	A	A	A	0	A	A
WP	EE022	F	2	2	1	5	62-65	63.9
WP	EE024	M?	A	A	A	0	A	A
WP	EE025	M?	A	A	A	0	A	A
WP	EE026	M	2	2	1	5	62-65	63.9

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
WP	EE037	M	1	1	1	3	51-57	54.4
WP	EE056	F	A	A	A	0	A	A
WP	EE062	M	1	1	1	3	51-57	54.4
WP	EE070	F	2	2	1	5	62-65	63.9
WP	EE079	M?	A	A	A	0	A	A
WP	EE080	M	2	2	1	5	62-65	63.9
WP	EE089	M	2	2	1	5	62-65	63.9
WP	EE097	F?	2	2	1	5	62-65	63.9
WP	EE098	M?	A	A	A	0	A	A
WP	EE099	F	2	2	1	5	62-65	63.9
WP	G251	F	A	A	A	0	A	A
WP	G265	M	2	2	1	5	62-65	63.9
WP	G278	M?	2	2	1	5	62-65	63.9
WP	G279	M?	2	2	1	5	62-65	63.9
WP	G296	F?	2	2	1	5	62-65	63.9
WP	G297	M?	2	2	1	5	62-65	63.9
WP	G303	M	1	2	1	4	62-65	63.9
WP	G310	M	1	2	1	4	62-65	63.9
WP	G361	F?	2	1	1	4	62-65	63.9
WP	G377	F?	2	1	1	4	62-65	63.9
WP	G379	M	2	2	1	5	62-65	63.9
WP	G381	M?	2	2	1	5	62-65	63.9
WP	G385	F?	3	3	2	8	73-76	75.1
WP	G406	M?	2	1	1	4	62-65	63.9
WP	G411	M	2	1	1	4	62-65	63.9
WP	G419	F?	2	1	1	4	62-65	63.9
WP	G451	F	A	A	A	0	A	A
WP	G474	F	2	2	1	5	62-65	63.9
WP	G482	M	2	2	1	5	62-65	63.9
WP	G516	M	2	1	1	4	62-65	63.9
WP	G561	M	1	1	1	3	51-57	54.4
WP	G565	M?	A	A	A	0	A	A
WP	G571	F?	2	1	1	4	62-65	63.9
WP	G587	M?	2	1	1	4	62-65	63.9
WP	G601	M?	2	2	1	5	62-65	63.9
WP	G607	M	A	A	A	0	A	A
WP	G628	F?	2	1	1	4	62-65	63.9
WP	NA046	M	2	1	1	4	62-65	63.9
WP	NA047	F	1	1	1	3	51-57	54.4
WP	NA059	F?	1	1	1	3	51-57	54.4
WP	NA075	M?	1	1	1	3	51-57	54.4
WP	NA078	M?	A	A	A	0	A	A
WP	NA080	M	1	1	1	3	51-57	54.4
WP	NA084	F	2	2	1	5	62-65	63.9
WP	NA088	F	2	1	1	4	62-65	63.9
WP	NA100	F	2	2	1	5	62-65	63.9
WP	NA166	M	2	1	1	4	62-65	63.9
WP	NA168	F	1	1	1	3	51-57	54.4
WP	NA171	M?	1	1	1	3	51-57	54.4
WP	NA181	M?	2	1	1	4	62-65	63.9
WP	NA183	M	A	A	A	0	A	A
WP	NA190	M?	2	2	1	5	62-65	63.9
WP	NA197	M	1	2	1	4	62-65	63.9
WP	NA199	M	1	2	1	4	62-65	63.9
WP	NA202	F	3	2	1	6	73-76	75.1
WP	NA203	F	1	2	1	4	62-65	63.9

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
WP	NA217	M	2	3	2	7	73-76	75.1
WP	NA218	M	2	1	1	4	62-65	63.9
WP	NA224	M	A	A	A	0	A	A
WP	NA233	F	A	A	A	0	A	A
WP	NA234	M	A	A	A	0	A	A
WP	SA003	M?	2	2	1	5	62-65	63.9
WP	SA012	M	2	2	1	5	62-65	63.9
WP	SA013	F?	1	2	1	4	62-65	63.9
WP	SA015	M	1	1	1	3	51-57	54.4
WP	SA021	M	A	A	A	0	A	A
WP	SA033	M?	A	A	A	0	A	A
WP	SA034	M	1	1	1	3	51-57	54.4
WP	SA047	F?	1	1	1	3	51-57	54.4
WP	SA050	F	A	A	A	0	A	A
WP	SA052	M?	1	1	1	3	51-57	54.4
WP	SA053	F?	2	1	1	4	62-65	63.9
WP	SA054	F	A	A	A	0	A	A
WP	SA056	M?	1	1	1	3	51-57	54.4
WP	V11	M?	2	2	1	5	62-65	63.9
WP	V14	F?	A	A	A	0	A	A
WP	V15	M?	2	2	2	6	73-76	75.1
WP	V18	M?	1	2	1	4	62-65	63.9
WP	V19	M?	A	A	A	0	A	A
WP	V26	F	1	2	1	4	62-65	63.9
WP	V27	M?	1	2	1	4	62-65	63.9
WP	V29	F	A	A	A	0	A	A
WP	V33	F	2	1	1	4	62-65	63.9
WP	V38	M?	A	A	A	0	A	A
WP	V39	M	A	A	A	0	A	A
WP	V40	M	A	A	A	0	A	A
WP	V45	M?	2	1	1	4	62-65	63.9
WP	V46	F	2	2	1	5	62-65	63.9
WP	V51	M?	1	1	1	3	51-57	54.4
WP	V61	F	1	1	1	3	51-57	54.4
WP	WCO009	F	A	A	A	0	A	A
WP	WCO012	M?	A	A	A	0	A	A
WP	WCO013	F?	A	A	A	0	A	A
WP	WCO015	M	1	1	1	3	51-57	54.4
WP	WCO017	F?	2	3	1	6	73-76	75.1
WP	WCO018	M	A	A	A	0	A	A
WP	WCO022	F	1	2	1	4	62-65	63.9
WP	WCO026	F?	3	3	2	8	73-76	75.1
WP	WCO028	F	1	2	1	4	62-65	63.9
WP	WCO029	F	2	1	1	4	62-65	63.9
WP	WCO036	F	A	A	A	0	A	A
WP	WCO037	M?	1	1	1	3	51-57	54.4
WP	WCO041	M	A	A	A	0	A	A
WP	WCO045	F?	2	1	1	4	62-65	63.9
WP	WCO056	F	1	1	1	3	51-57	54.4
WP	WCO057	M?	A	A	A	0	A	A
WP	WCO059	M?	2	2	1	5	62-65	63.9
WP	WCO109	F	2	1	1	4	62-65	63.9
WP	WCO115	M?	2	2	1	5	62-65	63.9
WP	WCO117	M	1	2	1	4	62-65	63.9
WP	WCO124	F	2	2	1	5	62-65	63.9
WP	WCO130	F	1	1	1	3	51-57	54.4

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
WP	WCO131	M?	2	2	1	5	62-65	63.9
WP	WCO137	M?	A	A	A	0	A	A
WP	WCO142	M?	A	A	A	0	A	A
WP	WCO146	M	1	1	1	3	51-57	54.4
WP	WCO153	M?	A	A	A	0	A	A
WP	WCO162	F?	2	1	1	4	62-65	63.9
WP	WCO164A	M	A	A	A	0	A	A
WP	WCO165	F?	1	2	1	4	62-65	63.9
WP	WCO165A	M	A	A	A	0	A	A
WP	WCO167	F	A	A	A	0	A	A
WP	WCO169	M	A	A	A	0	A	A
WP	WCO170	F	3	3	1	7	73-76	75.1
WP	WCO173	F	1	1	1	3	51-57	54.4
WP	WCO179	F?	1	2	1	4	62-65	63.9
WP	WCO184	F	1	1	1	3	51-57	54.4
WP	WCO187	F	A	A	A	0	A	A
WP	WCO199	F	1	1	1	3	51-57	54.4
WP	WCO200	M?	2	1	1	4	62-65	63.9
WP	WCO203	M?	A	A	A	0	A	A
WP	WCO204	F	A	A	A	0	A	A

Appendix 4 – Dens process (C2)

Raw data from age estimation using the dens process of the axis (Falys, 2012).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	7	F	3	3	1	7	72-77	75.1
BAR	18	F	1	2	1	4	58-63	60.8
BAR	99	M	1	1	1	3	51-59	55.1
BAR	126	M	A	A	A	0	A	A
BAR	127	M?	1	2	1	4	61-66	63.6
BAR	128	M	A	A	A	0	A	A
BAR	132	M?	1	3	1	5	61-66	63.6
BAR	179	M	1	2	1	4	61-66	63.6
BAR	187	F	A	A	A	0	A	A
BAR	204	F	A	A	A	0	A	A
BAR	208	M	A	A	A	0	A	A
BAR	241	M	1	2	1	4	61-66	63.6
BAR	266	M	A	A	A	0	A	A
BAR	269	M	1	2	2	5	61-66	63.6
BAR	272	M	1	2	1	4	61-66	63.6
BAR	276	F	A	A	A	A	A	A
BAR	308	M	1	2	1	4	61-66	63.6
BAR	309	F	3	3	2	8	72-77	75.1
BAR	311	F?	1	1	1	3	58-63	60.8
BAR	326	F	1	2	1	4	58-63	60.8
BAR	327	M	1	2	1	4	61-66	63.6
BAR	363	M	2	3	2	7	72-76	74.5
BAR	380	?	A	A	A	0	A	A
BAR	425	M	2	2	2	6	72-76	74.5
BAR	427	M	1	1	1	3	51-59	55.1
BAR	428	F	1	2	1	4	58-63	60.8
BAR	431	F	1	2	1	4	58-63	60.8
BAR	446	M	A	A	A	0	A	A
BAR	488	M	A	A	A	0	A	A
BAR	499	F	A	A	A	0	A	A
BAR	513	F?	A	A	A	0	A	A
BAR	539	F	2	2	1	5	66-73	70
BAR	548	M?	A	A	A	0	A	A
BAR	550	F	1	2	1	4	58-63	60.8
BAR	552	F	1	2	1	4	58-63	60.8
BAR	558	M?	1	2	1	4	61-66	63.6
BAR	578	F?	A	A	A	0	A	A
BAR	582	M	2	3	1	6	72-76	74.5
BAR	588	M	A	A	A	0	A	A
BAR	591	M?	1	2	2	5	61-66	63.6
BAR	594	M?	1	2	1	4	61-66	63.6
BAR	597	M	1	2	1	4	61-66	63.6

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	598	M	1	2	1	4	61-66	63.6
BAR	605	M	A	A	A	0	A	A
BAR	606	F	A	A	A	0	A	A
BAR	607	F	1	1	1	3	58-63	60.8
BAR	613	F	A	A	A	0	A	A
BAR	619	M	3	3	2	8	72-76	74.5
BAR	624	M	1	3	1	5	61-66	63.6
BAR	650	M	2	3	2	7	72-76	74.5
BAR	675	F	1	1	1	3	58-63	60.8
BAR	706	M	A	A	A	0	A	A
BAR	717	F	A	A	A	0	A	A
BAR	737	M	A	A	A	0	A	A
BAR	748	F	1	2	1	4	58-63	60.8
BAR	749	F	A	A	A	0	A	A
BAR	750	F?	A	A	A	0	A	A
BAR	765	M	1	3	1	5	61-66	63.6
BAR	771	F	3	3	2	8	72-77	75.1
BAR	778	M	A	A	A	0	A	A
BAR	788	F	A	A	A	0	A	A
BAR	834	M	2	2	1	5	61-66	63.6
BAR	850	F	2	3	2	7	72-77	75.1
BAR	854	F	1	1	1	3	58-63	60.8
BAR	867	M	1	2	2	5	61-66	63.6
BAR	870	M	1	1	1	3	51-59	55.1
BAR	894	F?	A	A	A	0	A	A
BAR	918	M	A	A	A	0	A	A
BAR	947	M	1	1	1	3	51-59	55.1
BAR	948	F	1	1	1	3	58-63	60.8
BAR	950	M?	A	A	A	0	A	A
BAR	971	F	2	2	2	6	72-77	75.1
BAR	975	M?	1	1	1	3	51-59	55.1
BAR	976	M	A	A	A	0	A	A
BAR	981	M?	A	A	A	0	A	A
BAR	989	M	1	2	1	4	61-66	63.6
BAR	1015	M	1	1	1	3	51-59	55.1
BAR	1020	M	1	2	1	4	61-66	63.6
BAR	1022	M	1	2	1	4	61-66	63.6
BAR	1028	F	1	2	1	4	58-63	60.8
BAR	1030	F?	A	A	A	0	A	A
BAR	1039	F	A	A	A	0	A	A
BAR	1043	M	1	2	1	4	61-66	63.6
BAR	1047	M	1	2	1	4	61-66	63.6
BAR	1049	F	A	A	A	0	A	A
BAR	1062	F	A	A	A	0	A	A
BAR	1063	M	2	3	2	7	72-76	74.5
BAR	1064	F	A	A	A	0	A	A
BAR	1068	F	A	A	A	0	A	A
BAR	1071	F	1	1	1	3	58-63	60.8
BAR	1085	M?	A	A	A	0	A	A
BAR	1096	F	1	2	1	4	58-63	60.8
BAR	1100	M	1	3	1	5	61-66	63.6
BAR	1103	M	1	2	1	4	61-66	63.6
BAR	1104	M	1	2	1	4	61-66	63.6
BAR	1106	M	A	A	A	0	A	A
BAR	1120	F	1	2	1	4	58-63	60.8
BAR	1122	M	A	A	A	0	A	A
BAR	1133	F	A	A	A	0	A	A
BAR	1134	M	A	A	A	0	A	A
BAR	1139	M	2	3	1	6	72-76	74.5

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	1144	F	2	2	1	5	66-73	70
BAR	1146	M?	1	1	1	3	51-59	55.1
BAR	1148	F	A	A	A	0	A	A
BAR	1149	M	A	A	A	0	A	A
BAR	1151	F	1	3	2	6	72-77	75.1
BAR	1162	M	1	2	1	4	61-66	63.6
BAR	1169	M	1	2	1	4	61-66	63.6
BAR	1176	M	3	2	1	6	72-76	74.5
BAR	1183	M?	1	1	1	3	51-59	55.1
BAR	1197	F	1	1	1	3	58-63	60.8
BAR	1202	F	A	A	A	0	A	A
BAR	1204	M	1	2	2	5	61-66	63.6
BAR	1214	M	A	A	A	0	A	A
BAR	1220	F?	1	2	1	4	58-63	60.8
BAR	1235	F	1	2	1	4	58-63	60.8
BAR	1236	F	A	A	A	0	A	A
BAR	1251	M	1	2	1	4	61-66	63.6
BAR	1254	F	2	3	1	6	72-77	75.1
BAR	1255	F	A	A	A	0	A	A
BAR	1263	M?	A	A	A	0	A	A
BAR	1268	M	1	2	1	4	61-66	63.6
BAR	1291	M?	2	2	1	5	61-66	63.6
BAR	1297	M	1	2	1	4	61-66	63.6
BAR	1299	F?	1	2	1	4	58-63	60.8
BAR	1307	M	A	A	A	0	A	A
BAR	1315	M	A	A	A	0	A	A
BAR	1316	M	1	2	1	4	61-66	63.6
BAR	1324	M	1	2	1	4	61-66	63.6
BAR	1409	M?	2	3	1	6	72-76	74.5
BAR	1438	M	A	A	A	0	A	A
BAR	1498	F	A	A	A	0	A	A
BAR	1538	F	A	A	A	0	A	A
BAR	1542	F	1	2	1	4	58-63	60.8
BAR	1548	M	1	2	1	4	61-66	63.6
BAR	1556	M	A	A	A	0	A	A
BAR	1566	M	1	2	1	4	61-66	63.6
BAR	1571	F	A	A	A	0	A	A
BAR	1615	M	A	A	A	0	A	A
BAR	1655	F	A	A	A	0	A	A
BAR	1691	M	1	2	1	4	61-66	63.6
BAR	1695	F?	2	2	1	5	66-73	70
BAR	1707	M	A	A	A	0	A	A
BAR	1723	M	A	A	A	0	A	A
BAR	1750	F	A	A	A	0	A	A
BAR	1756	M?	1	2	1	4	61-66	63.6
BAR	1765	F	2	2	1	5	66-73	70
BAR	1769	M	A	A	A	0	A	A
BAR	1775	M	2	3	1	6	72-76	74.5
BAR	1788	M	A	A	A	0	A	A
BAR	1805	M	1	2	1	4	61-66	63.6
BAR	1824	M	2	3	2	7	72-76	74.5
BAR	1843	M	1	2	1	4	61-66	63.6
BAR	1849	M	1	1	1	3	51-59	55.1
BAR	1856	?	A	A	A	0	A	A
BAR	1863	M	1	2	1	4	61-66	63.6
BAR	1869	M?	2	3	2	7	72-76	74.5
BAR	1871	M	1	2	1	4	61-66	63.6
BAR	1875	F	1	2	1	4	58-63	60.8
BAR	1889	F?	1	1	1	3	58-63	60.8

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	1892	F	1	1	1	3	58-63	60.8
BAR	1897	M	A	A	A	0	A	A
BAR	1910	M	1	2	1	4	61-66	63.6
BAR	1911	M	1	2	1	4	61-66	63.6
BAR	1920	M	1	2	2	5	61-66	63.6
BAR	1922	M	1	3	1	5	61-66	63.6
BAR	1926	M	1	2	1	4	61-66	63.6
BAR	1993	M	A	A	A	0	A	A
BAR	1995	M	1	3	1	5	61-66	63.6
BAR	2027	M	1	3	1	5	61-66	63.6
BAR	2064	F	A	A	A	0	A	A
BAR	2130	F	A	A	A	0	A	A
BAR	2142	F	A	A	A	0	A	A
BAR	2176	F	1	2	1	4	58-63	60.8
BAR	2187	F	1	2	1	4	58-63	60.8
BAR	2193	M	1	1	1	3	51-59	55.1
BAR	2200	M	A	A	A	0	A	A
BAR	2206	M	A	A	A	0	A	A
BAR	2216	F	1	1	1	3	58-63	60.8
BAR	2219	M	1	2	1	4	61-66	63.6
BAR	2236	F	A	A	A	0	A	A
BAR	2244	M	A	A	A	0	A	A
BAR	2248	M	1	2	1	4	61-66	63.6
BAR	2251	M	1	2	1	4	61-66	63.6
BAR	2259	F	A	A	A	0	A	A
BAR	2274	M	1	2	1	4	61-66	63.6
BAR	2283	F	1	2	1	4	58-63	60.8
BAR	2284	F?	A	A	A	0	A	A
BAR	2289	M	A	A	A	0	A	A
BAR	2294	M	1	1	1	3	51-59	55.1
BAR	2297	F?	2	2	1	5	66-73	70
BAR	2298	M	1	3	1	5	61-66	63.6
BAR	2304	M	A	A	A	0	A	A
BAR	2309	M	2	2	2	6	72-76	74.5
BAR	2320	M	2	2	1	5	61-66	63.6
BAR	2327	M	A	A	A	0	A	A
BAR	2337	M	1	2	1	4	61-66	63.6
BAR	2338	M	A	A	A	0	A	A
BAR	2345	M	A	A	A	0	A	A
BAR	2348	F	A	A	A	0	A	A
BAR	2356	F	2	2	1	5	66-73	70
BAR	2376	M	1	2	1	4	61-66	63.6
BAR	2386	F	2	3	2	7	72-77	75.1
BAR	2408	F	A	A	A	0	A	A
BAR	2411	F?	1	2	1	4	58-63	60.8
BAR	2413	M?	1	2	1	4	61-66	63.6
BAR	2428	F	2	2	1	5	66-73	70
BAR	2436	F?	1	3	1	5	66-73	70
BAR	2451	M?	A	A	A	0	A	A
BAR	2452	M	A	A	A	0	A	A
BAR	2457	F	A	A	A	0	A	A
BAR	2465	F	1	2	1	4	58-63	60.8
BAR	2466	M	1	2	1	4	61-66	63.6
BAR	2469	M	A	A	A	0	A	A
BAR	2471	M	A	A	A	0	A	A
BAR	2485	M	1	2	1	4	61-66	63.6
BAR	2491	M?	A	A	A	0	A	A
BAR	2495	M	3	3	1	7	72-76	74.5
BAR	2499	M	2	3	1	6	72-76	74.5

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
BAR	2503	F	1	2	1	4	58-63	60.8
BAR	2514	M	1	2	1	4	61-66	63.6
BAR	2520	F?	1	2	1	4	58-63	60.8
BAR	2583	M	2	2	2	6	72-76	74.5
BAR	2603	M	A	A	A	0	A	A
BAR	2612	M	2	3	2	7	72-76	74.5
BAR	2616	?	A	A	A	0	A	A
BAR	2666	F?	A	A	A	0	A	A
BAR	2684	M	2	3	1	6	72-76	74.5
BAR	2700	M	1	2	1	4	61-66	63.6
BAR	2714	M	1	2	1	4	61-66	63.6
BAR	2718	F	1	1	1	3	58-63	60.8
BAR	2720	M	A	A	A	0	A	A
BAR	2721	M	A	A	A	0	A	A
BAR	2722	F	A	A	A	0	A	A
BAR	2727	F	2	2	1	5	66-73	70
BAR	2730	M	1	2	1	4	61-66	63.6
BAR	2731	M	A	A	A	0	A	A
BAR	2732	F	3	3	2	8	72-77	75.1
BAR	2739	M	1	1	1	3	51-59	55.1
BAR	2751	F	1	2	1	4	58-63	60.8
BAR	2758	M	A	A	A	0	A	A
BAR	2766	F	A	A	A	0	A	A
BAR	2775	F	2	3	1	6	72-77	75.1
BAR	2780	F	A	A	A	0	A	A
BAR	2783	M	A	A	A	0	A	A
BAR	2784	M	2	3	1	6	72-76	74.5
BAR	2786	M	1	1	1	3	51-59	55.1
BAR	2798	M?	A	A	A	0	A	A
BAR	2799	M	1	2	1	4	61-66	63.6
FGH	1021	M?	2	1	1	4	61-66	63.6
FGH	1037	F	A	A	A	0	A	A
FGH	1047	F	1	1	1	3	58-63	60.8
FGH	1049	F?	2	2	1	5	66-73	70
FGH	1051	M	2	2	1	5	61-66	63.6
FGH	1053	F?	A	A	A	0	A	A
FGH	1057	F	1	2	1	4	58-63	60.8
FGH	1063	M	1	2	1	4	61-66	63.6
FGH	1075	M	3	3	2	8	72-76	74.5
FGH	1079	F	A	A	A	0	A	A
FGH	1081	M?	1	2	1	4	61-66	63.6
FGH	1091	F?	A	A	A	0	A	A
FGH	1097	F?	2	2	1	5	66-73	70
FGH	1099	F?	A	A	A	0	A	A
FGH	1101	F	1	1	1	3	58-63	60.8
FGH	1104	F	A	A	A	0	A	A
FGH	1110	F	A	A	A	0	A	A
FGH	1113	M	1	1	1	3	51-59	55.1
FGH	1115	F	2	2	1	5	66-73	70
FGH	1117	M	1	1	1	3	51-59	55.1
FGH	1130	M	2	1	1	4	61-66	63.6
FGH	1139	M?	2	2	2	6	72-76	74.5
FGH	1147	M	1	1	1	3	51-59	55.1
FGH	1150	F	A	A	A	0	A	A
FGH	1163	M?	2	2	1	5	61-66	63.6
FGH	1171	M?	2	2	1	5	61-66	63.6
FGH	1180	F	A	A	A	0	A	A
FGH	1184	M	1	1	1	3	51-59	55.1
FGH	1188	M	2	2	1	5	61-66	63.6

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
FGH	1190	F	A	A	A	0	A	A
FGH	1208	F?	2	2	1	5	66-73	70
FGH	1228	M	3	3	2	8	72-76	74.5
FGH	1230	F?	2	2	1	5	66-73	70
FGH	1237	M?	A	A	A	0	A	A
FGH	1255	F?	A	A	A	0	A	A
FGH	1257	F	A	A	A	0	A	A
FGH	1280	M?	2	2	1	5	61-66	63.6
FGH	1284	F?	A	A	A	0	A	A
FGH	1286	F	2	2	1	5	66-73	70
FGH	1297	F?	2	3	2	7	72-77	75.1
FGH	1305	F?	2	2	1	5	66-73	70
FGH	1312	F	2	2	1	5	66-73	70
FGH	1313	M?	2	2	1	5	61-66	63.6
FGH	1327	M?	2	2	1	5	61-66	63.6
FGH	1354	M	A	A	A	0	A	A
FGH	1385	M	3	3	1	7	72-76	74.5
FGH	1391	F	A	A	A	0	A	A
FGH	1412	M	2	2	1	5	61-66	63.6
FGH	1441	M?	2	3	1	6	72-76	74.5
FGH	1455	F	A	A	A	0	A	A
FGH	1469	F	1	2	1	4	58-63	60.8
FGH	1471	F	A	A	A	0	A	A
FGH	1484	F	3	2	2	7	72-77	75.1
FGH	1486	M	2	2	1	5	61-66	63.6
FGH	1521	F	A	A	A	0	A	A
FGH	1525	F?	2	2	1	5	66-73	70
FGH	1553	M?	2	2	1	5	61-66	63.6
FGH	1560	M?	2	2	1	5	61-66	63.6
FGH	1569	F?	1	2	2	5	66-73	70
FGH	1579	F?	2	2	1	5	66-73	70
FGH	1581	F?	2	2	1	5	66-73	70
FGH	1583	M	2	2	1	5	61-66	63.6
FGH	1589	F	A	A	A	0	A	A
FGH	1597	F	2	2	1	5	66-73	70
SHOW	5010a	F	1	1	1	3	58-63	60.8
SHOW	5066	M	1	2	1	4	61-66	63.6
SHOW	5091	F	1	1	1	3	58-63	60.8
SHOW	5098	F	A	A	A	0	A	A
SHOW	5103	F	2	3	1	6	72-77	75.1
SHOW	5105	F	3	3	2	8	72-77	75.1
SHOW	5110	F	4	4	1	9	72-77	75.1
SHOW	5123	F	3	2	1	6	72-77	75.1
SHOW	5159	M	A	A	A	0	A	A
SHOW	5172	M	A	A	A	0	A	A
SHOW	5173	M	2	2	1	5	61-66	63.6
SHOW	5186	M?	2	2	1	5	61-66	63.6
SHOW	5190	F	1	1	1	3	58-63	60.8
SHOW	5203	M	2	2	1	5	61-66	63.6
SHOW	5204	M	1	2	1	4	61-66	63.6
SHOW	5207	M	2	2	1	5	61-66	63.6
SHOW	5208	M?	2	2	1	5	61-66	63.6
SHOW	5211	F	1	1	1	3	58-63	60.8
SHOW	5218	F?	A	A	A	0	A	A
SHOW	5222	M	1	2	1	4	61-66	63.6
SHOW	5225	F	A	A	A	0	A	A
SHOW	5228	F?	3	3	1	7	72-77	75.1
SHOW	5233	M	2	1	1	4	61-66	63.6
SHOW	5237	M	2	2	1	5	61-66	63.6

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
SHOW	5241	F	A	A	A	0	A	A
SHOW	5243	M	2	2	2	6	72-76	74.5
SHOW	5244	M?	2	1	1	4	61-66	63.6
SHOW	5254	F	2	2	1	5	66-73	70
SHOW	5258	F	A	A	A	0	A	A
SHOW	5267	F	A	A	A	0	A	A
SHOW	5269	M	2	2	1	5	61-66	63.6
SHOW	5270	F?	1	2	1	4	58-63	60.8
SHOW	5283	M	A	A	A	0	A	A
SHOW	5290	F?	A	A	A	0	A	A
SHOW	5292	F	A	A	A	0	A	A
SHOW	5298	F	3	3	1	7	72-77	75.1
SHOW	5302	F	A	A	A	0	A	A
SHOW	5311	F?	2	3	1	6	72-77	75.1
SHOW	5316	F?	A	A	A	0	A	A
SHOW	5320	F	A	A	A	0	A	A
SHOW	5323	M	2	2	1	5	61-66	63.6
SHOW	5329	M	2	1	1	4	61-66	63.6
SHOW	5347	M	3	3	2	8	72-76	74.5
SHOW	5350	F	3	3	2	8	72-77	75.1
SHOW	5364	F	A	A	A	0	A	A
SHOW	5384	M	2	3	1	6	72-76	74.5
SHOW	5393	F	1	1	1	3	58-63	60.8
SHOW	5402	M	A	A	A	0	A	A
SHOW	5415	F	3	1	1	5	66-73	70
SHOW	5421	M?	2	2	1	5	61-66	63.6
SHOW	5438	M	1	3	1	5	61-66	63.6
SHOW	5445	M	1	2	1	4	61-66	63.6
SHOW	5451	M	1	2	2	5	61-66	63.6
SHOW	5453	M	A	A	A	0	A	A
SHOW	5457	M	A	A	A	0	A	A
SHOW	5461	M?	1	3	1	5	61-66	63.6
SHOW	5463	M?	2	1	1	4	61-66	63.6
SHOW	5475	M?	2	2	1	5	61-66	63.6
SHOW	5488	F	2	1	1	4	58-63	60.8
SHOW	5492	F	2	2	1	5	66-73	70
SHOW	5494	F	2	2	1	5	66-73	70
SHOW	5501	F	1	1	1	3	58-63	60.8
SHOW	5507	F?	1	1	1	3	58-63	60.8
SHOW	5508	F	1	2	1	4	58-63	60.8
SHOW	5529	F	1	2	1	4	58-63	60.8
SHOW	5534	F	1	1	1	3	58-63	60.8
SHOW	5539	M	1	2	1	4	61-66	63.6
SHOW	5544	M	A	A	A	0	A	A
SHOW	5562	F	1	2	1	4	58-63	60.8
SHOW	5563	M	1	2	1	4	61-66	63.6
SHOW	5588	F	1	2	1	4	58-63	60.8
SHOW	5601	F	1	1	1	3	58-63	60.8
SHOW	5603	M	1	1	1	3	51-59	55.1
SHOW	5617	M	1	2	1	4	61-66	63.6
SHOW	5632	F	3	2	1	6	72-77	75.1
SHOW	5644	M	1	2	1	4	61-66	63.6
SHOW	5657	F	1	2	1	4	58-63	60.8
SHOW	5671	M	1	2	1	4	61-66	63.6
SHOW	5680	M	1	3	2	6	72-76	74.5
SHOW	5699	F	2	2	2	6	72-77	75.1
SHOW	5702	M	A	A	A	0	A	A
SHOW	5710	M	1	2	1	4	61-66	63.6
SHOW	5740	F	A	A	A	0	A	A

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
SHOW	5773	M	1	2	1	4	61-66	63.6
SHOW	5774	F	1	3	1	5	66-73	70
SHOW	5794	M	1	3	1	5	61-66	63.6
SHOW	5835	F	A	A	A	0	A	A
SHOW	5845	M	1	2	1	4	61-66	63.6
SHOW	5884	F	1	1	1	3	58-63	60.8
SHOW	5909	F	1	1	1	3	58-63	60.8
SHOW	5977	M?	A	A	A	0	A	A
SHOW	6003	F	1	2	1	4	58-63	60.8
SHOW	6026	M	A	A	A	0	A	A
SHOW	6027	F	A	A	A	0	A	A
SHOW	6029	M	1	2	1	4	61-66	63.6
SHOW	6030	F	1	2	1	4	58-63	60.8
SHOW	6042	M	1	1	1	3	51-59	55.1
SHOW	6043	F	1	1	1	3	58-63	60.8
SHOW	6048	M	1	2	1	4	61-66	63.6
SHOW	6060	M	1	2	1	4	61-66	63.6
SHOW	6070	F	3	3	2	8	72-77	75.1
SHOW	6072	M	A	A	A	0	A	A
SHOW	6074	F	A	A	A	0	A	A
SHOW	6081	M	3	3	2	8	72-76	74.5
SHOW	6082	F	1	3	1	5	66-73	70
SHOW	6083	M	1	3	1	5	61-66	63.6
SHOW	6088	M	1	3	1	5	61-66	63.6
SHOW	6093	F	1	2	1	4	58-63	60.8
SHOW	6098	M	1	2	1	4	61-66	63.6
SHOW	6103	M	1	3	1	5	61-66	63.6
SHOW	6105	M	1	2	1	4	61-66	63.6
WP	EE004	M?	2	2	1	5	61-66	63.6
WP	EE013	M	A	A	A	0	A	A
WP	EE015	F	3	3	2	8	72-77	75.1
WP	EE019	F	A	A	A	0	A	A
WP	EE022	F	2	2	1	5	66-73	70
WP	EE024	M?	A	A	A	0	A	A
WP	EE025	M?	A	A	A	0	A	A
WP	EE026	M	2	3	1	6	72-76	74.5
WP	EE037	M	2	2	1	5	61-66	63.6
WP	EE056	F	A	A	A	0	A	A
WP	EE062	M	1	1	1	3	51-59	55.1
WP	EE070	F	2	2	1	5	66-73	70
WP	EE079	M?	4	4	-	8	72-76	74.5
WP	EE080	M	2	2	1	5	61-66	63.6
WP	EE089	M	A	A	A	0	A	A
WP	EE097	F?	2	2	1	5	66-73	70
WP	EE098	M?	A	A	A	0	A	A
WP	EE099	F	1	2	1	4	58-63	60.8
WP	G251	F	2	2	1	5	66-73	70
WP	G265	M	2	2	1	5	61-66	63.6
WP	G278	M?	2	2	2	6	72-76	74.5
WP	G279	M?	3	2	1	6	72-76	74.5
WP	G296	F?	2	2	1	5	66-73	70
WP	G297	M?	2	2	1	5	61-66	63.6
WP	G303	M	A	A	A	0	A	A
WP	G310	M	2	2	1	5	61-66	63.6
WP	G361	F?	2	2	1	5	66-73	70
WP	G377	F?	2	2	1	5	66-73	70
WP	G379	M	2	2	1	5	61-66	63.6
WP	G381	M?	2	2	1	5	61-66	63.6
WP	G385	F?	3	3	2	8	72-77	75.1

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
WP	G406	M?	2	2	1	5	61-66	63.6
WP	G411	M	A	A	A	0	A	A
WP	G419	F?	2	2	1	5	66-73	70
WP	G451	F	A	A	A	0	A	A
WP	G474	F	2	2	1	5	66-73	70
WP	G482	M	2	2	1	5	61-66	63.6
WP	G516	M	A	A	A	0	A	A
WP	G561	M	2	1	1	4	61-66	63.6
WP	G565	M?	A	A	A	0	A	A
WP	G571	F?	2	2	1	5	66-73	70
WP	G587	M?	2	1	1	4	61-66	63.6
WP	G601	M?	1	2	1	4	61-66	63.6
WP	G607	M	A	A	A	0	A	A
WP	G628	F?	2	1	1	4	58-63	60.8
WP	NA046	M	3	3	1	7	72-76	74.5
WP	NA047	F	2	1	1	4	58-63	60.8
WP	NA059	F?	1	1	1	3	58-63	60.8
WP	NA075	M?	2	2	1	5	61-66	63.6
WP	NA078	M?	A	A	A	0	A	A
WP	NA080	M	1	1	1	3	51-59	55.1
WP	NA084	F	2	2	1	5	66-73	70
WP	NA088	F	2	2	1	5	66-73	70
WP	NA100	F	2	2	1	5	66-73	70
WP	NA166	M	2	2	1	5	61-66	63.6
WP	NA168	F	3	3	1	7	72-77	75.1
WP	NA171	M?	1	2	1	4	61-66	63.6
WP	NA181	M?	2	3	1	6	72-76	74.5
WP	NA183	M	A	A	A	0	A	A
WP	NA190	M?	A	A	A	0	A	A
WP	NA197	M	2	3	1	6	72-76	74.5
WP	NA199	M	2	2	1	5	61-66	63.6
WP	NA202	F	3	3	1	7	72-77	75.1
WP	NA203	F	2	2	1	5	66-73	70
WP	NA217	M	4	4	2	10	72-76	74.5
WP	NA218	M	1	2	1	4	61-66	63.6
WP	NA224	M	A	A	A	0	A	A
WP	NA233	F	A	A	A	0	A	A
WP	NA234	M	A	A	A	0	A	A
WP	SA003	M?	2	2	1	5	61-66	63.6
WP	SA012	M	2	2	1	5	61-66	63.6
WP	SA013	F?	3	2	1	6	72-77	75.1
WP	SA015	M	2	2	1	5	61-66	63.6
WP	SA021	M	A	A	A	0	A	A
WP	SA033	M?	A	A	A	0	A	A
WP	SA034	M	3	3	1	7	72-76	74.5
WP	SA047	F?	2	2	1	5	66-73	70
WP	SA050	F	A	A	A	0	A	A
WP	SA052	M?	2	2	1	5	61-66	63.6
WP	SA053	F?	2	2	1	5	66-73	70
WP	SA054	F	A	A	A	0	A	A
WP	SA056	M?	2	2	1	5	61-66	63.6
WP	V11	M?	2	2	1	5	61-66	63.6
WP	V14	F?	A	A	A	0	A	A
WP	V15	M?	2	2	2	6	72-76	74.5
WP	V18	M?	2	1	1	4	61-66	63.6
WP	V19	M?	A	A	A	0	A	A
WP	V26	F	2	1	1	4	58-63	60.8
WP	V27	M?	2	2	1	5	61-66	63.6
WP	V29	F	A	A	A	0	A	A

Site	Sk. No.	Sex	Porosity	Osteophytes	Eburnation	Composite Score	Est. Age	Mean
WP	V33	F	2	1	1	4	58-63	60.8
WP	V38	M?	A	A	A	0	A	A
WP	V39	M	A	A	A	0	A	A
WP	V40	M	A	A	A	0	A	A
WP	V45	M?	2	1	1	4	61-66	63.6
WP	V46	F	3	2	1	6	72-77	75.1
WP	V51	M?	1	2	1	4	61-66	63.6
WP	V61	F	1	1	1	3	58-63	60.8
WP	WCO009	F	A	A	A	0	A	A
WP	WCO012	M?	A	A	A	0	A	A
WP	WCO013	F?	1	1	1	3	58-63	60.8
WP	WCO015	M	2	2	1	5	61-66	63.6
WP	WCO017	F?	2	3	1	6	72-77	75.1
WP	WCO018	M	A	A	A	0	A	A
WP	WCO022	F	2	3	1	6	72-77	75.1
WP	WCO026	F?	3	3	2	8	72-77	75.1
WP	WCO028	F	1	1	1	3	58-63	60.8
WP	WCO029	F	2	2	1	5	66-73	70
WP	WCO036	F	A	A	A	0	A	A
WP	WCO037	M?	2	2	1	5	61-66	63.6
WP	WCO041	M	A	A	A	0	A	A
WP	WCO045	F?	3	3	1	7	72-77	75.1
WP	WCO056	F	2	1	1	4	58-63	60.8
WP	WCO057	M?	A	A	A	0	A	A
WP	WCO059	M?	3	3	1	7	72-76	74.5
WP	WCO109	F	2	2	1	5	66-73	70
WP	WCO115	M?	A	A	A	0	A	A
WP	WCO117	M	1	2	1	4	61-66	63.6
WP	WCO124	F	2	2	1	5	66-73	70
WP	WCO130	F	3	3	1	7	72-77	75.1
WP	WCO131	M?	2	3	1	6	72-76	74.5
WP	WCO137	M?	2	2	1	5	61-66	63.6
WP	WCO142	M?	A	A	A	0	A	A
WP	WCO146	M	2	2	1	5	61-66	63.6
WP	WCO153	M?	A	A	A	0	A	A
WP	WCO162	F?	2	2	1	5	66-73	70
WP	WCO164A	M	A	A	A	0	A	A
WP	WCO165	F?	2	2	1	5	66-73	70
WP	WCO165A	M	2	2	1	5	61-66	63.6
WP	WCO167	F	A	A	A	0	A	A
WP	WCO169	M	A	A	A	0	A	A
WP	WCO170	F	4	4	1	9	72-77	75.1
WP	WCO173	F	1	2	1	4	58-63	60.8
WP	WCO179	F?	A	A	A	0	A	A
WP	WCO184	F	1	2	1	4	58-63	60.8
WP	WCO187	F	A	A	A	0	A	A
WP	WCO199	F	1	1	1	3	58-63	60.8
WP	WCO200	M?	2	2	1	5	61-66	63.6
WP	WCO203	M?	A	A	A	0	A	A
WP	WCO204	F	3	2	1	6	72-77	75.1

Appendix 5 – Third cervical (C3)

Raw data from age estimation using the third cervical vertebra (Falys, 2012).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

Por. = porosity

Ost. = Osteophyte formation

Eb. = Eburnation

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	BODY			FACETS			Composite Score	Est. Age	Mean	Notes
			Por.	Ost.	Eb.	Por.	Ost.	Eb.				
BAR	7	F	2	2	1	A	A	A	5	53-58	55.6	
BAR	18	F	3	3	1	2	2	1	12	71-75	73.1	
BAR	99	M	2	1	1	2	1	1	8	55-59	57.4	
BAR	126	M	2	2	1	A	A	A	5	53-58	55.6	C5 USED
BAR	127	M?	3	3	1	3	3	2	15	70-73	71.8	
BAR	128	M	2	1	1	1	1	1	7	46-55	50.6	C6 USED
BAR	132	M?	2	2	1	1	1	1	8	55-59	57.4	
BAR	179	M	2	2	1	1	2	1	9	55-59	57.4	
BAR	187	F	A	A	A	A	A	A	0	A	A	
BAR	204	F	A	A	A	A	A	A	0	A	A	
BAR	208	M	A	A	A	A	A	A	0	A	A	
BAR	241	M	3	2	1	2	2	1	11	70-73	71.8	
BAR	266	M	A	A	A	A	A	A	0	A	A	
BAR	269	M	3	2	1	2	2	2	12	70-73	71.8	
BAR	272	M	2	2	1	1	2	1	9	55-59	57.4	
BAR	276	F	A	A	A	A	A	A	0	A	A	
BAR	308	M	2	2	1	A	A	A	5	53-58	55.6	
BAR	309	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	311	F?	2	2	1	3	2	2	12	71-75	73.1	
BAR	326	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	327	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	363	M	2	3	1	3	3	2	14	70-73	71.8	
BAR	380	?	A	A	A	A	A	A	0	A	A	
BAR	425	M	A	A	A	A	A	A	0	A	A	
BAR	427	M	2	2	1	1	1	1	8	55-59	57.4	
BAR	428	F	3	2	1	2	1	1	10	57-62	59.7	
BAR	431	F	2	3	1	2	2	1	11	71-75	73.1	
BAR	446	M	3	3	1	1	1	1	10	55-59	57.4	
BAR	488	M	A	A	A	A	A	A	0	A	A	
BAR	499	F	2	2	1	A	A	A	5	53-58	55.6	
BAR	513	F?	A	A	A	A	A	A	0	A	A	
BAR	539	F	3	3	1	2	2	2	13	71-75	73.1	
BAR	548	M?	2	1	1	3	3	1	11	70-73	71.8	C7 USED
BAR	550	F	3	3	1	2	1	1	11	71-75	73.1	
BAR	552	F	2	2	1	1	1	1	8	57-62	59.7	

Site	Sk. No.	Sex	BODY			FACETS			Composite score	Est. Age	Mean	Notes
			Por.	Ost.	Eb.	Por.	Ost.	Eb.				
BAR	558	M?	2	1	1	1	2	1	8	55-59	57.4	
BAR	578	F?	2	1	1	A	A	A	4	53-58	55.6	
BAR	582	M	3	3	1	1	1	1	10	55-59	57.4	C4 USED
BAR	588	M	A	A	A	A	A	A	0	A	A	
BAR	591	M?	1	2	1	2	3	2	11	70-73	71.8	
BAR	594	M?	2	2	2	3	3	2	14	70-73	71.8	
BAR	597	M	3	2	1	3	3	2	14	70-73	71.8	
BAR	598	M	2	2	2	3	3	2	14	70-73	71.8	
BAR	605	M	A	A	A	A	A	A	0	A	A	
BAR	606	F	A	A	A	A	A	A	0	A	A	
BAR	607	F	3	2	1	1	1	1	9	57-62	59.7	
BAR	613	F	1	1	1	1	1	1	6	N/A	N/A	C4 USED
BAR	619	M	2	2	1	3	3	2	13	70-73	71.8	
BAR	624	M	3	2	1	2	3	2	13	70-73	71.8	
BAR	650	M	3	3	1	1	1	1	10	55-59	57.4	
BAR	675	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	706	M	A	A	A	A	A	A	0	A	A	
BAR	717	F	A	A	A	A	A	A	0	A	A	
BAR	737	M	A	A	A	A	A	A	0	A	A	
BAR	748	F	1	2	1	1	1	1	7	44-56	50.3	
BAR	749	F	3	2	1	1	1	1	9	57-62	59.7	
BAR	750	F?	A	A	A	A	A	A	0	A	A	
BAR	765	M	2	2	1	1	1	1	8	55-59	57.4	
BAR	771	F	2	2	1	1	2	1	9	57-62	59.7	
BAR	778	M	A	A	A	A	A	A	0	A	A	
BAR	788	F	A	A	A	A	A	A	0	A	A	
BAR	834	M	2	2	1	1	2	1	9	55-59	57.4	
BAR	850	F	3	2	1	3	3	1	13	71-75	73.1	
BAR	854	F	3	3	1	A	A	A	7	63-67	65	
BAR	867	M	3	3	2	1	1	1	11	70-73	71.8	
BAR	870	M	3	3	1	2	2	1	12	70-73	71.8	
BAR	894	F?	A	A	A	A	A	A	0	A	A	
BAR	918	M	A	A	A	A	A	A	0	A	A	
BAR	947	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	948	F	2	2	1	2	2	2	11	71-75	73.1	
BAR	950	M?	2	1	1	1	1	1	7	46-55	50.6	
BAR	971	F	2	1	1	2	1	2	9	57-62	59.7	
BAR	975	M?	2	1	1	1	1	1	7	46-55	50.6	
BAR	976	M	4	4	1	4	4	1	18	74-80	77.6	C5 USED
BAR	981	M?	A	A	A	A	A	A	0	A	A	
BAR	989	M	1	2	1	3	3	2	12	70-73	71.8	
BAR	1015	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	1020	M	3	3	1	2	1	1	11	70-73	71.8	
BAR	1022	M	2	2	1	1	2	1	9	55-59	57.4	
BAR	1028	F	2	2	1	2	1	1	9	57-62	59.7	
BAR	1030	F?	2	1	1	1	1	1	7	44-56	50.3	C6 USED
BAR	1039	F	A	A	A	A	A	A	0	A	A	
BAR	1043	M	2	2	1	1	1	1	8	55-59	57.4	
BAR	1047	M	2	2	1	1	1	1	8	55-59	57.4	
BAR	1049	F	A	A	A	A	A	A	0	A	A	
BAR	1062	F	A	A	A	A	A	A	0	A	A	
BAR	1063	M	2	2	1	3	3	2	13	70-73	71.8	
BAR	1064	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	1068	F	3	3	1	2	3	2	14	71-75	73.1	C5 USED
BAR	1071	F	2	2	1	1	1	1	8	57-62	59.7	C4? USED

Site	Sk. No.	Sex	BODY			FACETS			Composite Score	Est. Age	Mean	Notes
			Por.	Ost.	Eb.	Por.	Ost.	Eb.				
BAR	1085	M?	A	A	A	A	A	A	0	A	A	
BAR	1096	F	2	2	1	2	1	1	9	57-62	59.7	
BAR	1100	M	3	3	1	3	3	2	15	70-73	71.8	
BAR	1103	M	3	3	1	3	3	2	15	70-73	71.8	
BAR	1104	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	1106	M	3	2	1	1	2	1	10	55-59	57.4	
BAR	1120	F	2	1	1	2	2	2	10	57-62	59.7	
BAR	1122	M	A	A	A	A	A	A	0	A	A	
BAR	1133	F	A	A	A	A	A	A	0	A	A	
BAR	1134	M	2	1	1	1	1	1	7	46-55	50.6	C7 USED
BAR	1139	M	3	3	2	A	A	A	8	74-77	75.6	
BAR	1144	F	2	2	1	1	1	1	8	57-62	59.7	C6 USED
BAR	1146	M?	2	2	1	A	A	A	5	53-58	55.6	
BAR	1148	F	A	A	A	A	A	A	0	A	A	
BAR	1149	M	2	1	1	1	1	1	7	46-55	50.6	C5 USED
BAR	1151	F	3	3	1	3	3	2	15	71-75	73.1	
BAR	1162	M	2	2	2	A	A	A	6	63-67	65	
BAR	1169	M	2	2	1	2	1	1	9	55-59	50.6	
BAR	1176	M	2	2	1	1	2	1	9	55-59	57.4	
BAR	1183	M?	2	1	1	1	1	1	7	46-55	50.6	
BAR	1197	F	2	2	1	2	1	1	9	57-62	59.7	
BAR	1202	F	3	2	1	2	1	2	11	71-75	73.1	
BAR	1204	M	3	3	1	3	3	2	15	70-73	71.8	
BAR	1214	M	2	1	1	1	2	1	8	55-59	57.4	
BAR	1220	F?	2	1	1	1	2	1	8	57-62	59.7	
BAR	1235	F	2	1	1	3	2	1	10	57-62	59.7	
BAR	1236	F	2	2	1	1	1	1	8	57-62	59.7	
BAR	1251	M	2	2	1	1	2	1	9	55-59	57.4	
BAR	1254	F	2	2	1	2	3	2	12	71-75	73.1	
BAR	1255	F	A	A	A	A	A	A	0	A	A	
BAR	1263	M?	A	A	A	A	A	A	0	A	A	
BAR	1268	M	2	3	1	2	3	1	12	70-73	71.8	C5 USED
BAR	1291	M?	2	2	1	1	2	1	9	55-59	57.4	
BAR	1297	M	2	1	1	1	2	1	8	55-59	57.4	
BAR	1299	F?	3	2	1	3	3	2	14	71-75	73.1	
BAR	1307	M	A	A	A	A	A	A	0	A	A	
BAR	1315	M	3	2	1	3	3	2	14	70-73	71.8	
BAR	1316	M	3	3	1	1	1	1	10	55-59	57.4	C5 USED
BAR	1324	M	1	1	1	1	2	1	7	46-55	50.6	
BAR	1409	M?	3	3	1	1	1	1	10	55-59	57.4	
BAR	1438	M	A	A	A	A	A	A	0	A	A	
BAR	1498	F	2	2	1	3	2	2	12	71-75	73.1	
BAR	1538	F	A	A	A	A	A	A	0	A	A	
BAR	1542	F	2	1	1	A	A	A	4	53-58	55.6	
BAR	1548	M	3	3	2	2	3	1	14	70-73	71.8	
BAR	1556	M	A	A	A	A	A	A	0	A	A	
BAR	1566	M	2	2	1	A	A	A	5	53-58	55.6	C4 USED
BAR	1571	F	A	A	A	A	A	A	0	A	A	
BAR	1615	M	2	1	1	1	2	1	8	55-59	57.4	C6 USED
BAR	1655	F	A	A	A	A	A	A	0	A	A	
BAR	1691	M	2	1	1	2	1	1	8	55-59	57.4	
BAR	1695	F?	2	1	1	1	2	1	8	57-62	59.7	
BAR	1707	M	A	A	A	A	A	A	0	A	A	
BAR	1723	M	A	A	A	A	A	A	0	A	A	
BAR	1750	F	A	A	A	A	A	A	0	A	A	

			BODY			FACETS			Composite Score	Est. Age	Mean	Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.				
BAR	1756	M?	2	1	1	1	1	1	7	46-55	50.6	
BAR	1765	F	3	3	1	3	3	2	15	71-75	73.1	
BAR	1769	M	2	3	1	3	3	2	14	70-73	71.8	C5 USED
BAR	1775	M	2	2	1	1	1	1	8	55-59	57.4	
BAR	1788	M	A	A	A	A	A	A	0	A	A	
BAR	1805	M	3	3	2	2	3	2	15	70-73	71.8	
BAR	1824	M	2	1	1	2	2	1	9	55-59	57.4	
BAR	1843	M	2	1	1	1	2	2	9	55-59	57.4	
BAR	1849	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	1856	?	2	2	1	1	1	1	8	55-62	58.5	C5 USED
BAR	1863	M	2	2	1	1	2	2	10	55-59	57.4	
BAR	1869	M?	3	2	1	3	3	2	14	70-73	71.8	
BAR	1871	M	2	2	1	3	2	2	12	70-73	71.8	
BAR	1875	F	2	1	1	1	1	1	7	44-56	50.3	C4 USED
BAR	1889	F?	2	1	1	3	3	2	12	71-75	73.1	
BAR	1892	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	1897	M	3	3	1	A	A	A	7	63-67	65	C6 USED
BAR	1910	M	2	2	1	2	3	2	12	70-73	71.8	
BAR	1911	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	1920	M	2	1	1	3	3	2	12	70-73	71.8	
BAR	1922	M	4	4	1	4	4	2	19	74-80	77.6	
BAR	1926	M	2	2	1	1	2	2	10	55-59	57.4	
BAR	1993	M	2	2	1	1	2	2	10	55-59	57.4	
BAR	1995	M	3	3	1	3	3	2	15	70-73	71.8	
BAR	2027	M	2	1	1	1	2	1	8	55-59	57.4	
BAR	2064	F	A	A	A	A	A	A	0	A	A	
BAR	2130	F	A	A	A	A	A	A	0	A	A	
BAR	2142	F	2	1	1	A	A	A	4	53-58	55.6	C4/5 USED
BAR	2176	F	3	3	1	1	1	1	10	57-62	59.7	
BAR	2187	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	2193	M	3	2	1	A	A	A	6	63-67	65	C6 USED
BAR	2200	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	2206	M	2	1	1	1	1	1	7	46-55	50.6	C4? USED
BAR	2216	F	2	1	1	1	2	1	8	57-62	59.7	
BAR	2219	M	2	2	1	3	3	1	12	70-73	71.8	
BAR	2236	F	A	A	A	A	A	A	0	A	A	
BAR	2244	M	A	A	A	A	A	A	0	A	A	
BAR	2248	M	2	1	1	3	3	1	11	70-73	71.8	
BAR	2251	M	2	1	1	2	2	1	9	55-59	57.4	
BAR	2259	F	A	A	A	A	A	A	0	A	A	
BAR	2274	M	3	3	1	3	3	2	15	70-73	71.8	
BAR	2283	F	1	2	1	1	1	1	7	44-56	50.3	
BAR	2284	F?	A	A	A	A	A	A	0	A	A	
BAR	2289	M	A	A	A	A	A	A	0	A	A	
BAR	2294	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	2297	F?	2	1	1	2	3	2	11	71-75	73.1	
BAR	2298	M	2	1	1	1	2	1	8	55-59	57.4	
BAR	2304	M	A	A	A	A	A	A	0	A	A	
BAR	2309	M	3	2	1	3	2	2	13	70-73	71.8	
BAR	2320	M	2	2	1	2	3	2	12	70-73	71.8	
BAR	2327	M	A	A	A	A	A	A	0	A	A	
BAR	2337	M	2	2	1	A	A	A	5	53-58	55.6	
BAR	2338	M	A	A	A	A	A	A	0	A	A	
BAR	2345	M	2	1	1	A	A	A	4	53-58	55.6	BODY C3 USED
BAR	2348	F	2	1	1	1	1	1	7	44-56	50.3	

			BODY			FACETS			Composite Score	Est.		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.		Age	Mean	
BAR	2356	F	2	2	1	1	1	1	8	57-62	59.7	
BAR	2376	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	2386	F	2	2	1	3	3	2	13	71-75	73.1	
BAR	2408	F	A	A	A	A	A	A	0	A	A	
BAR	2411	F?	3	2	1	2	3	2	13	71-75	73.1	C4/5 USED
BAR	2413	M?	3	3	1	3	3	1	14	70-73	71.8	
BAR	2428	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	2436	F?	2	1	1	1	1	1	7	44-56	50.3	
BAR	2451	M?	2	1	1	1	1	1	7	46-55	50.6	
BAR	2452	M	A	A	A	A	A	A	0	A	A	
BAR	2457	F	A	A	A	A	A	A	0	A	A	
BAR	2465	F	2	1	1	2	1	1	8	57-62	59.7	C5 USED
BAR	2466	M	2	1	1	1	1	1	7	46-55	50.6	C4 USED
BAR	2469	M	A	A	A	A	A	A	0	A	A	
BAR	2471	M	3	1	1	1	2	1	9	55-59	57.4	
BAR	2485	M	2	1	1	3	3	2	12	70-73	71.8	
BAR	2491	M?	2	3	1	1	2	1	10	55-59	57.4	C6/7 USED
BAR	2495	M	3	3	1	1	1	1	10	55-59	57.4	
BAR	2499	M	2	1	1	3	3	2	12	70-73	71.8	
BAR	2503	F	1	1	1	1	1	1	6	N/A	N/A	
BAR	2514	M	2	1	1	2	3	1	10	55-59	57.4	
BAR	2520	F?	3	3	1	2	3	2	14	71-75	73.1	
BAR	2583	M	3	2	1	1	1	2	10	55-59	57.4	
BAR	2603	M	2	2	1	1	1	1	8	55-59	57.4	C4/5 USED
BAR	2612	M	3	2	1	1	2	1	10	55-59	57.4	
BAR	2616	?	3	3	1	1	2	2	12	70-75	72.4	
BAR	2666	F?	A	A	A	A	A	A	0	A	A	
BAR	2684	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	2700	M	2	1	1	1	2	1	8	55-59	57.4	
BAR	2714	M	3	3	1	1	2	1	11	70-73	71.8	C5 USED
BAR	2718	F	2	1	1	1	2	1	8	57-62	59.7	
BAR	2720	M	A	A	A	A	A	A	0	A	A	
BAR	2721	M	A	A	A	A	A	A	0	A	A	
BAR	2722	F	A	A	A	A	A	A	0	A	A	
BAR	2727	F	2	1	1	1	1	1	7	44-56	50.3	
BAR	2730	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	2731	M	A	A	A	A	A	A	0	A	A	
BAR	2732	F	2	1	1	3	3	1	11	71-75	73.1	
BAR	2739	M	2	1	1	1	1	1	7	46-55	50.6	
BAR	2751	F	2	2	1	3	3	2	13	71-75	73.1	
BAR	2758	M	2	1	1	2	2	2	10	55-59	57.4	C4 USED
BAR	2766	F	A	A	A	A	A	A	0	A	A	
BAR	2775	F	3	2	1	1	3	2	12	71-75	73.1	
BAR	2780	F	A	A	A	A	A	A	0	A	A	
BAR	2783	M	2	1	1	1	1	1	7	46-55	50.6	C7 USED
BAR	2784	M	3	3	1	2	2	2	13	70-73	71.8	
BAR	2786	M	2	1	1	1	1	1	7	46-55	50.6	C4 USED
BAR	2798	M?	2	1	1	1	2	1	8	55-59	57.4	
BAR	2799	M	2	1	1	2	3	2	11	70-73	71.8	
FGH	1021	M?	2	2	1	3	3	2	13	70-73	71.8	
FGH	1037	F	A	A	A	A	A	A	0	A	A	
FGH	1047	F	3	1	1	3	3	2	13	71-75	73.1	
FGH	1049	F?	1	1	1	1	1	1	6	N/A	N/A	
FGH	1051	M	2	2	1	3	3	2	13	70-73	71.8	
FGH	1053	F?	A	A	A	A	A	A	0	A	A	

			BODY			FACETS			Composite Score	Est.		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.		Age	Mean	
FGH	1057	F	2	1	1	2	1	1	8	57-62	59.7	
FGH	1063	M	2	2	1	1	2	1	9	55-59	57.4	
FGH	1075	M	2	2	1	3	3	2	13	70-73	71.8	
FGH	1079	F	2	3	1	A	A	A	6	63-67	65	
FGH	1081	M?	2	1	1	1	1	1	7	46-55	50.6	
FGH	1091	F?	2	1	1	3	3	2	12	71-75	73.1	C7 USED
FGH	1097	F?	2	2	1	3	3	2	13	71-75	73.1	
FGH	1099	F?	A	A	A	A	A	A	0	A	A	
FGH	1101	F	2	1	1	1	2	1	8	57-62	59.7	
FGH	1104	F	A	A	A	A	A	A	0	A	A	
FGH	1110	F	2	2	1	1	2	2	10	57-62	59.7	
FGH	1113	M	1	1	1	1	1	1	6	N/A	N/A	
FGH	1115	F	3	3	1	1	2	1	11	71-75	73.1	
FGH	1117	M	2	3	1	1	2	1	10	55-59	57.4	
FGH	1130	M	2	1	1	3	3	2	12	70-73	71.8	
FGH	1139	M?	2	2	1	3	3	2	13	70-73	71.8	
FGH	1147	M	3	3	1	1	1	1	10	55-59	57.4	
FGH	1150	F	A	A	A	A	A	A	0	A	A	
FGH	1163	M?	3	3	1	2	2	1	12	70-73	71.8	
FGH	1171	M?	2	1	1	1	2	1	8	55-59	57.4	
FGH	1180	F	A	A	A	A	A	A	0	A	A	
FGH	1184	M	2	1	1	3	3	2	12	70-73	71.8	
FGH	1188	M	2	1	1	1	2	1	8	55-59	57.4	
FGH	1190	F	A	A	A	A	A	A	0	A	A	
FGH	1208	F?	2	1	1	1	2	1	8	57-62	59.7	
FGH	1228	M	3	2	1	3	3	2	14	70-73	71.8	
FGH	1230	F?	2	1	1	1	1	1	7	44-56	50.3	
FGH	1237	M?	A	A	A	A	A	A	0	A	A	
FGH	1255	F?	A	A	A	A	A	A	0	A	A	
FGH	1257	F	2	1	1	1	3	1	9	57-62	59.7	C4 USED
FGH	1280	M?	2	1	1	3	3	2	12	70-73	71.8	
FGH	1284	F?	A	A	A	A	A	A	0	A	A	
FGH	1286	F	3	3	1	1	1	1	10	57-62	59.7	
FGH	1297	F?	2	3	1	3	3	2	14	71-75	73.1	
FGH	1305	F?	2	1	1	1	2	1	8	57-62	59.7	
FGH	1312	F	2	1	1	1	1	1	7	44-56	50.3	
FGH	1313	M?	2	2	1	1	2	2	10	55-59	57.4	
FGH	1327	M?	2	1	1	1	1	1	7	46-55	50.6	
FGH	1354	M	A	A	A	A	A	A	0	A	A	
FGH	1385	M	4	4	1	4	4	2	19	74-80	77.6	FUSED TO C4
FGH	1391	F	A	A	A	A	A	A	0	A	A	
FGH	1412	M	2	2	1	3	3	1	12	70-73	71.8	
FGH	1441	M?	2	3	1	3	3	2	14	70-73	71.8	
FGH	1455	F	A	A	A	A	A	A	0	A	A	
FGH	1469	F	2	2	2	A	A	A	6	63-67	65	
FGH	1471	F	A	A	A	A	A	A	0	A	A	
FGH	1484	F	3	3	1	3	3	2	15	71-75	73.1	
FGH	1486	M	2	1	1	2	1	1	8	55-59	57.4	
FGH	1521	F	A	A	A	A	A	A	0	A	A	
FGH	1525	F?	2	1	1	1	1	1	7	44-56	50.3	
FGH	1553	M?	2	1	1	3	3	2	12	70-73	71.8	
FGH	1560	M?	2	1	1	1	2	1	8	55-59	57.4	
FGH	1569	F?	2	2	1	1	2	1	9	57-62	59.7	
FGH	1579	F?	2	1	1	2	1	1	8	57-62	59.7	
FGH	1581	F?	3	3	1	A	A	A	7	63-67	65	

			BODY			FACETS			Composite Score	Est.		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.		Age	Mean	
FGH	1583	M	2	1	1	1	1	1	7	46-55	50.6	
FGH	1589	F	A	A	A	A	A	A	0	A	A	
FGH	1597	F	2	1	1	2	1	1	8	57-62	59.7	
SHOW	5010a	F	A	A	A	A	A	A	0	A	A	
SHOW	5066	M	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5091	F	3	2	1	2	1	1	10	57-62	59.7	
SHOW	5098	F	3	1	1	1	2	1	9	57-62	59.7	
SHOW	5103	F	2	2	1	1	2	1	9	57-62	59.7	
SHOW	5105	F	3	3	1	3	3	2	15	71-75	73.1	
SHOW	5110	F	2	2	1	4	4	2	15	71-75	73.1	
SHOW	5123	F	3	3	1	2	1	1	11	71-75	73.1	
SHOW	5159	M	A	A	A	A	A	A	0	A	A	
SHOW	5172	M	A	A	A	A	A	A	0	A	A	
SHOW	5173	M	2	2	1	1	2	1	9	55-59	57.4	
SHOW	5186	M?	3	2	1	1	1	1	9	55-59	57.4	
SHOW	5190	F	2	1	1	1	2	1	8	57-62	59.7	
SHOW	5203	M	2	2	1	3	3	2	13	70-73	71.8	
SHOW	5204	M	2	1	1	1	1	1	7	46-55	50.6	
SHOW	5207	M	3	1	1	1	1	1	8	55-59	57.4	
SHOW	5208	M?	2	2	1	1	1	1	8	55-59	57.4	
SHOW	5211	F	2	1	1	1	2	1	8	57-62	59.7	
SHOW	5218	F?	2	1	1	1	1	1	7	44-56	50.3	C6 USED
SHOW	5222	M	2	1	1	1	1	1	7	46-55	50.6	
SHOW	5225	F	2	1	1	1	2	1	8	57-62	59.7	C6 USED
SHOW	5228	F?	3	3	2	3	3	2	16	71-75	73.1	
SHOW	5233	M	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5237	M	2	1	1	3	3	1	11	70-73	71.8	
SHOW	5241	F	A	A	A	A	A	A	0	A	A	
SHOW	5243	M	2	2	1	2	3	2	12	70-73	71.8	
SHOW	5244	M?	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5254	F	2	2	1	1	2	1	9	57-62	59.7	
SHOW	5258	F	A	A	A	A	A	A	0	A	A	
SHOW	5267	F	3	2	1	3	3	1	13	71-75	73.1	
SHOW	5269	M	3	2	1	1	1	1	9	55-59	57.4	
SHOW	5270	F?	3	3	1	1	2	1	11	71-75	73.1	
SHOW	5283	M	A	A	A	A	A	A	0	A	A	
SHOW	5290	F?	2	1	1	1	1	1	7	44-56	50.3	C4 USED
SHOW	5292	F	2	1	1	1	1	1	7	44-56	50.3	
SHOW	5298	F	3	3	1	3	3	2	15	71-75	73.1	
SHOW	5302	F	A	A	A	A	A	A	0	A	A	
SHOW	5311	F?	2	3	1	2	3	1	12	71-75	73.1	
SHOW	5316	F?	A	A	A	A	A	A	0	A	A	
SHOW	5320	F	1	1	1	1	1	1	6	N/A	N/A	
SHOW	5323	M	2	1	1	2	1	1	8	55-59	57.4	
SHOW	5329	M	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5347	M	3	3	1	3	3	2	15	70-73	71.8	
SHOW	5350	F	2	2	1	3	3	2	13	71-75	73.1	
SHOW	5364	F	2	2	1	2	1	1	9	57-62	59.7	C4 USED
SHOW	5384	M	2	2	1	1	1	1	8	55-59	57.4	
SHOW	5393	F	2	1	1	2	2	1	9	57-62	59.7	
SHOW	5402	M	A	A	A	A	A	A	0	A	A	
SHOW	5415	F	3	2	2	1	1	1	10	57-62	59.7	
SHOW	5421	M?	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5438	M	2	1	1	3	3	2	12	70-73	71.8	
SHOW	5445	M	1	2	1	1	1	1	7	46-55	50.6	

			BODY			FACETS			Composite Score	Est.		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.		Age	Mean	
SHOW	5451	M	2	1	1	3	3	2	12	70-73	71.8	
SHOW	5453	M	A	A	A	A	A	A	0	A	A	
SHOW	5457	M	3	2	1	1	1	1	9	55-59	57.4	C7 USED
SHOW	5461	M?	1	2	1	2	2	2	10	55-59	57.4	
SHOW	5463	M?	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5475	M?	2	1	1	3	2	1	10	55-59	57.4	
SHOW	5488	F	2	1	1	1	1	1	7	44-56	50.3	
SHOW	5492	F	3	2	2	1	2	1	11	71-75	73.1	
SHOW	5494	F	2	3	1	3	3	1	13	71-75	73.1	
SHOW	5501	F	3	3	1	3	2	2	14	71-75	73.1	
SHOW	5507	F?	3	1	1	2	3	1	11	71-75	73.1	
SHOW	5508	F	3	2	1	3	3	2	14	71-75	73.1	
SHOW	5529	F	2	1	1	1	2	1	8	57-62	59.7	
SHOW	5534	F	2	1	1	1	2	1	8	57-62	59.7	
SHOW	5539	M	3	1	1	1	2	1	9	55-59	57.4	
SHOW	5544	M	3	2	1	2	3	2	13	70-73	71.8	
SHOW	5562	F	2	1	1	1	2	1	8	57-62	59.7	
SHOW	5563	M	2	1	1	1	1	1	7	46-55	50.6	
SHOW	5588	F	2	1	1	2	1	1	8	57-62	59.7	
SHOW	5601	F	A	A	A	A	A	A	0	A	A	
SHOW	5603	M	2	1	1	1	1	1	7	46-55	50.6	
SHOW	5617	M	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5632	F	2	2	1	3	3	1	12	71-75	73.1	
SHOW	5644	M	3	3	1	3	3	1	14	70-73	71.8	
SHOW	5657	F	1	1	1	1	2	1	7	44-56	50.3	
SHOW	5671	M	2	2	1	1	2	1	9	55-59	57.4	
SHOW	5680	M	3	2	1	2	3	1	12	70-73	71.8	
SHOW	5699	F	3	3	1	3	3	1	14	71-75	73.1	
SHOW	5702	M	A	A	A	A	A	A	0	A	A	
SHOW	5710	M	2	1	1	1	1	1	7	46-55	50.6	
SHOW	5740	F	A	A	A	A	A	A	0	A	A	
SHOW	5773	M	2	1	1	3	2	2	11	70-73	71.8	
SHOW	5774	F	3	3	1	1	1	1	10	57-62	59.7	
SHOW	5794	M	3	3	1	3	3	1	14	70-73	71.8	
SHOW	5835	F	A	A	A	A	A	A	0	A	A	
SHOW	5845	M	2	1	1	1	2	1	8	55-59	57.4	
SHOW	5884	F	2	1	1	1	1	1	7	44-56	50.3	
SHOW	5909	F	2	2	1	3	3	2	13	71-75	73.1	
SHOW	5977	M?	A	A	A	A	A	A	0	A	A	
SHOW	6003	F	3	3	1	4	4	1	16	71-75	73.1	RH FACET FUSED ONLY
SHOW	6026	M	A	A	A	A	A	A	0	A	A	
SHOW	6027	F	A	A	A	A	A	A	0	A	A	
SHOW	6029	M	2	1	1	A	A	A	4	53-58	55.6	
SHOW	6030	F	3	2	1	2	1	1	10	57-62	59.7	
SHOW	6042	M	2	1	1	1	1	1	7	46-55	50.6	
SHOW	6043	F	2	2	1	2	3	1	11	71-75	73.1	
SHOW	6048	M	2	1	1	3	3	2	12	70-73	71.8	
SHOW	6060	M	3	3	1	1	2	1	11	70-73	71.8	
SHOW	6070	F	2	1	1	3	2	2	11	71-75	73.1	
SHOW	6072	M	2	1	1	1	2	1	8	55-59	57.4	C5 USED
SHOW	6074	F	3	1	1	1	2	1	9	57-62	59.7	
SHOW	6081	M	2	2	1	3	3	2	13	70-73	71.8	
SHOW	6082	F	2	1	1	1	2	1	8	57-62	59.7	
SHOW	6083	M	2	2	1	1	2	1	9	55-59	57.4	
SHOW	6088	M	3	3	1	2	2	1	12	70-73	71.8	

			BODY			FACETS			Composite Score	Est. Age		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.			Mean	
SHOW	6093	F	3	3	1	1	2	1	11	71-75	73.1	
SHOW	6098	M	2	1	1	1	2	1	8	55-59	57.4	
SHOW	6103	M	4	4	1	4	4	2	19	74-80	77.6	
SHOW	6105	M	2	1	1	2	2	1	9	55-59	57.4	
WP	EE004	M?	2	1	1	1	1	1	7	46-55	50.6	
WP	EE013	M	2	1	1	1	1	1	7	46-55	50.6	C6 USED
WP	EE015	F	3	2	1	3	3	1	13	71-75	73.1	
WP	EE019	F	2	1	1	3	2	1	10	57-62	59.7	C5 USED
WP	EE022	F	2	2	1	1	1	1	8	57-62	59.7	
WP	EE024	M?	A	A	A	A	A	A	0	A	A	
WP	EE025	M?	A	A	A	A	A	A	0	A	A	
WP	EE026	M	3	2	1	1	1	1	9	55-59	57.4	
WP	EE037	M	2	1	1	1	1	1	7	46-55	50.6	
WP	EE056	F	A	A	A	A	A	A	0	A	A	
WP	EE062	M	2	1	1	1	1	1	7	46-55	50.6	
WP	EE070	F	2	1	1	1	2	1	8	57-62	59.7	
WP	EE079	M?	2	2	1	4	4	1	14	70-73	71.8	LH FACETS FUSED ONLY
WP	EE080	M	2	1	1	1	2	1	8	55-59	57.4	
WP	EE089	M	3	2	1	1	1	1	9	55-59	57.4	C6/7 USED
WP	EE097	F?	3	2	1	2	1	1	10	57-62	59.7	
WP	EE098	M?	A	A	A	A	A	A	0	A	A	
WP	EE099	F	2	1	1	2	2	2	10	57-62	59.7	
WP	G251	F	2	1	1	1	1	1	7	44-56	50.3	
WP	G265	M	2	1	1	1	2	1	8	55-59	57.4	
WP	G278	M?	3	1	1	2	2	2	11	70-73	71.8	
WP	G279	M?	2	1	1	1	1	1	7	46-55	50.6	
WP	G296	F?	2	1	1	1	2	1	8	57-62	59.7	
WP	G297	M?	2	1	1	1	2	1	8	55-59	57.4	
WP	G303	M	3	2	1	A	A	A	6	63-67	65	
WP	G310	M	2	1	1	1	1	1	7	46-55	50.6	
WP	G361	F?	2	2	1	A	A	A	5	53-58	55.6	BODY C3 USED
WP	G377	F?	2	1	1	1	2	1	8	57-62	59.7	
WP	G379	M	3	2	1	2	2	1	11	70-73	71.8	
WP	G381	M?	2	1	1	1	2	1	8	55-59	57.4	
WP	G385	F?	3	3	1	2	2	1	12	71-75	73.1	
WP	G406	M?	3	1	1	1	2	1	9	55-59	57.4	
WP	G411	M	2	2	1	2	2	1	10	55-59	57.4	
WP	G419	F?	2	1	1	3	2	2	11	71-75	73.1	
WP	G451	F	3	3	1	1	2	1	11	71-75	73.1	C7? USED
WP	G474	F	2	1	1	3	3	1	11	71-75	73.1	
WP	G482	M	2	1	1	1	2	1	8	55-59	57.4	
WP	G516	M	2	1	1	A	A	A	4	53-58	55.6	BODY C3 USED
WP	G561	M	2	1	1	1	2	1	8	55-59	57.4	
WP	G565	M?	A	A	A	A	A	A	0	A	A	
WP	G571	F?	2	1	1	2	2	1	9	57-62	59.7	
WP	G587	M?	2	1	1	2	2	1	9	55-59	57.4	
WP	G601	M?	3	2	1	2	3	2	13	70-73	71.8	
WP	G607	M	A	A	A	A	A	A	0	A	A	
WP	G628	F?	2	1	1	1	1	1	7	44-56	50.3	
WP	NA046	M	3	3	1	3	3	1	14	70-73	71.8	
WP	NA047	F	2	1	1	1	1	1	7	44-56	50.3	
WP	NA059	F?	2	1	1	2	1	1	8	57-62	59.7	
WP	NA075	M?	2	1	1	2	1	1	8	55-59	57.4	
WP	NA078	M?	A	A	A	A	A	A	0	A	A	
WP	NA080	M	2	2	1	1	2	1	9	55-59	57.4	

			BODY			FACETS			Composite Score	Est.		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.		Age	Mean	
WP	NA084	F	2	1	1	1	1	1	7	44-56	50.3	
WP	NA088	F	2	1	1	1	2	1	8	57-62	59.7	
WP	NA100	F	2	1	1	1	2	2	9	57-62	59.7	
WP	NA166	M	2	1	1	1	2	1	8	55-59	57.4	
WP	NA168	F	2	2	1	3	3	1	12	71-75	73.1	
WP	NA171	M?	2	2	1	1	1	1	8	55-59	57.4	
WP	NA181	M?	3	3	1	3	3	1	14	70-73	71.8	
WP	NA183	M	A	A	A	A	A	A	0	A	A	
WP	NA190	M?	2	2	1	1	1	1	8	55-59	57.4	
WP	NA197	M	2	2	1	3	3	2	13	70-73	71.8	
WP	NA199	M	2	1	1	1	1	1	7	46-55	50.6	
WP	NA202	F	2	1	1	3	3	1	11	71-75	73.1	
WP	NA203	F	2	1	1	1	1	1	7	44-56	50.3	
WP	NA217	M	4	4	1	4	4	1	18	74-80	77.6	
WP	NA218	M	2	1	1	1	2	1	8	55-59	57.4	
WP	NA224	M	A	A	A	A	A	A	0	A	A	
WP	NA233	F	A	A	A	A	A	A	0	A	A	
WP	NA234	M	A	A	A	A	A	A	0	A	A	
WP	SA003	M?	2	1	1	1	2	1	8	55-59	57.4	
WP	SA012	M	2	1	1	1	2	1	8	55-59	57.4	
WP	SA013	F?	3	1	1	2	2	1	10	57-62	59.7	
WP	SA015	M	3	1	1	2	2	1	10	55-59	57.4	
WP	SA021	M	2	1	1	A	A	A	4	53-58	55.6	C4 USED
WP	SA033	M?	A	A	A	A	A	A	0	A	A	
WP	SA034	M	2	2	1	3	3	2	13	70-73	71.8	
WP	SA047	F?	2	1	1	1	1	1	7	44-56	50.3	C5? USED
WP	SA050	F	A	A	A	A	A	A	0	A	A	
WP	SA052	M?	2	1	1	1	2	1	8	55-59	57.4	
WP	SA053	F?	2	2	1	1	1	1	8	57-62	59.7	
WP	SA054	F	A	A	A	A	A	A	0	A	A	
WP	SA056	M?	3	2	1	1	2	1	10	55-59	57.4	
WP	V11	M?	3	1	1	1	2	1	9	55-59	57.4	
WP	V14	F?	A	A	A	A	A	A	0	A	A	
WP	V15	M?	2	2	1	3	3	2	13	70-73	71.8	
WP	V18	M?	2	2	1	2	2	2	11	70-73	71.8	
WP	V19	M?	2	2	1	1	2	1	9	55-59	57.4	
WP	V26	F	2	1	1	1	2	1	8	57-62	59.7	
WP	V27	M?	2	3	1	1	1	1	9	55-59	57.4	
WP	V29	F	A	A	A	A	A	A	0	A	A	
WP	V33	F	2	1	1	1	1	1	7	44-56	50.3	
WP	V38	M?	2	2	1	1	1	1	8	55-59	57.4	C4 USED
WP	V39	M	A	A	A	A	A	A	0	A	A	
WP	V40	M	A	A	A	A	A	A	0	A	A	
WP	V45	M?	2	1	1	1	1	1	7	46-55	50.6	
WP	V46	F	3	2	1	1	1	1	9	57-62	59.7	
WP	V51	M?	2	1	2	1	1	1	8	55-59	57.4	
WP	V61	F	2	1	1	1	1	1	7	44-56	50.3	
WP	WCO009	F	A	A	A	A	A	A	0	A	A	
WP	WCO012	M?	A	A	A	A	A	A	0	A	A	
WP	WCO013	F?	3	3	1	2	3	1	13	71-75	73.1	C6 USED
WP	WCO015	M	2	1	1	1	2	1	8	55-59	57.4	
WP	WCO017	F?	2	1	1	1	1	1	7	44-56	50.3	
WP	WCO018	M	A	A	A	A	A	A	0	A	A	
WP	WCO022	F	2	1	1	1	2	1	8	57-62	59.7	
WP	WCO026	F?	2	1	1	3	3	2	12	71-75	73.1	

			BODY			FACETS			Composite Score	Est. Age		Notes
Site	Sk. No.	Sex	Por.	Ost.	Eb.	Por.	Ost.	Eb.			Mean	
WP	WCO028	F	3	2	1	3	3	2	14	71-75	73.1	
WP	WCO029	F	3	3	1	2	1	1	11	71-75	73.1	
WP	WCO036	F	A	A	A	A	A	A	0	A	A	
WP	WCO037	M?	2	1	1	1	1	1	7	46-55	50.6	
WP	WCO041	M	A	A	A	A	A	A	0	A	A	
WP	WCO045	F?	3	3	1	1	2	1	11	71-75	73.1	
WP	WCO056	F	2	1	1	1	2	1	8	57-62	59.7	
WP	WCO057	M?	A	A	A	A	A	A	0	A	A	
WP	WCO059	M?	2	1	1	2	3	1	10	55-59	57.4	
WP	WCO109	F	2	1	1	1	2	1	8	57-62	59.7	
WP	WCO115	M?	A	A	A	A	A	A	0	A	A	
WP	WCO117	M	2	1	1	1	2	1	8	55-59	57.4	
WP	WCO124	F	3	1	1	2	2	1	10	57-62	59.7	
WP	WCO130	F	3	2	1	3	3	1	13	71-75	73.1	
WP	WCO131	M?	2	2	1	1	2	1	9	55-59	57.4	
WP	WCO137	M?	2	1	1	2	2	1	9	55-59	57.4	
WP	WCO142	M?	A	A	A	A	A	A	0	A	A	
WP	WCO146	M	2	1	1	1	2	1	8	55-59	57.4	
WP	WCO153	M?	A	A	A	A	A	A	0	A	A	
WP	WCO162	F?	3	2	1	1	2	1	10	57-62	59.7	
WP	WCO164A	M	A	A	A	A	A	A	0	A	A	
WP	WCO165	F?	2	2	1	1	1	1	8	57-62	59.7	
WP	WCO165A	M	2	1	1	1	1	1	7	46-55	50.6	
WP	WCO167	F	A	A	A	A	A	A	0	A	A	
WP	WCO169	M	A	A	A	A	A	A	0	A	A	
WP	WCO170	F	4	4	1	4	4	1	18	75-81	78.1	C3 FUSED TO C2 AND C4
WP	WCO173	F	3	2	1	1	1	1	9	57-62	59.7	
WP	WCO179	F?	2	2	1	1	2	1	9	57-62	59.7	
WP	WCO184	F	2	1	1	1	2	1	8	57-62	59.7	
WP	WCO187	F	A	A	A	A	A	A	0	A	A	
WP	WCO199	F	2	1	1	1	2	1	8	57-62	59.7	
WP	WCO200	M?	2	1	1	1	2	1	8	55-59	57.4	C4 USED
WP	WCO203	M?	A	A	A	A	A	A	0	A	A	
WP	WCO204	F	3	3	1	A	A	A	7	63-67	65	

Appendix 6 – Sternal clavicle

Raw data from age estimation using the sternal end of the clavicle (Falys and Prangle, 2015).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
BAR	7	F	3	4	2	9	53-91	72.0
BAR	18	F	2	2	2	6	41-88	64.5
BAR	99	M	3	2	1	6	37-73	55.2
BAR	126	M	3	3	3	9	47-85	65.7
BAR	127	M?	3	3	4	10	58-91	74.9
BAR	128	M	A	A	A	0	A	A
BAR	132	M?	3	2	2	7	37-73	55.2
BAR	179	M	4	3	3	10	58-91	74.9
BAR	187	F	A	A	A	0	A	A
BAR	204	F	A	A	A	0	A	A
BAR	208	M	A	A	A	0	A	A
BAR	241	M	4	2	3	9	47-85	65.7
BAR	266	M	A	A	A	0	A	A
BAR	269	M	3	2	2	7	37-73	55.2
BAR	272	M	5	5	4	14	70-97	83.1
BAR	276	F	A	A	A	0	A	A
BAR	308	M	3	2	2	7	37-73	55.2
BAR	309	F	A	A	A	0	A	A
BAR	311	F?	A	A	A	0	A	A
BAR	326	F	3	2	2	7	41-88	64.5
BAR	327	M	4	4	3	11	58-91	74.9
BAR	363	M	2	2	1	5	36-61	48.8
BAR	380	?	A	A	A	0	A	A
BAR	425	M	4	4	3	11	58-91	74.9
BAR	427	M	2	3	2	7	37-73	55.2
BAR	428	F	3	4	2	9	53-91	72.0
BAR	431	F	3	2	3	8	41-88	64.5
BAR	446	M	4	3	3	10	58-91	74.9
BAR	488	M	A	A	A	0	A	A
BAR	499	F	6	4	3	13	85-89	87.0
BAR	513	F?	A	A	A	0	A	A
BAR	539	F	2	2	2	6	41-88	64.5
BAR	548	M?	A	A	A	0	A	A
BAR	550	F	A	A	A	0	A	A
BAR	552	F	4	2	2	8	41-88	64.5
BAR	558	M?	3	3	2	8	47-85	65.7
BAR	578	F?	A	A	A	0	A	A
BAR	582	M	3	2	2	7	37-73	55.2
BAR	588	M	A	A	A	0	A	A

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
BAR	591	M?	4	4	3	11	58-91	74.9
BAR	594	M?	2	2	2	6	37-73	55.2
BAR	597	M	4	5	2	11	58-91	74.9
BAR	598	M	4	4	3	11	58-91	74.9
BAR	605	M	A	A	A	0	A	A
BAR	606	F	4	5	2	11	63-96	79.3
BAR	607	F	3	2	2	7	41-88	64.5
BAR	613	F	2	2	2	6	41-88	64.5
BAR	619	M	4	4	3	11	58-91	74.9
BAR	624	M	3	2	2	7	37-73	55.2
BAR	650	M	2	3	3	8	47-85	65.7
BAR	675	F	3	2	2	7	41-88	64.5
BAR	706	M	A	A	A	0	A	A
BAR	717	F	A	A	A	0	A	A
BAR	737	M	3	4	2	9	47-85	65.7
BAR	748	F	3	4	2	9	53-91	72.0
BAR	749	F	3	4	2	9	53-91	72.0
BAR	750	F?	A	A	A	0	A	A
BAR	765	M	5	4	2	11	58-91	74.9
BAR	771	F	3	4	2	9	53-91	72.0
BAR	778	M	A	A	A	0	A	A
BAR	788	F	2	2	2	6	41-88	64.5
BAR	834	M	5	4	2	11	58-91	74.9
BAR	850	F	4	4	2	10	53-91	72.0
BAR	854	F	A	A	A	0	A	A
BAR	867	M	5	5	2	12	58-91	74.9
BAR	870	M	A	A	A	0	A	A
BAR	894	F?	2	2	1	5	35-63	49.3
BAR	918	M	2	2	2	6	37-73	55.2
BAR	947	M	2	2	2	6	37-73	55.2
BAR	948	F	A	A	A	0	A	A
BAR	950	M?	4	4	2	10	58-91	74.9
BAR	971	F	A	A	A	0	A	A
BAR	975	M?	2	1	2	5	36-61	48.8
BAR	976	M	2	4	2	8	47-85	65.7
BAR	981	M?	2	2	2	6	37-73	55.2
BAR	989	M	6	6	3	15	70-97	83.1
BAR	1015	M	3	4	2	9	47-85	65.7
BAR	1020	M	3	2	3	8	47-85	65.7
BAR	1022	M	3	3	2	8	47-85	65.7
BAR	1028	F	2	4	2	8	41-88	64.5
BAR	1030	F?	A	A	A	0	A	A
BAR	1039	F	A	A	A	0	A	A
BAR	1043	M	2	3	2	7	37-73	55.2
BAR	1047	M	3	2	3	8	47-85	65.7
BAR	1049	F	6	6	3	15	85-89	87.0
BAR	1062	F	3	4	3	10	53-91	72.0
BAR	1063	M	6	6	4	16	70-97	83.1
BAR	1064	F	3	2	2	7	41-88	64.5
BAR	1068	F	3	2	3	8	41-88	64.5
BAR	1071	F	3	2	2	7	41-88	64.5
BAR	1085	M?	A	A	A	0	A	A
BAR	1096	F	A	A	A	0	A	A
BAR	1100	M	3	3	2	8	47-85	65.7
BAR	1103	M	5	4	2	11	58-91	74.9
BAR	1104	M	A	A	A	0	A	A

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
BAR	1106	M	1	2	2	5	36-61	48.8
BAR	1120	F	A	A	A	0	A	A
BAR	1122	M	5	4	2	11	58-91	74.9
BAR	1133	F	A	A	A	0	A	A
BAR	1134	M	A	A	A	0	A	A
BAR	1139	M	3	4	4	11	58-91	74.9
BAR	1144	F	3	4	1	8	41-88	64.5
BAR	1146	M?	4	2	2	8	47-85	65.7
BAR	1148	F	2	2	2	6	41-88	64.5
BAR	1149	M	3	4	2	9	47-85	65.7
BAR	1151	F	2	2	1	5	35-63	49.3
BAR	1162	M	A	A	A	0	A	A
BAR	1169	M	2	2	2	6	37-73	55.2
BAR	1176	M	3	4	2	9	47-85	65.7
BAR	1183	M?	4	2	2	8	47-85	65.7
BAR	1197	F	A	A	A	0	A	A
BAR	1202	F	2	2	2	6	41-88	64.5
BAR	1204	M	2	1	1	4	36-61	48.8
BAR	1214	M	4	3	2	9	47-85	65.7
BAR	1220	F?	4	2	2	8	41-88	64.5
BAR	1235	F	2	2	2	6	41-88	64.5
BAR	1236	F	A	A	A	0	A	A
BAR	1251	M	2	2	2	6	37-73	55.2
BAR	1254	F	3	4	2	9	53-91	72.0
BAR	1255	F	A	A	A	0	A	A
BAR	1263	M?	2	1	1	4	36-61	48.8
BAR	1268	M	2	2	3	7	37-73	55.2
BAR	1291	M?	3	2	2	7	37-73	55.2
BAR	1297	M	2	2	2	6	37-73	55.2
BAR	1299	F?	2	1	2	5	35-63	49.3
BAR	1307	M	A	A	A	0	A	A
BAR	1315	M	4	3	2	9	47-85	65.7
BAR	1316	M	3	3	2	8	47-85	65.7
BAR	1324	M	2	2	1	5	36-61	48.8
BAR	1409	M?	2	3	2	7	37-73	55.2
BAR	1438	M	A	A	A	0	A	A
BAR	1498	F	2	2	2	6	41-88	64.5
BAR	1538	F	A	A	A	0	A	A
BAR	1542	F	2	2	1	5	35-63	49.3
BAR	1548	M	4	4	3	11	58-91	74.9
BAR	1556	M	2	2	1	5	36-61	48.8
BAR	1566	M	A	A	A	0	A	A
BAR	1571	F	A	A	A	0	A	A
BAR	1615	M	2	3	2	7	37-73	55.2
BAR	1655	F	A	A	A	0	A	A
BAR	1691	M	2	2	2	6	37-73	55.2
BAR	1695	F?	2	2	2	6	41-88	64.5
BAR	1707	M	4	4	3	11	58-91	74.9
BAR	1723	M	A	A	A	0	A	A
BAR	1750	F	A	A	A	0	A	A
BAR	1756	M?	3	3	3	9	47-85	65.7
BAR	1765	F	3	3	2	8	41-88	64.5
BAR	1769	M	3	4	2	9	47-85	65.7
BAR	1775	M	3	4	2	9	47-85	65.7
BAR	1788	M	3	3	3	9	47-85	65.7
BAR	1805	M	4	2	2	8	47-85	65.7

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
BAR	1824	M	3	2	2	7	37-73	55.2
BAR	1843	M	3	3	2	8	47-85	65.7
BAR	1849	M	6	6	3	15	70-97	83.1
BAR	1856	?	A	A	A	0	A	A
BAR	1863	M	3	3	3	9	47-85	65.7
BAR	1869	M?	A	A	A	0	A	A
BAR	1871	M	3	2	2	7	37-73	55.2
BAR	1875	F	3	2	2	7	41-88	64.5
BAR	1889	F?	6	6	2	14	85-89	87.0
BAR	1892	F	4	2	2	8	41-88	64.5
BAR	1897	M	A	A	A	0	A	A
BAR	1910	M	A	A	A	0	A	A
BAR	1911	M	2	2	3	7	37-73	55.2
BAR	1920	M	4	2	3	9	47-85	65.7
BAR	1922	M	4	4	3	11	58-91	74.9
BAR	1926	M	5	4	3	12	58-91	74.9
BAR	1993	M	4	3	3	10	58-91	74.9
BAR	1995	M	4	4	2	10	58-91	74.9
BAR	2027	M	3	3	2	8	47-85	65.7
BAR	2064	F	A	A	A	0	A	A
BAR	2130	F	A	A	A	0	A	A
BAR	2142	F	4	4	1	9	53-91	72.0
BAR	2176	F	2	2	2	6	41-88	64.5
BAR	2187	F	3	3	2	8	41-88	64.5
BAR	2193	M	2	4	2	8	47-85	65.7
BAR	2200	M	1	2	2	5	36-61	48.8
BAR	2206	M	2	2	2	6	37-73	55.2
BAR	2216	F	4	2	2	8	41-88	64.5
BAR	2219	M	4	2	2	8	47-85	65.7
BAR	2236	F	A	A	A	0	A	A
BAR	2244	M	A	A	A	0	A	A
BAR	2248	M	5	5	4	14	70-97	83.1
BAR	2251	M	3	4	3	10	58-91	74.9
BAR	2259	F	1	2	2	5	35-63	49.3
BAR	2274	M	4	4	3	11	58-91	74.9
BAR	2283	F	3	2	2	7	41-88	64.5
BAR	2284	F?	A	A	A	0	A	A
BAR	2289	M	A	A	A	0	A	A
BAR	2294	M	A	A	A	0	A	A
BAR	2297	F?	2	4	2	8	41-88	64.5
BAR	2298	M	A	A	A	0	A	A
BAR	2304	M	A	A	A	0	A	A
BAR	2309	M	5	5	3	13	70-97	83.1
BAR	2320	M	3	4	3	10	58-91	74.9
BAR	2327	M	A	A	A	0	A	A
BAR	2337	M	A	A	A	0	A	A
BAR	2338	M	4	4	3	11	58-91	74.9
BAR	2345	M	2	2	2	6	37-73	55.2
BAR	2348	F	3	2	2	7	41-88	64.5
BAR	2356	F	3	2	2	7	41-88	64.5
BAR	2376	M	2	2	2	6	37-73	55.2
BAR	2386	F	4	4	3	11	63-96	79.3
BAR	2408	F	A	A	A	0	A	A
BAR	2411	F?	A	A	A	0	A	A
BAR	2413	M?	3	4	2	9	47-85	65.7
BAR	2428	F	2	2	1	5	35-63	49.3

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
BAR	2436	F?	2	4	3	9	53-91	72.0
BAR	2451	M?	2	4	1	7	37-73	55.2
BAR	2452	M	A	A	A	0	A	A
BAR	2457	F	A	A	A	0	A	A
BAR	2465	F	2	2	2	6	41-88	64.5
BAR	2466	M	4	4	2	10	58-91	74.9
BAR	2469	M	A	A	A	0	A	A
BAR	2471	M	2	2	2	6	37-73	55.2
BAR	2485	M	3	4	2	9	47-85	65.7
BAR	2491	M?	3	4	2	9	47-85	65.7
BAR	2495	M	3	2	2	7	37-73	55.2
BAR	2499	M	3	3	2	8	47-85	65.7
BAR	2503	F	2	2	2	6	41-88	64.5
BAR	2514	M	A	A	A	0	A	A
BAR	2520	F?	3	4	2	9	53-91	72.0
BAR	2583	M	5	4	2	11	58-91	74.9
BAR	2603	M	A	A	A	0	A	A
BAR	2612	M	2	4	2	8	47-85	65.7
BAR	2616	?	3	2	1	6	37-88	59.85
BAR	2666	F?	A	A	A	0	A	A
BAR	2684	M	2	2	2	6	37-73	55.2
BAR	2700	M	2	3	2	7	37-73	55.2
BAR	2714	M	5	6	4	15	70-97	83.1
BAR	2718	F	2	2	1	5	35-63	49.3
BAR	2720	M	4	4	2	10	58-91	74.9
BAR	2721	M	A	A	A	0	A	A
BAR	2722	F	2	2	2	6	41-88	64.5
BAR	2727	F	2	3	2	7	41-88	64.5
BAR	2730	M	2	2	3	7	37-73	55.2
BAR	2731	M	3	3	1	7	37-73	55.2
BAR	2732	F	3	3	2	8	41-88	64.5
BAR	2739	M	3	2	2	7	37-73	55.2
BAR	2751	F	4	3	2	9	53-91	72.0
BAR	2758	M	3	4	2	9	47-85	65.7
BAR	2766	F	A	A	A	0	A	A
BAR	2775	F	A	A	A	0	A	A
BAR	2780	F	A	A	A	0	A	A
BAR	2783	M	2	2	2	6	37-73	55.2
BAR	2784	M	4	2	3	9	47-85	65.7
BAR	2786	M	3	2	2	7	37-73	55.2
BAR	2798	M?	A	A	A	0	A	A
BAR	2799	M	3	2	1	6	37-73	55.2
FGH	1021	M?	3	4	2	9	47-85	65.7
FGH	1037	F	3	4	2	9	53-91	72.0
FGH	1047	F	3	4	2	9	53-91	72.0
FGH	1049	F?	3	3	2	8	41-88	64.5
FGH	1051	M	6	6	3	15	70-97	83.1
FGH	1053	F?	3	2	2	7	41-88	64.5
FGH	1057	F	6	6	4	16	85-89	87.0
FGH	1063	M	A	A	A	0	A	A
FGH	1075	M	6	6	4	16	70-97	83.1
FGH	1079	F	3	3	2	8	41-88	64.5
FGH	1081	M?	2	2	2	6	37-73	55.2
FGH	1091	F?	4	4	3	11	63-96	79.3
FGH	1097	F?	3	3	2	8	41-88	64.5
FGH	1099	F?	3	2	2	7	41-88	64.5

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
FGH	1101	F	3	2	2	7	41-88	64.5
FGH	1104	F	A	A	A	0	A	A
FGH	1110	F	3	3	2	8	41-88	64.5
FGH	1113	M	2	2	2	6	37-73	55.2
FGH	1115	F	6	5	4	15	85-89	87.0
FGH	1117	M	5	4	3	12	58-91	74.9
FGH	1130	M	6	6	2	14	70-97	83.1
FGH	1139	M?	6	4	4	14	70-97	83.1
FGH	1147	M	5	6	4	15	70-97	83.1
FGH	1150	F	A	A	A	0	A	A
FGH	1163	M?	6	6	3	15	70-97	83.1
FGH	1171	M?	4	4	3	11	58-91	74.9
FGH	1180	F	3	2	1	6	41-88	64.5
FGH	1184	M	3	4	3	10	58-91	74.9
FGH	1188	M	2	3	2	7	37-73	55.2
FGH	1190	F	A	A	A	0	A	A
FGH	1208	F?	3	4	2	9	53-91	72.0
FGH	1228	M	6	5	4	15	70-97	83.1
FGH	1230	F?	3	4	2	9	53-91	72.0
FGH	1237	M?	A	A	A	0	A	A
FGH	1255	F?	A	A	A	0	A	A
FGH	1257	F	2	3	2	7	41-88	64.5
FGH	1280	M?	5	4	3	12	58-91	74.9
FGH	1284	F?	A	A	A	0	A	A
FGH	1286	F	2	3	2	7	41-88	64.5
FGH	1297	F?	3	2	2	7	41-88	64.5
FGH	1305	F?	3	3	2	8	41-88	64.5
FGH	1312	F	2	3	2	7	41-88	64.5
FGH	1313	M?	5	4	4	13	70-97	83.1
FGH	1327	M?	6	6	4	16	70-97	83.1
FGH	1354	M	A	A	A	0	A	A
FGH	1385	M	4	3	3	10	58-91	74.9
FGH	1391	F	A	A	A	0	A	A
FGH	1412	M	3	3	2	8	47-85	65.7
FGH	1441	M?	6	6	3/4	12	58-91	74.9
FGH	1455	F	A	A	A	0	A	A
FGH	1469	F	3	3	1	7	41-88	64.5
FGH	1471	F	3	3	1	7	41-88	64.5
FGH	1484	F	5	4	2	11	63-96	79.3
FGH	1486	M	4	3	2	9	47-85	65.7
FGH	1521	F	A	A	A	0	A	A
FGH	1525	F?	2	3	1	6	41-88	64.5
FGH	1553	M?	3	4	2	9	47-85	65.7
FGH	1560	M?	3	2	2	7	37-73	55.2
FGH	1569	F?	3	4	2	9	53-91	72.0
FGH	1579	F?	3	4	2	9	53-91	72.0
FGH	1581	F?	4	4	2	10	53-91	72.0
FGH	1583	M	2	3	2	7	37-73	55.2
FGH	1589	F	A	A	A	0	A	A
FGH	1597	F	3	3	2	8	41-88	64.5
SHOW	5010a	F	A	A	A	0	A	A
SHOW	5066	M	5	4	3	12	58-91	74.9
SHOW	5091	F	3	2	2	7	41-88	64.5
SHOW	5098	F	2	3	2	7	41-88	64.5
SHOW	5103	F	A	A	A	0	A	A
SHOW	5105	F	5	5	4	14	85-89	87.0

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
SHOW	5110	F	3	3	2	8	41-88	64.5
SHOW	5123	F	3	3	2	8	41-88	64.5
SHOW	5159	M	4	4	3	11	58-91	74.9
SHOW	5172	M	A	A	A	0	A	A
SHOW	5173	M	2	4	1	7	37-73	55.2
SHOW	5186	M?	1	3	A	4	36-61	48.8
SHOW	5190	F	3	3	2	8	41-88	64.5
SHOW	5203	M	3	3	2	8	47-85	65.7
SHOW	5204	M	2	2	2	6	37-73	55.2
SHOW	5207	M	4	4/5	2	10	58-91	74.9
SHOW	5208	M?	2	2	2	6	37-73	55.2
SHOW	5211	F	3	3	2	8	41-88	64.5
SHOW	5218	F?	3	3	2	8	41-88	64.5
SHOW	5222	M	3	2	1	6	37-73	55.2
SHOW	5225	F	3	3	1	7	41-88	64.5
SHOW	5228	F?	4	4	3	11	63-96	79.3
SHOW	5233	M	5	4	1	10	58-91	74.9
SHOW	5237	M	3	4	2	9	47-85	65.7
SHOW	5241	F	2	1	1	4	35-63	49.3
SHOW	5243	M	3	4	4	11	58-91	74.9
SHOW	5244	M?	3	2	2	7	37-73	55.2
SHOW	5254	F	4	4	3	11	63-96	79.3
SHOW	5258	F	2	1	1	4	35-63	49.3
SHOW	5267	F	2	4	1	7	41-88	64.5
SHOW	5269	M	3	4	2	9	47-85	65.7
SHOW	5270	F?	3	2	1	6	41-88	64.5
SHOW	5283	M	A	A	A	0	A	A
SHOW	5290	F?	1	1	2	4	35-63	49.3
SHOW	5292	F	A	A	A	0	A	A
SHOW	5298	F	3	3/4	1	7	41-88	64.5
SHOW	5302	F	A	A	A	0	A	A
SHOW	5311	F?	2	1	2	5	35-63	49.3
SHOW	5316	F?	A	A	A	0	A	A
SHOW	5320	F	1	2	1	4	35-63	49.3
SHOW	5323	M	2	2	1	5	36-61	48.8
SHOW	5329	M	2	4	2	8	47-85	65.7
SHOW	5347	M	3/4	3	2	8	47-85	65.7
SHOW	5350	F	2	2	2	6	41-88	64.5
SHOW	5364	F	2	2	1	5	35-63	49.3
SHOW	5384	M	4	3	3	10	58-91	74.9
SHOW	5393	F	1	2	2	5	35-63	49.3
SHOW	5402	M	2	2	2	6	37-73	55.2
SHOW	5415	F	2	1	2	5	35-63	49.3
SHOW	5421	M?	2	2	2	6	37-73	55.2
SHOW	5438	M	3	3	2	8	47-85	65.7
SHOW	5445	M	2	3	1	6	37-73	55.2
SHOW	5451	M	2	3	2	7	37-73	55.2
SHOW	5453	M	3	3	1	7	37-73	55.2
SHOW	5457	M	3	1	1	5	36-61	48.8
SHOW	5461	M?	2	3	2	7	37-73	55.2
SHOW	5463	M?	2	3	1	6	37-73	55.2
SHOW	5475	M?	2	4	2	8	47-85	65.7
SHOW	5488	F	3/4	3	2	8	41-88	64.5
SHOW	5492	F	2	2	1	5	35-63	49.3
SHOW	5494	F	4	4	3	11	63-96	79.3
SHOW	5501	F	3	4	3	10	53-91	72.0

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
SHOW	5507	F?	3	3	2	8	41-88	64.5
SHOW	5508	F	A	A	A	0	A	A
SHOW	5529	F	3	2	2	7	41-88	64.5
SHOW	5534	F	2	2	2	6	41-88	64.5
SHOW	5539	M	2	2	2	6	37-73	55.2
SHOW	5544	M	1	2	1	4	36-61	48.8
SHOW	5562	F	A	A	A	0	A	A
SHOW	5563	M	A	A	A	0	A	A
SHOW	5588	F	2	2	2	6	41-88	64.5
SHOW	5601	F	4	2	2	8	41-88	64.5
SHOW	5603	M	4	3	2	9	47-85	65.7
SHOW	5617	M	2	2	2	6	37-73	55.2
SHOW	5632	F	3	3	2	8	41-88	64.5
SHOW	5644	M	2	4	2	8	47-85	65.7
SHOW	5657	F	1	2	2	5	35-63	49.3
SHOW	5671	M	4	5	3	12	58-91	74.9
SHOW	5680	M	5	5	3	13	70-97	83.1
SHOW	5699	F	A	A	A	0	A	A
SHOW	5702	M	2	2	1	5	36-61	48.8
SHOW	5710	M	2	2	1	5	36-61	48.8
SHOW	5740	F	A	A	A	0	A	A
SHOW	5773	M	6	4	3	13	70-97	83.1
SHOW	5774	F	A	A	A	0	A	A
SHOW	5794	M	5	4	4	13	70-97	83.1
SHOW	5835	F	A	A	A	0	A	A
SHOW	5845	M	2	2	2	6	37-73	55.2
SHOW	5884	F	2	2	1	5	35-63	49.3
SHOW	5909	F	2	2	2	6	41-88	64.5
SHOW	5977	M?	A	A	A	0	A	A
SHOW	6003	F	2	2	2	6	41-88	64.5
SHOW	6026	M	A	A	A	0	A	A
SHOW	6027	F	3	2	2	7	41-88	64.5
SHOW	6029	M	2	2	2	6	37-73	55.2
SHOW	6030	F	5	4	3	12	63-96	79.3
SHOW	6042	M	2	1	2	5	36-61	48.8
SHOW	6043	F	3	3	2	8	41-88	64.5
SHOW	6048	M	1	1	2	4	36-61	48.8
SHOW	6060	M	A	A	A	0	A	A
SHOW	6070	F	2	3	2	7	41-88	64.5
SHOW	6072	M	A	A	A	0	A	A
SHOW	6074	F	2	3	2	7	41-88	64.5
SHOW	6081	M	4	2	2	8	47-85	65.7
SHOW	6082	F	3	2	3	8	41-88	64.5
SHOW	6083	M	2	2	2	6	37-73	55.2
SHOW	6088	M	4	5	4	13	70-97	83.1
SHOW	6093	F	1	2	1	4	35-63	49.3
SHOW	6098	M	3	4	2	9	47-85	65.7
SHOW	6103	M	5	5	3	13	70-97	83.1
SHOW	6105	M	5	4	2	11	58-91	74.9
WP	EE004	M?	A	A	A	0	A	A
WP	EE013	M	3	2	2	7	37-73	55.2
WP	EE015	F	6	5	3	14	85-89	87.0
WP	EE019	F	3	2	2	7	41-88	64.5
WP	EE022	F	2	3	1	6	41-88	64.5
WP	EE024	M?	A	A	A	0	A	A
WP	EE025	M?	A	A	A	0	A	A

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
WP	EE026	M	3	4	2	9	47-85	65.7
WP	EE037	M	4	4	2	10	58-91	74.9
WP	EE056	F	A	A	A	0	A	A
WP	EE062	M	3	2	2	7	37-73	55.2
WP	EE070	F	2	2	2	6	41-88	64.5
WP	EE079	M?	6	6	4	16	70-97	83.1
WP	EE080	M	2	3	1	6	37-73	55.2
WP	EE089	M	A	A	A	0	A	A
WP	EE097	F?	A	A	A	0	A	A
WP	EE098	M?	A	A	A	0	A	A
WP	EE099	F	3	3	2	8	41-88	64.5
WP	G251	F	2	2	1	5	35-63	49.3
WP	G265	M	2	3	2	7	37-73	55.2
WP	G278	M?	4	2	2	8	47-85	65.7
WP	G279	M?	4	4	2	10	58-91	74.9
WP	G296	F?	3	4	2	9	53-91	72.0
WP	G297	M?	5	3	3	11	58-91	74.9
WP	G303	M	A	A	A	0	A	A
WP	G310	M	2	1	1	4	36-61	48.8
WP	G361	F?	3	2	2	7	41-88	64.5
WP	G377	F?	2	2	2	6	41-88	64.5
WP	G379	M	3	3	2	8	47-85	65.7
WP	G381	M?	2	3	2	7	37-73	55.2
WP	G385	F?	2	3	2	7	41-88	64.5
WP	G406	M?	3	4	2	9	47-85	65.7
WP	G411	M	2	2	2	6	37-73	55.2
WP	G419	F?	3	4	1	8	41-88	64.5
WP	G451	F	3	3	2	8	41-88	64.5
WP	G474	F	3	4	2	9	53-91	72.0
WP	G482	M	4	4	2	10	58-91	74.9
WP	G516	M	A	A	A	0	A	A
WP	G561	M	2	2	2	6	37-73	55.2
WP	G565	M?	A	A	A	0	A	A
WP	G571	F?	3	3	2	8	41-88	64.5
WP	G587	M?	2	3	2	7	37-73	55.2
WP	G601	M?	4	4	2	10	58-91	74.9
WP	G607	M	2	2	2	6	37-73	55.2
WP	G628	F?	2	3	2	7	41-88	64.5
WP	NA046	M	2	2	3	7	37-73	55.2
WP	NA047	F	2	2	2	6	41-88	64.5
WP	NA059	F?	3	4	2	9	53-91	72.0
WP	NA075	M?	A	A	A	0	A	A
WP	NA078	M?	3	1	2	6	37-73	55.2
WP	NA080	M	2	2	2	6	37-73	55.2
WP	NA084	F	2	2	1	5	35-63	49.3
WP	NA088	F	2	2	2	6	41-88	64.5
WP	NA100	F	2	2	2	6	41-88	64.5
WP	NA166	M	1	2	1	4	36-61	48.8
WP	NA168	F	3	3	1	7	41-88	64.5
WP	NA171	M?	2	3	1	6	37-73	55.2
WP	NA181	M?	4	4	2	10	58-91	74.9
WP	NA183	M	3	1	2	6	37-73	55.2
WP	NA190	M?	2	3	2	7	37-73	55.2
WP	NA197	M	3	2	2	7	37-73	55.2
WP	NA199	M	3	3	2	8	47-85	65.7
WP	NA202	F	3	4	2	9	53-91	72.0

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
WP	NA203	F	3	2	2	7	41-88	64.5
WP	NA217	M	5	4	4	13	70-97	83.1
WP	NA218	M	3	4	3	10	58-91	74.9
WP	NA224	M	A	A	A	0	A	A
WP	NA233	F	A	A	A	0	A	A
WP	NA234	M	A	A	A	0	A	A
WP	SA003	M?	2	3	2	7	37-73	55.2
WP	SA012	M	2	4	2	8	47-85	65.7
WP	SA013	F?	2	2	2	6	41-88	64.5
WP	SA015	M	A	A	A	0	A	A
WP	SA021	M	2	2	A	4	36-61	48.8
WP	SA033	M?	A	A	A	0	A	A
WP	SA034	M	3	2	3	8	47-85	65.7
WP	SA047	F?	A	A	A	0	A	A
WP	SA050	F	A	A	A	0	A	A
WP	SA052	M?	3	4	2	9	47-85	65.7
WP	SA053	F?	2	3	2	7	41-88	64.5
WP	SA054	F	1	1	2	4	35-63	49.3
WP	SA056	M?	3	3	2	8	47-85	65.7
WP	V11	M?	3	3	2	8	47-85	65.7
WP	V14	F?	A	A	A	0	A	A
WP	V15	M?	2	2	2	6	37-73	55.2
WP	V18	M?	3	3	2	8	47-85	65.7
WP	V19	M?	4	3	2	9	47-85	65.7
WP	V26	F	3	2	2	7	41-88	64.5
WP	V27	M?	3	4	3	10	58-91	74.9
WP	V29	F	2	1	2	5	35-63	49.3
WP	V33	F	2	2	1	5	35-63	49.3
WP	V38	M?	2	4	2	8	47-85	65.7
WP	V39	M	A	A	A	0	A	A
WP	V40	M	A	A	A	0	A	A
WP	V45	M?	2	2	2	6	37-73	55.2
WP	V46	F	2	2	2	6	41-88	64.5
WP	V51	M?	A	A	A	0	A	A
WP	V61	F	2	2	1	5	35-63	49.3
WP	WCO009	F	A	A	A	0	A	A
WP	WCO012	M?	A	A	A	0	A	A
WP	WCO013	F?	A	A	A	0	A	A
WP	WCO015	M	2	3	1	6	37-73	55.2
WP	WCO017	F?	3	3	3	9	53-91	72.0
WP	WCO018	M	A	A	A	0	A	A
WP	WCO022	F	1	2	1	4	35-63	49.3
WP	WCO026	F?	2	3	1	6	41-88	64.5
WP	WCO028	F	2	2	1	5	35-63	49.3
WP	WCO029	F	2	3	2	7	41-88	64.5
WP	WCO036	F	A	A	A	0	A	A
WP	WCO037	M?	3	3	2	8	47-85	65.7
WP	WCO041	M	A	A	A	0	A	A
WP	WCO045	F?	5	4	2	11	63-96	79.3
WP	WCO056	F	3	3	1	7	41-88	64.5
WP	WCO057	M?	4	4	3	11	58-91	74.9
WP	WCO059	M?	2	3	1	6	37-73	55.2
WP	WCO109	F	2	3	2	7	41-88	64.5
WP	WCO115	M?	A	A	A	0	A	A
WP	WCO117	M	4	4	3	11	58-91	74.9
WP	WCO124	F	2	2	1	5	35-63	49.3

Site	Sk. No.	Sex	Topography	Porosity	Osteophytes	Composite Score	Est. Age	Mean
WP	WCO130	F	2	3	2	7	41-88	64.5
WP	WCO131	M?	3	4	1	8	47-85	65.7
WP	WCO137	M?	2	3	2	7	37-73	55.2
WP	WCO142	M?	A	A	A	0	A	A
WP	WCO146	M	3	5	2	10	58-91	74.9
WP	WCO153	M?	A	A	A	0	A	A
WP	WCO162	F?	3	3	3	9	53-91	72.0
WP	WCO164A	M	A	A	A	0	A	A
WP	WCO165	F?	4	4	2	10	53-91	72.0
WP	WCO165A	M	3	1	2	6	37-73	55.2
WP	WCO167	F	3	2	2	7	41-88	64.5
WP	WCO169	M	A	A	A	0	A	A
WP	WCO170	F	5	4	2	11	63-96	79.3
WP	WCO173	F	2	2	2	6	41-88	64.5
WP	WCO179	F?	3	4	2	9	53-91	72.0
WP	WCO184	F	2	2	1	5	35-63	49.3
WP	WCO187	F	3	2	1	6	41-88	64.5
WP	WCO199	F	2	2	1	5	35-63	49.3
WP	WCO200	M?	4	3	1	8	47-85	65.7
WP	WCO203	M?	A	A	A	0	A	A
WP	WCO204	F	A	A	A	0	A	A

Appendix 7 – First rib

Raw data from age estimation using the first rib (DiGangi et al., 2009).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

N/A = element partially absent, no age estimation could be undertaken

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
BAR	7	F	4	3	39-61	50.23
BAR	18	F	3	2	23-43	32.07
BAR	99	M	N/A	N/A	N/A	N/A
BAR	126	M	A	A	A	A
BAR	127	M?	4	1	21-42	30.46
BAR	128	M	A	A	A	A
BAR	132	M?	5	4	56-75	66.19
BAR	179	M	4	1	21-42	30.46
BAR	187	F	N/A	N/A	N/A	N/A
BAR	204	F	N/A	N/A	N/A	N/A
BAR	208	M	A	A	A	A
BAR	241	M	4	1	21-42	30.46
BAR	266	M	N/A	N/A	N/A	N/A
BAR	269	M	N/A	N/A	N/A	N/A
BAR	272	M	A	A	A	A
BAR	276	F	A	A	A	A
BAR	308	M	5	3	50-70	60.87
BAR	309	F	N/A	N/A	N/A	N/A
BAR	311	F?	N/A	N/A	N/A	N/A
BAR	326	F	3	1	13-29	20.19
BAR	327	M	5	3	50-70	60.87
BAR	363	M	N/A	N/A	N/A	N/A
BAR	380	?	A	A	A	A
BAR	425	M	N/A	N/A	N/A	N/A
BAR	427	M	5	3	50-70	60.87
BAR	428	F	N/A	N/A	N/A	N/A
BAR	431	F	4	4	47-68	58.39
BAR	446	M	4	2	33-55	43.95
BAR	488	M	A	A	A	A
BAR	499	F	5	3	50-70	60.87
BAR	513	F?	A	A	A	A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
BAR	539	F	N/A	N/A	N/A	N/A
BAR	548	M?	A	A	A	A
BAR	550	F	A	A	A	A
BAR	552	F	5	3	50-70	60.87
BAR	558	M?	N/A	N/A	N/A	N/A
BAR	578	F?	3	2	23-43	32.07
BAR	582	M	5	3	50-70	60.87
BAR	588	M	A	A	A	A
BAR	591	M?	A	A	A	A
BAR	594	M?	N/A	N/A	N/A	N/A
BAR	597	M	N/A	N/A	N/A	N/A
BAR	598	M	5	1	37-60	49.45
BAR	605	M	A	A	A	A
BAR	606	F	N/A	N/A	N/A	N/A
BAR	607	F	3	1	13-29	20.19
BAR	613	F	3	1	13-29	20.19
BAR	619	M	4	2	33-55	43.95
BAR	624	M	4	1	21-42	30.46
BAR	650	M	4	2	33-55	43.95
BAR	675	F	2	3	22-43	31.59
BAR	706	M	A	A	A	A
BAR	717	F	A	A	A	A
BAR	737	M	4	2	33-55	43.95
BAR	748	F	N/A	N/A	N/A	N/A
BAR	749	F	N/A	N/A	N/A	N/A
BAR	750	F?	A	A	A	A
BAR	765	M	4	1	21-42	30.46
BAR	771	F	N/A	N/A	N/A	N/A
BAR	778	M	A	A	A	A
BAR	788	F	A	A	A	A
BAR	834	M	N/A	N/A	N/A	N/A
BAR	850	F	N/A	N/A	N/A	N/A
BAR	854	F	A	A	A	A
BAR	867	M	N/A	N/A	N/A	N/A
BAR	870	M	N/A	N/A	N/A	N/A
BAR	894	F?	A	A	A	A
BAR	918	M	A	A	A	A
BAR	947	M	N/A	N/A	N/A	N/A
BAR	948	F	A	A	A	A
BAR	950	M?	A	A	A	A
BAR	971	F	A	A	A	A
BAR	975	M?	4	1	21-42	30.46
BAR	976	M	A	A	A	A
BAR	981	M?	N/A	N/A	N/A	N/A
BAR	989	M	4	1	21-42	30.46

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
BAR	1015	M	A	A	A	A
BAR	1020	M	5	1	37-60	49.45
BAR	1022	M	5	1	37-60	49.45
BAR	1028	F	5	3	50-70	60.87
BAR	1030	F?	A	A	A	A
BAR	1039	F	A	A	A	A
BAR	1043	M	5	1	37-60	49.45
BAR	1047	M	N/A	N/A	N/A	N/A
BAR	1049	F	N/A	N/A	N/A	N/A
BAR	1062	F	A	A	A	A
BAR	1063	M	A	A	A	A
BAR	1064	F	5	2	46-67	57.26
BAR	1068	F	A	A	A	A
BAR	1071	F	N/A	N/A	N/A	N/A
BAR	1085	M?	A	A	A	A
BAR	1096	F	A	A	A	A
BAR	1100	M	4	1	21-42	30.46
BAR	1103	M	4	3	39-61	50.23
BAR	1104	M	A	A	A	A
BAR	1106	M	4	3	39-61	50.23
BAR	1120	F	A	A	A	A
BAR	1122	M	N/A	N/A	N/A	N/A
BAR	1133	F	A	A	A	A
BAR	1134	M	A	A	A	A
BAR	1139	M	N/A	N/A	N/A	N/A
BAR	1144	F	A	A	A	A
BAR	1146	M?	A	A	A	A
BAR	1148	F	A	A	A	A
BAR	1149	M	N/A	N/A	N/A	N/A
BAR	1151	F	N/A	N/A	N/A	N/A
BAR	1162	M	A	A	A	A
BAR	1169	M	N/A	N/A	N/A	N/A
BAR	1176	M	N/A	N/A	N/A	N/A
BAR	1183	M?	4	2	33-55	43.95
BAR	1197	F	N/A	N/A	N/A	N/A
BAR	1202	F	5	2	46-67	57.26
BAR	1204	M	N/A	N/A	N/A	N/A
BAR	1214	M	N/A	N/A	N/A	N/A
BAR	1220	F?	N/A	N/A	N/A	N/A
BAR	1235	F	N/A	N/A	N/A	N/A
BAR	1236	F	5	3	50-70	60.87
BAR	1251	M	5	1	37-60	49.45
BAR	1254	F	3	1	13-29	20.19
BAR	1255	F	A	A	A	A
BAR	1263	M?	A	A	A	A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
BAR	1268	M	5	1	37-60	49.45
BAR	1291	M?	5	3	50-70	60.87
BAR	1297	M	N/A	N/A	N/A	N/A
BAR	1299	F?	A	A	A	A
BAR	1307	M	A	A	A	A
BAR	1315	M	A	A	A	A
BAR	1316	M	N/A	N/A	N/A	N/A
BAR	1324	M	4	1	21-42	30.46
BAR	1409	M?	A	A	A	A
BAR	1438	M	A	A	A	A
BAR	1498	F	A	A	A	A
BAR	1538	F	A	A	A	A
BAR	1542	F	N/A	N/A	N/A	N/A
BAR	1548	M	4	1	21-42	30.46
BAR	1556	M	4	1	21-42	30.46
BAR	1566	M	A	A	A	A
BAR	1571	F	A	A	A	A
BAR	1615	M	N/A	N/A	N/A	N/A
BAR	1655	F	A	A	A	A
BAR	1691	M	5	1	37-60	49.45
BAR	1695	F?	N/A	N/A	N/A	N/A
BAR	1707	M	5	4	56-75	66.19
BAR	1723	M	A	A	A	A
BAR	1750	F	A	A	A	A
BAR	1756	M?	3	1	13-29	20.19
BAR	1765	F	N/A	N/A	N/A	N/A
BAR	1769	M	N/A	N/A	N/A	N/A
BAR	1775	M	A	A	A	A
BAR	1788	M	5	1	37-60	49.45
BAR	1805	M	5	1	37-60	49.45
BAR	1824	M	4	2	33-55	43.95
BAR	1843	M	5	1	37-60	49.45
BAR	1849	M	4	1	21-42	30.46
BAR	1856	?	5	1	37-60	49.45
BAR	1863	M	5	1	37-60	49.45
BAR	1869	M?	A	A	A	A
BAR	1871	M	A	A	A	A
BAR	1875	F	3	1	13-29	20.19
BAR	1889	F?	A	A	A	A
BAR	1892	F	3	1	13-29	20.19
BAR	1897	M	A	A	A	A
BAR	1910	M	A	A	A	A
BAR	1911	M	5	1	37-60	49.45
BAR	1920	M	4	2	33-55	43.95
BAR	1922	M	N/A	N/A	N/A	N/A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
BAR	1926	M	4	1	21-42	30.46
BAR	1993	M	4	1	21-42	30.46
BAR	1995	M	5	2	46-67	57.26
BAR	2027	M	5	3	50-70	60.87
BAR	2064	F	A	A	A	A
BAR	2130	F	A	A	A	A
BAR	2142	F	5	3	50-70	60.87
BAR	2176	F	3	2	23-43	32.07
BAR	2187	F	A	A	A	A
BAR	2193	M	4	3	39-61	50.23
BAR	2200	M	A	A	A	A
BAR	2206	M	A	A	A	A
BAR	2216	F	A	A	A	A
BAR	2219	M	5	1	37-60	49.45
BAR	2236	F	N/A	N/A	N/A	N/A
BAR	2244	M	A	A	A	A
BAR	2248	M	5	4	56-75	66.19
BAR	2251	M	4	1	21-42	30.46
BAR	2259	F	N/A	N/A	N/A	N/A
BAR	2274	M	5	3	50-70	60.87
BAR	2283	F	3	4	38-61	50.26
BAR	2284	F?	4	4	47-68	58.39
BAR	2289	M	A	A	A	A
BAR	2294	M	A	A	A	A
BAR	2297	F?	4	2	33-55	43.95
BAR	2298	M	5	3	50-70	60.87
BAR	2304	M	A	A	A	A
BAR	2309	M	A	A	A	A
BAR	2320	M	5	1	37-60	49.45
BAR	2327	M	A	A	A	A
BAR	2337	M	N/A	N/A	N/A	N/A
BAR	2338	M	N/A	N/A	N/A	N/A
BAR	2345	M	A	A	A	A
BAR	2348	F	5	4	56-75	66.19
BAR	2356	F	4	1	21-42	30.46
BAR	2376	M	5	1	37-60	49.45
BAR	2386	F	4	1	21-42	30.46
BAR	2408	F	A	A	A	A
BAR	2411	F?	A	A	A	A
BAR	2413	M?	N/A	N/A	N/A	N/A
BAR	2428	F	N/A	N/A	N/A	N/A
BAR	2436	F?	4	1	21-42	30.46
BAR	2451	M?	N/A	N/A	N/A	N/A
BAR	2452	M	A	A	A	A
BAR	2457	F	A	A	A	A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
BAR	2465	F	N/A	N/A	N/A	N/A
BAR	2466	M	4	2	33-55	43.95
BAR	2469	M	A	A	A	A
BAR	2471	M	5	3	50-70	60.87
BAR	2485	M	4	1	21-42	30.46
BAR	2491	M?	N/A	N/A	N/A	N/A
BAR	2495	M	N/A	N/A	N/A	N/A
BAR	2499	M	4	3	39-61	50.23
BAR	2503	F	N/A	N/A	N/A	N/A
BAR	2514	M	A	A	A	A
BAR	2520	F?	N/A	N/A	N/A	N/A
BAR	2583	M	A	A	A	A
BAR	2603	M	N/A	N/A	N/A	N/A
BAR	2612	M	5	3	50-70	60.87
BAR	2616	?	5	1	37-60	49.45
BAR	2666	F?	A	A	A	A
BAR	2684	M	3	1	13-29	20.19
BAR	2700	M	3	1	13-29	20.19
BAR	2714	M	5	3	50-70	60.87
BAR	2718	F	1	1	12-18	12.00
BAR	2720	M	A	A	A	A
BAR	2721	M	A	A	A	A
BAR	2722	F	4	1	21-42	30.46
BAR	2727	F	N/A	N/A	N/A	N/A
BAR	2730	M	5	1	37-60	49.45
BAR	2731	M	N/A	N/A	N/A	N/A
BAR	2732	F	5	1	37-60	49.45
BAR	2739	M	4	1	21-42	30.46
BAR	2751	F	3	1	13-29	20.19
BAR	2758	M	A	A	A	A
BAR	2766	F	A	A	A	A
BAR	2775	F	N/A	N/A	N/A	N/A
BAR	2780	F	A	A	A	A
BAR	2783	M	A	A	A	A
BAR	2784	M	4	2	33-55	43.95
BAR	2786	M	4	1	21-42	30.46
BAR	2798	M?	A	A	A	A
BAR	2799	M	N/A	N/A	N/A	N/A
FGH	1021	M?	5	1	37-60	49.45
FGH	1037	F	A	A	A	A
FGH	1047	F	A	A	A	A
FGH	1049	F?	A	A	A	A
FGH	1051	M	A	A	A	A
FGH	1053	F?	2	1	12-23	15.10
FGH	1057	F	A	A	A	A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
FGH	1063	M	A	A	A	A
FGH	1075	M	A	A	A	A
FGH	1079	F	A	A	A	A
FGH	1081	M?	A	A	A	A
FGH	1091	F?	5	1	37-60	49.45
FGH	1097	F?	A	A	A	A
FGH	1099	F?	A	A	A	A
FGH	1101	F	4	3	39-61	50.23
FGH	1104	F	A	A	A	A
FGH	1110	F	A	A	A	A
FGH	1113	M	A	A	A	A
FGH	1115	F	A	A	A	A
FGH	1117	M	5	4	56-75	66.19
FGH	1130	M	5	2	46-67	57.26
FGH	1139	M?	5	3	50-70	60.87
FGH	1147	M	5	3	50-70	60.87
FGH	1150	F	A	A	A	A
FGH	1163	M?	5	4	56-75	66.19
FGH	1171	M?	5	1	37-60	49.45
FGH	1180	F	2	1	12-23	15.10
FGH	1184	M	4	1	21-42	30.46
FGH	1188	M	A	A	A	A
FGH	1190	F	A	A	A	A
FGH	1208	F?	A	A	A	A
FGH	1228	M	5	4	56-75	66.19
FGH	1230	F?	A	A	A	A
FGH	1237	M?	A	A	A	A
FGH	1255	F?	A	A	A	A
FGH	1257	F	A	A	A	A
FGH	1280	M?	A	A	A	A
FGH	1284	F?	A	A	A	A
FGH	1286	F	5	4	56-75	66.19
FGH	1297	F?	4	1	21-42	30.46
FGH	1305	F?	5	4	56-75	66.19
FGH	1312	F	2	1	12-23	15.10
FGH	1313	M?	5	1	37-60	49.45
FGH	1327	M?	4	4	47-68	58.39
FGH	1354	M	A	A	A	A
FGH	1385	M	5	3	50-70	60.87
FGH	1391	F	A	A	A	A
FGH	1412	M	A	A	A	A
FGH	1441	M?	A	A	A	A
FGH	1455	F	A	A	A	A
FGH	1469	F	A	A	A	A
FGH	1471	F	A	A	A	A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
FGH	1484	F	5	1	37-60	49.45
FGH	1486	M	A	A	A	A
FGH	1521	F	A	A	A	A
FGH	1525	F?	A	A	A	A
FGH	1553	M?	3	1	13-29	20.19
FGH	1560	M?	5	1	37-60	49.45
FGH	1569	F?	A	A	A	A
FGH	1579	F?	5	4	56-75	66.19
FGH	1581	F?	5	4	56-75	66.19
FGH	1583	M	5	1	37-60	49.45
FGH	1589	F	A	A	A	A
FGH	1597	F	A	A	A	A
SHOW	5010a	F	A	A	A	A
SHOW	5066	M	4	2	33-55	43.95
SHOW	5091	F	3	1	13-29	20.19
SHOW	5098	F	N/A	N/A	N/A	N/A
SHOW	5103	F	5	2	46-67	57.26
SHOW	5105	F	A	A	A	A
SHOW	5110	F	4	1	21-42	30.46
SHOW	5123	F	2	1	12-23	15.10
SHOW	5159	M	5	3	50-70	60.87
SHOW	5172	M	A	A	A	A
SHOW	5173	M	4	1	21-42	30.46
SHOW	5186	M?	A	A	A	A
SHOW	5190	F	5	1	37-60	49.45
SHOW	5203	M	N/A	N/A	N/A	N/A
SHOW	5204	M	N/A	N/A	N/A	N/A
SHOW	5207	M	5	2	46-67	57.26
SHOW	5208	M?	N/A	N/A	N/A	N/A
SHOW	5211	F	A	A	A	A
SHOW	5218	F?	3	1	13-29	20.19
SHOW	5222	M	N/A	N/A	N/A	N/A
SHOW	5225	F	N/A	N/A	N/A	N/A
SHOW	5228	F?	5	2	46-67	57.26
SHOW	5233	M	A	A	A	A
SHOW	5237	M	5	2	46-67	57.26
SHOW	5241	F	2	1	12-23	15.10
SHOW	5243	M	5	1	37-60	49.45
SHOW	5244	M?	N/A	N/A	N/A	N/A
SHOW	5254	F	3	2	23-43	32.07
SHOW	5258	F	N/A	N/A	N/A	N/A
SHOW	5267	F	3	3	29-51	39.34
SHOW	5269	M	5	2	46-67	57.26
SHOW	5270	F?	2	1	12-23	15.10
SHOW	5283	M	A	A	A	A

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
SHOW	5290	F?	A	A	A	A
SHOW	5292	F	A	A	A	A
SHOW	5298	F	2	1	12-23	15.10
SHOW	5302	F	A	A	A	A
SHOW	5311	F?	4	1	21-42	30.46
SHOW	5316	F?	A	A	A	A
SHOW	5320	F	3	1	13-29	20.19
SHOW	5323	M	4	1	21-42	30.46
SHOW	5329	M	N/A	N/A	N/A	N/A
SHOW	5347	M	5	2	46-67	57.26
SHOW	5350	F	3	1	13-29	20.19
SHOW	5364	F	A	A	A	A
SHOW	5384	M	4	1	21-42	30.46
SHOW	5393	F	3	1	13-29	20.19
SHOW	5402	M	4	3	39-61	50.23
SHOW	5415	F	3	1	13-29	20.19
SHOW	5421	M?	5	2	46-67	57.26
SHOW	5438	M	4	2	33-55	43.95
SHOW	5445	M	3	1	13-29	20.19
SHOW	5451	M	4	1	21-42	30.46
SHOW	5453	M	A	A	A	A
SHOW	5457	M	N/A	N/A	N/A	N/A
SHOW	5461	M?	5	2	46-67	57.26
SHOW	5463	M?	4	1	21-42	30.46
SHOW	5475	M?	A	A	A	A
SHOW	5488	F	4	2	33-55	43.95
SHOW	5492	F	4	4	47-68	58.39
SHOW	5494	F	5	3	50-70	60.87
SHOW	5501	F	5	3	50-70	60.87
SHOW	5507	F?	5	1	37-60	49.45
SHOW	5508	F	A	A	A	A
SHOW	5529	F	A	A	A	A
SHOW	5534	F	3	1	13-29	20.19
SHOW	5539	M	N/A	N/A	N/A	N/A
SHOW	5544	M	N/A	N/A	N/A	N/A
SHOW	5562	F	N/A	N/A	N/A	N/A
SHOW	5563	M	N/A	N/A	N/A	N/A
SHOW	5588	F	4	2	33-55	43.95
SHOW	5601	F	A	A	A	A
SHOW	5603	M	N/A	N/A	N/A	N/A
SHOW	5617	M	4	1	21-42	30.46
SHOW	5632	F	5	3	50-70	60.87
SHOW	5644	M	4	3	39-61	50.23
SHOW	5657	F	3	2	23-43	32.07
SHOW	5671	M	4	2	33-55	43.95

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
SHOW	5680	M	N/A	N/A	N/A	N/A
SHOW	5699	F	N/A	N/A	N/A	N/A
SHOW	5702	M	N/A	N/A	N/A	N/A
SHOW	5710	M	3	3	29-51	39.34
SHOW	5740	F	A	A	A	A
SHOW	5773	M	5	3	50-70	60.87
SHOW	5774	F	N/A	N/A	N/A	N/A
SHOW	5794	M	4	1	21-42	30.46
SHOW	5835	F	A	A	A	A
SHOW	5845	M	4	1	21-42	30.46
SHOW	5884	F	A	A	A	A
SHOW	5909	F	N/A	N/A	N/A	N/A
SHOW	5977	M?	A	A	A	A
SHOW	6003	F	5	3	50-70	60.87
SHOW	6026	M	A	A	A	A
SHOW	6027	F	A	A	A	A
SHOW	6029	M	A	A	A	A
SHOW	6030	F	5	1	37-60	49.45
SHOW	6042	M	N/A	N/A	N/A	N/A
SHOW	6043	F	4	1	21-42	30.46
SHOW	6048	M	4	1	21-42	30.46
SHOW	6060	M	A	A	A	A
SHOW	6070	F	3	1	13-29	20.19
SHOW	6072	M	A	A	A	A
SHOW	6074	F	5	3	50-70	60.87
SHOW	6081	M	4	3	39-61	50.23
SHOW	6082	F	4	1	21-42	30.46
SHOW	6083	M	4	1	21-42	30.46
SHOW	6088	M	4	1	21-42	30.46
SHOW	6093	F	3	1	13-29	20.19
SHOW	6098	M	4	1	21-42	30.46
SHOW	6103	M	5	1	37-60	49.45
SHOW	6105	M	5	2	46-67	57.26
WP	EE004	M?	A	A	A	A
WP	EE013	M	5	2	46-67	57.26
WP	EE015	F	5	3	50-70	60.87
WP	EE019	F	A	A	A	A
WP	EE022	F	A	A	A	A
WP	EE024	M?	A	A	A	A
WP	EE025	M?	A	A	A	A
WP	EE026	M	3	1	13-29	20.19
WP	EE037	M	5	1	37-60	49.45
WP	EE056	F	A	A	A	A
WP	EE062	M	3	1	13-29	20.19
WP	EE070	F	1	1	12-18	12.00

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
WP	EE079	M?	A	A	A	A
WP	EE080	M	5	1	37-60	49.45
WP	EE089	M	A	A	A	A
WP	EE097	F?	5	1	37-60	49.45
WP	EE098	M?	A	A	A	A
WP	EE099	F	5	1	37-60	49.45
WP	G251	F	5	1	37-60	49.45
WP	G265	M	5	1	37-60	49.45
WP	G278	M?	A	A	A	A
WP	G279	M?	5	1	37-60	49.45
WP	G296	F?	5	1	37-60	49.45
WP	G297	M?	4	1	21-42	30.46
WP	G303	M	A	A	A	A
WP	G310	M	A	A	A	A
WP	G361	F?	A	A	A	A
WP	G377	F?	5	2	46-67	57.26
WP	G379	M	5	1	37-60	49.45
WP	G381	M?	5	2	46-67	57.26
WP	G385	F?	3	1	13-29	20.19
WP	G406	M?	3	1	13-29	20.19
WP	G411	M	3	1	13-29	20.19
WP	G419	F?	A	A	A	A
WP	G451	F	A	A	A	A
WP	G474	F	A	A	A	A
WP	G482	M	A	A	A	A
WP	G516	M	2	1	12-23	15.10
WP	G561	M	5	3	50-70	60.87
WP	G565	M?	A	A	A	A
WP	G571	F?	4	1	21-42	30.46
WP	G587	M?	3	1	13-29	20.19
WP	G601	M?	5	1	37-60	49.45
WP	G607	M	A	A	A	A
WP	G628	F?	5	1	37-60	49.45
WP	NA046	M	5	1	37-60	49.45
WP	NA047	F	A	A	A	A
WP	NA059	F?	5	1	37-60	49.45
WP	NA075	M?	A	A	A	A
WP	NA078	M?	A	A	A	A
WP	NA080	M	A	A	A	A
WP	NA084	F	A	A	A	A
WP	NA088	F	3	4	38-61	50.26
WP	NA100	F	A	A	A	A
WP	NA166	M	3	1	13-29	20.19
WP	NA168	F	5	3	50-70	60.87
WP	NA171	M?	4	2	33-55	43.95

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
WP	NA181	M?	5	3	50-70	60.87
WP	NA183	M	A	A	A	A
WP	NA190	M?	5	1	37-60	49.45
WP	NA197	M	5	1	37-60	49.45
WP	NA199	M	4	1	21-42	30.46
WP	NA202	F	5	4	56-75	66.19
WP	NA203	F	A	A	A	A
WP	NA217	M	A	A	A	A
WP	NA218	M	A	A	A	A
WP	NA224	M	A	A	A	A
WP	NA233	F	A	A	A	A
WP	NA234	M	A	A	A	A
WP	SA003	M?	4	2	33-55	43.95
WP	SA012	M	4	1	21-42	30.46
WP	SA013	F?	3	1	13-29	20.19
WP	SA015	M	A	A	A	A
WP	SA021	M	A	A	A	A
WP	SA033	M?	A	A	A	A
WP	SA034	M	4	2	33-55	43.95
WP	SA047	F?	A	A	A	A
WP	SA050	F	A	A	A	A
WP	SA052	M?	4	2	33-55	43.95
WP	SA053	F?	A	A	A	A
WP	SA054	F	A	A	A	A
WP	SA056	M?	5	1	37-60	49.45
WP	V11	M?	5	1	37-60	49.45
WP	V14	F?	A	A	A	A
WP	V15	M?	1	2	12-24	16.34
WP	V18	M?	5	2	46-67	57.26
WP	V19	M?	A	A	A	A
WP	V26	F	4	1	21-42	30.46
WP	V27	M?	4	1	21-42	30.46
WP	V29	F	4	1	21-42	30.46
WP	V33	F	4	1	21-42	30.46
WP	V38	M?	5	1	37-60	49.45
WP	V39	M	A	A	A	A
WP	V40	M	3	1	13-29	20.19
WP	V45	M?	5	2	46-67	57.26
WP	V46	F	3	1	13-29	20.19
WP	V51	M?	5	1	37-60	49.45
WP	V61	F	4	2	33-55	43.95
WP	WCO009	F	A	A	A	A
WP	WCO012	M?	A	A	A	A
WP	WCO013	F?	A	A	A	A
WP	WCO015	M	4	1	21-42	30.46

Site	Sk. No.	Sex	Coastal Face	Tubercle facet	Est. Age	Mean
WP	WCO017	F?	3	1	13-29	20.19
WP	WCO018	M	A	A	A	A
WP	WCO022	F	1	1	12-18	12.00
WP	WCO026	F?	1	4	21-42	30.31
WP	WCO028	F	A	A	A	A
WP	WCO029	F	3	4	38-61	50.26
WP	WCO036	F	A	A	A	A
WP	WCO037	M?	4	1	21-42	30.46
WP	WCO041	M	A	A	A	A
WP	WCO045	F?	3	1	13-29	20.19
WP	WCO056	F	4	1	21-42	30.46
WP	WCO057	M?	A	A	A	A
WP	WCO059	M?	4	1	21-42	30.46
WP	WCO109	F	5	1	37-60	49.45
WP	WCO115	M?	A	A	A	A
WP	WCO117	M	4	1	21-42	30.46
WP	WCO124	F	A	A	A	A
WP	WCO130	F	A	A	A	A
WP	WCO131	M?	4	4	47-68	58.39
WP	WCO137	M?	1	1	12-18	12.00
WP	WCO142	M?	A	A	A	A
WP	WCO146	M	A	A	A	A
WP	WCO153	M?	A	A	A	A
WP	WCO162	F?	4	1	21-42	30.46
WP	WCO164A	M	A	A	A	A
WP	WCO165	F?	A	A	A	A
WP	WCO165A	M	A	A	A	A
WP	WCO167	F	A	A	A	A
WP	WCO169	M	A	A	A	A
WP	WCO170	F	3	4	38-61	50.26
WP	WCO173	F	3	2	23-43	32.07
WP	WCO179	F?	A	A	A	A
WP	WCO184	F	3	1	13-29	20.19
WP	WCO187	F	A	A	A	A
WP	WCO199	F	A	A	A	A
WP	WCO200	M?	5	2	46-67	57.26
WP	WCO203	M?	A	A	A	A
WP	WCO204	F	3	1	13-29	20.19

Appendix 8 – Fourth rib

Raw data from age estimation using the fourth rib (İşcan et al., 1984a, 1985).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	7	F	6/7	43-71	57.95
BAR	18	F	6	43-58	50.7
BAR	99	M	5	34-42	38.8
BAR	126	M	8	65-78	71.5
BAR	127	M?	6	44-55	50
BAR	128	M	6/7	44-64	54.6
BAR	132	M?	7	54-64	59.2
BAR	179	M	7	54-64	59.2
BAR	187	F	8	70-82	76.4
BAR	204	F	6	43-58	50.7
BAR	208	M	A	A	A
BAR	241	M	8	65-78	71.5
BAR	266	M	6	44-55	50
BAR	269	M	A	A	A
BAR	272	M	8	65-78	71.5
BAR	276	F	A	A	A
BAR	308	M	7	54-64	59.2
BAR	309	F	A	A	A
BAR	311	F?	5/6	33-58	45.35
BAR	326	F	6	43-58	50.7
BAR	327	M	6	44-55	50
BAR	363	M	A	A	A
BAR	380	?	A	A	A
BAR	425	M	A	A	A
BAR	427	M	7	54-64	59.2
BAR	428	F	A	A	A
BAR	431	F	7	59-71	65.2
BAR	446	M	7	54-64	59.2
BAR	488	M	6	44-55	50
BAR	499	F	A	A	A
BAR	513	F?	A	A	A
BAR	539	F	5	33-46	40
BAR	548	M?	A	A	A
BAR	550	F	6	43-58	50.7
BAR	552	F	6	43-58	50.7
BAR	558	M?	6	44-55	50
BAR	578	F?	6	43-58	50.7
BAR	582	M	A	A	A
BAR	588	M	A	A	A
BAR	591	M?	5	34-42	38.8
BAR	594	M?	6	44-55	50
BAR	597	M	7	54-64	59.2

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	598	M	A	A	A
BAR	605	M	A	A	A
BAR	606	F	6/7	43-71	57.95
BAR	607	F	6	43-58	50.7
BAR	613	F	6	43-58	50.7
BAR	619	M	8	65-78	71.5
BAR	624	M	7	54-64	59.2
BAR	650	M	7	54-64	59.2
BAR	675	F	A	A	A
BAR	706	M	7	54-64	59.2
BAR	717	F	7	59-71	65.2
BAR	737	M	7	54-64	59.2
BAR	748	F	6	43-58	50.7
BAR	749	F	6/7	43-71	57.95
BAR	750	F?	A	A	A
BAR	765	M	7	54-64	59.2
BAR	771	F	A	A	A
BAR	778	M	A	A	A
BAR	788	F	A	A	A
BAR	834	M	7/8	54-78	65.35
BAR	850	F	6	43-58	50.7
BAR	854	F	A	A	A
BAR	867	M	6	44-55	50
BAR	870	M	7	54-64	59.2
BAR	894	F?	A	A	A
BAR	918	M	A	A	A
BAR	947	M	A	A	A
BAR	948	F	A	A	A
BAR	950	M?	6/7	44-64	54.6
BAR	971	F	A	A	A
BAR	975	M?	7	54-64	59.2
BAR	976	M	5/6	34-55	44.4
BAR	981	M?	7	54-64	59.2
BAR	989	M	7	54-64	59.2
BAR	1015	M	7	54-64	59.2
BAR	1020	M	7	54-64	59.2
BAR	1022	M	7	54-64	59.2
BAR	1028	F	6	43-58	50.7
BAR	1030	F?	A	A	A
BAR	1039	F	5	33-46	40
BAR	1043	M	6	44-55	50
BAR	1047	M	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	1049	F	6	43-58	50.7
BAR	1062	F	A	A	A
BAR	1063	M	8	65-78	71.5
BAR	1064	F	5/6	33-58	45.35
BAR	1068	F	6/7	43-71	57.95
BAR	1071	F	A	A	A
BAR	1085	M?	7	54-64	59.2
BAR	1096	F	A	A	A
BAR	1100	M	A	A	A
BAR	1103	M	6	44-55	50
BAR	1104	M	A	A	A
BAR	1106	M	6	44-55	50
BAR	1120	F	A	A	A
BAR	1122	M	6/7	44-64	54.6
BAR	1133	F	A	A	A
BAR	1134	M	A	A	A
BAR	1139	M	A	A	A
BAR	1144	F	A	A	A
BAR	1146	M?	A	A	A
BAR	1148	F	A	A	A
BAR	1149	M	5	34-42	38.8
BAR	1151	F	A	A	A
BAR	1162	M	A	A	A
BAR	1169	M	A	A	A
BAR	1176	M	A	A	A
BAR	1183	M?	6	44-55	50
BAR	1197	F	A	A	A
BAR	1202	F	6	43-58	50.7
BAR	1204	M	7	54-64	59.2
BAR	1214	M	6	44-55	50
BAR	1220	F?	6	43-58	50.7
BAR	1235	F	A	A	A
BAR	1236	F	8	70-82	76.4
BAR	1251	M	6	44-55	50
BAR	1254	F	6	43-58	50.7
BAR	1255	F	A	A	A
BAR	1263	M?	8	65-78	71.5
BAR	1268	M	6	44-55	50
BAR	1291	M?	7	54-64	59.2
BAR	1297	M	A	A	A
BAR	1299	F?	A	A	A
BAR	1307	M	A	A	A
BAR	1315	M	7	54-64	59.2
BAR	1316	M	6	44-55	50
BAR	1324	M	5/6	34-55	44.4
BAR	1409	M?	6	44-55	50
BAR	1438	M	7	54-64	59.2
BAR	1498	F	7	59-71	65.2
BAR	1538	F	5	33-46	40
BAR	1542	F	A	A	A
BAR	1548	M	6	44-55	50
BAR	1556	M	6	44-55	50
BAR	1566	M	A	A	A
BAR	1571	F	A	A	A
BAR	1615	M	6	44-55	50
BAR	1655	F	5/6	33-58	45.35
BAR	1691	M	5	34-42	38.8
BAR	1695	F?	6	43-58	50.7
BAR	1707	M	7	54-64	59.2

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	1723	M	A	A	A
BAR	1750	F	A	A	A
BAR	1756	M?	7	54-64	59.2
BAR	1765	F	5/6	33-58	45.35
BAR	1769	M	7	54-64	59.2
BAR	1775	M	8	65-78	71.5
BAR	1788	M	A	A	A
BAR	1805	M	7	54-64	59.2
BAR	1824	M	A	A	A
BAR	1843	M	5	34-42	38.8
BAR	1849	M	A	A	A
BAR	1856	?	A	A	A
BAR	1863	M	7	54-64	59.2
BAR	1869	M?	A	A	A
BAR	1871	M	6	44-55	50
BAR	1875	F	A	A	A
BAR	1889	F?	A	A	A
BAR	1892	F	6	43-58	50.7
BAR	1897	M	A	A	A
BAR	1910	M	7	54-64	59.2
BAR	1911	M	6	44-55	50
BAR	1920	M	6	44-55	50
BAR	1922	M	6	44-55	50
BAR	1926	M	6	44-55	50
BAR	1993	M	7	54-64	59.2
BAR	1995	M	8	65-78	71.5
BAR	2027	M	7	54-64	59.2
BAR	2064	F	A	A	A
BAR	2130	F	8	70-82	76.4
BAR	2142	F	6	43-58	50.7
BAR	2176	F	6	43-58	50.7
BAR	2187	F	A	A	A
BAR	2193	M	7	54-64	59.2
BAR	2200	M	6	44-55	50
BAR	2206	M	8	65-78	71.5
BAR	2216	F	5/6	33-58	45.35
BAR	2219	M	6	44-55	50
BAR	2236	F	A	A	A
BAR	2244	M	7	54-64	59.2
BAR	2248	M	6	44-55	50
BAR	2251	M	7	54-64	59.2
BAR	2259	F	5	33-46	40
BAR	2274	M	8	65-78	71.5
BAR	2283	F	A	A	A
BAR	2284	F?	A	A	A
BAR	2289	M	5/6	34-55	44.4
BAR	2294	M	6	44-55	50
BAR	2297	F?	8	70-82	76.4
BAR	2298	M	A	A	A
BAR	2304	M	A	A	A
BAR	2309	M	6	44-55	50
BAR	2320	M	6	44-55	50
BAR	2327	M	A	A	A
BAR	2337	M	6	44-55	50
BAR	2338	M	6/7	44-64	54.6
BAR	2345	M	6/7	44-64	54.6
BAR	2348	F	6	43-58	50.7
BAR	2356	F	7	59-71	65.2
BAR	2376	M	8	65-78	71.5

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	2386	F	7	59-71	65.2
BAR	2408	F	A	A	A
BAR	2411	F?	A	A	A
BAR	2413	M?	A	A	A
BAR	2428	F	A	A	A
BAR	2436	F?	A	A	A
BAR	2451	M?	6	44-55	50
BAR	2452	M	A	A	A
BAR	2457	F	A	A	A
BAR	2465	F	6	43-58	50.7
BAR	2466	M	A	A	A
BAR	2469	M	7	54-64	59.2
BAR	2471	M	7	54-64	59.2
BAR	2485	M	5	34-42	38.8
BAR	2491	M?	6	44-55	50
BAR	2495	M	A	A	A
BAR	2499	M	7/8	54-78	65.35
BAR	2503	F	6	43-58	50.7
BAR	2514	M	A	A	A
BAR	2520	F?	7	59-71	65.2
BAR	2583	M	A	A	A
BAR	2603	M	6	44-55	50
BAR	2612	M	8	65-78	71.5
BAR	2616	?	7	54-71	62.2
BAR	2666	F?	6	43-58	50.7
BAR	2684	M	7	54-64	59.2
BAR	2700	M	6	44-55	50
BAR	2714	M	8	65-78	71.5
BAR	2718	F	5/6	33-58	45.35
BAR	2720	M	A	A	A
BAR	2721	M	A	A	A
BAR	2722	F	6	43-58	50.7
BAR	2727	F	6	43-58	50.7
BAR	2730	M	6	44-55	50
BAR	2731	M	A	A	A
BAR	2732	F	6	43-58	50.7
BAR	2739	M	6/7	44-64	54.6
BAR	2751	F	7	59-71	65.2
BAR	2758	M	6	44-55	50
BAR	2766	F	5/6	33-58	45.35
BAR	2775	F	A	A	A
BAR	2780	F	A	A	A
BAR	2783	M	6	44-55	50
BAR	2784	M	6	44-55	50
BAR	2786	M	A	A	A
BAR	2798	M?	A	A	A
BAR	2799	M	6	44-55	50
FGH	1021	M?	7	54-64	59.2
FGH	1037	F	5	33-46	40
FGH	1047	F	6	43-58	50.7
FGH	1049	F?	7	59-71	65.2
FGH	1051	M	8	65-78	71.5
FGH	1053	F?	5	33-46	40
FGH	1057	F	7	59-71	65.2
FGH	1063	M	7	54-64	59.2
FGH	1075	M	7	54-64	59.2
FGH	1079	F	3/4	20-31	25.15
FGH	1081	M?	A	A	A
FGH	1091	F?	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
FGH	1097	F?	A	A	A
FGH	1099	F?	A	A	A
FGH	1101	F	5	33-46	40
FGH	1104	F	A	A	A
FGH	1110	F	A	A	A
FGH	1113	M	8	65-78	71.5
FGH	1115	F	6	43-58	50.7
FGH	1117	M	7	54-64	59.2
FGH	1130	M	6	44-55	50
FGH	1139	M?	8	65-78	71.5
FGH	1147	M	6	44-55	50
FGH	1150	F	6	43-58	50.7
FGH	1163	M?	7	54-64	59.2
FGH	1171	M?	7	54-64	59.2
FGH	1180	F	5	33-46	40
FGH	1184	M	5	34-42	38.8
FGH	1188	M	5	34-42	38.8
FGH	1190	F	5	33-46	40
FGH	1208	F?	8	70-82	76.4
FGH	1228	M	8	65-78	71.5
FGH	1230	F?	5	33-46	40
FGH	1237	M?	A	A	A
FGH	1255	F?	5	33-46	40
FGH	1257	F	5	33-46	40
FGH	1280	M?	6	44-55	50
FGH	1284	F?	4	24-31	27.7
FGH	1286	F	6	43-58	50.7
FGH	1297	F?	5	33-46	40
FGH	1305	F?	6	43-58	50.7
FGH	1312	F	6	43-58	50.7
FGH	1313	M?	7	54-64	59.2
FGH	1327	M?	6	44-55	50
FGH	1354	M	6	44-55	50
FGH	1385	M	7	54-64	59.2
FGH	1391	F	A	A	A
FGH	1412	M	7	54-64	59.2
FGH	1441	M?	A	A	A
FGH	1455	F	A	A	A
FGH	1469	F	A	A	A
FGH	1471	F	A	A	A
FGH	1484	F	6	43-58	50.7
FGH	1486	M	5	34-42	38.8
FGH	1521	F	6/7	43-71	57.95
FGH	1525	F?	5/6	33-58	45.35
FGH	1553	M?	6/7	44-64	54.6
FGH	1560	M?	5	34-42	38.8
FGH	1569	F?	6	43-58	50.7
FGH	1579	F?	6	43-58	50.7
FGH	1581	F?	6/7	43-71	57.95
FGH	1583	M	6	44-55	50
FGH	1589	F	A	A	A
FGH	1597	F	5	33-46	40
SHOW	5010a	F	A	A	A
SHOW	5066	M	6	44-55	50
SHOW	5091	F	6	43-58	50.7
SHOW	5098	F	A	A	A
SHOW	5103	F	7	59-71	65.2
SHOW	5105	F	A	A	A
SHOW	5110	F	6	43-58	50.7

Site	Sk. No.	Sex	Score	Est. Age	Mean
SHOW	5123	F	A	A	A
SHOW	5159	M	8	65-78	71.5
SHOW	5172	M	A	A	A
SHOW	5173	M	7	54-64	59.2
SHOW	5186	M?	A	A	A
SHOW	5190	F	6	43-58	50.7
SHOW	5203	M	A	A	A
SHOW	5204	M	6	44-55	50
SHOW	5207	M	8	65-78	71.5
SHOW	5208	M?	7	54-64	59.2
SHOW	5211	F	6	43-58	50.7
SHOW	5218	F?	6	43-58	50.7
SHOW	5222	M	8	65-78	71.5
SHOW	5225	F	6/7	43-71	57.95
SHOW	5228	F?	8	70-82	76.4
SHOW	5233	M	6	44-55	50
SHOW	5237	M	7	54-64	59.2
SHOW	5241	F	6	43-58	50.7
SHOW	5243	M	8	65-78	71.5
SHOW	5244	M?	A	A	A
SHOW	5254	F	7	59-71	65.2
SHOW	5258	F	4	24-31	27.7
SHOW	5267	F	5	33-46	40
SHOW	5269	M	8	65-78	71.5
SHOW	5270	F?	5/6	33-58	45.35
SHOW	5283	M	A	A	A
SHOW	5290	F?	A	A	A
SHOW	5292	F	A	A	A
SHOW	5298	F	6/7	43-71	57.95
SHOW	5302	F	A	A	A
SHOW	5311	F?	A	A	A
SHOW	5316	F?	A	A	A
SHOW	5320	F	A	A	A
SHOW	5323	M	6/7	44-64	54.6
SHOW	5329	M	6	44-55	50
SHOW	5347	M	A	A	A
SHOW	5350	F	6	43-58	50.7
SHOW	5364	F	5/6	33-58	45.35
SHOW	5384	M	8	65-78	71.5
SHOW	5393	F	6/7	43-71	57.95
SHOW	5402	M	6/7	44-64	54.6
SHOW	5415	F	5	33-46	40
SHOW	5421	M?	8	65-78	71.5
SHOW	5438	M	7	54-64	59.2
SHOW	5445	M	5/6	34-55	44.4
SHOW	5451	M	7	54-64	59.2
SHOW	5453	M	A	A	A
SHOW	5457	M	5	34-42	38.8
SHOW	5461	M?	7/8	54-78	65.35
SHOW	5463	M?	6	44-55	50
SHOW	5475	M?	A	A	A
SHOW	5488	F	6	43-58	50.7
SHOW	5492	F	A	A	A
SHOW	5494	F	6	43-58	50.7
SHOW	5501	F	8	70-82	76.4
SHOW	5507	F?	8	70-82	76.4
SHOW	5508	F	6	43-58	50.7
SHOW	5529	F	A	A	A
SHOW	5534	F	6	43-58	50.7

Site	Sk. No.	Sex	Score	Est. Age	Mean
SHOW	5539	M	6	44-55	50
SHOW	5544	M	6/7	44-64	54.6
SHOW	5562	F	6/7	43-71	57.95
SHOW	5563	M	6	44-55	50
SHOW	5588	F	6	43-58	50.7
SHOW	5601	F	6	43-58	50.7
SHOW	5603	M	6	44-55	50
SHOW	5617	M	6/7	44-64	54.6
SHOW	5632	F	A	A	A
SHOW	5644	M	6	44-55	50
SHOW	5657	F	6	43-58	50.7
SHOW	5671	M	7	54-64	59.2
SHOW	5680	M	A	A	A
SHOW	5699	F	A	A	A
SHOW	5702	M	7	54-64	59.2
SHOW	5710	M	6	44-55	50
SHOW	5740	F	A	A	A
SHOW	5773	M	5	34-42	38.8
SHOW	5774	F	7	59-71	65.2
SHOW	5794	M	8	65-78	71.5
SHOW	5835	F	A	A	A
SHOW	5845	M	6	44-55	50
SHOW	5884	F	A	A	A
SHOW	5909	F	7	59-71	65.2
SHOW	5977	M?	A	A	A
SHOW	6003	F	6	43-58	50.7
SHOW	6026	M	A	A	A
SHOW	6027	F	A	A	A
SHOW	6029	M	6	44-55	50
SHOW	6030	F	6	43-58	50.7
SHOW	6042	M	A	A	A
SHOW	6043	F	6	43-58	50.7
SHOW	6048	M	8	65-78	71.5
SHOW	6060	M	A	A	A
SHOW	6070	F	6	43-58	50.7
SHOW	6072	M	A	A	A
SHOW	6074	F	6	43-58	50.7
SHOW	6081	M	6/7	44-64	54.6
SHOW	6082	F	6	43-58	50.7
SHOW	6083	M	6	44-55	50
SHOW	6088	M	6	44-55	50
SHOW	6093	F	A	A	A
SHOW	6098	M	A	A	A
SHOW	6103	M	8	65-78	71.5
SHOW	6105	M	8	65-78	71.5
WP	EE004	M?	A	A	A
WP	EE013	M	7	54-64	59.2
WP	EE015	F	A	A	A
WP	EE019	F	A	A	A
WP	EE022	F	6	43-58	50.7
WP	EE024	M?	A	A	A
WP	EE025	M?	A	A	A
WP	EE026	M	4/5	25-42	33.5
WP	EE037	M	6	44-55	50
WP	EE056	F	5	33-46	40
WP	EE062	M	6	44-55	50
WP	EE070	F	6	43-58	50.7
WP	EE079	M?	7	54-64	59.2
WP	EE080	M	6/7	44-64	54.6

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	EE089	M	A	A	A
WP	EE097	F?	6	43-58	50.7
WP	EE098	M?	A	A	A
WP	EE099	F	5	33-46	40
WP	G251	F	4	24-31	27.7
WP	G265	M	7	54-64	59.2
WP	G278	M?	6/7	44-64	54.6
WP	G279	M?	7	54-64	59.2
WP	G296	F?	6	43-58	50.7
WP	G297	M?	6	44-55	50
WP	G303	M	A	A	A
WP	G310	M	A	A	A
WP	G361	F?	6	43-58	50.7
WP	G377	F?	6	43-58	50.7
WP	G379	M	A	A	A
WP	G381	M?	6	44-55	50
WP	G385	F?	6	43-58	50.7
WP	G406	M?	6/7	44-64	54.6
WP	G411	M	A	A	A
WP	G419	F?	A	A	A
WP	G451	F	6/7	43-71	57.95
WP	G474	F	6	43-58	50.7
WP	G482	M	A	A	A
WP	G516	M	6	44-55	50
WP	G561	M	A	A	A
WP	G565	M?	6	44-55	50
WP	G571	F?	3	20-24	22.6
WP	G587	M?	6	44-55	50
WP	G601	M?	6	44-55	50
WP	G607	M	6	44-55	50
WP	G628	F?	A	A	A
WP	NA046	M	8	65-78	71.5
WP	NA047	F	7	59-71	65.2
WP	NA059	F?	6	43-58	50.7
WP	NA075	M?	A	A	A
WP	NA078	M?	7	54-64	59.2
WP	NA080	M	A	A	A
WP	NA084	F	6	43-58	50.7
WP	NA088	F	5	33-46	40
WP	NA100	F	6/7	43-71	57.95
WP	NA166	M	5	34-42	38.8
WP	NA168	F	4/5	24-46	33.85
WP	NA171	M?	6/7	44-64	54.6
WP	NA181	M?	7	54-64	59.2
WP	NA183	M	7	54-64	59.2
WP	NA190	M?	6/7	44-64	54.6
WP	NA197	M	7	54-64	59.2
WP	NA199	M	6	44-55	50
WP	NA202	F	7/8	59-82	70.8
WP	NA203	F	5	33-46	40
WP	NA217	M	A	A	A
WP	NA218	M	7/8	54-78	65.35
WP	NA224	M	A	A	A
WP	NA233	F	A	A	A
WP	NA234	M	A	A	A
WP	SA003	M?	7	54-64	59.2
WP	SA012	M	6	44-55	50
WP	SA013	F?	7	59-71	65.2
WP	SA015	M	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	SA021	M	A	A	A
WP	SA033	M?	A	A	A
WP	SA034	M	7	54-64	59.2
WP	SA047	F?	6	43-58	50.7
WP	SA050	F	A	A	A
WP	SA052	M?	6/7	44-64	54.6
WP	SA053	F?	8	70-82	76.4
WP	SA054	F	A	A	A
WP	SA056	M?	5	34-42	38.8
WP	V11	M?	7	54-64	59.2
WP	V14	F?	A	A	A
WP	V15	M?	6	44-55	50
WP	V18	M?	7	54-64	59.2
WP	V19	M?	A	A	A
WP	V26	F	6	43-58	50.7
WP	V27	M?	6/7	44-64	54.6
WP	V29	F	6	43-58	50.7
WP	V33	F	5/6	33-58	45.35
WP	V38	M?	6	44-55	50
WP	V39	M	A	A	A
WP	V40	M	A	A	A
WP	V45	M?	6	44-55	50
WP	V46	F	5	33-46	40
WP	V51	M?	6	44-55	50
WP	V61	F	6	43-58	50.7
WP	WCO009	F	A	A	A
WP	WCO012	M?	A	A	A
WP	WCO013	F?	A	A	A
WP	WCO015	M	6	44-55	50
WP	WCO017	F?	A	A	A
WP	WCO018	M	A	A	A
WP	WCO022	F	4	24-31	27.7
WP	WCO026	F?	7	59-71	65.2
WP	WCO028	F	A	A	A
WP	WCO029	F	6	43-58	50.7
WP	WCO036	F	A	A	A
WP	WCO037	M?	6	44-55	50
WP	WCO041	M	4	25-30	28.2
WP	WCO045	F?	A	A	A
WP	WCO056	F	A	A	A
WP	WCO057	M?	7	54-64	59.2
WP	WCO059	M?	A	A	A
WP	WCO109	F	6	43-58	50.7
WP	WCO115	M?	A	A	A
WP	WCO117	M	4/5	25-42	33.5
WP	WCO124	F	6	43-58	50.7
WP	WCO130	F	A	A	A
WP	WCO131	M?	7	54-64	59.2
WP	WCO137	M?	6	44-55	50
WP	WCO142	M?	A	A	A
WP	WCO146	M	5/6	34-55	44.4
WP	WCO153	M?	A	A	A
WP	WCO162	F?	7	59-71	65.2
WP	WCO164A	M	7	54-64	59.2
WP	WCO165	F?	A	A	A
WP	WCO165A	M	7	54-64	59.2
WP	WCO167	F	A	A	A
WP	WCO169	M	A	A	A
WP	WCO170	F	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	WCO173	F	6	43-58	50.7
WP	WCO179	F?	A	A	A
WP	WCO184	F	6	43-58	50.7
WP	WCO187	F	5	33-46	40
WP	WCO199	F	A	A	A
WP	WCO200	M?	6	44-55	50
WP	WCO203	M?	A	A	A
WP	WCO204	F	A	A	A

Appendix 9 – Iliac crest

Raw data from age estimation using the iliac crest of the ilium (Falys, 2012).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	7	F	3	69-74	71.1
BAR	18	F	2	69-74	71.1
BAR	99	M	A	A	A
BAR	126	M	2	66-70	64.8
BAR	127	M?	3	72-77	75.1
BAR	128	M	A	A	A
BAR	132	M?	2	66-70	64.8
BAR	179	M	3	72-77	75.1
BAR	187	F	4	73-82	77.8
BAR	204	F	2	69-74	71.1
BAR	208	M	A	A	A
BAR	241	M	2	66-70	64.8
BAR	266	M	3	72-77	75.1
BAR	269	M	A	A	A
BAR	272	M	3	72-77	75.1
BAR	276	F	0	57-63	60.4
BAR	308	M	1	57-61	59.2
BAR	309	F	1	57-63	60.4
BAR	311	F?	2	69-74	71.1
BAR	326	F	1	57-63	60.4
BAR	327	M	1	57-61	59.2
BAR	363	M	A	A	A
BAR	380	?	A	A	A
BAR	425	M	1	57-61	59.2
BAR	427	M	1	57-61	59.2
BAR	428	F	A	A	A
BAR	431	F	3	69-74	71.1
BAR	446	M	2	66-70	64.8
BAR	488	M	1	57-61	59.2
BAR	499	F	1	57-63	60.4
BAR	513	F?	2	69-74	71.1
BAR	539	F	1	57-63	60.4
BAR	548	M?	1	57-61	59.2
BAR	550	F	A	A	A
BAR	552	F	2	69-74	71.1
BAR	558	M?	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	578	F?	A	A	A
BAR	582	M	A	A	A
BAR	588	M	A	A	A
BAR	591	M?	3	72-77	75.1
BAR	594	M?	A	A	A
BAR	597	M	1	57-61	59.2
BAR	598	M	A	A	A
BAR	605	M	1	57-61	59.2
BAR	606	F	1	57-63	60.4
BAR	607	F	2	69-74	71.1
BAR	613	F	0	57-63	60.4
BAR	619	M	4	72-77	75.1
BAR	624	M	2	66-70	64.8
BAR	650	M	3	72-77	75.1
BAR	675	F	0	57-63	60.4
BAR	706	M	3	72-77	75.1
BAR	717	F	2	69-74	71.1
BAR	737	M	1	57-61	59.2
BAR	748	F	A	A	A
BAR	749	F	A	A	A
BAR	750	F?	2	69-74	71.1
BAR	765	M	2	66-70	64.8
BAR	771	F	2	69-74	71.1
BAR	778	M	2	66-70	64.8
BAR	788	F	2	69-74	71.1
BAR	834	M	2	66-70	64.8
BAR	850	F	1	57-63	60.4
BAR	854	F	2	69-74	71.1
BAR	867	M	1	57-61	59.2
BAR	870	M	A	A	A
BAR	894	F?	A	A	A
BAR	918	M	1	57-61	59.2
BAR	947	M	1	57-61	59.2
BAR	948	F	3	69-74	71.1
BAR	950	M?	A	A	A
BAR	971	F	1	57-63	60.4
BAR	975	M?	A	A	A
BAR	976	M	A	A	A
BAR	981	M?	3	72-77	75.1
BAR	989	M	2	66-70	64.8
BAR	1015	M	A	A	A
BAR	1020	M	2	66-70	64.8
BAR	1022	M	3	72-77	75.1
BAR	1028	F	A	A	A
BAR	1030	F?	1	57-63	60.4
BAR	1039	F	A	A	A
BAR	1043	M	1	57-61	59.2
BAR	1047	M	1	57-61	59.2
BAR	1049	F	2	69-74	71.1
BAR	1062	F	A	A	A
BAR	1063	M	4	72-77	75.1
BAR	1064	F	1	57-63	60.4
BAR	1068	F	A	A	A
BAR	1071	F	1	57-63	60.4
BAR	1085	M?	2	66-70	64.8
BAR	1096	F	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	1100	M	0	57-61	59.2
BAR	1103	M	A	A	A
BAR	1104	M	A	A	A
BAR	1106	M	1	57-61	59.2
BAR	1120	F	A	A	A
BAR	1122	M	A	A	A
BAR	1133	F	A	A	A
BAR	1134	M	A	A	A
BAR	1139	M	A	A	A
BAR	1144	F	A	A	A
BAR	1146	M?	A	A	A
BAR	1148	F	2	69-74	71.1
BAR	1149	M	1	57-61	59.2
BAR	1151	F	A	A	A
BAR	1162	M	A	A	A
BAR	1169	M	1	57-61	59.2
BAR	1176	M	1	57-61	59.2
BAR	1183	M?	1	57-61	59.2
BAR	1197	F	A	A	A
BAR	1202	F	1	57-63	60.4
BAR	1204	M	1	57-61	59.2
BAR	1214	M	2	66-70	64.8
BAR	1220	F?	A	A	A
BAR	1235	F	A	A	A
BAR	1236	F	A	A	A
BAR	1251	M	1	57-61	59.2
BAR	1254	F	1	57-63	60.4
BAR	1255	F	A	A	A
BAR	1263	M?	A	A	A
BAR	1268	M	2	66-70	64.8
BAR	1291	M?	A	A	A
BAR	1297	M	A	A	A
BAR	1299	F?	A	A	A
BAR	1307	M	2	66-70	64.8
BAR	1315	M	1	57-61	59.2
BAR	1316	M	A	A	A
BAR	1324	M	A	A	A
BAR	1409	M?	A	A	A
BAR	1438	M	2	66-70	64.8
BAR	1498	F	2	69-74	71.1
BAR	1538	F	A	A	A
BAR	1542	F	0	57-63	60.4
BAR	1548	M	2	66-70	64.8
BAR	1556	M	1	57-61	59.2
BAR	1566	M	A	A	A
BAR	1571	F	A	A	A
BAR	1615	M	2	66-70	64.8
BAR	1655	F	1	57-63	60.4
BAR	1691	M	1	57-61	59.2
BAR	1695	F?	1	57-63	60.4
BAR	1707	M	1	57-61	59.2
BAR	1723	M	A	A	A
BAR	1750	F	A	A	A
BAR	1756	M?	1	57-61	59.2
BAR	1765	F	A	A	A
BAR	1769	M	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	1775	M	1	57-61	59.2
BAR	1788	M	A	A	A
BAR	1805	M	1	57-61	59.2
BAR	1824	M	A	A	A
BAR	1843	M	1	57-61	59.2
BAR	1849	M	A	A	A
BAR	1856	?	A	A	A
BAR	1863	M	2	66-70	64.8
BAR	1869	M?	A	A	A
BAR	1871	M	1	57-61	59.2
BAR	1875	F	2	69-74	71.1
BAR	1889	F?	A	A	A
BAR	1892	F	1	57-63	60.4
BAR	1897	M	A	A	A
BAR	1910	M	1	57-61	59.2
BAR	1911	M	0	57-61	59.2
BAR	1920	M	1	57-61	59.2
BAR	1922	M	1	57-61	59.2
BAR	1926	M	2	66-70	64.8
BAR	1993	M	2	66-70	64.8
BAR	1995	M	1	57-61	59.2
BAR	2027	M	2	66-70	64.8
BAR	2064	F	2	69-74	71.1
BAR	2130	F	A	A	A
BAR	2142	F	A	A	A
BAR	2176	F	1	57-63	60.4
BAR	2187	F	2	69-74	71.1
BAR	2193	M	2	66-70	64.8
BAR	2200	M	0	57-61	59.2
BAR	2206	M	2	66-70	64.8
BAR	2216	F	A	A	A
BAR	2219	M	1	57-61	59.2
BAR	2236	F	A	A	A
BAR	2244	M	1	57-61	59.2
BAR	2248	M	A	A	A
BAR	2251	M	2	66-70	64.8
BAR	2259	F	2	69-74	71.1
BAR	2274	M	3	72-77	75.1
BAR	2283	F	2	69-74	71.1
BAR	2284	F?	1	57-63	60.4
BAR	2289	M	4/5	72-77	75.1
BAR	2294	M	0	57-61	59.2
BAR	2297	F?	1	57-63	60.4
BAR	2298	M	A	A	A
BAR	2304	M	A	A	A
BAR	2309	M	1	57-61	59.2
BAR	2320	M	1	57-61	59.2
BAR	2327	M	1	57-61	59.2
BAR	2337	M	A	A	A
BAR	2338	M	A	A	A
BAR	2345	M	1	57-61	59.2
BAR	2348	F	0	57-63	60.4
BAR	2356	F	2	69-74	71.1
BAR	2376	M	2	66-70	64.8
BAR	2386	F	2	69-74	71.1
BAR	2408	F	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	2411	F?	A	A	A
BAR	2413	M?	A	A	A
BAR	2428	F	0	57-63	60.4
BAR	2436	F?	A	A	A
BAR	2451	M?	0	57-61	59.2
BAR	2452	M	A	A	A
BAR	2457	F	A	A	A
BAR	2465	F	A	A	A
BAR	2466	M	1	57-61	59.2
BAR	2469	M	1	57-61	59.2
BAR	2471	M	1	57-61	59.2
BAR	2485	M	1	57-61	59.2
BAR	2491	M?	3	72-77	75.1
BAR	2495	M	A	A	A
BAR	2499	M	1	57-61	59.2
BAR	2503	F	0	57-63	60.4
BAR	2514	M	A	A	A
BAR	2520	F?	3	69-74	71.1
BAR	2583	M	A	A	A
BAR	2603	M	A	A	A
BAR	2612	M	2	66-70	64.8
BAR	2616	?	3	69-77	73.1
BAR	2666	F?	1	57-63	60.4
BAR	2684	M	1	57-61	59.2
BAR	2700	M	1	57-61	59.2
BAR	2714	M	4	72-77	75.1
BAR	2718	F	1	57-63	60.4
BAR	2720	M	1	57-61	59.2
BAR	2721	M	1	57-61	59.2
BAR	2722	F	1	57-63	60.4
BAR	2727	F	1	57-63	60.4
BAR	2730	M	1	57-61	59.2
BAR	2731	M	0	57-61	59.2
BAR	2732	F	A	A	A
BAR	2739	M	1	57-61	59.2
BAR	2751	F	1	57-63	60.4
BAR	2758	M	3	72-77	75.1
BAR	2766	F	1	57-63	60.4
BAR	2775	F	2	69-74	71.1
BAR	2780	F	A	A	A
BAR	2783	M	1	57-61	59.2
BAR	2784	M	3	72-77	75.1
BAR	2786	M	2	66-70	64.8
BAR	2798	M?	1	57-61	59.2
BAR	2799	M	0	57-61	59.2
FGH	1021	M?	3	72-77	75.1
FGH	1037	F	2	69-74	71.1
FGH	1047	F	2	69-74	71.1
FGH	1049	F?	4	73-82	77.8
FGH	1051	M	4	72-77	75.1
FGH	1053	F?	2	69-74	71.1
FGH	1057	F	5	PATH?	PATH
FGH	1063	M	5	PATH?	PATH
FGH	1075	M	5	PATH?	PATH
FGH	1079	F	5	PATH?	PATH
FGH	1081	M?	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
FGH	1091	F?	3	69-74	71.1
FGH	1097	F?	3	69-74	71.1
FGH	1099	F?	A	A	A
FGH	1101	F	1	57-63	60.4
FGH	1104	F	4	73-82	77.8
FGH	1110	F	A	A	A
FGH	1113	M	1	57-61	59.2
FGH	1115	F	4	73-82	77.8
FGH	1117	M	3	72-77	75.1
FGH	1130	M	1	57-61	59.2
FGH	1139	M?	5	PATH?	PATH
FGH	1147	M	1	57-61	59.2
FGH	1150	F	A	A	A
FGH	1163	M?	3	72-77	75.1
FGH	1171	M?	4	72-77	75.1
FGH	1180	F	2	69-74	71.1
FGH	1184	M	1	57-61	59.2
FGH	1188	M	2	66-70	64.8
FGH	1190	F	1	57-63	60.4
FGH	1208	F?	3	69-74	71.1
FGH	1228	M	5	PATH?	PATH
FGH	1230	F?	4	73-82	77.8
FGH	1237	M?	2	66-70	64.8
FGH	1255	F?	2	69-74	71.1
FGH	1257	F	2	69-74	71.1
FGH	1280	M?	A	A	A
FGH	1284	F?	A	A	A
FGH	1286	F	4	73-82	77.8
FGH	1297	F?	4	73-82	77.8
FGH	1305	F?	2	69-74	71.1
FGH	1312	F	1	57-63	60.4
FGH	1313	M?	4	72-77	75.1
FGH	1327	M?	3	72-77	75.1
FGH	1354	M	2	66-70	64.8
FGH	1385	M	4	72-77	75.1
FGH	1391	F	A	A	A
FGH	1412	M	2	66-70	64.8
FGH	1441	M?	A	A	A
FGH	1455	F	A	A	A
FGH	1469	F	A	A	A
FGH	1471	F	3	69-74	71.1
FGH	1484	F	4	73-82	77.8
FGH	1486	M	3	72-77	75.1
FGH	1521	F	3	69-74	71.1
FGH	1525	F?	1	57-63	60.4
FGH	1553	M?	3	72-77	75.1
FGH	1560	M?	4	72-77	75.1
FGH	1569	F?	1	57-63	60.4
FGH	1579	F?	5	PATH?	PATH
FGH	1581	F?	3	69-74	71.1
FGH	1583	M	3	72-77	75.1
FGH	1589	F	1	57-63	60.4
FGH	1597	F	A	A	A
SHOW	5010a	F	A	A	A
SHOW	5066	M	A	A	A
SHOW	5091	F	1	57-63	60.4

Site	Sk. No.	Sex	Score	Est. Age	Mean
SHOW	5098	F	A	A	A
SHOW	5103	F	3	69-74	71.1
SHOW	5105	F	A	A	A
SHOW	5110	F	2	69-74	71.1
SHOW	5123	F	A	A	A
SHOW	5159	M	3	72-77	75.1
SHOW	5172	M	A	A	A
SHOW	5173	M	2	66-70	64.8
SHOW	5186	M?	A	A	A
SHOW	5190	F	3	69-74	71.1
SHOW	5203	M	A	A	A
SHOW	5204	M	A	A	A
SHOW	5207	M	2	66-70	64.8
SHOW	5208	M?	3	72-77	75.1
SHOW	5211	F	3	69-74	71.1
SHOW	5218	F?	2	69-74	71.1
SHOW	5222	M	3	72-77	75.1
SHOW	5225	F	2	69-74	71.1
SHOW	5228	F?	A	A	A
SHOW	5233	M	3	72-77	75.1
SHOW	5237	M	1	57-61	59.2
SHOW	5241	F	1	57-63	60.4
SHOW	5243	M	4	72-77	75.1
SHOW	5244	M?	1	57-61	59.2
SHOW	5254	F	4	73-82	77.8
SHOW	5258	F	0	57-63	60.4
SHOW	5267	F	1	57-63	60.4
SHOW	5269	M	3	72-77	75.1
SHOW	5270	F?	3	69-74	71.1
SHOW	5283	M	A	A	A
SHOW	5290	F?	2	69-74	71.1
SHOW	5292	F	0	57-63	60.4
SHOW	5298	F	3	69-74	71.1
SHOW	5302	F	A	A	A
SHOW	5311	F?	4	73-82	77.8
SHOW	5316	F?	1	57-63	60.4
SHOW	5320	F	0	57-63	60.4
SHOW	5323	M	1	57-61	59.2
SHOW	5329	M	2	66-70	64.8
SHOW	5347	M	3	72-77	75.1
SHOW	5350	F	1	57-63	60.4
SHOW	5364	F	1	57-63	60.4
SHOW	5384	M	3	72-77	75.1
SHOW	5393	F	A	A	A
SHOW	5402	M	1	57-61	59.2
SHOW	5415	F	3	69-74	71.1
SHOW	5421	M?	3/4	72-77	75.1
SHOW	5438	M	2	66-70	64.8
SHOW	5445	M	1	57-61	59.2
SHOW	5451	M	3	72-77	75.1
SHOW	5453	M	3	72-77	75.1
SHOW	5457	M	A	A	A
SHOW	5461	M?	A	A	A
SHOW	5463	M?	0	57-61	59.2
SHOW	5475	M?	A	A	A
SHOW	5488	F	1	57-63	60.4

Site	Sk. No.	Sex	Score	Est. Age	Mean
SHOW	5492	F	1	57-63	60.4
SHOW	5494	F	2	69-74	71.1
SHOW	5501	F	3	69-74	71.1
SHOW	5507	F?	3	69-74	71.1
SHOW	5508	F	A	A	A
SHOW	5529	F	3	69-74	71.1
SHOW	5534	F	0	57-63	60.4
SHOW	5539	M	1	57-61	59.2
SHOW	5544	M	2	66-70	64.8
SHOW	5562	F	A	A	A
SHOW	5563	M	1	57-61	59.2
SHOW	5588	F	1	57-63	60.4
SHOW	5601	F	2	69-74	71.1
SHOW	5603	M	1	57-61	59.2
SHOW	5617	M	3	72-77	75.1
SHOW	5632	F	A	A	A
SHOW	5644	M	3	72-77	75.1
SHOW	5657	F	1	57-63	60.4
SHOW	5671	M	2	66-70	64.8
SHOW	5680	M	A	A	A
SHOW	5699	F	2	69-74	71.1
SHOW	5702	M	1	57-61	59.2
SHOW	5710	M	1	57-61	59.2
SHOW	5740	F	1	57-63	60.4
SHOW	5773	M	3	72-77	75.1
SHOW	5774	F	A	A	A
SHOW	5794	M	1	57-61	59.2
SHOW	5835	F	1	57-63	60.4
SHOW	5845	M	2	66-70	64.8
SHOW	5884	F	0	57-63	60.4
SHOW	5909	F	1	57-63	60.4
SHOW	5977	M?	3	72-77	75.1
SHOW	6003	F	1	57-63	60.4
SHOW	6026	M	1	57-61	59.2
SHOW	6027	F	A	A	A
SHOW	6029	M	1	57-61	59.2
SHOW	6030	F	3	69-74	71.1
SHOW	6042	M	1	57-61	59.2
SHOW	6043	F	3	69-74	71.1
SHOW	6048	M	1	57-61	59.2
SHOW	6060	M	A	A	A
SHOW	6070	F	1	57-63	60.4
SHOW	6072	M	1	57-61	59.2
SHOW	6074	F	2	69-74	71.1
SHOW	6081	M	3	72-77	75.1
SHOW	6082	F	1	57-63	60.4
SHOW	6083	M	1	57-61	59.2
SHOW	6088	M	2	66-70	64.8
SHOW	6093	F	2	69-74	71.1
SHOW	6098	M	1	57-61	59.2
SHOW	6103	M	2	66-70	64.8
SHOW	6105	M	2	66-70	64.8
WP	EE004	M?	4	72-77	75.1
WP	EE013	M	3	72-77	75.1
WP	EE015	F	A	A	A
WP	EE019	F	2	69-74	71.1

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	EE022	F	2	69-74	71.1
WP	EE024	M?	A	A	A
WP	EE025	M?	3	72-77	75.1
WP	EE026	M	3	72-77	75.1
WP	EE037	M	3	72-77	75.1
WP	EE056	F	A	A	A
WP	EE062	M	1	57-61	59.2
WP	EE070	F	2	69-74	71.1
WP	EE079	M?	A	A	A
WP	EE080	M	4	72-77	75.1
WP	EE089	M	A	A	A
WP	EE097	F?	4	73-82	77.8
WP	EE098	M?	A	A	A
WP	EE099	F	3	69-74	71.1
WP	G251	F	A	A	A
WP	G265	M	4	72-77	75.1
WP	G278	M?	4	72-77	75.1
WP	G279	M?	A	A	A
WP	G296	F?	2	69-74	71.1
WP	G297	M?	3	72-77	75.1
WP	G303	M	2	66-70	64.8
WP	G310	M	A	A	A
WP	G361	F?	A	A	A
WP	G377	F?	2	69-74	71.1
WP	G379	M	A	A	A
WP	G381	M?	A	A	A
WP	G385	F?	3	69-74	71.1
WP	G406	M?	3	72-77	75.1
WP	G411	M	A	A	A
WP	G419	F?	A	A	A
WP	G451	F	3	69-74	71.1
WP	G474	F	2	69-74	71.1
WP	G482	M	A	A	A
WP	G516	M	3	72-77	75.1
WP	G561	M	3	72-77	75.1
WP	G565	M?	A	A	A
WP	G571	F?	2	69-74	71.1
WP	G587	M?	A	A	A
WP	G601	M?	1	57-61	59.2
WP	G607	M	3	72-77	75.1
WP	G628	F?	A	A	A
WP	NA046	M	4	72-77	75.1
WP	NA047	F	2	69-74	71.1
WP	NA059	F?	3	69-74	71.1
WP	NA075	M?	3	72-77	75.1
WP	NA078	M?	2	66-70	64.8
WP	NA080	M	A	A	A
WP	NA084	F	A	A	A
WP	NA088	F	3	69-74	71.1
WP	NA100	F	3	69-74	71.1
WP	NA166	M	1	57-61	59.2
WP	NA168	F	2	69-74	71.1
WP	NA171	M?	2	66-70	64.8
WP	NA181	M?	4	72-77	75.1
WP	NA183	M	A	A	A
WP	NA190	M?	3	72-77	75.1

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	NA197	M	5	PATH	PATH
WP	NA199	M	3	72-77	75.1
WP	NA202	F	2	69-74	71.1
WP	NA203	F	A	A	A
WP	NA217	M	A	A	A
WP	NA218	M	4	72-77	75.1
WP	NA224	M	3	72-77	75.1
WP	NA233	F	A	A	A
WP	NA234	M	A	A	A
WP	SA003	M?	4	72-77	75.1
WP	SA012	M	4	72-77	75.1
WP	SA013	F?	4	73-82	77.8
WP	SA015	M	A	A	A
WP	SA021	M	2	66-70	64.8
WP	SA033	M?	A	A	A
WP	SA034	M	5	PATH	PATH
WP	SA047	F?	A	A	A
WP	SA050	F	A	A	A
WP	SA052	M?	3	72-77	75.1
WP	SA053	F?	3	69-74	71.1
WP	SA054	F	2	69-74	71.1
WP	SA056	M?	A	A	A
WP	V11	M?	3	72-77	75.1
WP	V14	F?	A	A	A
WP	V15	M?	3	72-77	75.1
WP	V18	M?	1	57-61	59.2
WP	V19	M?	A	A	A
WP	V26	F	2	69-74	71.1
WP	V27	M?	3	72-77	75.1
WP	V29	F	2	69-74	71.1
WP	V33	F	3	69-74	71.1
WP	V38	M?	2	66-70	64.8
WP	V39	M	A	A	A
WP	V40	M	A	A	A
WP	V45	M?	3	72-77	75.1
WP	V46	F	3	69-74	71.1
WP	V51	M?	2	66-70	64.8
WP	V61	F	1	57-63	60.4
WP	WCO009	F	A	A	A
WP	WCO012	M?	A	A	A
WP	WCO013	F?	A	A	A
WP	WCO015	M	2	66-70	64.8
WP	WCO017	F?	A	A	A
WP	WCO018	M	A	A	A
WP	WCO022	F	2	69-74	71.1
WP	WCO026	F?	A	A	A
WP	WCO028	F	A	A	A
WP	WCO029	F	A	A	A
WP	WCO036	F	3	69-74	71.1
WP	WCO037	M?	A	A	A
WP	WCO041	M	1	57-61	59.2
WP	WCO045	F?	A	A	A
WP	WCO056	F	3	69-74	71.1
WP	WCO057	M?	2	66-70	64.8
WP	WCO059	M?	4	72-77	75.1
WP	WCO109	F	A	A	A

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	WCO115	M?	A	A	A
WP	WCO117	M	3	72-77	75.1
WP	WCO124	F	A	A	A
WP	WCO130	F	A	A	A
WP	WCO131	M?	A	A	A
WP	WCO137	M?	A	A	A
WP	WCO142	M?	A	A	A
WP	WCO146	M	3	72-77	75.1
WP	WCO153	M?	A	A	A
WP	WCO162	F?	3	69-74	71.1
WP	WCO164A	M	1	57-61	59.2
WP	WCO165	F?	A	A	A
WP	WCO165A	M	3	72-77	75.1
WP	WCO167	F	A	A	A

WP	WCO169	M	A	A	A
WP	WCO170	F	2	69-74	71.1
WP	WCO173	F	A	A	A
WP	WCO179	F?	2	69-74	71.1
WP	WCO184	F	2	69-74	71.1
WP	WCO187	F	A	A	A
WP	WCO199	F	A	A	A
WP	WCO200	M?	4	72-77	75.1
WP	WCO203	M?	A	A	A
WP	WCO204	F	A	A	A

Appendix 10 – Auricular surface

Raw data from age estimation using the auricular surface of the ilium (Buckberry and Chamberlain, 2002).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
BAR	7	F	5	5	2	2	2	16	39-91	66.71
BAR	18	F	4	1	3	2	2	12	29-81	51.41
BAR	99	M	2	2	1	1	2	8	21-38	29.33
BAR	126	M	5	5	3	2	3	18	53-92	72.25
BAR	127	M?	4	5	3	3	3	18	53-92	72.25
BAR	128	M	3	3	3	2	2	13	29-88	59.94
BAR	132	M?	4	5	3	2	3	17	53-92	72.25
BAR	179	M	4	4	2	2	2	14	29-88	59.94
BAR	187	F	1	2	3	1	2	9	16-65	37.86
BAR	204	F	4	4	3	1	3	15	39-91	66.71
BAR	208	M	4	3	2	1	1	11	29-81	51.41
BAR	241	M	3	4	3	2	2	14	29-88	59.94
BAR	266	M	3	4	3	2	2	14	29-88	59.94
BAR	269	M	4	5	3	2	2	16	39-91	66.71
BAR	272	M	3	5	3	1	3	15	39-91	66.71
BAR	276	F	2	4	3	1	2	12	29-81	51.41
BAR	308	M	5	3	3	2	2	15	39-91	66.71
BAR	309	F	4	4	3	2	3	16	39-91	66.71
BAR	311	F?	2	3	2	2	2	11	29-81	51.41
BAR	326	F	3	4	3	1	1	12	29-81	51.41
BAR	327	M	3	4	3	2	2	14	29-88	59.94
BAR	363	M	4	3	2	2	3	14	29-88	59.94
BAR	380	?	3	3	3	1	1	11	29-81	51.41
BAR	425	M	4	4	3	3	3	17	53-92	72.25
BAR	427	M	2	4	3	3	2	14	29-88	59.94
BAR	428	F	4	3	3	2	2	14	29-88	59.94
BAR	431	F	5	4	3	2	2	16	39-91	66.71
BAR	446	M	5	3	2	1	1	12	29-81	51.41
BAR	488	M	2	4	3	1	3	13	29-88	59.94
BAR	499	F	5	4	3	3	2	17	53-92	72.25
BAR	513	F?	4	4	3	2	2	15	39-91	66.71
BAR	539	F	3	5	3	3	2	16	39-91	66.71
BAR	548	M?	2	2	2	1	1	8	21-38	29.33
BAR	550	F	4	4	3	2	2	15	39-91	66.71
BAR	552	F	4	4	3	2	2	15	39-91	66.71

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
BAR	558	M?	4	4	3	2	2	15	39-91	66.71
BAR	578	F?	4	3	2	1	1	11	29-81	51.41
BAR	582	M	3	4	3	2	2	14	29-88	59.94
BAR	588	M	4	3	2	1	1	11	29-81	51.41
BAR	591	M?	4	3	2	1	3	13	29-88	59.94
BAR	594	M?	3	2	2	1	1	9	16-65	37.86
BAR	597	M	2	3	3	2	1	11	29-81	51.41
BAR	598	M	5	4	3	3	3	18	53-92	72.25
BAR	605	M	A	A	A	A	A	A	A	A
BAR	606	F	4	4	3	3	1	15	39-91	66.71
BAR	607	F	3	2	2	2	2	11	29-81	51.41
BAR	613	F	3	4	2	1	1	11	29-81	51.41
BAR	619	M	4	5	3	2	3	17	53-92	72.25
BAR	624	M	5	5	3	2	2	17	53-92	72.25
BAR	650	M	2	3	3	3	3	14	29-88	59.94
BAR	675	F	2	2	3	1	1	9	16-65	37.86
BAR	706	M	5	5	3	2	2	17	53-92	72.25
BAR	717	F	3	4	3	2	3	15	39-91	66.71
BAR	737	M	2	3	3	3	2	13	29-88	59.94
BAR	748	F	5	4	2	2	2	15	39-91	66.71
BAR	749	F	2	4	3	3	1	13	29-88	59.94
BAR	750	F?	5	4	3	1	1	14	29-88	59.94
BAR	765	M	2	2	3	1	2	10	16-65	37.86
BAR	771	F	2	3	3	1	1	10	16-65	37.86
BAR	778	M	4	2	2	1	2	11	29-81	51.41
BAR	788	F	3	4	3	3	2	15	39-91	66.71
BAR	834	M	2	4	3	2	2	13	29-88	59.94
BAR	850	F	2	3	3	2	1	11	29-81	51.41
BAR	854	F	4	3	2	1	2	12	29-81	51.41
BAR	867	M	4	3	3	1	2	13	29-88	59.94
BAR	870	M	4	5	3	3	3	18	53-92	72.25
BAR	894	F?	4	3	3	2	1	13	29-88	59.94
BAR	918	M	4	2	2	1	2	11	29-81	51.41
BAR	947	M	4	5	3	2	2	16	39-91	66.71
BAR	948	F	4	4	3	2	1	14	29-88	59.94
BAR	950	M?	4	4	3	1	2	14	29-88	59.94
BAR	971	F	4	4	3	2	2	15	39-91	66.71
BAR	975	M?	4	1	2	1	2	10	16-65	37.86
BAR	976	M	4	2	2	1	1	10	16-65	37.86
BAR	981	M?	4	2	2	1	2	11	29-81	51.41
BAR	989	M	3	4	3	2	1	13	29-88	59.94
BAR	1015	M	4	3	2	2	1	12	29-81	51.41
BAR	1020	M	5	5	3	3	1	17	53-92	72.25
BAR	1022	M	3	4	3	1	2	13	29-88	59.94
BAR	1028	F	3	3	3	3	1	13	29-88	59.94
BAR	1030	F?	3	2	3	1	2	11	29-81	51.41
BAR	1039	F	4	4	3	2	2	15	39-91	66.71
BAR	1043	M	2	3	3	1	2	11	29-81	51.41
BAR	1047	M	2	3	3	1	1	10	16-65	37.86
BAR	1049	F	5	5	3	3	2	18	53-92	72.25
BAR	1062	F	3	4	3	2	2	14	29-88	59.94
BAR	1063	M	4	4	3	2	3	16	39-91	66.71
BAR	1064	F	3	4	3	2	2	14	29-88	59.94
BAR	1068	F	4	5	3	3	3	18	53-92	72.25
BAR	1071	F	3	2	2	1	1	9	16-65	37.86
BAR	1085	M?	4	4	3	1	2	14	29-88	59.94

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
BAR	1096	F	5	5	2	2	2	16	39-91	66.71
BAR	1100	M	3	4	3	2	3	15	39-91	66.71
BAR	1103	M	A	A	A	A	A	A	A	A
BAR	1104	M	4	2	1	1	2	10	16-65	37.86
BAR	1106	M	4	5	3	1	3	16	39-91	66.71
BAR	1120	F	3	4	3	2	2	14	29-88	59.94
BAR	1122	M	4	2	2	1	1	10	16-65	37.86
BAR	1133	F	3	2	3	1	1	10	16-65	37.86
BAR	1134	M	3	3	3	1	2	12	29-81	51.41
BAR	1139	M	4	5	3	3	3	18	53-92	72.25
BAR	1144	F	5	5	3	3	3	19	53-92	72.25
BAR	1146	M?	4	3	3	1	2	13	29-88	59.94
BAR	1148	F	4	4	3	2	3	16	39-91	66.71
BAR	1149	M	3	4	3	3	1	14	29-88	59.94
BAR	1151	F	3	2	2	1	1	9	16-65	37.86
BAR	1162	M	4	3	3	2	3	15	39-91	66.71
BAR	1169	M	4	4	3	2	2	15	39-91	66.71
BAR	1176	M	2	4	3	3	2	14	29-88	59.94
BAR	1183	M?	4	2	3	2	1	12	29-81	51.41
BAR	1197	F	3	3	3	2	1	12	29-81	51.41
BAR	1202	F	3	3	3	2	2	13	29-88	59.94
BAR	1204	M	4	5	3	2	3	17	53-92	72.25
BAR	1214	M	2	3	3	1	1	10	16-65	37.86
BAR	1220	F?	3	4	3	2	1	13	29-88	59.94
BAR	1235	F	3	3	3	2	3	14	29-88	59.94
BAR	1236	F	4	4	3	1	1	13	29-88	59.94
BAR	1251	M	4	3	3	2	2	14	29-88	59.94
BAR	1254	F	3	3	3	2	2	13	29-88	59.94
BAR	1255	F	3	2	2	1	1	9	16-65	37.86
BAR	1263	M?	2	2	3	2	1	10	16-65	37.86
BAR	1268	M	5	5	3	2	3	18	53-92	72.25
BAR	1291	M?	4	4	3	2	3	16	39-91	66.71
BAR	1297	M	3	4	3	2	2	14	29-88	59.94
BAR	1299	F?	4	5	3	3	2	17	53-92	72.25
BAR	1307	M	3	2	3	2	2	12	29-81	51.41
BAR	1315	M	3	3	2	2	2	12	29-81	51.41
BAR	1316	M	3	3	3	2	1	12	29-81	51.41
BAR	1324	M	3	2	2	1	1	9	16-65	37.86
BAR	1409	M?	2	3	3	2	1	11	29-81	51.41
BAR	1438	M	3	4	3	3	1	14	29-88	59.94
BAR	1498	F	4	3	3	2	2	14	29-88	59.94
BAR	1538	F	3	3	3	1	2	12	29-81	51.41
BAR	1542	F	3	3	3	2	1	12	29-81	51.41
BAR	1548	M	4	2	3	2	2	13	29-88	59.94
BAR	1556	M	3	2	3	2	3	13	29-88	59.94
BAR	1566	M	4	5	3	2	2	16	39-91	66.71
BAR	1571	F	4	2	3	2	1	12	29-81	51.41
BAR	1615	M	3	2	3	1	2	11	29-81	51.41
BAR	1655	F	3	3	3	1	1	11	29-81	51.41
BAR	1691	M	2	2	2	1	2	9	16-65	37.86
BAR	1695	F?	3	4	3	3	1	14	29-88	59.94
BAR	1707	M	3	3	3	2	3	14	29-88	59.94
BAR	1723	M	A	A	A	A	A	A	A	A
BAR	1750	F	3	3	3	2	2	13	29-88	59.94
BAR	1756	M?	3	3	2	1	1	10	16-65	37.86
BAR	1765	F	4	3	3	2	2	14	29-88	59.94

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
BAR	1769	M	3	3	3	1	3	13	29-88	59.94
BAR	1775	M	3	4	3	3	2	15	39-91	66.71
BAR	1788	M	3	3	3	1	3	13	29-88	59.94
BAR	1805	M	4	3	3	2	2	14	29-88	59.94
BAR	1824	M	3	3	3	1	3	13	29-88	59.94
BAR	1843	M	3	3	3	2	2	13	29-88	59.94
BAR	1849	M	4	3	3	2	2	14	29-88	59.94
BAR	1856	?	3	2	2	1	2	10	16-65	37.86
BAR	1863	M	3	3	3	1	3	13	29-88	59.94
BAR	1869	M?	3	3	3	2	2	13	29-88	59.94
BAR	1871	M	4	4	3	3	3	17	53-92	72.25
BAR	1875	F	3	3	2	1	1	10	16-65	37.86
BAR	1889	F?	3	3	3	1	2	12	29-81	51.41
BAR	1892	F	2	3	3	1	2	11	29-81	51.41
BAR	1897	M	3	3	3	1	2	12	29-81	51.41
BAR	1910	M	3	3	3	1	3	13	29-88	59.94
BAR	1911	M	4	2	2	1	2	11	29-81	51.41
BAR	1920	M	3	3	3	3	2	14	29-88	59.94
BAR	1922	M	2	1	2	2	2	9	16-65	37.86
BAR	1926	M	4	3	3	1	2	13	29-88	59.94
BAR	1993	M	3	3	3	3	2	14	29-88	59.94
BAR	1995	M	3	3	3	2	1	12	29-81	51.41
BAR	2027	M	3	3	3	2	3	14	29-88	59.94
BAR	2064	F	2	2	3	1	1	9	16-65	37.86
BAR	2130	F	4	3	3	2	3	15	39-91	66.71
BAR	2142	F	4	3	3	2	2	14	29-88	59.94
BAR	2176	F	3	3	3	1	3	13	29-88	59.94
BAR	2187	F	3	2	2	1	1	9	16-65	37.86
BAR	2193	M	3	3	3	2	2	13	29-88	59.94
BAR	2200	M	3	3	3	2	3	14	29-88	59.94
BAR	2206	M	4	3	3	1	3	14	29-88	59.94
BAR	2216	F	4	3	3	3	2	15	39-91	66.71
BAR	2219	M	3	3	3	2	2	13	29-88	59.94
BAR	2236	F	4	4	3	3	2	16	39-91	66.71
BAR	2244	M	3	3	3	2	3	14	29-88	59.94
BAR	2248	M	2	3	3	1	2	11	29-81	51.41
BAR	2251	M	3	3	3	2	3	14	29-88	59.94
BAR	2259	F	3	3	3	3	2	14	29-88	59.94
BAR	2274	M	3	4	3	2	3	15	39-91	66.71
BAR	2283	F	3	2	2	1	2	10	16-65	37.86
BAR	2284	F?	4	4	3	3	3	17	53-92	72.25
BAR	2289	M	3	2	2	1	2	10	16-65	37.86
BAR	2294	M	2	3	3	2	1	11	29-81	51.41
BAR	2297	F?	4	3	3	2	2	14	29-88	59.94
BAR	2298	M	4	2	3	1	2	12	29-81	51.41
BAR	2304	M	3	2	2	1	2	10	16-65	37.86
BAR	2309	M	3	2	2	1	2	10	16-65	37.86
BAR	2320	M	4	5	3	2	3	17	53-92	72.25
BAR	2327	M	2	3	3	1	2	11	29-81	51.41
BAR	2337	M	4	4	3	2	3	16	39-91	66.71
BAR	2338	M	4	3	3	1	3	14	29-88	59.94
BAR	2345	M	3	2	2	1	3	11	29-81	51.41
BAR	2348	F	3	3	3	2	2	13	29-88	59.94
BAR	2356	F	3	3	3	2	1	12	29-81	51.41
BAR	2376	M	3	4	3	2	3	15	39-91	66.71
BAR	2386	F	2	2	3	1	1	9	16-65	37.86

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
BAR	2408	F	3	3	3	1	1	11	29-81	51.41
BAR	2411	F?	3	3	3	3	3	15	39-91	66.71
BAR	2413	M?	3	3	3	2	3	14	29-88	59.94
BAR	2428	F	3	3	3	2	1	12	29-81	51.41
BAR	2436	F?	A	A	A	A	A	A	A	A
BAR	2451	M?	2	2	2	1	2	9	16-65	37.86
BAR	2452	M	A	A	A	A	A	A	A	A
BAR	2457	F	2	3	3	2	3	13	29-88	59.94
BAR	2465	F	3	3	3	1	1	11	29-81	51.41
BAR	2466	M	3	3	3	2	2	13	29-88	59.94
BAR	2469	M	3	2	2	1	1	9	16-65	37.86
BAR	2471	M	3	3	3	2	2	13	29-88	59.94
BAR	2485	M	2	3	3	1	3	12	29-81	51.41
BAR	2491	M?	3	2	2	1	3	11	29-81	51.41
BAR	2495	M	2	3	3	1	1	10	16-65	37.86
BAR	2499	M	2	3	3	2	3	13	29-88	59.94
BAR	2503	F	2	3	3	1	1	10	16-65	37.86
BAR	2514	M	A	A	A	A	A	A	A	A
BAR	2520	F?	3	2	3	3	3	14	29-88	59.94
BAR	2583	M	2	3	3	1	2	11	29-81	51.41
BAR	2603	M	3	3	3	2	3	14	29-88	59.94
BAR	2612	M	3	3	3	1	2	12	29-81	51.41
BAR	2616	?	2	3	3	3	2	13	29-88	59.94
BAR	2666	F?	3	3	3	2	1	12	29-81	51.41
BAR	2684	M	2	3	2	1	3	11	29-81	51.41
BAR	2700	M	2	3	3	1	1	10	16-65	37.86
BAR	2714	M	2	3	3	1	3	12	29-81	51.41
BAR	2718	F	1	2	3	1	2	9	16-65	37.86
BAR	2720	M	2	2	3	1	1	9	16-65	37.86
BAR	2721	M	A	A	A	A	A	A	A	A
BAR	2722	F	2	2	3	1	1	9	16-65	37.86
BAR	2727	F	3	3	3	1	2	12	29-81	51.41
BAR	2730	M	2	3	3	3	3	14	29-88	59.94
BAR	2731	M	2	3	2	1	1	9	16-65	37.86
BAR	2732	F	4	3	3	1	2	13	29-88	59.94
BAR	2739	M	2	3	3	1	2	11	29-81	51.41
BAR	2751	F	2	3	3	3	2	13	29-88	59.94
BAR	2758	M	3	2	3	3	3	14	29-88	59.94
BAR	2766	F	4	3	3	1	2	13	29-88	59.94
BAR	2775	F	3	3	3	2	1	12	29-81	51.41
BAR	2780	F	2	3	3	2	3	13	29-88	59.94
BAR	2783	M	2	2	3	1	1	9	16-65	37.86
BAR	2784	M	3	2	2	1	3	11	29-81	51.41
BAR	2786	M	3	3	3	1	1	11	29-81	51.41
BAR	2798	M?	4	3	3	1	2	13	29-88	59.94
BAR	2799	M	3	3	3	2	1	12	29-81	51.41
FGH	1021	M?	4	4	3	2	1	14	29-88	59.94
FGH	1037	F	2	2	2	1	1	8	21-38	29.33
FGH	1047	F	2	3	2	2	2	11	29-81	51.41
FGH	1049	F?	3	3	3	2	1	12	29-81	51.41
FGH	1051	M	4	5	3	3	3	18	53-92	72.25
FGH	1053	F?	5	3	3	1	1	13	29-88	59.94
FGH	1057	F	4	4	3	1	1	13	29-88	59.94
FGH	1063	M	2	5	3	2	1	13	29-88	59.94
FGH	1075	M	5	5	3	2	2	17	53-92	72.25
FGH	1079	F	5	5	3	2	2	17	53-92	72.25

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
FGH	1081	M?	?	?	?	?	?	0	?	?
FGH	1091	F?	4	4	3	3	2	16	39-91	66.71
FGH	1097	F?	5	4	3	2	2	16	39-91	66.71
FGH	1099	F?	2	3	3	2	3	13	29-88	59.94
FGH	1101	F	4	4	3	2	1	14	29-88	59.94
FGH	1104	F	4	4	3	3	1	15	39-91	66.71
FGH	1110	F	4	3	3	1	2	13	29-88	59.94
FGH	1113	M	2	3	3	1	1	10	16-65	37.86
FGH	1115	F	3	3	2	1	1	10	16-65	37.86
FGH	1117	M	4	5	3	3	2	17	53-92	72.25
FGH	1130	M	5	4	3	2	2	16	39-91	66.71
FGH	1139	M?	3	4	3	2	3	15	39-91	66.71
FGH	1147	M	4	4	3	2	3	16	39-91	66.71
FGH	1150	F	4	4	3	3	3	17	53-92	72.25
FGH	1163	M?	5	5	3	3	3	19	53-92	72.25
FGH	1171	M?	2	2	2	2	1	9	16-65	37.86
FGH	1180	F	5	1	2	1	1	10	16-65	37.86
FGH	1184	M	3	3	3	1	1	11	29-81	51.41
FGH	1188	M	4	5	3	3	1	16	39-91	66.71
FGH	1190	F	3	4	3	2	1	13	29-88	59.94
FGH	1208	F?	2	4	3	3	1	13	29-88	59.94
FGH	1228	M	4	2	2	1	3	12	29-81	51.41
FGH	1230	F?	4	4	3	1	1	13	29-88	59.94
FGH	1237	M?	?	?	?	?	?	0	?	?
FGH	1255	F?	3	3	3	1	2	12	29-81	51.41
FGH	1257	F	4	3	3	2	2	14	29-88	59.94
FGH	1280	M?	3	3	3	2	1	12	29-81	51.41
FGH	1284	F?	3	3	3	2	1	12	29-81	51.41
FGH	1286	F	2	4	3	1	2	12	29-81	51.41
FGH	1297	F?	4	3	1	1	1	10	16-65	37.86
FGH	1305	F?	4	4	3	1	2	14	29-88	59.94
FGH	1312	F	3	3	3	2	2	13	29-88	59.94
FGH	1313	M?	5	5	3	3	2	18	53-92	72.25
FGH	1327	M?	4	4	3	2	2	15	39-91	66.71
FGH	1354	M	4	3	3	1	1	12	29-81	51.41
FGH	1385	M	3	4	3	2	1	13	29-88	59.94
FGH	1391	F	3	3	3	2	2	13	29-88	59.94
FGH	1412	M	4	3	2	1	1	11	29-81	51.41
FGH	1441	M?	4	4	3	1	2	14	29-88	59.94
FGH	1455	F	3	3	2	1	1	10	16-65	37.86
FGH	1469	F	3	3	3	1	1	11	29-81	51.41
FGH	1471	F	4	4	3	1	1	13	29-88	59.94
FGH	1484	F	4	4	3	1	2	14	29-88	59.94
FGH	1486	M	2	2	1	1	1	7	21-38	29.33
FGH	1521	F	4	3	3	1	1	12	29-81	51.41
FGH	1525	F?	3	3	3	2	2	13	29-88	59.94
FGH	1553	M?	3	2	2	1	1	9	16-65	37.86
FGH	1560	M?	3	3	3	2	2	13	29-88	59.94
FGH	1569	F?	2	3	2	1	2	10	16-65	37.86
FGH	1579	F?	4	3	3	2	2	14	29-88	59.94
FGH	1581	F?	4	5	3	3	3	18	53-92	72.25
FGH	1583	M	5	5	3	3	3	19	53-92	72.25
FGH	1589	F	3	2	2	1	1	9	16-65	37.86
FGH	1597	F	3	4	3	1	1	12	29-81	51.41
SHOW	5010a	F	A	A	A	A	A	A	A	A
SHOW	5066	M	5	5	2	2	2	16	39-91	66.71

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
SHOW	5091	F	2	2	1	1	1	7	21-38	29.33
SHOW	5098	F	4	3	3	2	1	13	29-88	59.94
SHOW	5103	F	4	4	2	1	2	13	29-88	59.94
SHOW	5105	F	4	3	2	1	1	11	29-81	51.41
SHOW	5110	F	3	4	3	3	1	14	29-88	59.94
SHOW	5123	F	5	4	3	3	2	17	53-92	72.25
SHOW	5159	M	4	3	2	1	2	12	29-81	51.41
SHOW	5172	M	A	A	A	A	A	A	A	A
SHOW	5173	M	3	3	2	1	2	11	29-81	51.41
SHOW	5186	M?	4	3	3	2	2	14	29-88	59.94
SHOW	5190	F	3	3	3	2	2	13	29-88	59.94
SHOW	5203	M	A	A	A	A	A	A	A	A
SHOW	5204	M	3	2	2	1	2	10	16-65	37.86
SHOW	5207	M	3	3	3	1	2	12	29-81	51.41
SHOW	5208	M?	3	3	2	1	1	10	16-65	37.86
SHOW	5211	F	4	4	2	1	2	13	29-88	59.94
SHOW	5218	F?	5	5	3	3	2	18	53-92	72.25
SHOW	5222	M	3	3	3	2	1	12	29-81	51.41
SHOW	5225	F	3	3	3	2	1	12	29-81	51.41
SHOW	5228	F?	4	5	3	2	2	16	39-91	66.71
SHOW	5233	M	4	3	3	1	1	12	29-81	51.41
SHOW	5237	M	5	3	3	1	1	13	29-88	59.94
SHOW	5241	F	5	4	3	1	2	15	39-91	66.71
SHOW	5243	M	3	4	2	1	1	11	29-81	51.41
SHOW	5244	M?	3	4	3	3	3	16	39-91	66.71
SHOW	5254	F	5	5	2	1	2	15	39-91	66.71
SHOW	5258	F	3	4	3	3	2	15	39-91	66.71
SHOW	5267	F	4	3	3	1	1	12	29-81	51.41
SHOW	5269	M	3	5	3	1	3	15	39-91	66.71
SHOW	5270	F?	3	3	2	2	2	12	29-81	51.41
SHOW	5283	M	4	5	3	2	3	17	53-92	72.25
SHOW	5290	F?	4	3	3	1	2	13	29-88	59.94
SHOW	5292	F	3	2	3	2	1	11	29-81	51.41
SHOW	5298	F	3	2	2	1	1	9	16-65	37.86
SHOW	5302	F	4	2	2	1	2	11	29-81	51.41
SHOW	5311	F?	4	4	2	1	2	13	29-88	59.94
SHOW	5316	F?	4	3	3	2	2	14	29-88	59.94
SHOW	5320	F	3	4	3	1	2	13	29-88	59.94
SHOW	5323	M	3	5	3	2	2	15	39-91	66.71
SHOW	5329	M	2	2	3	1	1	9	16-65	37.86
SHOW	5347	M	3	3	2	1	3	12	29-81	51.41
SHOW	5350	F	4	3	2	2	2	13	29-88	59.94
SHOW	5364	F	2	3	2	3	1	11	29-81	51.41
SHOW	5384	M	4	4	3	2	3	16	39-91	66.71
SHOW	5393	F	4	5	2	1	3	15	39-91	66.71
SHOW	5402	M	4	4	3	2	3	16	39-91	66.71
SHOW	5415	F	4	3	3	2	2	14	29-88	59.94
SHOW	5421	M?	4	5	3	3	3	18	53-92	72.25
SHOW	5438	M	4	4	3	1	2	14	29-88	59.94
SHOW	5445	M	3	4	3	1	2	13	29-88	59.94
SHOW	5451	M	5	3	2	2	2	14	29-88	59.94
SHOW	5453	M	4	2	2	1	1	10	16-65	37.86
SHOW	5457	M	3	2	2	1	3	11	29-81	51.41
SHOW	5461	M?	5	3	3	2	2	15	39-91	66.71
SHOW	5463	M?	4	5	3	2	2	16	39-91	66.71
SHOW	5475	M?	5	5	3	2	3	18	53-92	72.25

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
SHOW	5488	F	1	3	2	1	1	8	21-38	29.33
SHOW	5492	F	3	3	3	2	2	13	29-88	59.94
SHOW	5494	F	4	5	3	3	1	16	39-91	66.71
SHOW	5501	F	4	3	3	2	2	14	29-88	59.94
SHOW	5507	F?	3	3	3	1	1	11	29-81	51.41
SHOW	5508	F	4	4	3	2	3	16	39-91	66.71
SHOW	5529	F	4	4	3	1	1	13	29-88	59.94
SHOW	5534	F	2	2	2	1	1	8	21-38	29.33
SHOW	5539	M	2	2	2	1	3	10	16-65	37.86
SHOW	5544	M	4	4	3	1	2	14	29-88	59.94
SHOW	5562	F	4	3	3	2	2	14	29-88	59.94
SHOW	5563	M	3	2	3	1	1	10	16-65	37.86
SHOW	5588	F	4	4	3	2	1	14	29-88	59.94
SHOW	5601	F	3	3	2	2	1	11	29-81	51.41
SHOW	5603	M	4	2	3	1	2	12	29-81	51.41
SHOW	5617	M	3	4	3	1	2	13	29-88	59.94
SHOW	5632	F	4	4	3	3	3	17	53-92	72.25
SHOW	5644	M	3	3	3	2	2	13	29-88	59.94
SHOW	5657	F	3	2	2	1	1	9	16-65	37.86
SHOW	5671	M	3	3	3	2	2	13	29-88	59.94
SHOW	5680	M	5	3	3	2	3	16	39-91	66.71
SHOW	5699	F	3	4	3	2	1	13	29-88	59.94
SHOW	5702	M	?	?	?	?	?	0	?	?
SHOW	5710	M	3	2	3	2	1	11	29-81	51.41
SHOW	5740	F	2	2	3	2	2	11	29-81	51.41
SHOW	5773	M	2	3	3	2	2	12	29-81	51.41
SHOW	5774	F	5	4	3	3	2	17	53-92	72.25
SHOW	5794	M	2	3	3	1	3	12	29-81	51.41
SHOW	5835	F	3	2	2	1	1	9	16-65	37.86
SHOW	5845	M	3	3	3	2	2	13	29-88	59.94
SHOW	5884	F	3	3	3	1	1	11	29-81	51.41
SHOW	5909	F	3	2	3	2	1	11	29-81	51.41
SHOW	5977	M?	3	2	2	1	1	9	16-65	37.86
SHOW	6003	F	3	3	3	3	2	14	29-88	59.94
SHOW	6026	M	2	1	2	1	1	7	21-38	29.33
SHOW	6027	F	4	3	3	2	3	15	39-91	66.71
SHOW	6029	M	2	3	3	2	2	12	29-81	51.41
SHOW	6030	F	4	5	3	3	3	18	53-92	72.25
SHOW	6042	M	1	2	3	1	2	9	16-65	37.86
SHOW	6043	F	3	3	3	2	1	12	29-81	51.41
SHOW	6048	M	3	3	3	2	2	13	29-88	59.94
SHOW	6060	M	3	3	3	3	2	14	29-88	59.94
SHOW	6070	F	4	2	3	2	2	13	29-88	59.94
SHOW	6072	M	2	3	3	2	3	13	29-88	59.94
SHOW	6074	F	4	3	3	2	3	15	39-91	66.71
SHOW	6081	M	5	5	3	2	3	18	53-92	72.25
SHOW	6082	F	3	3	3	1	2	12	29-81	51.41
SHOW	6083	M	2	3	2	1	3	11	29-81	51.41
SHOW	6088	M	2	3	3	1	2	11	29-81	51.41
SHOW	6093	F	3	3	3	1	1	11	29-81	51.41
SHOW	6098	M	4	2	2	2	2	12	29-81	51.41
SHOW	6103	M	2	3	3	2	2	12	29-81	51.41
SHOW	6105	M	3	3	3	3	3	15	39-91	66.71
WP	EE004	M?	4	3	3	2	3	15	39-91	66.71
WP	EE013	M	4	2	2	2	1	11	29-81	51.41
WP	EE015	F	4	4	3	2	2	15	39-91	66.71

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
WP	EE019	F	3	3	3	3	1	13	29-88	59.94
WP	EE022	F	4	3	2	1	1	11	29-81	51.41
WP	EE024	M?	5	5	3	3	2	18	53-92	72.25
WP	EE025	M?	4	5	2	1	2	14	29-88	59.94
WP	EE026	M	5	3	3	2	3	16	39-91	66.71
WP	EE037	M	3	2	3	1	1	10	16-65	37.86
WP	EE056	F	5	5	3	3	2	18	53-92	72.25
WP	EE062	M	2	3	2	1	3	11	29-81	51.41
WP	EE070	F	4	3	3	3	1	14	29-88	59.94
WP	EE079	M?	4	3	3	1	2	13	29-88	59.94
WP	EE080	M	2	3	3	1	1	10	16-65	37.86
WP	EE089	M	A	A	A	A	A	A	A	A
WP	EE097	F?	4	3	3	2	2	14	29-88	59.94
WP	EE098	M?	4	5	3	3	3	18	53-92	72.25
WP	EE099	F	3	2	2	1	1	9	16-65	37.86
WP	G251	F	4	3	3	2	1	13	29-88	59.94
WP	G265	M	2	3	3	2	2	12	29-81	51.41
WP	G278	M?	4	3	3	1	2	13	29-88	59.94
WP	G279	M?	3	3	3	2	1	12	29-81	51.41
WP	G296	F?	4	3	3	1	1	12	29-81	51.41
WP	G297	M?	2	2	3	1	3	11	29-81	51.41
WP	G303	M	3	4	3	3	3	16	39-91	66.71
WP	G310	M	2	3	2	1	1	9	16-65	37.86
WP	G361	F?	3	3	3	1	2	12	29-81	51.41
WP	G377	F?	3	3	3	2	1	12	29-81	51.41
WP	G379	M	4	4	3	3	2	16	39-91	66.71
WP	G381	M?	2	2	3	1	2	10	16-65	37.86
WP	G385	F?	3	3	3	1	1	11	29-81	51.41
WP	G406	M?	3	4	3	2	1	13	29-88	59.94
WP	G411	M	2	2	3	1	1	9	16-65	37.86
WP	G419	F?	3	4	3	2	3	15	39-91	66.71
WP	G451	F	3	3	3	1	2	12	29-81	51.41
WP	G474	F	4	3	3	3	1	14	29-88	59.94
WP	G482	M	3	3	3	2	3	14	29-88	59.94
WP	G516	M	3	3	3	2	3	14	29-88	59.94
WP	G561	M	2	3	3	1	3	12	29-81	51.41
WP	G565	M?	3	2	3	1	3	12	29-81	51.41
WP	G571	F?	4	3	3	2	1	13	29-88	59.94
WP	G587	M?	2	3	3	2	2	12	29-81	51.41
WP	G601	M?	3	3	3	1	1	11	29-81	51.41
WP	G607	M	2	3	3	1	3	12	29-81	51.41
WP	G628	F?	4	5	3	3	1	16	39-91	66.71
WP	NA046	M	3	3	3	2	2	13	29-88	59.94
WP	NA047	F	2	2	3	2	1	10	16-65	37.86
WP	NA059	F?	3	3	3	1	2	12	29-81	51.41
WP	NA075	M?	2	3	3	3	2	13	29-88	59.94
WP	NA078	M?	2	3	3	1	1	10	16-65	37.86
WP	NA080	M	2	3	3	1	1	10	16-65	37.86
WP	NA084	F	2	3	3	1	1	10	16-65	37.86
WP	NA088	F	3	3	3	1	1	11	29-81	51.41
WP	NA100	F	2	4	3	1	2	12	29-81	51.41
WP	NA166	M	2	1	2	1	1	7	21-38	29.33
WP	NA168	F	4	4	3	3	3	17	53-92	72.25
WP	NA171	M?	4	3	3	2	1	13	29-88	59.94
WP	NA181	M?	3	4	3	2	1	13	29-88	59.94
WP	NA183	M	4	2	3	1	1	11	29-81	51.41

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
WP	NA190	M?	3	3	3	2	2	13	29-88	59.94
WP	NA197	M	2	3	3	3	3	14	29-88	59.94
WP	NA199	M	3	3	3	2	3	14	29-88	59.94
WP	NA202	F	3	5	3	3	2	16	39-91	66.71
WP	NA203	F	2	3	3	3	1	12	29-81	51.41
WP	NA217	M	2	3	3	2	3	13	29-88	59.94
WP	NA218	M	2	2	3	1	3	11	29-81	51.41
WP	NA224	M	2	2	3	2	3	12	29-81	51.41
WP	NA233	F	A	A	A	A	A	A	A	A
WP	NA234	M	A	A	A	A	A	A	A	A
WP	SA003	M?	4	3	3	3	2	15	39-91	66.71
WP	SA012	M	2	2	2	1	1	8	21-38	29.33
WP	SA013	F?	4	4	3	2	1	14	29-88	59.94
WP	SA015	M	4	4	3	3	2	16	39-91	66.71
WP	SA021	M	4	3	3	3	2	15	39-91	66.71
WP	SA033	M?	4	3	3	2	3	15	39-91	66.71
WP	SA034	M	3	3	2	1	1	10	16-65	37.86
WP	SA047	F?	3	2	3	1	2	11	29-81	51.41
WP	SA050	F	A	A	A	A	A	A	A	A
WP	SA052	M?	3	3	3	2	2	13	29-88	59.94
WP	SA053	F?	3	4	3	3	1	14	29-88	59.94
WP	SA054	F	4	2	3	2	1	12	29-81	51.41
WP	SA056	M?	3	3	3	1	1	11	29-81	51.41
WP	V11	M?	3	4	3	2	2	14	29-88	59.94
WP	V14	F?	4	5	3	2	2	16	39-91	66.71
WP	V15	M?	4	4	3	2	3	16	39-91	66.71
WP	V18	M?	3	3	3	1	3	13	29-88	59.94
WP	V19	M?	3	3	3	2	3	14	29-88	59.94
WP	V26	F	4	4	3	3	2	16	39-91	66.71
WP	V27	M?	3	3	3	1	2	12	29-81	51.41
WP	V29	F	3	3	3	2	2	13	29-88	59.94
WP	V33	F	3	5	3	1	2	14	29-88	59.94
WP	V38	M?	3	3	3	1	3	13	29-88	59.94
WP	V39	M	A	A	A	A	A	A	A	A
WP	V40	M	A	A	A	A	A	A	A	A
WP	V45	M?	2	3	3	2	2	12	29-81	51.41
WP	V46	F	3	4	3	3	3	16	39-91	66.71
WP	V51	M?	A	A	A	A	A	A	A	A
WP	V61	F	4	3	3	1	2	13	29-88	59.94
WP	WCO009	F	1	1	3	1	1	7	21-38	29.33
WP	WCO012	M?	2	3	3	1	3	12	29-81	51.41
WP	WCO013	F?	3	3	3	3	3	15	39-91	66.71
WP	WCO015	M	2	3	3	1	1	10	16-65	37.86
WP	WCO017	F?	4	3	3	3	3	16	39-91	66.71
WP	WCO018	M	2	3	3	3	3	14	29-88	59.94
WP	WCO022	F	3	3	3	2	2	13	29-88	59.94
WP	WCO026	F?	4	3	3	3	3	16	39-91	66.71
WP	WCO028	F	4	5	3	3	3	18	53-92	72.25
WP	WCO029	F	3	3	3	2	2	13	29-88	59.94
WP	WCO036	F	3	2	3	2	3	13	29-88	59.94
WP	WCO037	M?	3	3	3	2	3	14	29-88	59.94
WP	WCO041	M	2	3	3	1	1	10	16-65	37.86
WP	WCO045	F?	4	5	3	3	3	18	53-92	72.25
WP	WCO056	F	3	3	3	1	2	12	29-81	51.41
WP	WCO057	M?	3	4	3	2	3	15	39-91	66.71
WP	WCO059	M?	4	4	3	2	1	14	29-88	59.94

Site	Sk. No.	Sex	Transverse Organisation	Surface Texture	Micro porosity	Macro porosity	Apical Changes	Composite Score	Est. Age	Mean
WP	WCO109	F	2	3	3	2	1	11	29-81	51.41
WP	WCO115	M?	3	5	3	2	3	16	39-91	66.71
WP	WCO117	M	2	3	3	2	3	13	29-88	59.94
WP	WCO124	F	3	3	3	2	3	14	29-88	59.94
WP	WCO130	F	4	3	3	2	3	15	39-91	66.71
WP	WCO131	M?	3	3	3	2	2	13	29-88	59.94
WP	WCO137	M?	3	4	3	2	2	14	29-88	59.94
WP	WCO142	M?	4	5	3	2	1	15	39-91	66.71
WP	WCO146	M	3	2	3	1	2	11	29-81	51.41
WP	WCO153	M?	4	5	3	2	2	16	39-91	66.71
WP	WCO162	F?	2	3	3	2	3	13	29-88	59.94
WP	WCO164A	M	3	4	3	3	3	16	39-91	66.71
WP	WCO165	F?	4	5	3	3	1	16	39-91	66.71
WP	WCO165A	M	3	2	3	1	2	11	29-81	51.41
WP	WCO167	F	3	3	3	1	1	11	29-81	51.41
WP	WCO169	M	A	A	A	A	A	A	A	A
WP	WCO170	F	4	5	3	3	3	18	53-92	72.25
WP	WCO173	F	4	3	3	1	1	12	29-81	51.41
WP	WCO179	F?	3	3	3	2	2	13	29-88	59.94
WP	WCO184	F	4	3	3	2	1	13	29-88	59.94
WP	WCO187	F	4	4	3	1	2	14	29-88	59.94
WP	WCO199	F	3	4	3	3	3	16	39-91	66.71
WP	WCO200	M?	3	4	3	2	2	14	29-88	59.94
WP	WCO203	M?	3	3	3	2	2	13	29-88	59.94
WP	WCO204	F	3	4	3	3	3	16	39-91	66.71

Appendix 11 – Pubic symphysis

Raw data from age estimation using the pubic symphysis of the os pubis (Brooks and Suchey, 1990).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
BAR	7	F	5	6	6	25-87	56
BAR	18	F	A	A	A	A	A
BAR	99	M	A	A	A	A	A
BAR	126	M	A	A	A	A	A
BAR	127	M?	5	5	5	27-66	45.6
BAR	128	M	A	A	A	A	A
BAR	132	M?	4	4	4	23-57	35.2
BAR	179	M	5	5	5	27-66	45.6
BAR	187	F	5	6	4	26-87	48.8
BAR	204	F	4	5	4	26-83	41.5
BAR	208	M	5	5	4	23-66	42.1
BAR	241	M	4	5	4	23-66	38.7
BAR	266	M	4	6	5	23-86	47.3
BAR	269	M	A	A	A	A	A
BAR	272	M	5	6	6	27-86	56.0
BAR	276	F	A	A	A	A	A
BAR	308	M	4	5	4	23-66	38.7
BAR	309	F	5	6	6	25-87	56
BAR	311	F?	4	5	5	26-83	44.8
BAR	326	F	6	6	4	26-87	52.7
BAR	327	M	4	5	4	23-66	38.7
BAR	363	M	5	5	4	23-66	42.1
BAR	380	?	A	A	A	A	A
BAR	425	M	5	6	5	27-86	50.8
BAR	427	M	4	5	5	23-66	42.1
BAR	428	F	A	A	A	A	A
BAR	431	F	6	6	6	42-87	60
BAR	446	M	5	5	4	23-66	42.1
BAR	488	M	5	6	6	27-86	56.0
BAR	499	F	A	A	A	A	A
BAR	513	F?	A	A	A	A	A
BAR	539	F	A	A	A	A	A
BAR	548	M?	A	A	A	A	A
BAR	550	F	A	A	A	A	A
BAR	552	F	5	5	5	26-83	48.1
BAR	558	M?	A	A	A	A	A
BAR	578	F?	A	A	A	A	A
BAR	582	M	A	A	A	A	A

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
BAR	588	M	4	5	5	23-66	42.1
BAR	591	M?	A	A	A	A	A
BAR	594	M?	A	A	A	A	A
BAR	597	M	5	5	5	27-66	45.6
BAR	598	M	6	6	6	27-86	61.2
BAR	605	M	5	5	5	27-66	45.6
BAR	606	F	A	A	A	A	A
BAR	607	F	A	A	A	A	A
BAR	613	F	3	4	4	21-70	35.7
BAR	619	M	5	6	5	27-86	50.8
BAR	624	M	4	5	5	23-66	42.1
BAR	650	M	5	6	6	27-86	56.0
BAR	675	F	A	A	A	A	A
BAR	706	M	4	5	4	23-66	38.7
BAR	717	F	4	5	4	26-83	41.5
BAR	737	M	4	4	5	23-66	38.7
BAR	748	F	5	5	5	26-83	48.1
BAR	749	F	4	3	4	21-70	35.7
BAR	750	F?	A	A	A	A	A
BAR	765	M	5	5	5	27-66	45.6
BAR	771	F	5	6	5	25-87	52.1
BAR	778	M	5	5	4	23-66	42.1
BAR	788	F	4	4	5	26-83	41.5
BAR	834	M	4	5	4	23-66	38.7
BAR	850	F	4	5	5	26-83	44.8
BAR	854	F	A	A	A	A	A
BAR	867	M	4	5	4	23-66	38.7
BAR	870	M	A	A	A	A	A
BAR	894	F?	A	A	A	A	A
BAR	918	M	A	A	A	A	A
BAR	947	M	5	3	4	21-66	36.5
BAR	948	F	5	5	4	26-83	44.8
BAR	950	M?	4	5	5	23-66	42.1
BAR	971	F	6	6	6	42-87	60
BAR	975	M?	A	A	A	A	A
BAR	976	M	4	4	5	23-66	38.7
BAR	981	M?	5	5	5	27-66	45.6
BAR	989	M	5	5	4	23-66	42.1
BAR	1015	M	4	5	3	21-66	36.5
BAR	1020	M	5	5	4	23-66	42.1
BAR	1022	M	A	A	A	A	A
BAR	1028	F	5	6	5	25-87	52.1
BAR	1030	F?	A	A	A	A	A
BAR	1039	F	A	A	A	A	A
BAR	1043	M	5	6	5	27-86	50.8
BAR	1047	M	4	4	4	23-57	35.2
BAR	1049	F	A	A	A	A	A
BAR	1062	F	A	A	A	A	A
BAR	1063	M	5	5	4	23-66	42.1
BAR	1064	F	5	4	5	26-83	44.8
BAR	1068	F	5	5	4	26-83	44.8
BAR	1071	F	A	A	A	A	A
BAR	1085	M?	6	5	4	23-86	47.3
BAR	1096	F	A	A	A	A	A
BAR	1100	M	5	5	4	23-66	42.1
BAR	1103	M	5	5	6	27-86	50.8

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
BAR	1104	M	A	A	A	A	A
BAR	1106	M	5	5	4	23-66	42.1
BAR	1120	F	A	A	A	A	A
BAR	1122	M	4	5	4	23-66	38.7
BAR	1133	F	A	A	A	A	A
BAR	1134	M	4	5	4	23-66	38.7
BAR	1139	M	A	A	A	A	A
BAR	1144	F	A	A	A	A	A
BAR	1146	M?	A	A	A	A	A
BAR	1148	F	A	A	A	A	A
BAR	1149	M	4	6	5	23-86	47.3
BAR	1151	F	5	4	5	26-83	44.8
BAR	1162	M	A	A	A	A	A
BAR	1169	M	4	4	4	23-57	35.2
BAR	1176	M	4	4	4	23-57	35.2
BAR	1183	M?	4	3	4	21-57	33.0
BAR	1197	F	A	A	A	A	A
BAR	1202	F	A	A	A	A	A
BAR	1204	M	5	5	4	23-66	42.1
BAR	1214	M	A	A	A	A	A
BAR	1220	F?	A	A	A	A	A
BAR	1235	F	4	3	4	21-70	35.7
BAR	1236	F	4	5	5	26-83	44.8
BAR	1251	M	4	4	4	23-57	35.2
BAR	1254	F	5	6	5	25-87	52.1
BAR	1255	F	5	4	4	26-83	41.5
BAR	1263	M?	4	5	4	23-66	38.7
BAR	1268	M	A	A	A	A	A
BAR	1291	M?	A	A	A	A	A
BAR	1297	M	A	A	A	A	A
BAR	1299	F?	A	A	A	A	A
BAR	1307	M	4	5	4	23-66	38.7
BAR	1315	M	A	A	A	A	A
BAR	1316	M	5	5	6	27-86	50.8
BAR	1324	M	4	5	4	23-66	38.7
BAR	1409	M?	5	5	5	27-66	45.6
BAR	1438	M	4	5	5	23-66	42.1
BAR	1498	F	6	6	6	42-87	60
BAR	1538	F	5	6	6	25-87	56
BAR	1542	F	A	A	A	A	A
BAR	1548	M	5	6	5	27-86	50.8
BAR	1556	M	5	5	5	27-66	45.6
BAR	1566	M	4	5	4	23-66	38.7
BAR	1571	F	A	A	A	A	A
BAR	1615	M	4	4	4	23-57	35.2
BAR	1655	F	6	5	5	25-87	52.1
BAR	1691	M	4	5	4	23-66	38.7
BAR	1695	F?	A	A	A	A	A
BAR	1707	M	4	6	4	23-86	43.9
BAR	1723	M	4	5	4	23-66	38.7
BAR	1750	F	5	5	4	26-83	44.8
BAR	1756	M?	4	4	4	23-57	35.2
BAR	1765	F	A	A	A	A	A
BAR	1769	M	5	6	6	27-86	56.0
BAR	1775	M	5	6	4	23-86	47.3
BAR	1788	M	4	5	4	23-66	38.7

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
BAR	1805	M	4	4	4	23-57	35.2
BAR	1824	M	5	5	5	27-66	45.6
BAR	1843	M	3	4	4	21-57	33.0
BAR	1849	M	A	A	A	A	A
BAR	1856	?	5	5	4	23-83	43.45
BAR	1863	M	4	6	4	23-86	43.9
BAR	1869	M?	A	A	A	A	A
BAR	1871	M	4	5	4	23-66	38.7
BAR	1875	F	5	5	4	26-83	44.8
BAR	1889	F?	A	A	A	A	A
BAR	1892	F	4	4	4	26-70	38.2
BAR	1897	M	A	A	A	A	A
BAR	1910	M	5	5	4	23-66	42.1
BAR	1911	M	4	3	3	21-57	30.9
BAR	1920	M	5	5	4	23-66	42.1
BAR	1922	M	5	6	4	23-86	47.3
BAR	1926	M	5	4	4	23-66	38.7
BAR	1993	M	4	5	6	23-86	47.3
BAR	1995	M	4	6	5	23-86	47.3
BAR	2027	M	4	5	4	23-66	38.7
BAR	2064	F	A	A	A	A	A
BAR	2130	F	5	6	6	25-87	56
BAR	2142	F	4	6	6	26-87	52.7
BAR	2176	F	3	4	4	21-70	35.7
BAR	2187	F	5	6	5	25-87	52.1
BAR	2193	M	4	5	4	23-66	38.7
BAR	2200	M	3	4	4	21-57	33.0
BAR	2206	M	5	5	5	27-66	45.6
BAR	2216	F	1	2	6	15-87	34.8
BAR	2219	M	5	5	4	23-66	42.1
BAR	2236	F	A	A	A	A	A
BAR	2244	M	5	6	5	27-86	50.8
BAR	2248	M	4	5	5	23-66	42.1
BAR	2251	M	5	6	6	27-86	56.0
BAR	2259	F	4	5	4	26-83	41.5
BAR	2274	M	4	5	4	23-66	38.7
BAR	2283	F	A	A	A	A	A
BAR	2284	F?	A	A	A	A	A
BAR	2289	M	4	3	4	21-57	33.0
BAR	2294	M	5	5	4	23-66	42.1
BAR	2297	F?	5	6	6	25-87	56
BAR	2298	M	6	6	6	27-86	61.2
BAR	2304	M	4	4	4	23-57	35.2
BAR	2309	M	4	5	4	23-66	38.7
BAR	2320	M	A	A	A	A	A
BAR	2327	M	5	4	4	23-66	38.7
BAR	2337	M	A	A	A	A	A
BAR	2338	M	4	5	5	23-66	42.1
BAR	2345	M	5	6	6	27-86	56.0
BAR	2348	F	5	5	5	26-83	48.1
BAR	2356	F	4	5	5	26-83	44.8
BAR	2376	M	4	5	5	23-66	42.1
BAR	2386	F	5	6	6	25-87	56
BAR	2408	F	A	A	A	A	A
BAR	2411	F?	5	6	6	25-87	56
BAR	2413	M?	A	A	A	A	A

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
BAR	2428	F	A	A	A	A	A
BAR	2436	F?	5	5	4	26-83	44.8
BAR	2451	M?	A	A	A	A	A
BAR	2452	M	5	5	5	27-66	45.6
BAR	2457	F	A	A	A	A	A
BAR	2465	F	A	A	A	A	A
BAR	2466	M	A	A	A	A	A
BAR	2469	M	3	3	4	21-57	30.9
BAR	2471	M	4	5	4	23-66	38.7
BAR	2485	M	5	5	4	23-66	42.1
BAR	2491	M?	A	A	A	A	A
BAR	2495	M	4	4	4	23-57	35.2
BAR	2499	M	4	5	4	23-66	38.7
BAR	2503	F	4	3	4	21-70	35.7
BAR	2514	M	5	5	4	23-66	42.1
BAR	2520	F?	5	6	5	25-87	52.1
BAR	2583	M	A	A	A	A	A
BAR	2603	M	4	4	4	23-57	35.2
BAR	2612	M	5	5	5	27-66	45.6
BAR	2616	?	A	A	A	A	A
BAR	2666	F?	A	A	A	A	A
BAR	2684	M	6	6	6	27-86	61.2
BAR	2700	M	3	4	4	21-57	33.0
BAR	2714	M	5	5	4	23-66	42.1
BAR	2718	F	3	2	4	19-70	31.3
BAR	2720	M	4	4	4	23-57	35.2
BAR	2721	M	5	6	6	27-86	56.0
BAR	2722	F	5	3	4	21-83	39
BAR	2727	F	A	A	A	A	A
BAR	2730	M	4	5	4	23-66	38.7
BAR	2731	M	4	5	4	23-66	38.7
BAR	2732	F	A	A	A	A	A
BAR	2739	M	5	3	5	21-66	40.0
BAR	2751	F	A	A	A	A	A
BAR	2758	M	A	A	A	A	A
BAR	2766	F	A	A	A	A	A
BAR	2775	F	5	5	4	26-83	44.8
BAR	2780	F	A	A	A	A	A
BAR	2783	M	A	A	A	A	A
BAR	2784	M	5	5	5	27-66	45.6
BAR	2786	M	A	A	A	A	A
BAR	2798	M?	A	A	A	A	A
BAR	2799	M	A	A	A	A	A
FGH	1021	M?	3	4	5	21-66	36.5
FGH	1037	F	4	6	5	26-87	48.8
FGH	1047	F	A	A	A	A	A
FGH	1049	F?	A	A	A	A	A
FGH	1051	M	6	6	5	27-86	56.0
FGH	1053	F?	A	A	A	A	A
FGH	1057	F	A	A	A	A	A
FGH	1063	M	5	5	5	27-66	45.6
FGH	1075	M	6	6	6	34-86	61.2
FGH	1079	F	5	6	5	25-87	52.1
FGH	1081	M?	A	A	A	A	A
FGH	1091	F?	A	A	A	A	A
FGH	1097	F?	A	A	A	A	A

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
FGH	1099	F?	A	A	A	A	A
FGH	1101	F	5	5	5	25-83	48.1
FGH	1104	F	A	A	A	A	A
FGH	1110	F	5	6	6	25-87	56
FGH	1113	M	5	5	4	23-66	42.1
FGH	1115	F	A	A	A	A	A
FGH	1117	M	5	5	5	27-66	45.6
FGH	1130	M	3	5	4	21-66	36.5
FGH	1139	M?	5	6	5	27-86	50.8
FGH	1147	M	4	5	4	23-66	38.7
FGH	1150	F	A	A	A	A	A
FGH	1163	M?	5	5	6	27-86	50.8
FGH	1171	M?	A	A	A	A	A
FGH	1180	F	3	3	4	21-70	33.2
FGH	1184	M	4	4	4	23-57	35.2
FGH	1188	M	A	A	A	A	A
FGH	1190	F	A	A	A	A	A
FGH	1208	F?	5	6	5	25-87	52.1
FGH	1228	M	A	A	A	A	A
FGH	1230	F?	A	A	A	A	A
FGH	1237	M?	A	A	A	A	A
FGH	1255	F?	A	A	A	A	A
FGH	1257	F	5	6	5	25-87	52.1
FGH	1280	M?	A	A	A	A	A
FGH	1284	F?	A	A	A	A	A
FGH	1286	F	A	A	A	A	A
FGH	1297	F?	5	5	4	26-83	44.8
FGH	1305	F?	4	5	5	26-83	44.8
FGH	1312	F	2	3	5	19-83	34.6
FGH	1313	M?	A	A	A	A	A
FGH	1327	M?	A	A	A	A	A
FGH	1354	M	4	5	6	23-86	47.3
FGH	1385	M	4	5	5	23-66	42.1
FGH	1391	F	5	6	6	25-87	56
FGH	1412	M	3	3	5	21-66	34.3
FGH	1441	M?	5	5	5	27-66	45.6
FGH	1455	F	A	A	A	A	A
FGH	1469	F	A	A	A	A	A
FGH	1471	F	4	4	4	26-70	38.2
FGH	1484	F	5	6	6	25-87	56
FGH	1486	M	4	4	4	23-57	35.2
FGH	1521	F	4	5	5	26-83	44.8
FGH	1525	F?	4	3	4	21-70	35.7
FGH	1553	M?	5	6	4	23-86	47.3
FGH	1560	M?	3	3	5	21-66	34.3
FGH	1569	F?	A	A	A	A	A
FGH	1579	F?	5	5	6	25-87	52.1
FGH	1581	F?	4	5	5	26-83	44.8
FGH	1583	M	1	3	4	15-57	27.5
FGH	1589	F	A	A	A	A	A
FGH	1597	F	5	6	5	25-87	52.1
SHOW	5010a	F	4	4	5	26-83	41.5
SHOW	5066	M	A	A	A	A	A
SHOW	5091	F	4	4	5	26-83	41.5
SHOW	5098	F	4	4	5	26-83	41.5
SHOW	5103	F	4	4	4	26-70	38.2

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
SHOW	5105	F	A	A	A	A	A
SHOW	5110	F	4	5	5	26-83	44.8
SHOW	5123	F	5	5	5	26-83	48.1
SHOW	5159	M	4	6	4	23-86	43.9
SHOW	5172	M	4	5	5	23-66	42.1
SHOW	5173	M	5	5	4	23-66	42.1
SHOW	5186	M?	4	4	4	23-57	35.2
SHOW	5190	F	4	6	4	26-87	45.5
SHOW	5203	M	5	5	5	27-66	45.6
SHOW	5204	M	A	A	A	A	A
SHOW	5207	M	5	5	5	27-66	45.6
SHOW	5208	M?	4	4	5	23-66	38.7
SHOW	5211	F	A	A	A	A	A
SHOW	5218	F?	A	A	A	A	A
SHOW	5222	M	5	5	5	27-66	45.6
SHOW	5225	F	4	4	5	26-83	41.5
SHOW	5228	F?	4	5	4	26-83	41.5
SHOW	5233	M	4	4	4	23-57	35.2
SHOW	5237	M	3	4	4	21-57	33.0
SHOW	5241	F	2	2	4	19-70	29.4
SHOW	5243	M	3	5	4	21-66	36.5
SHOW	5244	M?	5	5	5	27-66	45.6
SHOW	5254	F	5	6	6	25-87	56
SHOW	5258	F	A	A	A	A	A
SHOW	5267	F	4	3	5	21-83	39
SHOW	5269	M	5	5	5	27-66	45.6
SHOW	5270	F?	4	4	5	26-83	41.5
SHOW	5283	M	4	4	4	23-57	35.2
SHOW	5290	F?	A	A	A	A	A
SHOW	5292	F	4	6	5	26-87	48.8
SHOW	5298	F	4	6	5	26-87	48.8
SHOW	5302	F	5	5	4	26-83	44.8
SHOW	5311	F?	A	A	A	A	A
SHOW	5316	F?	A	A	A	A	A
SHOW	5320	F	A	A	A	A	A
SHOW	5323	M	5	5	5	27-66	45.6
SHOW	5329	M	4	5	4	23-66	38.7
SHOW	5347	M	5	6	6	27-86	56.0
SHOW	5350	F	4	4	5	26-83	41.5
SHOW	5364	F	A	A	A	A	A
SHOW	5384	M	4	4	4	23-57	35.2
SHOW	5393	F	4	6	5	26-87	48.8
SHOW	5402	M	5	5	5	27-66	45.6
SHOW	5415	F	3	3	3	21-53	30.7
SHOW	5421	M?	4	3	4	21-57	33.0
SHOW	5438	M	4	4	4	23-57	35.2
SHOW	5445	M	2	3	4	19-57	29.1
SHOW	5451	M	5	5	5	27-66	45.6
SHOW	5453	M	5	5	4	23-66	42.1
SHOW	5457	M	4	5	4	23-66	38.7
SHOW	5461	M?	A	A	A	A	A
SHOW	5463	M?	4	4	4	23-57	35.2
SHOW	5475	M?	A	A	A	A	A
SHOW	5488	F	5	5	4	26-83	44.8
SHOW	5492	F	A	A	A	A	A
SHOW	5494	F	A	A	A	A	A

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
SHOW	5501	F	5	6	5	25-87	52.1
SHOW	5507	F?	5	5	4	26-83	44.8
SHOW	5508	F	A	A	A	A	A
SHOW	5529	F	A	A	A	A	A
SHOW	5534	F	4	4	4	26-70	38.2
SHOW	5539	M	4	4	4	23-57	35.2
SHOW	5544	M	4	4	3	21-57	33.0
SHOW	5562	F	A	A	A	A	A
SHOW	5563	M	4	6	4	23-86	43.9
SHOW	5588	F	A	A	A	A	A
SHOW	5601	F	A	A	A	A	A
SHOW	5603	M	A	A	A	A	A
SHOW	5617	M	A	A	A	A	A
SHOW	5632	F	5	6	6	25-87	56
SHOW	5644	M	4	5	4	23-66	38.7
SHOW	5657	F	4	3	4	21-70	35.7
SHOW	5671	M	5	5	4	23-66	42.1
SHOW	5680	M	6	6	6	34-86	61.2
SHOW	5699	F	5	6	5	25-87	52.1
SHOW	5702	M	4	5	4	23-66	38.7
SHOW	5710	M	3	3	4	21-57	30.9
SHOW	5740	F	A	A	A	A	A
SHOW	5773	M	5	6	4	23-86	47.3
SHOW	5774	F	6	6	6	42-87	60
SHOW	5794	M	5	5	4	23-66	42.1
SHOW	5835	F	4	3	3	21-70	33.2
SHOW	5845	M	6	6	5	27-86	56.0
SHOW	5884	F	4	3	4	21-70	35.7
SHOW	5909	F	5	5	4	26-83	44.8
SHOW	5977	M?	A	A	A	A	A
SHOW	6003	F	5	5	4	26-83	44.8
SHOW	6026	M	A	A	A	A	A
SHOW	6027	F	A	A	A	A	A
SHOW	6029	M	A	A	A	A	A
SHOW	6030	F	A	A	A	A	A
SHOW	6042	M	4	5	4	23-66	38.7
SHOW	6043	F	5	6	4	26-87	48.8
SHOW	6048	M	4	5	4	23-66	38.7
SHOW	6060	M	A	A	A	A	A
SHOW	6070	F	4	6	6	26-87	52.7
SHOW	6072	M	4	5	5	23-66	42.1
SHOW	6074	F	4	5	5	26-83	44.8
SHOW	6081	M	4	5	5	23-66	42.1
SHOW	6082	F	4	5	4	26-83	41.5
SHOW	6083	M	5	5	5	27-66	45.6
SHOW	6088	M	4	6	5	23-86	47.3
SHOW	6093	F	A	A	A	A	A
SHOW	6098	M	6	5	6	27-86	56.0
SHOW	6103	M	4	5	4	23-66	38.7
SHOW	6105	M	6	5	4	23-86	47.3
WP	EE004	M?	5	6	5	27-86	50.8
WP	EE013	M	4	5	4	23-66	38.7
WP	EE015	F	A	A	A	A	A
WP	EE019	F	4	6	5	26-87	48.8
WP	EE022	F	3	3	4	21-70	33.2
WP	EE024	M?	A	A	A	A	A

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
WP	EE025	M?	A	A	A	A	A
WP	EE026	M	5	6	6	27-86	56.0
WP	EE037	M	A	A	A	A	A
WP	EE056	F	4	5	6	26-87	48.8
WP	EE062	M	4	4	4	23-57	35.2
WP	EE070	F	4	4	5	26-83	41.5
WP	EE079	M?	A	A	A	A	A
WP	EE080	M	5	4	5	23-66	42.1
WP	EE089	M	6	5	5	27-86	50.8
WP	EE097	F?	A	A	A	A	A
WP	EE098	M?	A	A	A	A	A
WP	EE099	F	6	6	6	42-87	60
WP	G251	F	4	5	4	26-83	41.5
WP	G265	M	1	4	4	15-57	29.6
WP	G278	M?	4	4/5	4	23-66	36.9
WP	G279	M?	5	5	6	27-86	50.8
WP	G296	F?	A	A	A	A	A
WP	G297	M?	5	5	5	27-66	45.6
WP	G303	M	5	5	4	23-66	42.1
WP	G310	M	5	4	4	23-66	38.7
WP	G361	F?	A	A	A	A	A
WP	G377	F?	4	4	4	26-70	38.2
WP	G379	M	3	5	5	21-66	40.0
WP	G381	M?	4	3	4	21-57	33.0
WP	G385	F?	2	3	4	19-70	31.3
WP	G406	M?	4	4	5	23-66	38.7
WP	G411	M	2	2	4	19-57	27.3
WP	G419	F?	5	5	5	25-83	48.1
WP	G451	F	6	5	5	25-87	52.1
WP	G474	F	4	4	5	26-83	41.5
WP	G482	M	4	5	5	23-66	42.1
WP	G516	M	4	4	4	23-57	35.2
WP	G561	M	5	4	4	23-66	38.7
WP	G565	M?	A	A	A	A	A
WP	G571	F?	5	5	4	26-83	44.8
WP	G587	M?	2	4	4	19-57	31.3
WP	G601	M?	5	5	5	27-66	45.6
WP	G607	M	5	5	5	27-66	45.6
WP	G628	F?	A	A	A	A	A
WP	NA046	M	5	5	4	23-66	42.1
WP	NA047	F	4/5	5	4	26-83	43.5
WP	NA059	F?	A	A	A	A	A
WP	NA075	M?	4	1	4	15-57	29.6
WP	NA078	M?	A	A	A	A	A
WP	NA080	M	4	4	4	23-57	35.2
WP	NA084	F	2	2	4	19-70	29.4
WP	NA088	F	4	4	5	26-83	41.5
WP	NA100	F	5	5	5	25-83	48.1
WP	NA166	M	2	3	4	19-57	29.1
WP	NA168	F	4	4	4	26-70	38.2
WP	NA171	M?	A	A	A	A	A
WP	NA181	M?	4	5	5	23-66	42.1
WP	NA183	M	4	5	4	23-66	38.7
WP	NA190	M?	4	4	4	23-57	35.2
WP	NA197	M	A	A	A	A	A
WP	NA199	M	2	3	4	19-57	29.1

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
WP	NA202	F	6	6	6	42-87	60
WP	NA203	F	A	A	A	A	A
WP	NA217	M	A	A	A	A	A
WP	NA218	M	4	5	4	23-66	38.7
WP	NA224	M	3	3	4	21-57	30.9
WP	NA233	F	5	6	6	25-87	56
WP	NA234	M	5	4	4	23-66	38.7
WP	SA003	M?	4	4	4	23-57	35.2
WP	SA012	M	4	4	4	23-57	35.2
WP	SA013	F?	A	A	A	A	A
WP	SA015	M	5	6	6	27-86	56.0
WP	SA021	M	3	4	4	21-57	33.0
WP	SA033	M?	A	A	A	A	A
WP	SA034	M	4	4	4	23-57	35.2
WP	SA047	F?	4	5	4	26-83	41.5
WP	SA050	F	5	6	5	25-87	52.1
WP	SA052	M?	6	5	5	27-86	50.8
WP	SA053	F?	4	4	4	26-70	38.2
WP	SA054	F	2	1	1	15-40	21.3
WP	SA056	M?	4	4	5	21-66	38.7
WP	V11	M?	4	6	6	23-86	52.5
WP	V14	F?	A	A	A	A	A
WP	V15	M?	4	5	5	23-66	42.1
WP	V18	M?	A	A	A	A	A
WP	V19	M?	4	3	4	21-57	33.0
WP	V26	F	5	6	6	25-87	56
WP	V27	M?	A	A	A	A	A
WP	V29	F	4	4	4	26-70	38.2
WP	V33	F	5	5	4	26-83	44.8
WP	V38	M?	5	4	4	23-66	38.7
WP	V39	M	5	5	6	27-86	50.8
WP	V40	M	4	4	4	23-57	35.2
WP	V45	M?	4	5	4	23-66	38.7
WP	V46	F	4	3	4	21-70	35.7
WP	V51	M?	4	4	4	23-57	35.2
WP	V61	F	4	3	4	21-70	35.7
WP	WCO009	F	4	3	4	21-70	35.7
WP	WCO012	M?	1	2	4	15-57	25.7
WP	WCO013	F?	A	A	A	A	A
WP	WCO015	M	A	A	A	A	A
WP	WCO017	F?	4	5	4	26-83	41.5
WP	WCO018	M	3	4	4	21-57	33.0
WP	WCO022	F	2	3	4	19-70	31.3
WP	WCO026	F?	A	A	A	A	A
WP	WCO028	F	A	A	A	A	A
WP	WCO029	F	A	A	A	A	A
WP	WCO036	F	5	5	5	25-83	48.1
WP	WCO037	M?	4	5	4	23-66	38.7
WP	WCO041	M	2	3	4	19-57	29.1
WP	WCO045	F?	4	5	5	26-83	44.8
WP	WCO056	F	5	6	6	25-87	56
WP	WCO057	M?	5	5	5	27-66	45.6
WP	WCO059	M?	4	4	4	23-57	35.2
WP	WCO109	F	4	6	6	26-87	52.7
WP	WCO115	M?	A	A	A	A	A
WP	WCO117	M	3	3	4	21-57	30.9

Site	Sk. No.	Sex	Symphyseal	Ventral Rampart	Porosity	Est. Age	Mean
WP	WCO124	F	5	4	5	26-83	44.8
WP	WCO130	F	A	A	A	A	A
WP	WCO131	M?	5	6	5	27-86	50.8
WP	WCO137	M?	4	4	4	23-57	35.2
WP	WCO142	M?	A	A	A	A	A
WP	WCO146	M	5	5	4	23-66	42.1
WP	WCO153	M?	6	6	6	34-86	61.2
WP	WCO162	F?	5	6	6	25-87	56
WP	WCO164A	M	6	6	6	34-86	61.2
WP	WCO165	F?	A	A	A	A	A
WP	WCO165A	M	4	5	4	23-66	38.7
WP	WCO167	F	4	4	6	26-87	45.5
WP	WCO169	M	4	5	4	23-66	38.7
WP	WCO170	F	5	6	6	25-87	56
WP	WCO173	F	4	4	4	26-70	38.2
WP	WCO179	F?	A	A	A	A	A
WP	WCO184	F	4	5	4?	26-83	41.5
WP	WCO187	F	A	A	A	A	A
WP	WCO199	F	5	6	5	25-87	52.1
WP	WCO200	M?	3	3	4	21-57	30.9
WP	WCO203	M?	A	A	A	A	A
WP	WCO204	F	A	A	A	A	A

Appendix 12 – Ischium

Raw data from age estimation using the upper tuberosity of the ischium (Falys, 2012).

BAR = Barton-upon-Humber

FGH = Fishergate House

SHOW = St. Helen-on-the-Walls

WP = Wharram Percy

Sk. No. = Skeleton number

A = Absent

Est. Age = estimated age at death using this method (years)

Mean = mean age produced by the age range (years)

Site	Sk. No.	Sex	Score	Est. Age	Mean

BAR	7	F	3	50-91	70.3
BAR	18	F	1	38-54	45.8
BAR	99	M	1	38-54	45.8
BAR	126	M	A	A	A
BAR	127	M?	3	50-91	70.3
BAR	128	M	4	64-93	78.9
BAR	132	M?	2	41-71	55.6
BAR	179	M	3	50-91	70.3
BAR	187	F	4	64-93	78.9
BAR	204	F	1	38-54	45.8
BAR	208	M	1	38-54	45.8
BAR	241	M	1	38-54	45.8
BAR	266	M	3	50-91	70.3
BAR	269	M	3	50-91	70.3
BAR	272	M	3	50-91	70.3
BAR	276	F	1	38-54	45.8
BAR	308	M	2	41-71	55.6
BAR	309	F	3	50-91	70.3
BAR	311	F?	1	38-54	45.8
BAR	326	F	1	38-54	45.8
BAR	327	M	3	50-91	70.3
BAR	363	M	1	38-54	45.8
BAR	380	?	1	38-54	45.8
BAR	425	M	3	50-91	70.3
BAR	427	M	2/3	41-91	62.95
BAR	428	F	A	A	A
BAR	431	F	4	64-93	78.9
BAR	446	M	1	38-54	45.8
BAR	488	M	1	38-54	45.8
BAR	499	F	A	A	A
BAR	513	F?	4	64-93	78.9
BAR	539	F	2	41-71	55.6
BAR	548	M?	3	50-91	70.3
BAR	550	F	3	50-91	70.3
BAR	552	F	4	64-93	78.9
BAR	558	M?	1	38-54	45.8
BAR	578	F?	1	38-54	45.8
BAR	582	M	1	38-54	45.8
BAR	588	M	2	41-71	55.6
BAR	591	M?	3	50-91	70.3
BAR	594	M?	2	41-71	55.6
BAR	597	M	4	64-93	78.9

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	598	M	4	64-93	78.9
BAR	605	M	2	41-71	55.6
BAR	606	F	3	50-91	70.3
BAR	607	F	3	50-91	70.3
BAR	613	F	1	38-54	45.8
BAR	619	M	A	A	A
BAR	624	M	3	50-91	70.3
BAR	650	M	4	64-93	78.9
BAR	675	F	1	38-54	45.8
BAR	706	M	3	50-91	70.3
BAR	717	F	4	64-93	78.9
BAR	737	M	3	50-91	70.3
BAR	748	F	3	50-91	70.3
BAR	749	F	3	50-91	70.3
BAR	750	F?	1	38-54	45.8
BAR	765	M	1	38-54	45.8
BAR	771	F	3	50-91	70.3
BAR	778	M	2	41-71	55.6
BAR	788	F	2	41-71	55.6
BAR	834	M	1	38-54	45.8
BAR	850	F	2	41-71	55.6
BAR	854	F	3	50-91	70.3
BAR	867	M	3	50-91	70.3
BAR	870	M	2	41-71	55.6
BAR	894	F?	A	A	A
BAR	918	M	4	64-93	78.9
BAR	947	M	1	38-54	45.8
BAR	948	F	4	64-93	78.9
BAR	950	M?	3	50-91	70.3
BAR	971	F	3	50-91	70.3
BAR	975	M?	1	38-54	45.8
BAR	976	M	2	41-71	55.6
BAR	981	M?	1	38-54	45.8
BAR	989	M	4	64-93	78.9
BAR	1015	M	A	A	A
BAR	1020	M	2	41-71	55.6
BAR	1022	M	3	50-91	70.3
BAR	1028	F	A	A	A
BAR	1030	F?	1	38-54	45.8
BAR	1039	F	1	38-54	45.8

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	1043	M	1	38-54	45.8
BAR	1047	M	1	38-54	45.8
BAR	1049	F	4	64-93	78.9
BAR	1062	F	3	50-91	70.3
BAR	1063	M	4	64-93	78.9
BAR	1064	F	3	50-91	70.3
BAR	1068	F	4	64-93	78.9
BAR	1071	F	1	38-54	45.8
BAR	1085	M?	1	38-54	45.8
BAR	1096	F	A	A	A
BAR	1100	M	2	41-71	55.6
BAR	1103	M	A	A	A
BAR	1104	M	A	A	A
BAR	1106	M	1	38-54	45.8
BAR	1120	F	3	50-91	70.3
BAR	1122	M	2	41-71	55.6
BAR	1133	F	4	64-93	78.9
BAR	1134	M	1	38-54	45.8
BAR	1139	M	2	41-71	55.6
BAR	1144	F	2	41-71	55.6
BAR	1146	M?	3	50-91	70.3
BAR	1148	F	1	38-54	45.8
BAR	1149	M	2	41-71	55.6
BAR	1151	F	A	A	A
BAR	1162	M	A	A	A
BAR	1169	M	2	41-71	55.6
BAR	1176	M	2	41-71	55.6
BAR	1183	M?	2	41-71	55.6
BAR	1197	F	1	38-54	45.8
BAR	1202	F	3	50-91	70.3
BAR	1204	M	1	38-54	45.8
BAR	1214	M	3	50-91	70.3
BAR	1220	F?	1	38-54	45.8
BAR	1235	F	1	38-54	45.8
BAR	1236	F	4	64-93	78.9
BAR	1251	M	1	38-54	45.8
BAR	1254	F	3	50-91	70.3
BAR	1255	F	3	50-91	70.3
BAR	1263	M?	1	38-54	45.8
BAR	1268	M	2	41-71	55.6
BAR	1291	M?	3	50-91	70.3
BAR	1297	M	3	50-91	70.3
BAR	1299	F?	2	41-71	55.6
BAR	1307	M	2	41-71	55.6
BAR	1315	M	3	50-91	70.3
BAR	1316	M	1	38-54	45.8
BAR	1324	M	1	38-54	45.8
BAR	1409	M?	A	A	A
BAR	1438	M	1	38-54	45.8
BAR	1498	F	1	38-54	45.8
BAR	1538	F	2	41-71	55.6
BAR	1542	F	2	41-71	55.6
BAR	1548	M	4	64-93	78.9
BAR	1556	M	1	38-54	45.8
BAR	1566	M	3	50-91	70.3
BAR	1571	F	3	50-91	70.3

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	1615	M	1	38-54	45.8
BAR	1655	F	1	38-54	45.8
BAR	1691	M	1	38-54	45.8
BAR	1695	F?	A	A	A
BAR	1707	M	4	64-93	78.9
BAR	1723	M	2	41-71	55.6
BAR	1750	F	4	64-93	78.9
BAR	1756	M?	1	38-54	45.8
BAR	1765	F	A	A	A
BAR	1769	M	3	50-91	70.3
BAR	1775	M	1	38-54	45.8
BAR	1788	M	2	41-71	55.6
BAR	1805	M	3	50-91	70.3
BAR	1824	M	1	38-54	45.8
BAR	1843	M	2	41-71	55.6
BAR	1849	M	3	50-91	70.3
BAR	1856	?	A	A	A
BAR	1863	M	4	64-93	78.9
BAR	1869	M?	4	64-93	78.9
BAR	1871	M	1	38-54	45.8
BAR	1875	F	2	41-71	55.6
BAR	1889	F?	2	41-71	55.6
BAR	1892	F	1	38-54	45.8
BAR	1897	M	A	A	A
BAR	1910	M	3	50-91	70.3
BAR	1911	M	1	38-54	45.8
BAR	1920	M	4	64-93	78.9
BAR	1922	M	2	41-71	55.6
BAR	1926	M	4	64-93	78.9
BAR	1993	M	3	50-91	70.3
BAR	1995	M	3	50-91	70.3
BAR	2027	M	2	41-71	55.6
BAR	2064	F	2	41-71	55.6
BAR	2130	F	1	38-54	45.8
BAR	2142	F	3	50-91	70.3
BAR	2176	F	1	38-54	45.8
BAR	2187	F	A	A	A
BAR	2193	M	3	50-91	70.3
BAR	2200	M	1	38-54	45.8
BAR	2206	M	3	50-91	70.3
BAR	2216	F	3	50-91	70.3
BAR	2219	M	3	50-91	70.3
BAR	2236	F	3	50-91	70.3
BAR	2244	M	1	38-54	45.8
BAR	2248	M	2/3	41-91	62.95
BAR	2251	M	3	50-91	70.3
BAR	2259	F	3	50-91	70.3
BAR	2274	M	1	38-54	45.8
BAR	2283	F	3	50-91	70.3
BAR	2284	F?	2	41-71	55.6
BAR	2289	M	2	41-71	55.6
BAR	2294	M	1	38-54	45.8
BAR	2297	F?	4	64-93	78.9
BAR	2298	M	3	50-91	70.3
BAR	2304	M	A	A	A
BAR	2309	M	3	50-91	70.3

Site	Sk. No.	Sex	Score	Est. Age	Mean
BAR	2320	M	4	64-93	78.9
BAR	2327	M	1	38-54	45.8
BAR	2337	M	A	A	A
BAR	2338	M	4	64-93	78.9
BAR	2345	M	3	50-91	70.3
BAR	2348	F	2	41-71	55.6
BAR	2356	F	2/3	41-91	62.95
BAR	2376	M	3	50-91	70.3
BAR	2386	F	3	50-91	70.3
BAR	2408	F	A	A	A
BAR	2411	F?	3	50-91	70.3
BAR	2413	M?	A	A	A
BAR	2428	F	2	41-71	55.6
BAR	2436	F?	1	38-54	45.8
BAR	2451	M?	1	38-54	45.8
BAR	2452	M	3	50-91	70.3
BAR	2457	F	3	50-91	70.3
BAR	2465	F	1	38-54	45.8
BAR	2466	M	3	50-91	70.3
BAR	2469	M	1	38-54	45.8
BAR	2471	M	2	41-71	55.6
BAR	2485	M	1	38-54	45.8
BAR	2491	M?	3	50-91	70.3
BAR	2495	M	1	38-54	45.8
BAR	2499	M	4	64-93	78.9
BAR	2503	F	1	38-54	45.8
BAR	2514	M	A	A	A
BAR	2520	F?	3	50-91	70.3
BAR	2583	M	3	50-91	70.3
BAR	2603	M	4	64-93	78.9
BAR	2612	M	2	41-71	55.6
BAR	2616	?	A	A	A
BAR	2666	F?	A	A	A
BAR	2684	M	1	38-54	45.8
BAR	2700	M	4	64-93	78.9
BAR	2714	M	3	50-91	70.3
BAR	2718	F	1	38-54	45.8
BAR	2720	M	1	38-54	45.8
BAR	2721	M	1	38-54	45.8
BAR	2722	F	1	38-54	45.8
BAR	2727	F	A	A	A
BAR	2730	M	1	38-54	45.8
BAR	2731	M	2	41-71	55.6
BAR	2732	F	A	A	A
BAR	2739	M	1	38-54	45.8
BAR	2751	F	3	50-91	70.3
BAR	2758	M	3	50-91	70.3
BAR	2766	F	1	38-54	45.8
BAR	2775	F	3	50-91	70.3
BAR	2780	F	1	38-54	45.8
BAR	2783	M	2	41-71	55.6
BAR	2784	M	1	38-54	45.8
BAR	2786	M	2	41-71	55.6
BAR	2798	M?	4	64-93	78.9
BAR	2799	M	2	41-71	55.6
FGH	1021	M?	2	41-71	55.6

Site	Sk. No.	Sex	Score	Est. Age	Mean
FGH	1037	F	2	41-71	55.6
FGH	1047	F	2	41-71	55.6
FGH	1049	F?	3	50-91	70.3
FGH	1051	M	4	64-93	78.9
FGH	1053	F?	1	38-54	45.8
FGH	1057	F	4	64-93	78.9
FGH	1063	M	3	50-91	70.3
FGH	1075	M	4	64-93	78.9
FGH	1079	F	1	38-54	45.8
FGH	1081	M?	1	38-54	45.8
FGH	1091	F?	3	50-91	70.3
FGH	1097	F?	4	64-93	78.9
FGH	1099	F?	3	50-91	70.3
FGH	1101	F	3	50-91	70.3
FGH	1104	F	4	64-93	78.9
FGH	1110	F	2	41-71	55.6
FGH	1113	M	1	38-54	45.8
FGH	1115	F	4	64-93	78.9
FGH	1117	M	3	50-91	70.3
FGH	1130	M	4	64-93	78.9
FGH	1139	M?	3	50-91	70.3
FGH	1147	M	2	41-71	55.6
FGH	1150	F	4	64-93	78.9
FGH	1163	M?	4	64-93	78.9
FGH	1171	M?	1	38-54	45.8
FGH	1180	F	1	38-54	45.8
FGH	1184	M	1	38-54	45.8
FGH	1188	M	3	50-91	70.3
FGH	1190	F	3	50-91	70.3
FGH	1208	F?	A	A	A
FGH	1228	M	4	64-93	78.9
FGH	1230	F?	2	41-71	55.6
FGH	1237	M?	2	41-71	55.6
FGH	1255	F?	A	A	A
FGH	1257	F	4	64-93	78.9
FGH	1280	M?	3	50-91	70.3
FGH	1284	F?	2	41-71	55.6
FGH	1286	F	2	41-71	55.6
FGH	1297	F?	1	38-54	45.8
FGH	1305	F?	3	50-91	70.3
FGH	1312	F	1	38-54	45.8
FGH	1313	M?	4	64-93	78.9
FGH	1327	M?	3	50-91	70.3
FGH	1354	M	1	38-54	45.8
FGH	1385	M	3	50-91	70.3
FGH	1391	F	1	38-54	45.8
FGH	1412	M	1	38-54	45.8
FGH	1441	M?	4	64-93	78.9
FGH	1455	F	1	38-54	45.8
FGH	1469	F	1	38-54	45.8
FGH	1471	F	2	41-71	55.6
FGH	1484	F	3	50-91	70.3
FGH	1486	M	1	38-54	45.8
FGH	1521	F	2	41-71	55.6
FGH	1525	F?	1	38-54	45.8
FGH	1553	M?	3	50-91	70.3

Site	Sk. No.	Sex	Score	Est. Age	Mean
FGH	1560	M?	3	50-91	70.3
FGH	1569	F?	3	50-91	70.3
FGH	1579	F?	2	41-71	55.6
FGH	1581	F?	A	A	A
FGH	1583	M	1	38-54	45.8
FGH	1589	F	1	38-54	45.8
FGH	1597	F	1	38-54	45.8
SHOW	5010a	F	3	50-91	70.3
SHOW	5066	M	2	41-71	55.6
SHOW	5091	F	1	38-54	45.8
SHOW	5098	F	2	41-71	55.6
SHOW	5103	F	1	38-54	45.8
SHOW	5105	F	3	50-91	70.3
SHOW	5110	F	2	41-71	55.6
SHOW	5123	F	3	50-91	70.3
SHOW	5159	M	4	64-93	78.9
SHOW	5172	M	A	A	A
SHOW	5173	M	1	38-54	45.8
SHOW	5186	M?	2	41-71	55.6
SHOW	5190	F	2	41-71	55.6
SHOW	5203	M	3	50-91	70.3
SHOW	5204	M	1	38-54	45.8
SHOW	5207	M	2	41-71	55.6
SHOW	5208	M?	1	38-54	45.8
SHOW	5211	F	3	50-91	70.3
SHOW	5218	F?	2	41-71	55.6
SHOW	5222	M	3	50-91	70.3
SHOW	5225	F	2	41-71	55.6
SHOW	5228	F?	3	50-91	70.3
SHOW	5233	M	1	38-54	45.8
SHOW	5237	M	1	38-54	45.8
SHOW	5241	F	1	38-54	45.8
SHOW	5243	M	2	41-71	55.6
SHOW	5244	M?	2	41-71	55.6
SHOW	5254	F	4	64-93	78.9
SHOW	5258	F	1	38-54	45.8
SHOW	5267	F	1	38-54	45.8
SHOW	5269	M	3	50-91	70.3
SHOW	5270	F?	1	38-54	45.8
SHOW	5283	M	1	38-54	45.8
SHOW	5290	F?	3	50-91	70.3
SHOW	5292	F	3	50-91	70.3
SHOW	5298	F	3	50-91	70.3
SHOW	5302	F	1	38-54	45.8
SHOW	5311	F?	2	41-71	55.6
SHOW	5316	F?	1	38-54	45.8
SHOW	5320	F	3	50-91	70.3
SHOW	5323	M	3	50-91	70.3
SHOW	5329	M	1	38-54	45.8
SHOW	5347	M	4	64-93	78.9
SHOW	5350	F	1	38-54	45.8
SHOW	5364	F	2	41-71	55.6
SHOW	5384	M	2	41-71	55.6
SHOW	5393	F	1	38-54	45.8
SHOW	5402	M	3	50-91	70.3
SHOW	5415	F	2	41-71	55.6

Site	Sk. No.	Sex	Score	Est. Age	Mean
SHOW	5421	M?	1	38-54	45.8
SHOW	5438	M	2	41-71	55.6
SHOW	5445	M	1	38-54	45.8
SHOW	5451	M	2	41-71	55.6
SHOW	5453	M	3	50-91	70.3
SHOW	5457	M	1	38-54	45.8
SHOW	5461	M?	2	41-71	55.6
SHOW	5463	M?	2	41-71	55.6
SHOW	5475	M?	1	38-54	45.8
SHOW	5488	F	3	50-91	70.3
SHOW	5492	F	1	38-54	45.8
SHOW	5494	F	4	64-93	78.9
SHOW	5501	F	2	41-71	55.6
SHOW	5507	F?	1	38-54	45.8
SHOW	5508	F	4	64-93	78.9
SHOW	5529	F	4	64-93	78.9
SHOW	5534	F	2	41-71	55.6
SHOW	5539	M	2	41-71	55.6
SHOW	5544	M	A	A	A
SHOW	5562	F	3	50-91	70.3
SHOW	5563	M	3	50-91	70.3
SHOW	5588	F	2	41-71	55.6
SHOW	5601	F	3	50-91	70.3
SHOW	5603	M	1	38-54	45.8
SHOW	5617	M	3	50-91	70.3
SHOW	5632	F	4	64-93	78.9
SHOW	5644	M	4	64-93	78.9
SHOW	5657	F	1	38-54	45.8
SHOW	5671	M	1	38-54	45.8
SHOW	5680	M	4	64-93	78.9
SHOW	5699	F	2	41-71	55.6
SHOW	5702	M	1	38-54	45.8
SHOW	5710	M	1	38-54	45.8
SHOW	5740	F	1	38-54	45.8
SHOW	5773	M	1	38-54	45.8
SHOW	5774	F	3	50-91	70.3
SHOW	5794	M	4	64-93	78.9
SHOW	5835	F	3	50-91	70.3
SHOW	5845	M	3	50-91	70.3
SHOW	5884	F	1	38-54	45.8
SHOW	5909	F	1	38-54	45.8
SHOW	5977	M?	3	50-91	70.3
SHOW	6003	F	3	50-91	70.3
SHOW	6026	M	1	38-54	45.8
SHOW	6027	F	1	38-54	45.8
SHOW	6029	M	3	50-91	70.3
SHOW	6030	F	3	50-91	70.3
SHOW	6042	M	A	A	A
SHOW	6043	F	4	64-93	78.9
SHOW	6048	M	3	50-91	70.3
SHOW	6060	M	4	64-93	78.9
SHOW	6070	F	1	38-54	45.8
SHOW	6072	M	2	41-71	55.6
SHOW	6074	F	1	38-54	45.8
SHOW	6081	M	3	50-91	70.3
SHOW	6082	F	3	50-91	70.3

Site	Sk. No.	Sex	Score	Est. Age	Mean
SHOW	6083	M	1	38-54	45.8
SHOW	6088	M	3	50-91	70.3
SHOW	6093	F	1	38-54	45.8
SHOW	6098	M	2	41-71	55.6
SHOW	6103	M	3	50-91	70.3
SHOW	6105	M	3	50-91	70.3
WP	EE004	M?	3	50-91	70.3
WP	EE013	M	1	38-54	45.8
WP	EE015	F	4	64-93	78.9
WP	EE019	F	1	38-54	45.8
WP	EE022	F	1	38-54	45.8
WP	EE024	M?	1	38-54	45.8
WP	EE025	M?	A	A	A
WP	EE026	M	3	50-91	70.3
WP	EE037	M	3	50-91	70.3
WP	EE056	F	A	A	A
WP	EE062	M	2	41-71	55.6
WP	EE070	F	1	38-54	45.8
WP	EE079	M?	2/3	41-91	62.95
WP	EE080	M	1	38-54	45.8
WP	EE089	M	A	A	A
WP	EE097	F?	A	A	A
WP	EE098	M?	A	A	A
WP	EE099	F	3	50-91	70.3
WP	G251	F	1	38-54	45.8
WP	G265	M	2	41-71	55.6
WP	G278	M?	3	50-91	70.3
WP	G279	M?	4	64-93	78.9
WP	G296	F?	1	38-54	45.8
WP	G297	M?	3	50-91	70.3
WP	G303	M	1	38-54	45.8
WP	G310	M	1	38-54	45.8
WP	G361	F?	1	38-54	45.8
WP	G377	F?	1	38-54	45.8
WP	G379	M	2	41-71	55.6
WP	G381	M?	1	38-54	45.8
WP	G385	F?	1	38-54	45.8
WP	G406	M?	1	38-54	45.8
WP	G411	M	A	A	A
WP	G419	F?	1	38-54	45.8
WP	G451	F	3	50-91	70.3
WP	G474	F	2	41-71	55.6
WP	G482	M	1	38-54	45.8
WP	G516	M	1	38-54	45.8
WP	G561	M	1	38-54	45.8
WP	G565	M?	1	38-54	45.8
WP	G571	F?	1	38-54	45.8
WP	G587	M?	1	38-54	45.8
WP	G601	M?	2	41-71	55.6
WP	G607	M	3/4	50-93	74.6
WP	G628	F?	1	38-54	45.8
WP	NA046	M	2	41-71	55.6
WP	NA047	F	1	38-54	45.8
WP	NA059	F?	1	38-54	45.8
WP	NA075	M?	1	38-54	45.8
WP	NA078	M?	3	50-91	70.3

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	NA080	M	1	38-54	45.8
WP	NA084	F	1	38-54	45.8
WP	NA088	F	2	41-71	55.6
WP	NA100	F	2	41-71	55.6
WP	NA166	M	1	38-54	45.8
WP	NA168	F	2	41-71	55.6
WP	NA171	M?	2	41-71	55.6
WP	NA181	M?	1	38-54	45.8
WP	NA183	M	1	38-54	45.8
WP	NA190	M?	2	41-71	55.6
WP	NA197	M	4	64-93	78.9
WP	NA199	M	1	38-54	45.8
WP	NA202	F	4	64-93	78.9
WP	NA203	F	2	41-71	55.6
WP	NA217	M	4	64-93	78.9
WP	NA218	M	1	38-54	45.8
WP	NA224	M	1	38-54	45.8
WP	NA233	F	A	A	A
WP	NA234	M	A	A	A
WP	SA003	M?	1	38-54	45.8
WP	SA012	M	1	38-54	45.8
WP	SA013	F?	1	38-54	45.8
WP	SA015	M	1	38-54	45.8
WP	SA021	M	1	38-54	45.8
WP	SA033	M?	A	A	A
WP	SA034	M	3	50-91	70.3
WP	SA047	F?	1	38-54	45.8
WP	SA050	F	A	A	A
WP	SA052	M?	1	38-54	45.8
WP	SA053	F?	3	50-91	70.3
WP	SA054	F	1	38-54	45.8
WP	SA056	M?	1	38-54	45.8
WP	V11	M?	3	50-91	70.3
WP	V14	F?	2	41-71	55.6
WP	V15	M?	4	64-93	78.9
WP	V18	M?	A	A	A
WP	V19	M?	A	A	A
WP	V26	F	4	64-93	78.9
WP	V27	M?	3	50-91	70.3
WP	V29	F	1	38-54	45.8
WP	V33	F	2	41-71	55.6
WP	V38	M?	2	41-71	55.6
WP	V39	M	A	A	A
WP	V40	M	A	A	A
WP	V45	M?	1	38-54	45.8
WP	V46	F	1	38-54	45.8
WP	V51	M?	A	A	A
WP	V61	F	2	41-71	55.6
WP	WCO009	F	1	38-54	45.8
WP	WCO012	M?	A	A	A
WP	WCO013	F?	1/2	38-71	50.7
WP	WCO015	M	1	38-54	45.8
WP	WCO017	F?	2/3	41-91	62.95
WP	WCO018	M	2/3	41-91	62.95
WP	WCO022	F	1	38-54	45.8
WP	WCO026	F?	3	50-91	70.3

Site	Sk. No.	Sex	Score	Est. Age	Mean
WP	WCO028	F	1	38-54	45.8
WP	WCO029	F	4	64-93	78.9
WP	WCO036	F	1	38-54	45.8
WP	WCO037	M?	2	41-71	55.6
WP	WCO041	M	1	38-54	45.8
WP	WCO045	F?	3	50-91	70.3
WP	WCO056	F	1	38-54	45.8
WP	WCO057	M?	2	41-71	55.6
WP	WCO059	M?	3	50-91	70.3
WP	WCO109	F	1	38-54	45.8
WP	WCO115	M?	A	A	A
WP	WCO117	M	1	38-54	45.8
WP	WCO124	F	2	41-71	55.6
WP	WCO130	F	3	50-91	70.3
WP	WCO131	M?	A	A	A
WP	WCO137	M?	3	50-91	70.3
WP	WCO142	M?	2	41-71	55.6

WP	WCO146	M	3	50-91	70.3
WP	WCO153	M?	3	50-91	70.3
WP	WCO162	F?	2	41-71	55.6
WP	WCO164A	M	2	41-71	55.6
WP	WCO165	F?	A	A	A
WP	WCO165A	M	2	41-71	55.6
WP	WCO167	F	1	38-54	45.8
WP	WCO169	M	A	A	A
WP	WCO170	F	4	64-93	78.9
WP	WCO173	F	3	50-91	70.3
WP	WCO179	F?	3	50-91	70.3
WP	WCO184	F	1	38-54	45.8
WP	WCO187	F	A	A	A
WP	WCO199	F	4	64-93	78.9
WP	WCO200	M?	2	41-71	55.6
WP	WCO203	M?	2	41-71	55.6
WP	WCO204	F	A	A	A

Appendix 13 – Funerary archaeology

Archaeological burial evidence collated for individuals from the sample sites. All information was obtained from the published site reports or from the raw excavation data (Bell and Beresford, 1987; Dawes and Magilton, 1980; Holst, 2005; Magilton, 1980; Mays et al., 2007; Rodwell, 2011b; Waldron, 2007). Data was not included unless it was specifically recorded, however all the site reports note that general burial trends were followed by the majority of individuals. Meaning typical Christian burial practices: supine, extended burials, with hands extended on the pelvis or by the sides; in a generally West-East orientation (or in line with the church) with the heads at the West end, facing East; with no grave goods.

BAR = Barton-upon-Humber; FGH = Fishergate House, SHOW = St. Helen-on-the-Walls; WP = Wharram Percy. Sk. No. = Skeleton number; Cohort = estimated age at death using the ageing methods (years); Mean = mean age produced by the ageing methods (years).

Site	Sk. No.	Cohort	Mean	Sex	Cemetery Area	Orientation	Coffin	Shroud	Body Position	Arms	Legs	Burial Inclusions	Burial inclusion details/Notes
BAR	7	70+	65.0	F	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	18	46-59	57.0	F	Inside 8th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	99	35-45	48.0	M	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	126	60-69	66.0	M	Inside 6th church	W-E	?	-	-	-	-	-	-
BAR	127	60-69	61.6	M?	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	128	60-69	61.6	M	Inside 8th church	W-E	-	Y	Supine	-	Extended	-	-
BAR	132	60-69	59.3	M?	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	179	46-59	60.0	M	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	187	70+	64.0	F	South of 3rd church	W-E	Y	-	-	-	-	Y	Bone die
BAR	204	46-59	56.6	F	Inside 6th church	W-E	Y	-	Supine	-	Extended	Y	Lime covering skull & thorax
BAR	208	35-45	46.4	M	South-west of 9th church	W-E	?	-	-	-	-	-	-
BAR	241	46-59	56.7	M	Inside 8th church	W-E	-	-	Supine	-	Extended	Y	AE stud
BAR	266	46-59	60.5	M	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	269	60-69	67.1	M	Inside 7th church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	272	70+	67.5	M	South-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	276	35-45	52.5	F	South of 3rd church	W-E	-	-	-	-	-	-	Multiple burial

BAR	308	46-59	57.9	M	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	309	60-69	64.8	F	South of 3rd church	W-E	?	-	Supine	Crossed	Extended	-	-
BAR	311	35-45	55.8	F?	South-west of 9th church	W-E	?	-	Supine	-	Extended	-	-
BAR	326	46-59	50.8	F	South of 3rd church	W-E	?	-	Supine	Extended	Extended	-	-
BAR	327	46-59	59.2	M	South-west of 9th church	W-E	-	-	Supine	-	Extended	-	-
BAR	363	46-59	59.7	M	South of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	380	46-59	48.6	?	North of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	425	70+	68.2	M	In/Incorporated into 2nd/3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	427	46-59	56.6	M	South of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	428	46-59	63.3	F	South of 3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	431	70+	65.3	F	Inside 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	446	46-59	55.9	M	Inside 8th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	488	46-59	54.2	M	South-west of 9th church	W-E	?	-	Supine	-	Extended	-	-
BAR	499	70+	67.2	F	South-west of 8th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	513	70+	72.2	F?	South-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	539	46-59	63.2	F	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	548	46-59	57.7	M?	South of 3rd church	W-E	-	-	-	-	-	-	-
BAR	550	46-59	64.3	F	South of 3rd church	W-E	?	-	Supine	-	Extended	-	-
BAR	552	60-69	62.5	F	In/Incorporated into 2nd/3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	558	46-59	59.0	M?	East of 1st church, incorporated by 2nd	W-E	-	-	-	-	-	-	-
BAR	578	46-59	48.3	F?	North of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	582	46-59	59.7	M	Inside 5th church	W-E	-	-	Supine	-	Extended	-	-
BAR	588	46-59	49.7	M	-	W-E	-	-	-	-	-	-	-
BAR	591	60-69	64.9	M?	East of 1st church, incorporated by 2nd	W-E	-	-	Supine	-	Extended	-	-
BAR	594	46-59	55.7	M?	North of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	597	60-69	64.4	M	North of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	598	60-69	67.0	M	East of 1st church, incorporated by 2nd	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	605	46-59	53.5	M	East of 1st church, incorporated by 2nd	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	606	70+	66.9	F	North of 1st church	W-E	Y	-	-	-	-	-	-

BAR	607	46-59	55.9	F	North of 3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	613	46-59	47.0	F	East of 1st church, incorporated by 2nd	W-E	Y	-	Supine	Crossed	Extended	Y	Stone earmuffs
BAR	619	60-69	67.8	M	In/Incorporated into 8th/9th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	624	46-59	60.5	M	North of 1st church	W-E	Y	-	Supine	-	Extended	Y	Stone earmuffs
BAR	650	60-69	64.6	M	South-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	675	46-59	50.2	F	South-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	706	60-69	63.1	M	South-west of 9th church	W-E	-	-	-	-	-	-	-
BAR	717	46-59	64.7	F	South of 3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	737	46-59	56.7	M	South-west of 8th church	W-E	-	-	Supine	Crossed	Extended	Y	Charred board
BAR	748	60-69	61.8	F	South-west of 3rd church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	749	60-69	59.3	F	South-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	750	46-59	58.9	F?	South-west of 3rd church	W-E	-	-	-	-	-	-	-
BAR	765	46-59	54.4	M	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	771	70+	64.2	F	South-west of 8th church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	778	46-59	53.5	M	East of 1st church	W-E	-	-	-	-	-	-	-
BAR	788	46-59	59.9	F	South-west of 3rd church	NW-SE	-	-	Supine	Extended	Extended	-	-
BAR	834	60-69	60.6	M	South of 3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	850	46-59	62.0	F	South-west of 3rd church	W-E	?	-	Supine	Extended	Extended	-	-
BAR	854	46-59	63.7	F	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	867	46-59	61.1	M	South of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	870	46-59	61.4	M	South of 1st church	W-E	Y	-	Supine	Crossed	Extended	Y	7 stones placed around body
BAR	894	46-59	54.6	F?	South of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	918	60-69	61.2	M	South of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	947	46-59	54.1	M	South-west of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	948	46-59	64.6	F	South-west of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	950	46-59	58.7	M?	South-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	971	60-69	66.8	F	South-west of 3rd church	W-E	-	-	Supine	Crossed	Extended	Y	Large cobble on chest
BAR	975	46-59	49.0	M?	South-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	976	46-59	54.8	M	South of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	981	46-59	47.5	M?	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	989	60-69	62.9	M	South of 1st church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1015	46-59	54.6	M	South of 1st church	W-E	Y	-	Supine	Crossed	Extended	Y	Clay filled coffin

BAR	1020	46-59	60.8	M	South of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1022	46-59	62.7	M	South-west of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1028	46-59	59.1	F	South of 1st church	W-E	-	-	Supine	-	Extended	Y	Pot
BAR	1030	35-45	52.0	F?	South of 3rd church	W-E	-	-	-	-	-	-	-
BAR	1039	35-45	50.8	F	South-west of 3rd church	W-E	?	-	-	-	-	-	-
BAR	1043	46-59	54.7	M	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	1047	46-59	53.6	M	South-west of 3rd church	W-E	Y	-	Supine	-	Extended	Y	Glass
BAR	1049	70+	72.0	F	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	1062	60-69	67.4	F	Inside 8th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1063	70+	71.0	M	Inside 8th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1064	46-59	56.6	F	South of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	1068	60-69	65.3	F	South of 1st church	W-E	?	-	Supine	-	Extended	Y	Charred board; Pot
BAR	1071	46-59	56.1	F	South of 1st church	W-E	?	-	Supine	Extended	Extended	-	-
BAR	1085	46-59	55.4	M?	South-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	1096	46-59	62.4	F	South of 1st church	W-E	Y	-	Supine	-	Extended	Y	1 Stone earmuff
BAR	1100	46-59	57.7	M	Inside 5th church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1103	60-69	60.7	M	South of 1st church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1104	46-59	50.7	M	North of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	1106	46-59	53.8	M	South of 1st church	W-E	Y	-	Supine	Extended, behind back	Extended	-	-
BAR	1120	46-59	62.9	F	North of 3rd church	W-E	Y	-	Supine	Crossed	Extended	Y	Pillow stone (?); Bead
BAR	1122	46-59	52.3	M	South of 1st church	W-E	-	-	Supine	Extended	Extended	Y	2 Stones under body
BAR	1133	46-59	58.4	F	South-west of 3rd church	W-E	Y	-	Supine	-	Extended	Y	Metalwork
BAR	1134	46-59	46.6	M	South-west of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	1139	60-69	71.3	M	South of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1144	60-69	66.2	F	North of 1st church	W-E	-	-	-	-	-	-	-
BAR	1146	46-59	61.3	M?	South-west of 3rd church	W-E	-	-	-	-	-	-	-
BAR	1148	46-59	62.0	F	South-west of 1st church	W-E	-	-	-	-	-	-	-
BAR	1149	46-59	55.1	M	South-west of 1st church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1151	46-59	59.2	F	South of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1162	60-69	65.1	M	South-west of 1st church	NW-SE	Y	-	Supine	Crossed	Extended	-	-
BAR	1169	35-45	55.2	M	South-west of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1176	46-59	60.3	M	South of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1183	46-59	51.6	M?	North of 1st church	W-E	Y	-	Supine	-	Extended	Y	Timber grave lining
BAR	1197	46-59	54.4	F	South of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1202	46-59	62.3	F	North of 1st church	W-E	Y	-	Supine	Crossed	Extended	-	-

BAR	1204	46-59	59.8	M	South-west of 3rd church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1214	60-69	60.2	M	South-west of 1st church	W-E	Y	-	Supine	-	Extended	-	Multiple burial
BAR	1220	46-59	57.9	F?	North of 3rd church	W-E	?	-	Supine	-	Extended	Y	1 Stone earmuff
BAR	1235	35-45	55.8	F	South-west of 1st church	W-E	Y	-	Left side	-	-	-	-
BAR	1236	46-59	63.4	F	South of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1251	35-45	54.0	M	North of 1st church	W-E	-	-	-	-	-	-	-
BAR	1254	60-69	60.9	F	North of 1st church	W-E	?	-	Supine	Extended	Extended	-	-
BAR	1255	46-59	49.9	F	North of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1263	46-59	48.5	M?	South-west of 1st church	W-E	-	-	Supine	Crossed	Bent	-	-
BAR	1268	46-59	60.7	M	South-west of 1st church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	1291	60-69	61.0	M?	South-west of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1297	46-59	61.7	M	South-west of 3rd church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1299	46-59	62.5	F?	South-west of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1307	46-59	52.6	M	South-west of 3rd church	W-E	?	-	Supine	-	Extended	-	-
BAR	1315	46-59	62.9	M	South-west of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1316	46-59	54.9	M	South-west of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1324	35-45	47.1	M	South-west of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1409	46-59	56.9	M?	North of 9th church	W-E	-	-	Supine	-	Extended	-	-
BAR	1438	46-59	54.4	M	North-west of 9th church	W-E	?	-	Supine	-	Extended	-	-
BAR	1498	46-59	62.8	F	North-west of 9th church	SW-NE	Y	-	Supine	-	Extended	-	-
BAR	1538	46-59	50.8	F	North of 9th church	W-E	-	-	-	-	-	-	-
BAR	1542	46-59	55.5	F	North of 8th church	W-E	-	-	Right side	-	-	-	-
BAR	1548	46-59	60.9	M	North-west of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1556	46-59	48.5	M	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	1566	46-59	59.0	M	North of 9th church	NW-SE	-	-	-	-	-	-	-
BAR	1571	46-59	60.9	F	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	1615	46-59	51.4	M	North-west of 9th church	SW-NE	-	-	-	-	-	-	-
BAR	1655	35-45	51.0	F	North-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	1691	46-59	50.0	M	North of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	1695	46-59	61.3	F?	North-west of 9th church	SW-NE	-	-	Supine	-	Extended	-	-
BAR	1707	70+	63.2	M	North of 9th church (at north entrance)	W-E	-	-	Supine	Extended	Extended	-	-
BAR	1723	46-59	47.2	M	-	W-E	-	-	-	-	-	-	-
BAR	1750	46-59	61.2	F	North-west of 1st church	W-E	?	-	-	-	-	-	-
BAR	1756	46-59	48.6	M?	North of 9th church	W-E	?	-	Supine	-	Extended	-	-

BAR	1765	46-59	64.7	F	North-west of 1st church	W-E	-	-	-	-	-	-	-
BAR	1769	70+	63.8	M	North-west of 3rd church	W-E	-	-	-	-	-	-	-
BAR	1775	46-59	61.3	M	North of 9th church	W-E	-	-	Supine	-	Extended	-	-
BAR	1788	46-59	53.9	M	North of 1st church	NW-SE	Y	-	Supine	Extended	Extended	-	-
BAR	1805	46-59	59.4	M	North of 3rd church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	1824	46-59	57.2	M	North of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1843	46-59	54.7	M	North of 1st church	W-E	Y	-	Supine	Extended	Extended	Y	Red stone earmuffs
BAR	1849	60-69	57.7	M	North of 8th church (at north entrance)	SW-NE	-	-	-	-	-	-	-
BAR	1856	35-45	47.3	?	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	1863	60-69	60.7	M	North of 1st church	W-E	Y	-	Supine	Crossed	Extended	Y	Grass pillow and earmuffs; Willow/poplar wands
BAR	1869	60-69	72.0	M?	North of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	1871	46-59	57.1	M	North of 3rd church	W-E	-	-	-	-	-	-	-
BAR	1875	46-59	52.1	F	North of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	1889	70+	65.3	F?	North of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	1892	46-59	50.6	F	North of 1st church	W-E	Y	-	Supine	Crossed	Extended	-	2 ship roves/clench bolts
BAR	1897	46-59	60.1	M	North of 3rd church	W-E	Y	-	-	-	-	-	1 ship rove; nails
BAR	1910	46-59	60.1	M	North of 1st church	W-E	-	-	Supine	Crossed	Extended	-	Multiple burial (n=5, 2adult; 3xjuvenile)
BAR	1911	46-59	50.7	M	North of 1st church	W-E	-	-	Supine	Crossed	Extended	-	Multiple burial (n=5, 2adult; 3xjuvenile)
BAR	1920	46-59	61.0	M	North of 3rd church	W-E	Y	-	-	-	-	-	-
BAR	1922	46-59	58.9	M	North of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	1926	46-59	58.3	M	North of 1st church	W-E	Y	-	Supine	-	Extended	Y	2 willow/poplar wands
BAR	1993	60-69	58.7	M	North of 9th church	NW-SE	-	-	Supine	-	Extended	-	-
BAR	1995	60-69	63.1	M	North of 9th church	W-E	-	-	-	-	-	-	multiple burial
BAR	2027	46-59	58.4	M	North of 9th church	W-E	-	-	Supine	-	Extended	-	-
BAR	2064	35-45	54.9	F	North of 8th church	W-E	-	-	-	-	-	-	-
BAR	2130	60-69	61.2	F	North of 9th church	W-E	-	-	-	-	-	-	-
BAR	2142	60-69	60.3	F	North-west of 9th church	W-E	-	-	Supine	-	Extended	-	-
BAR	2176	46-59	53.4	F	North of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	2187	46-59	56.1	F	North of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	2193	60-69	59.3	M	North-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	2200	46-59	49.6	M	North-west of 9th church	SW-NE	-	-	-	-	-	-	-

BAR	2206	60-69	59.7	M	North-west of 9th church	SW-NE	-	-	-	-	-	-	-
BAR	2216	46-59	58.3	F	North of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	2219	46-59	59.6	M	North of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	2236	60-69	68.5	F	North-west of 9th church	W-E	-	-	-	-	-	-	-
BAR	2244	46-59	55.0	M	North-west of 8th church	W-E	-	-	-	-	-	-	"mother burial"
BAR	2248	60-69	61.7	M	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	2251	46-59	60.1	M	North of 9th church (at north entrance)	W-E	-	-	Supine	-	Extended	-	-
BAR	2259	46-59	47.4	F	North-west of 3rd church	SW-NE	-	-	Supine	-	Extended	-	-
BAR	2274	46-59	63.3	M	North-west of 9th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2283	46-59	57.9	F	North-west of 8th church	W-E	?	-	Supine	Extended	Extended	-	-
BAR	2284	46-59	61.7	F?	North-west of 3rd church	W-E	Y	-	-	-	-	-	-
BAR	2289	35-45	50.1	M	North-west of 3rd church	W-E	-	-	-	-	-	-	Multiple burial
BAR	2294	46-59	51.1	M	North of 8th church	W-E	-	-	-	-	-	-	-
BAR	2297	70+	64.8	F?	North of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2298	46-59	61.2	M	North of 3rd church	W-E	Y	-	-	-	-	-	Stone earmuffs
BAR	2304	35-45	36.5	M	North-west of 8th church	SW-NE	-	-	-	-	-	-	-
BAR	2309	60-69	62.3	M	North of 1st church	W-E	Y	-	Supine	Extended	Extended	-	-
BAR	2320	60-69	65.0	M	North of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2327	46-59	48.8	M	East of 9th church chancel	W-E	-	-	Supine	-	Extended	-	-
BAR	2337	60-69	60.0	M	North-west of 3rd church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2338	60-69	62.1	M	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	2345	46-59	57.5	M	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	2348	60-69	57.0	F	North of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	2356	60-69	58.4	F	North-west of 8th church	W-E	-	-	Supine	-	Extended	-	-
BAR	2376	60-69	58.9	M	North-west of 3rd church	W-E	?	-	Supine	Extended	Extended	Y	Pot; "mother burial"
BAR	2386	60-69	62.0	F	North of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	2408	46-59	51.4	F	North-west of 3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	2411	60-69	65.1	F?	North-west of 1st church	W-E	Y	-	-	-	-	-	-
BAR	2413	46-59	65.0	M?	North-west of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2428	35-45	57.3	F	North of 1st church	W-E	-	-	Supine	-	Extended	-	-
BAR	2436	46-59	52.2	F?	North-west of 8th church	W-E	-	-	-	-	-	-	-
BAR	2451	35-45	51.8	M?	North-west of 3rd church	W-E	Y	-	-	-	-	-	-
BAR	2452	46-59	58.0	M	North-west of 8th church	W-E	Y	-	-	-	-	-	-

BAR	2457	60-69	65.1	F	North-west of 1st church	W-E	?	-	-	-	-	?	1 ship rove
BAR	2465	46-59	56.7	F	North-west of 1st church	W-E	?	-	-	-	-	Y	Coin
BAR	2466	46-59	60.4	M	North-west of 1st church	SW-NE	?	-	Supine	Extended	Extended	Y	19 ship roves; Animal bones on feet
BAR	2469	46-59	46.6	M	North-west of 1st church	W-E	Y	-	-	-	-	Y	Roman pot
BAR	2471	46-59	56.7	M	North of 1st church	W-E	Y	-	-	-	-	Y	Willow/poplar wand; Unidentified organic material
BAR	2485	35-45	52.1	M	North-west of 3rd church	W-E	?	-	Supine	Extended	Extended	Y	Bronze object
BAR	2491	60-69	61.7	M?	North-west of 9th church	SW-NE	-	-	Supine	-	Extended	-	-
BAR	2495	46-59	52.8	M	North-west of 1st church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	2499	60-69	62.8	M	North-west of 8th church	SW-NE	-	-	Supine	-	Extended	Y	Half coin
BAR	2503	46-59	50.8	F	North-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	2514	46-59	54.4	M	North-west of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	2520	60-69	65.4	F?	North-west of 1st church	W-E	Y	-	Supine	-	Extended	-	1 ship rove
BAR	2583	60-69	67.3	M	North-west of 1st church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	2603	46-59	56.3	M	North-west of 9th church	SW-NE	-	-	Supine	-	Extended	-	-
BAR	2612	60-69	62.2	M	North of 3rd church	W-E	-	-	Supine	Extended	Extended	-	-
BAR	2616	46-59	62.8	?	North of 1st church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2666	35-45	54.2	F?	South-west of 9th church (by south entrance)	W-E	-	-	-	-	-	-	-
BAR	2684	46-59	55.2	M	South-west of 9th church (by south entrance)	W-E	-	-	Supine	-	Extended	-	Double burial
BAR	2700	46-59	50.6	M	South-west of 9th church (by south entrance)	W-E	-	-	Supine	-	Extended	-	-
BAR	2714	70+	66.5	M	South-west of 8th church (by south entrance)	W-E	Y	-	Supine	-	Extended	-	-
BAR	2718	35-45	45.7	F	South-west of 9th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2720	46-59	50.6	M	South-west of 8th church	W-E	Y	-	-	-	-	-	-
BAR	2721	46-59	53.7	M	South-west of 8th church (by south entrance)	W-E	-	-	-	-	-	-	-
BAR	2722	46-59	47.0	F	South-west of 3rd church	W-E	-	-	Supine	Crossed	Extended	-	-
BAR	2727	46-59	57.4	F	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	2730	46-59	53.6	M	South-west of 8th church	W-E	Y	-	Supine	-	Extended	-	-
BAR	2731	35-45	49.3	M	South-west of 3rd church	W-E	-	-	Supine	-	Extended	-	-
BAR	2732	60-69	64.0	F	South-west of 3rd church	W-E	-	-	-	-	-	-	-

BAR	2739	46-59	49.7	M	South-west of 3rd church	W-E	Y	-	Supine	Crossed	Extended	-	-
BAR	2751	60-69	60.2	F	South-west of 3rd church	W-E	-	-	-	-	-	-	-
BAR	2758	60-69	63.1	M	South-west of 3rd church	NW-SE	Y	-	-	-	-	Y	Glass bead
BAR	2766	35-45	52.9	F	South-west of 1st church	NW-SE	?	-	-	-	-	-	-
BAR	2775	60-69	64.2	F	South-west of 1st church	NW-SE	-	-	Supine	Crossed	Extended	-	-
BAR	2780	46-59	52.9	F	South-west of 1st church	W-E	-	-	-	-	-	-	-
BAR	2783	46-59	51.4	M	South-west of 1st church	NW-SE	Y	-	Supine	-	Extended	-	-
BAR	2784	46-59	58.8	M	South-west of 1st church	NW-SE	Y	-	Supine	-	Extended	-	2 ship roves
BAR	2786	46-59	51.9	M	South-west of 3rd church	W-E	-	-	-	-	-	-	-
BAR	2798	46-59	63.9	M?	South-west of 3rd church	W-E	-	-	-	-	-	-	-
BAR	2799	35-45	58.8	M	South-west of 1st church	NW-SE	-	-	Supine	Crossed	Extended	Y	Pot
FGH	1021	35-45	60.1	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1037	46-59	45.3	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1047	46-59	61.1	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1049	60-69	66.2	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1051	70+	70.7	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1053	35-45	49.4	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1057	70+	68.6	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1063	60-69	59.3	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1075	70+	72.0	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1079	46-59	63.2	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1081	35-45	53.9	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1091	46-59	68.3	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1097	60-69	69.7	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1099	46-59	64.9	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1101	46-59	56.8	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1104	70+	74.5	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1110	46-59	61.8	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1113	35-45	52.6	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1115	60-69	67.4	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1117	60-69	64.0	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1130	60-69	63.1	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1139	70+	68.2	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1147	46-59	58.1	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1150	46-59	67.3	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-

FGH	1163	70+	68.5	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1171	35-45	58.6	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1180	35-45	43.9	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1184	46-59	51.7	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1188	35-45	60.1	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1190	46-59	57.7	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1208	46-59	65.6	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1228	70+	70.2	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1230	35-45	61.2	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	Y	Scallop shell
FGH	1237	46-59	60.2	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1255	35-45	54.2	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1257	35-45	60.9	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1280	46-59	63.7	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1284	35-45	44.9	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1286	35-45	62.2	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1297	35-45	55.3	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	Y	Copper alloy ring
FGH	1305	46-59	62.1	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1312	35-45	51.5	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1313	70+	67.0	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1327	60-69	64.6	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1354	46-59	51.9	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1385	60-69	65.8	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1391	46-59	53.9	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1412	46-59	57.8	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1441	60-69	67.1	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1455	35-45	41.8	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1469	46-59	57.5	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1471	35-45	57.9	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1484	60-69	66.7	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1486	46-59	52.8	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1521	46-59	56.2	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1525	46-59	55.1	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1553	35-45	57.0	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1560	35-45	56.8	M?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1569	46-59	60.1	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-

FGH	1579	46-59	61.1	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1581	60-69	64.8	F?	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1583	46-59	55.3	M	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1589	35-45	48.0	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
FGH	1597	35-45	54.8	F	East of potential church	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	5010a	46-59	56.8	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5066	46-59	59.5	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5091	35-45	48.7	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5098	35-45	57.5	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5103	46-59	60.8	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5105	60-69	70.1	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5110	46-59	58.9	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5123	46-59	59.1	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5159	60-69	65.2	M	Inside church	SW-NE	Y	-	Supine	Extended	Extended	-	-
SHOW	5172	46-59	42.1	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5173	46-59	53.4	M	Inside church	SW-NE	-	-	Supine	Extended	Extended	?	Bone object in burial fill
SHOW	5186	35-45	53.6	M?	North-west of church	SW-NE	-	-	Supine	Crossed	Extended	-	-
SHOW	5190	46-59	57.2	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5203	46-59	61.9	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5204	35-45	51.1	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5207	60-69	60.6	M	Inside church	SW-NE	Y	-	Supine	Extended	Extended	-	-
SHOW	5208	46-59	56.4	M?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5211	60-69	62.6	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5218	46-59	54.9	F?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5222	46-59	59.7	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5225	46-59	57.4	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5228	60-69	67.1	F?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5233	46-59	56.4	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5237	46-59	57.9	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5241	35-45	45.3	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5243	60-69	62.5	M	Inside church	-	-	-	Supine	Extended	Extended	-	-
SHOW	5244	46-59	57.2	M?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5254	60-69	65.0	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5258	35-45	50.0	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5267	46-59	53.1	F	-	-	-	-	Supine	Extended	Extended	-	-

SHOW	5269	46-59	63.7	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5270	35-45	53.3	F?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5283	35-45	51.1	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5290	46-59	60.2	F?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5292	46-59	56.2	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5298	46-59	57.8	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5302	35-45	47.3	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5311	46-59	60.7	F?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5316	46-59	55.4	F?	Inside church	SW-NE	-	-	Supine	Extended	Extended	Y	Grave mortar lined with ashlar blocks 30cm long
SHOW	5320	35-45	52.0	F	South-east of church	-	-	-	Supine	Extended	Extended	-	-
SHOW	5323	46-59	56.1	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5329	46-59	53.1	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5347	60-69	67.3	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5350	46-59	55.5	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5364	46-59	53.6	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5384	60-69	60.5	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5393	46-59	51.5	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5402	46-59	57.4	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5415	35-45	52.0	F	Inside church	SW-NE	-	-	Supine	Extended	Extended	Y	Grave mortar lined
SHOW	5421	60-69	59.5	M?	Inside church	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	5438	46-59	58.4	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5445	35-45	49.2	M	North-west of church	SSW-NNE	-	-	Supine	Extended	Extended	-	-
SHOW	5451	46-59	58.0	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5453	46-59	56.1	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5457	35-45	46.8	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5461	60-69	60.6	M?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5463	46-59	52.8	M?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5475	46-59	61.4	M?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5488	46-59	52.8	F	Inside church	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	5492	35-45	58.9	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5494	70+	68.3	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5501	70+	64.6	F	Inside church	SW-NE	Y	-	Supine	Extended	Extended	-	-
SHOW	5507	46-59	59.2	F?	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5508	60-69	65.7	F	-	-	-	-	Supine	Extended	Extended	-	-

SHOW	5529	70+	67.1	F	North-west of church	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	5534	46-59	49.4	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5539	46-59	53.1	M	Inside church	SW-NE	-	-	Supine	Extended	Extended	?	Gold finger ring in burial fill
SHOW	5544	46-59	55.5	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5562	60-69	62.1	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5563	46-59	53.7	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5588	46-59	57.7	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5601	46-59	61.8	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5603	46-59	54.0	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5617	46-59	58.9	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5632	70+	68.1	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5644	60-69	61.8	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5657	35-45	47.7	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5671	46-59	57.6	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5680	70+	71.4	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5699	46-59	66.0	F	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5702	35-45	42.0	M	South of Church	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	5710	46-59	50.4	M	-	-	-	-	Supine	Extended	Extended	-	-
SHOW	5740	35-45	52.5	F	Inside church	SW-NE	-	-	Supine	Crossed	Extended	-	-
SHOW	5773	46-59	60.2	M	-	W-E	-	-	Supine	Extended	Extended	-	Coffin nail
SHOW	5774	60-69	65.9	F	-	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	5794	60-69	61.6	M	-	NW-SE	-	-	Supine	Crossed	Extended	-	-
SHOW	5835	46-59	50.4	F	-	NW-SE	-	-	Supine	Extended	Extended	-	-
SHOW	5845	46-59	56.4	M	-	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	5884	35-45	52.2	F	-	SW-NE	-	-	Supine	Crossed	Extended	-	-
SHOW	5909	46-59	58.3	F	-	NW-SE	-	-	Supine	Crossed	Extended	-	-
SHOW	5977	46-59	61.1	M?	-	SW-NE	-	-	Disturbed	Extended	Extended	-	-
SHOW	6003	60-69	60.9	F	-	SW-NE	-	-	Supine	Extended	Extended	Y	2 Ferrous objects
SHOW	6026	35-45	44.8	M	-	-	-	-	Disturbed	Extended	Extended	-	-
SHOW	6027	46-59	59.0	F	-	-	-	-	Disturbed	Extended	Extended	-	-
SHOW	6029	46-59	57.9	M	-	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	6030	60-69	64.2	F	-	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6042	35-45	49.2	M	-	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6043	60-69	59.4	F	-	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	6048	46-59	57.8	M	-	W-E	-	-	Supine	Extended	Extended	-	-

SHOW	6060	60-69	67.6	M	-	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6070	46-59	57.8	F	North-west of church	NW-SE	-	-	Supine	Extended	Extended	-	-
SHOW	6072	46-59	54.8	M	North-west of church	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6074	46-59	58.7	F	-	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6081	60-69	65.2	M	-	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6082	46-59	56.3	F	North-west of church	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	6083	46-59	52.3	M	North-west of church	NW-SE	-	-	Supine	Extended	Extended	-	-
SHOW	6088	70+	59.7	M	-	W-E	-	-	Supine	Extended	Extended	-	-
SHOW	6093	46-59	53.1	F	-	SW-NE	-	-	Supine	Extended	Extended	-	-
SHOW	6098	46-59	55.9	M	-	W-E	-	-	Supine	Extended	Extended	Y	Bronze pin, iron nail
SHOW	6103	70+	63.4	M	-	W-E	-	-	Supine	Extended	Extended	-	Nail
SHOW	6105	70+	63.8	M	-	W-E	-	-	Supine	Extended	Extended	-	-
WP	EE004	60-69	63.0	M?	Inside phase VI church	W-E	-	-	-	-	-	-	-
WP	EE013	35-45	54.2	M	East of church	-	Y	-	Supine	Crossed	Extended	Y	Liturgical goods, pewter chalice and paten; Binding strip fragment
WP	EE015	60-69	72.2	F	East of church	-	-	-	-	-	-	-	-
WP	EE019	35-45	58.3	F	East of church	-	-	-	-	-	-	-	-
WP	EE022	46-59	56.7	F	East of church	-	Y	-	-	-	-	Y	Stones around head
WP	EE024	35-45	59.0	M?	East of church	-	-	-	-	-	-	-	-
WP	EE025	60-69	67.5	M?	East of church	-	-	-	-	-	-	-	-
WP	EE026	46-59	58.3	M	East of church	-	-	-	-	-	-	-	-
WP	EE037	46-59	58.5	M	East of church	-	-	-	-	-	-	-	-
WP	EE056	46-59	53.7	F	East of church	-	-	-	-	-	-	-	-
WP	EE062	46-59	48.7	M	East of church	-	-	-	-	-	-	-	-
WP	EE070	46-59	53.9	F	East of church	-	-	-	-	-	-	-	-
WP	EE079	60-69	68.6	M?	Within side chapel	W-E	-	-	Supine	Crossed	Extended	-	-
WP	EE080	35-45	54.5	M	Within side chapel	W-E	-	-	Supine	Crossed	Extended	Y	Pewter chalice
WP	EE089	46-59	57.4	M	East of church	-	-	-	-	-	-	-	-
WP	EE097	46-59	61.6	F?	East of church	-	-	-	-	-	-	-	-
WP	EE098	70+	72.3	M?	East of church	-	-	-	-	-	-	-	-
WP	EE099	46-59	57.8	F	East of church	-	-	-	-	-	-	-	-
WP	G251	46-59	49.2	F	Northern Graveyard	W-E	?	?	Supine	Extended	Extended	-	-
WP	G265	35-45	56.0	M	Northern Graveyard	W-E	?	?	Supine	Extended	Extended	Y	Stone earmuffs
WP	G278	46-59	63.6	M?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-

WP	G279	60-69	61.5	M?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G296	35-45	59.3	F?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G297	46-59	58.3	M?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G303	35-45	58.1	M	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G310	35-45	49.9	M	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	Y	Stones around head
WP	G361	35-45	57.4	F?	Northern Graveyard	NW-SE	-	-	Supine	Extended	Extended	-	-
WP	G377	46-59	57.3	F?	Northern Graveyard	NW-SE	-	-	Supine	Extended	Extended	Y	Stones around head
WP	G379	46-59	59.6	M	Northern Graveyard	NW-SE	-	-	Supine	Extended	Extended	Y	Stones around head
WP	G381	46-59	51.6	M?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G385	35-45	55.8	F?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G406	46-59	54.5	M?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G411	46-59	43.6	M	Northern Graveyard	NW-SE	-	-	Supine	Extended	Extended	-	-
WP	G419	46-59	61.7	F?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G451	60-69	62.9	F	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G474	46-59	62.0	F	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G482	46-59	58.2	M	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G516	46-59	50.1	M	Northern Graveyard	W-E	-	-	Supine	Crossed	Extended	-	-
WP	G561	46-59	55.8	M	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G565	35-45	49.1	M?	Northern Graveyard	NW-SE	-	-	Supine	Extended	Extended	?	Weights on pelvis and R femur
WP	G571	46-59	53.3	F?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G587	35-45	48.8	M?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G601	46-59	58.5	M?	Northern Graveyard	NW-SE	-	-	Supine	Crossed	Extended	-	-
WP	G607	46-59	50.3	M	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	G628	46-59	57.4	F?	Northern Graveyard	W-E	-	-	Supine	Extended	Extended	Y	Stone earmuffs
WP	NA046	46-59	61.9	M	North of church	-	-	-	-	-	-	Y	Nail in mouth; Stone earmuffs
WP	NA047	35-45	54.8	F	North of church	-	-	-	-	-	-	-	-
WP	NA059	46-59	57.3	F?	North of church	-	-	-	-	-	-	-	-
WP	NA075	35-45	55.1	M?	North of church	-	-	-	-	-	-	-	-
WP	NA078	46-59	57.5	M?	North of church	-	-	-	-	-	-	-	-
WP	NA080	35-45	48.7	M	North of church	-	-	-	-	-	-	-	-
WP	NA084	35-45	49.7	F	North of church	-	-	-	-	-	-	-	-
WP	NA088	46-59	56.8	F	North of church	-	-	-	-	-	-	-	-
WP	NA100	46-59	60.3	F	North of church	-	-	-	-	-	-	-	-
WP	NA166	35-45	45.6	M	North of church	-	-	-	-	-	-	-	-
WP	NA168	46-59	59.9	F	North of church	-	-	-	-	-	-	-	-

WP	NA171	46-59	56.6	M?	North of church	-	-	-	-	-	-	-	-
WP	NA181	46-59	62.8	M?	North of church	-	-	-	-	-	-	-	-
WP	NA183	46-59	50.1	M	North of church	-	-	-	-	-	-	-	-
WP	NA190	35-45	56.3	M?	North of church	-	-	-	-	-	-	-	-
WP	NA197	60-69	64.1	M	North of church	-	-	-	-	-	-	-	-
WP	NA199	46-59	53.4	M	North of church	-	-	-	-	-	-	-	-
WP	NA202	70+	70.9	F	North of church	-	-	-	-	-	-	-	-
WP	NA203	46-59	56.5	F	North of church	-	-	-	-	-	-	-	-
WP	NA217	70+	74.9	M	North of church	-	-	-	-	-	-	-	-
WP	NA218	46-59	59.6	M	North of church	-	-	-	-	-	-	-	-
WP	NA224	46-59	50.8	M	North of church	-	-	-	-	-	-	Y	Stone slabs at head and foot
WP	NA233	46-59	56.0	F	North of church	-	-	-	-	-	-	-	-
WP	NA234	46-59	38.7	M	North of church	-	-	-	-	-	-	-	-
WP	SA003	46-59	56.6	M?	South of Church	-	-	-	-	-	-	-	-
WP	SA012	35-45	51.6	M	South of Church	-	-	-	-	-	-	-	-
WP	SA013	35-45	59.1	F?	South of Church	-	-	-	-	-	-	-	-
WP	SA015	46-59	57.3	M	South of Church	-	-	-	-	-	-	-	-
WP	SA021	46-59	52.5	M	South of Church	W-E	-	-	-	-	-	-	-
WP	SA033	35-45	66.7	M?	South of Church	-	-	-	-	-	-	-	-
WP	SA034	46-59	57.0	M	South of Church	-	Y	-	-	-	-	-	Stone cist
WP	SA047	35-45	52.0	F?	South of Church	-	-	-	-	-	-	-	-
WP	SA050	46-59	52.1	F	Southern Churchyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	SA052	46-59	57.1	M?	Southern Churchyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	SA053	46-59	63.8	F?	Southern Churchyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	SA054	35-45	47.8	F	Southern Churchyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	SA056	46-59	51.7	M?	Southern Churchyard	W-E	-	-	Supine	Extended	Extended	-	-
WP	V11	60-69	61.7	M?	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V14	46-59	61.2	F?	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V15	46-59	60.6	M?	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V18	60-69	62.6	M?	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V19	46-59	54.0	M?	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V26	60-69	60.3	F	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V27	60-69	60.2	M?	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V29	46-59	49.4	F	Vestry (external)	W-E	-	-	-	-	-	-	-
WP	V33	35-45	53.2	F	Vestry (external)	W-E	-	-	-	-	-	-	-

WP	V38	46-59	55.2	M?	Vestry (external)	-	-	-	-	-	-	Y	Stones at feet
WP	V39	46-59	50.8	M	Vestry (external)	-	-	-	-	-	-	-	-
WP	V40	35-45	27.7	M	Vestry (external)	-	-	-	-	-	-	-	-
WP	V45	46-59	55.2	M?	Vestry (external)	-	-	-	-	-	-	-	-
WP	V46	46-59	54.3	F	Vestry (external)	W-E	-	-	-	-	-	?	1st/2nd century glass bangle in fill
WP	V51	46-59	53.6	M?	Vestry (external)	W-E	-	-	Supine	Crossed	Extended	Y	Stone grave-cover; head and foot stones; double burial with juvenile c.6years
WP	V61	35-45	52.1	F	Vestry (external)	-	-	-	-	-	-	-	-
WP	WCO009	35-45	36.9	F	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO012	35-45	38.6	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO013	46-59	62.8	F?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO015	46-59	51.1	M	West of church	W-E	?	?	Supine	-	Extended	-	-
WP	WCO017	46-59	58.0	F?	West of church	W-E	?	?	Supine	-	Extended	-	-
WP	WCO018	35-45	52.0	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO022	46-59	49.6	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO026	60-69	65.0	F?	West of church	W-E	?	?	Supine	-	Extended	-	-
WP	WCO028	46-59	60.9	F	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO029	46-59	63.9	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO036	46-59	56.2	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO037	60-69	52.1	M?	West of church	W-E	?	?	Supine	-	Extended	-	-
WP	WCO041	35-45	40.0	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO045	70+	62.4	F?	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO056	35-45	54.9	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO057	60-69	52.4	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO059	70+	58.0	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO109	46-59	56.5	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO115	35-45	65.3	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO117	46-59	53.6	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO124	46-59	56.7	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO130	60-69	67.4	F	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO131	70+	61.2	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO137	46-59	50.5	M?	West of church	W-E	?	?	Supine	-	Extended	-	-
WP	WCO142	35-45	61.2	M?	West of church	W-E	N	-	Supine	-	Extended	-	-

WP	WCO146	46-59	59.3	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO153	60-69	66.1	M?	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO162	70+	60.4	F?	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO164A	60-69	60.4	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO165	60-69	66.5	F?	West of church	W-E	?	?	Supine	-	Extended	-	-
WP	WCO165A	46-59	56.2	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO167	46-59	51.8	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO169	35-45	38.7	M	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO170	70+	70.7	F	West of church	W-E	Y	-	Supine	Extended	Extended	-	-
WP	WCO173	46-59	53.6	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO179	60-69	66.2	F?	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO184	35-45	51.3	F	West of church	W-E	N	-	Supine	Extended	Extended	-	-
WP	WCO187	46-59	54.8	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO199	60-69	60.3	F	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO200	46-59	57.9	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO203	35-45	57.8	M?	West of church	W-E	N	-	Supine	-	Extended	-	-
WP	WCO204	46-59	56.8	F	West of church	W-E	N	-	Supine	-	Extended	-	-