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Understanding Disability and Physical Impairment in Early Medieval England: An
Integration of Osteoarchaeological and Funerary Evidence

By SOLANGE BOHLING,¹ KARINA CROUCHER,¹ and JO BUCKBERRY¹

THIS PAPER INVESTIGATES physical impairment and disability in the c 5th to 6th centuries AD in England through a combination of osteological and funerary analyses. A total of 1,261 individuals, 33 of whom had osteologically identifiable physical impairment, from nine early medieval cemeteries were included. The funerary data for all individuals in each cemetery was collected, and the individuals with physical impairment were analysed palaeopathologically. The burial treatment of individuals with and without physical impairment was compared both quantitatively and qualitatively, and patterns within and between cemeteries were explored to investigate contemporary perceptions and understandings of impairment and disability. The results suggest that some people with physical impairment and potential disability were buried with treatment that was arguably positive, while others were buried with treatment that was either normative or potentially negative. This suggests that, in the same way as the rest of the community, individuals with physical impairment and potential disability had a variety of identities (that may or may not have been influenced by their impairment or disability) and could occupy different social spaces/statuses.

Physical impairment (a deviation from the 'average' human body) and disability (the socially constructed limitations resulting from a physical impairment) are growing areas of interest within bioarchaeological and historical studies. By shedding light on experiences of physical impairment and the social construction of disability in archaeological contexts, researchers can better recognise the life experiences of a minority group that is frequently overlooked in archaeological and historical contexts. Lorna Tilley (2012; 2015) pioneered the academic push to identify and better understand the possibility of care in archaeological communities in response to disease, physical impairment, or disability. This was innovative in that it combined interdisciplinary lines of analyses (eg osteological, funerary, archaeological, historical, environmental) to infer the provision of care in archaeological communities on a case study basis. Recent research has begun to look at healthcare in the past on a population scale in order to better understand how living communities reacted and adapted to fluctuating care requirements (Tremblay Critcher 2017; Wesp 2017; Schrenk and Tremblay 2022). Similarly, the area of research that explores understandings of physical impairment and disability in the past at a population scale is in its infancy, but recent studies have demonstrated the value of approaching these topics at a community rather than individual level (Brownlee 2017; Zakrzewski et al 2017; Bohling et al 2022a;b).

Drawing on aspects of Tilley's (2012; 2015) research, the current research uses a population scale, bioarchaeological approach to explore physical impairment and disability in early medieval England (c 5th to 6th centuries AD) (see Bohling et al 2022b). Investigation of physical impairment and disability at a population, rather than individual, level allows for a more representative understanding of these concepts in specific past communities, as all individuals with a skeletally identifiable physical impairment are included. Through a combination of bioarchaeological and funerary analyses, the current research aims to explore what can be inferred about early medieval social perceptions of physical impairment and disability and how having a physical impairment or disability might have affected social placement and/or identity in this period.

UNDERSTANDING PHYSICAL IMPAIRMENT AND DISABILITY WITHIN THE CURRENT RESEARCH

Medical and social models have been influential factors in modern disability studies, and it is important to discuss how they have been integrated into bioarchaeological approaches to studying disability in the past. The medical model identifies a bodily deviation from the 'normal' human body as the direct cause of a person's disability, and considers it necessary to 'fix' patients with physical impairments to alleviate the consequences of disability (Shakespeare 2013). In contrast, the social model identifies society as the cause of a person's disability: it is not their physical impairment, but society's lack of accommodation which results in disabling limitations (Oliver 1990, 22–4). While the development of the social model has been enormously advantageous for people with disability around the world, the primary focus on society rather than physical impairment as the cause of disability can overlook the fact that some physical impairments are not possible to accommodate for in specific physical and social contexts (Shakespeare 2013).

Dimitris Anastasiou and James Kauffman (2013) call for an approach to disability that encompasses aspects of both models, and this combined approach is adopted in the current research. Palaeopathological analysis, which has its roots in the medical model, can identify osteological deviations from the 'average' human skeleton which may have resulted in physical impairment, and medical literature can help to explore the potential functional impacts of these impairments. However, it is also essential to consider how an individual's specific sociocultural and physical surroundings, or their personal circumstances, might have affected if, how, or why they were physically impaired or potentially disabled. The way in which a disability is experienced can be affected by numerous sociocultural factors, such as the perceived causality of the disability, socially valued and devalued personal characteristics or abilities, and the ability of an individual with disability to participate in adult society (Groce and Zola 1993), and also by individual factors such as gender/sex, age of onset, or financial circumstances (Roush 2017) (see Tab 1). Although the impacts of these sociocultural and individual factors are usually difficult (if not impossible) to determine in archaeological or historical contexts, it is essential to keep in mind the variable ways in which a person's community, identity, or

circumstances intersect with their personal experience of physical impairment or disability.

In this research, an individual with an osteologically identifiable deviation from the 'average' human skeleton was considered to have a 'physical impairment'. Informed by archaeological and historical contextualisation, an individual who may have been socially or functionally limited by their physical impairment and a potential lack of accommodation was considered to have a potential 'disability', although it should be noted that this designation was subjective and might be interpreted differently by other researchers. For ease of discussion, individuals with physical impairment have been grouped together, but this is with the understanding that their experiences of physical impairment or potential disability would have been variably affected by different sociocultural and individual factors, thus requiring person-specific analysis.

METHODS AND MATERIALS

The approach that was followed in this research is described in brief below and is visualised in Figure 1 (see Bohling et al 2022b for further detail).

Contextualisation

A literature review regarding funerary treatment in the early medieval period (c 5th to 6th centuries AD) allowed for a contextualised comparison of individuals with and without physical impairment, and provided a solid background from which to better understand specific early medieval burials. Given that there is no documentary evidence pertaining to physical impairment or disability in this period, archaeological, historical, and linguistic research regarding conceptions of disability in the c 7th to 11th centuries AD was addressed, and the extent to which later opinions can be applied to the earlier period was explored.

Data collection

For each cemetery assemblage, a random sample of 30 individuals was selected and analysed utilising standard osteological methods (see Bohling et al 2022b, section 2.2.2). Agreement between the lead author and previous researcher was compared quantitatively using Cohen's weighted kappa tests (see Viera and Garrett 2005; Bohling et al 2022b, section 2.2.2) with regards to age estimation and sex assessment, and qualitatively with regards to palaeopathological analysis. If agreement was considered sufficient (see Fig 1), the remainder of the extant osteological data was used, avoiding the need for re-analysis of the entire skeletal assemblage.

Based on the extant palaeopathological report, all individuals who had skeletal alterations potentially consistent with physical impairment were identified and re-analysed by the lead author. To be considered to have a physical impairment in this research, an individual had visible abnormalities that would have been noticeable to the surrounding community, functional abnormalities (nonnormative/restricted movement patterns), or osteologically identifiable conditions which may not have been noticeable to the surrounding community, but caused physically impairing symptoms (eg chronic pain due to advanced gout). For each individual with physical impairment, medical and palaeopathological literature aided in differential diagnoses and consideration of functional impacts.

Duration of the individual's physical impairment was considered (eg end-of-life, acquired in adulthood/childhood, present since birth) as this would directly affect an individual's experience of impairment (see above). Osteological alterations resulting in shorter-term physical impairment (eg well-healed and well-aligned metatarsal fracture) were not included in this research as the temporary functional impacts were less likely to influence a person's life experience significantly enough to be reflected in their funerary treatment. It is important to note that due to the nature of the osteological record, it is not possible to identify people who may have had mental or soft tissue impairments and therefore these individuals could not be included in the current research. The provision of external care to ensure survival was explored following the 'Bioarchaeology of Care' approach (Tilley 2012; 2015) for individuals with a physical impairment indicative of limited independent living (see Bohling 2020, section 10.2).

Finally, funerary treatment data was gathered for all individuals in the burial assemblage. The mortuary treatment variables recorded by the original excavators varied between sites, but usually information regarding grave location/orientation, body/limb positioning, and the inclusion of grave goods was provided.

Analysis

At each cemetery, the prevalence rate for each form of mortuary treatment variable was calculated, and forms of burial treatment that occurred in fewer than 10% of the burial assemblage were considered potentially nonnormative. This designation was subjective but aided in the identification of mortuary treatment that was notably less frequent within a specific community, thus requiring further investigation. Because age- and sex-based variability within early medieval funerary treatment was common (eg Lucy 1998; Stoodley 2000; Williams-Ward 2017; Mui 2018), each mortuary variable was compared across sex and age groups (adult vs non-adult) to identify any age- or sex-based patterns, and the funerary treatment of the individuals with physical impairment was considered with these observed patterns in mind.

For each individual, all funerary treatment variables were considered in conjunction with one another rather than as separate, unrelated entities. For example, an individual was buried in isolation, which might have negative connotations, but was also buried with 'rich' grave goods, potentially suggesting a higher social status. For each cemetery, the individuals with physical impairment and potential disability were considered as a group. Their burial treatment was compared to the remainder of the burial assemblage (qualitatively and quantitatively if required) to explore whether any specific funerary treatment might be associated with ability status, and the influence of certain factors (eg duration of impairment, location of abnormality) were investigated. In conjunction with literature review and theoretical archaeological frameworks, the qualitative and quantitative interpretations in the analysis phase allowed for an exploration of early medieval perceptions and understandings of physical impairment and disability. These interpretations also helped to investigate how having a physical impairment or disability might affect a

person's self or social identity or influence variable and identity-driven burial practices.

It should be noted that in the analysis stage, the inherent complexities associated with the interpretation of funerary ritual in archaeological contexts were considered. The funerary tableau studied by the archaeologist was created, influenced, changed, or managed by the individuals performing the funerary ritual (Parker Pearson 1993). It is necessary to take into account the agency of the living (and the dead), allowing archaeologists to consider the funerary tableau as a tool for political or social displays of power or legitimisation (Williams 2004), or the manipulation of the deceased's identity or memory, which may include references to perceptions of disability by the broader community.

MATERIALS

Nine early medieval cemeteries were included in this research: Apple Down, West Sussex (AD); Butler's Field, Gloucestershire (BF); Edix Hill, Cambridgeshire (EH); Finglesham, Kent (FS); Norton East Mill, Cleveland (NEM); St Anne's Hill, Eastbourne (SAH); Watchfield, Oxfordshire (WF); Windmill Hill, Nottinghamshire (WMH); and Worthy Park, Hampshire (WP) (Tab 2; Fig 2). A total of 1,261 individuals were included, 33 (2.6%) of whom had physical impairment.

DISABILITY IN EARLY MEDIEVAL ENGLAND

Disability in the c 7th to 11th centuries AD has been discussed in depth by many researchers who have been able to draw on religious, literary, judicial, linguistic, and osteological evidence (see Hadley and Buckberry 2005; Metzler 2006; Crawford 2010; Hadley 2010; Lee 2011; 2012; 2013; Bruce 2014; Thouroude 2015; Brownlee 2017; Bohling et al 2022a;b). Based on previous research, it appears that perceptions and understandings of disability in the later period were complex, as evidence is sometimes contradictory. Although law codes, linguistic evidence, and some texts discuss physical impairment and disability in relatively negative terms, some religious sources portray disability as a gift from God (see Crawford 2010; Lee 2011; 2012; 2013; Bruce 2014; Thouroude 2015). While we should not automatically

assume that someone with a physical impairment was definitively disabled, law codes written in the 7th century (see Attenborough 1922) suggest that the inability to speak, hear, or see, and the loss of limbs may have been considered disabling as injuries causing these conditions merited high compensation values (see Crawford 2010; Bohling 2020, section 2.4.2; Bohling et al 2022a;b).

Unfortunately, such documentary evidence from the c 5th to 6th centuries AD is not available. The projection of later concepts of disability, which may have been influenced by widespread conversion to Christianity (Bohling et al 2022a;b), onto the pre-Christian early period is not ideal. However, it seems likely that rules about compensation for injury existed in early medieval society prior to their codification in the seventh-century laws (Banham and Voth 2015), and therefore these law codes can still aid in the investigation of disability in the early period. Although literary evidence from the 5th and 6th centuries is not available, it is possible to integrate osteoarchaeological and funerary analyses to explore perceptions of disability in a nonliterate society.

RESULTS

For all nine sites, no significant qualitative differences were noted between the current and extant palaeopathological analyses. Agreement between the lead author and previous researchers with regards to age estimation and sex assessment was substantial or better in all but one site (NEM: $\kappa=0.29$ with regards to sex assessment; Tab 3). For Norton East Mill, Mandy Marlowe (1992) often assigned a definite sex when the remains were too incomplete to make a sex assessment. This may be due to increasing fragmentation of the remains during curation, or an increased level of caution often used in more recent analyses. The lead author re-assessed the entire Norton East Mill burial assemblage (N=118) for sex and age, and this data was utilised for the remainder of the research.

Brief summaries of the osteological alterations, probable diagnoses, funerary treatment, and grave good inclusions for each individual with physical impairment are provided in Table 4. See Bohling (2020) for osteological photographs, more detailed osteological descriptions and differential diagnoses, and discussion of functional impacts (Bohling 2020, ch 7; appendix 3, Sections 2–10). See

Supplementary Information included with the current article for *in situ* grave photographs/drawings, cemetery maps, and summary tables of the funerary treatment observed at each site.

As demonstrated in Table 4, funerary treatment of the individuals with physical impairment in the c 5th to 6th centuries was variable both within and between sites. Although the physical impairments and resulting functional impacts were extremely diverse, no ubiquitous funerary efforts were observed to distinguish those individuals with some form of functional restriction and/or altered participation pattern through nonnormative or 'deviant' burial practices (eg prone burial, burial in isolation, inclusion of large stones, decapitation) (Reynolds 2009). Nonetheless, many of these individuals did receive nonnormative or notable funerary treatment. However, it must be kept in mind that due to the extremely variable nature of early medieval mortuary practices in general, nonnormative burial treatment was also common among individuals without physical impairment.

Among the individuals with physical impairment, burials with probable positive connotations that required increased effort (eg bed burial, stone lining) and burials with potentially negative connotations (eg prone burial, burial away from the main burial concentration) were in evidence. Burial location varied widely within and between the analysed cemeteries. A majority of the individuals with physical impairment were buried well within the boundaries of the cemetery, but many were buried in marginal locations, some were buried in clusters with other individuals with physical impairment, and two were buried at a noticeable distance from the main cemetery. While many individuals with physical impairment were buried with normative body and/or limb positioning, some were buried with unique or less frequent body, head, arm, or leg positioning. Grave good assemblages also varied widely among the individuals with physical impairment: some individuals were buried with weapons, jewellery, curated objects, or unique items, while others were buried without grave goods.

INTERPRETATION AND DISCUSSION

This section addresses several aspects of burial treatment (burial location, body positioning, evidence of increased effort, and grave good inclusion) which

aided in the investigation of early medieval perceptions of physical impairment and people with potential disability. Essentially, all aspects of funerary treatment in the 5th and 6th centuries varied widely both within and between communities, and many social factors had a direct influence on burial treatment including age, sex, social status, kinship, and local or regional identities (Lucy 1997; 1998; Stoodley 1999; Crawford 2000; Stoodley 2000; 2002; Williams-Ward 2017; Mui 2018; Sayer 2020). It is critical to recognise how these different factors of self and social identity, including physical impairment and/or disability, may have influenced how a person was buried. The parenthetical percentages included in this section indicate the percent of the entire burial assemblage in which a specific funerary variable occurred.

BURIAL LOCATION

Burial location of the individuals with physical impairment varied greatly within and between sites. These individuals could be buried in central locations, in association with socially significant funerary features, clustered with other individuals with physical impairment, on the margins of the cemetery, or away from the main burial concentration.

Burial away from the main burial concentration

Two individuals with physical impairment were buried away from the main burial concentration of the cemetery at Butler's Field and St Anne's Hill. Butler's Field 6 (30–35-year-old female with bilateral posterior dislocation of the shoulders, Fig 3) was buried over 20 m away from the defined NW/SE edge of the main burial concentration (Fig 4A). Although there were other burials in this area, they were much more dispersed than in the main burial concentration. At St Anne's Hill, individual 481 (Grave 472, adult male with probable leprosy) was similarly buried away from the main burial concentration (Fig 4B). Unfortunately, the area to the north-east of St Anne's Hill 481 was not excavated, so burial in isolation cannot be confirmed. A 1992 evaluation recorded c 42 unexcavated graves in the area to the south of the main burial concentration, with the graves becoming less dense further south. St Anne's Hill 481 was buried even further south than this unexcavated area,

in a notably less-concentrated area of the cemetery, so if they were not buried in isolation, then they were certainly buried in a marginal position.

St Anne's Hill 481 was buried with unique leg positioning: the left leg was flexed and the right leg was severely bent across the left femur, resulting in a body position somewhere between flexed and crouched (Fig 5). Additionally, although having both arms bent was common (27.9%), having the right (4.2%) and left arms (8.1%) bent at less than a 90° angle was infrequent. St Anne's Hill 481 had both arms bent over the chest with the hands together as if clasping something (Doherty and Greatorex 2016, 40), a unique position in this cemetery. Notably, two other individuals (without skeletal physical impairment) at St Anne's Hill who were buried away from the main burial concentration (Fig 4B), also had less common body positioning: St Anne's Hill 62 (Grave 13, 46+ year old possible female) was buried on their left side (2.1%) in a flexed position (10.9%). St Anne's Hill 381 (Grave 380, unsexed adolescent) was buried on their right side (3.5%) in a flexed position (10.9%). Therefore, while different types of individuals were buried at a distance from the main cemetery in this community, there seems to be an association between burial outside the cemetery and the need to further distinguish the deceased individual via less common body positioning.

Burial in isolation or at a distance from the cemetery was relatively rare in early medieval England (Reynolds 2009, 202), but in the later 6th century, a pattern of spatial isolation of burials emerged (Reynolds 2009, 202–3). Andrew Reynolds (2009, 203) argues that there was an 'existing consciousness of exclusion at death [that was] ready to be developed and capitalized upon as a punitive measure', and from the later 7th century, socially 'deviant' individuals began to be buried in single burials, smaller groups of burials, or large-scale execution cemeteries that were spatially separate from normative cemeteries (Reynolds 2009, 96). However, using the 8th to 11th-century period in Wessex as an example, Annia Cherryson (2008) cautions against automatically assuming that burial in isolation was meant to have 'deviant', negative connotations as it is possible that this funerary treatment was less frequent, but still socially acceptable. The same caution should be applied to the 5th to 6th centuries AD. While a conscious decision with specific motivations influenced the burial of an individual in isolation or away from the main concentration of burials, it is possible that this funerary treatment was not meant to reflect 'deviancy', a term

we must use cautiously as it has more modern, biased, and negative connotations (Aspöck 2008).

Burial in isolation or away from the main burial concentration set the individual apart, as perhaps they were set apart in life due to a special occupation, status, or identity. Burial away from the main cemetery might have, paradoxically, made the burial *more* visible because it was distinct. Burial away from the main burial concentration might also have made the grave more *socially* visible: if someone was buried at a distance from the rest of the cemetery, this would have been a noticeable event within a small community, perhaps raising awareness of the individual's passing and consequently maintaining them within living social memory for longer. Graves placed close together in a densely populated area might have 'blended together' visually over time due to their physical proximity, or socially if the area became associated with 'those ancestors' rather than with a specific individual.

The idea that burial at a distance from the main cemetery may not have had entirely negative connotations is supported by the fact that individuals buried in such a way could also be accompanied by socially significant grave goods. Butler's Field 71 (40–45-year-old female, no physical impairment) was buried more than 20 m from the margin of the main burial concentration (Fig 4A) with a bag of 200 small garnets and a cowrie shell, while St Anne's Hill 481 (Grave 472, adult male with probable leprosy) and St Anne's Hill 381 (Grave 380, unsexed adolescent, no physical impairment) were buried away from the main burial concentration with a rare late-Roman period copper peacock-motif finger-ring (see 'Curated and unique objects' below) and iron arrowheads (unique to all of the analysed early medieval cemeteries in this research) respectively (Fig 4B). Additionally, St Anne's Hill 481 was buried with stones on the inside edges of the grave, although the number, size, and arrangement is unclear (Doherty and Greatorex 2016, 38–9). Stone lining would have required increased effort by those performing the burial, and their inclusion may have made the grave more visually distinctive or served a protective purpose, although containment of the 'dangerous dead' should also be considered (see 'Evidence of increased effort' below for further examples).

More negative motivations associated with 'deviancy' or otherness must also be considered in the analysis of burials outside of the main burial concentration. At

Butler's Field, a majority of the 14 burials outside the main concentration were females or non-adults (78.6%). This may be because females were more likely to move to a new settlement for marriage (Sayer 2014), and perhaps they and their children were not fully integrated into a community, and may have been buried separately to reflect their status as outsiders. Interestingly, the strontium and oxygen isotope values for St Anne's Hill 481 suggest an origin in eastern or northern Britain or in the coastal areas of Germany and Denmark (Doherty and Greatorex 2016, 51), and it remains a possibility that they were buried separately from the main cemetery because they were not local.

It is also possible that socially unacceptable actions/behaviours performed by the relatives of the deceased merited burial separate from the main concentration. This could explain why a neonate (BF-12), two younger children (BF-4 and BF-23; around two years old) and a 9–10-year-old (BF-74), who were probably too young to have been involved in actions considered socially inappropriate, were afforded this burial rite (Fig 4A). Or, perhaps because these children died prematurely, their deaths were considered particularly disruptive and therefore nonnormative burial location was required. Ethnographic studies have identified various motivations for 'deviant' burial including suspicious or bad deaths, heresy or excommunication, foreignness, immoral actions or behaviours, the conditions of birth, and family status (Ucko 1969; Shay 1985; Tsaliki 2008). While these motivations are culturally and community specific, it is certainly possible that similar rationales influenced early medieval 'deviant' or nonnormative burials.

Physical impairment and disability must also be discussed as potential factors in the burial locations of Butler's Field 6 and St Anne's Hill 481. The permanent bilateral posterior dislocation of both shoulders in Butler's Field 6 (Fig 3) probably resulted in abnormal posturing of the arms, and some movements would have been painful (Horn and Ufberg 2014). While the pain may have abated with time, both shoulders were probably stiff and not fully functional. Therefore, Butler's Field 6 was probably visually distinctive and functionally restricted, conditions which may have had adverse social or economic implications, or made participation in the expected activities of a middle-aged female difficult. St Anne's Hill 481 had probable leprosy, a disease which would have resulted in facial deformity including soft tissue alterations (Andersen and Manchester 1992), hand deformities that may have restricted

functionality, and pain and swelling of the lower legs (Resnick 2002), which may have resulted in an abnormal gait. St Anne's Hill 481 may not have been able to partake in activities expected of an adult male, which might have included manual labour or participation in military endeavours, thus placing them in a potentially socially or economically marginalised position. Therefore, it remains a possibility that the visual and/or functional otherness experienced by both Butler's Field 6 and St Anne's Hill 481 resulted in social stigma and perceived 'deviance' which necessitated nonnormative burial away from the main cemetery. However, because not all individuals with physical impairment were buried separately from the main burial concentration at Butler's Field or St Anne's Hill, it can be inferred that any association between physical/functional difference and perceived otherness must have varied on an individual basis.

Clustered burial

Clustering of individuals with physical impairment was observed at Worthy Park: four individuals with physical impairment and three females interred with fetuses/infants were buried close together in a central part of the cemetery in an area containing a large number of females and non-adults (Fig 6). At a cemetery at Great Chesterford (not analysed by the current authors), an individual with leprosy, two with tuberculosis, three with vertebral pathologies, two with cranial trauma, and a female with an infant were buried in a central cluster (Zakrzewski et al 2017). Although a cluster was not identified at Watchfield, individual 312 (20–25-year-old female with a traumatic injury and secondary osteoarthritis of the right elbow) and a 20–25-year-old female interred with a foetus (Grave 309) were buried close together at the south-western margin of the cemetery in an area almost exclusively reserved for females and non-adults (Fig 7). Similarly, at Finglesham, the only individual with physical impairment (FS-94, 30–40-year-old male with a traumatic injury and pronation fixation of the left forearm) was buried in an area of the cemetery that appeared to be reserved for females and non-adults (Fig 8). This physical association in death of individuals with physical impairment, females (some of whom may have died in childbirth), and non-adults requires further discussion.

An individual's body influences how they interact with their physical and social surroundings, and also how their community interacts with them (Zakrzewski et al 2017), and therefore can impact the construction of self or social identity. Sonia Zakrzewski et al (2017, 276) argue that individuals with disability 'may be considered to be in a liminal state, neither ill, nor healthy'. Their bodies may not adhere to common understandings of physical normativity, but in many cases, they are also not actively unwell. By occupying this liminal social space between the familiar concepts of sickness and health, individuals with physical impairment or disability may have experienced the social consequences of being considered 'sick' or 'not healthy', be those consequences positive (increased concern, desire to provide assistance), negative (physical avoidance, belief that shame or deviant actions were the cause of illness), or neutral. Perhaps the community was not sure how to treat people with disability as their health status and abilities were unclear and/or their body was 'different', resulting in communal feelings of discomfort and uncertainty that might lead to social marginalisation and 'othering'. Although physical impairments certainly result in a wide range of functional impacts, it is possible that in some communities like Worthy Park or Great Chesterford, having a functional restriction or obvious, long-term condition might situate someone within a group identity associated with otherness, social or physical vulnerability, or a need for post-mortem protection. This aspect of social identity might have been important enough to reflect in death with the close, physical association of graves that was observed at Worthy Park and Great Chesterford.

At Worthy Park, Great Chesterford, and Watchfield, individuals with physical impairment and potential disability were buried close to double burials containing females and infants/foetuses (Figs 6–8). Although it cannot be confirmed within the scope of this research, it is certainly possible that these double burials represent mother/child pairs who died before, during, or soon after childbirth. The bodies of pregnant women differ visibly from the average female body, and the physical consequences of pregnancy can result in temporary functional impairments (Cox 2012; Zakrzewski et al 2017). Perhaps, in a similar way to those with long term impairments, pregnant women in the early medieval period inhabited the liminal social space between being and not being fully healthy, and, given the precarious nature of pregnancy, would also have balanced upon the division between life and

death. The proximity of individuals with physical impairment with women who potentially died at childbirth or postpartum might suggest that their comparable occupation of the social space between sickness and health resulted in 'othering' or a perception of social or physical vulnerability that was necessary to reflect in death. In the cases of women dying by childbirth, this 'othering' was likely more temporary in life, but their death may have been considered 'bad' or more upsetting than usual due to the loss of two lives.

Finally, at Worthy Park, Watchfield, and Finglesham, some of the individuals with physical impairment or potential disability were buried in areas with a high proportion of females and non-adults (Figs 6–8). Seventh-century law codes (see Attenborough 1922) hint at the potential social, economic, or physical vulnerability of women. These laws suggest that while women had some forms of agency, their legal and economic statuses tended to be reliant on the statuses of their fathers or husbands (Crawford 2022, 14). Many laws refer to appropriate legal recourse for situations when a woman was affected by the actions of a man (eg Aethelberht caps 10, 16, 31, 76, 82–4), suggesting that this was a familiar occurrence, and there are explicit references to the forcible kidnapping of women (Aethelberht cap 82) (Attenborough 1922, 5–9, 15). Therefore, it is reasonable to assume that women might be considered physically or socially vulnerable in some circumstances. In a similar way, children might also share this vulnerable status. Based on analysis of grave good assemblages, it has been proposed that before the age of two or three years, early medieval children were not assigned a gender (Crawford 2000; Stoodley 2000). Perhaps without a gender, unborn, recently born, or younger children occupied the liminal social space between being and not being a member of the community.

In some communities, people experiencing 'othering', social marginalisation, or perceived physical or social vulnerability as a result of the liminal social space they occupied (eg between sickness and health, between communal belonging and not belonging) may have required physical association in death. This might be motivated by a need to reflect a shared group identity, or by the survivors' desire to provide protection and comfort in the afterlife for the community's more physically or socially vulnerable members.

BODY POSITIONING

Body and limb positionings were variable both within and between early medieval cemeteries, and while supine, extended burial was the most common positioning, flexed and crouched burials were also relatively frequent (Brush 1993; Lucy 2000, 80; Mui 2018). This pattern of variability was reflected in the body and limb positionings of the individuals with physical impairment, and there was evidence for extended, supine burial along with right/left side flexed and crouched burial, and prone burial.

Prone burial

Two individuals with physical impairment were buried prone: Edix Hill 130 (unsexed 15–16-year-old with nonspecific infection/inflammation or osteomyelitis of the right pelvis) and Norton East Mill 91 (adult male around 19 years of age with fracture and shortening of the right femur, Fig 9). Although it is tempting to interpret prone burial in a negative context (eg Hirst 1985, 36–7; Evison 1987, 134; Sherlock and Welch 1992, 26), there is a high degree of variability in terms of who was afforded prone burial within and between early medieval cemeteries (Reynolds 2009, 68–75).

At Norton East Mill, prone burial was afforded to 12.7% of the burial population: while it was not common, it certainly was not rare. The fact that extended burial (26.8%) was less frequent than flexed (42.3%) or crouched (31.0%) burial, indicates that body position in the Norton East Mill community was used differently than it was in other early medieval communities (Tab 5). It has been established that body positioning was used in early medieval contexts to reflect various aspects of self and social identity (Pader 1982; Lucy 1998; Williams-Ward 2017; Mui 2018), and the variety observed in body positioning within and between early medieval cemeteries suggests that different communities utilised body positioning to communicate different aspects of identity. Thus, due to the special nature of body orientation and position distribution at Norton East Mill, it is inappropriate to assign a

definite nonnormative or 'deviant' status to the prone burials (including NEM-91) for this particular community.

On the other hand, prone burial was nonnormative within the Edix Hill community (2.1%). Although the motivations for prone burial can only be speculated about, physical impairment and potential disability should not be dismissed as influencing factors. Edix Hill 130 was a 15–16-year-old unsexed adolescent, and although a specific diagnosis could not be confirmed, it is likely that they experienced similar symptoms to those associated with osteomyelitis of the pelvis, including pain in the hips and buttocks, weakness, fever, chills, difficulty walking, and abnormality of gait (Highland and LaMont 1983; Davidson et al 2003). It has been suggested that the noticeable increase in the number and type of grave goods of those aged around 18–20 years in early medieval communities indicates that these years corresponded with the transition from childhood to adulthood (Stoodley 2000). Perhaps functional disruptions around this period were considered particularly upsetting as the individual was restricted from 'becoming' an adult in the normative manner, and therefore it was necessary to distinguish their death in some nonnormative way.

EVIDENCE OF INCREASED EFFORT

Several of the individuals with physical impairment were afforded funerary treatment that would have required more time and effort on the part of those performing the burial. In most of these cases, this burial treatment had more positive connotations indicative of the social significance of the deceased, despite their visible or functional differences.

Butler's Field 65

Butler's Field 65 (5th- to 6th-century, 45+ year old male) had a traumatic facial injury resulting in bony asymmetry and probable soft tissue changes (eg scarring, deformation) which would have been evident in most of their social interactions (Fig 10). The possibility of sensory disruption should not be ruled out as restricted eye movement and double vision have been observed in modern cases of untreated zygomatic fractures (Rončević 1983), but these symptoms cannot be confirmed with

osteological analysis. Butler's Field 65 was buried with a spear (11.3%) and shield (5.0%), and with stone inclusions (8.1%), which consisted of an elaborate stone lining around most of the body (Fig 11A). While stones were naturally abundant, effort would have been required to find appropriately sized stones and place them carefully into position around the body. Butler's Field 65 was part of a consecutive multiple burial (2.7%). They were the original inhabitant of a grave which was enlarged at a later date to include two other individuals (BF-66A: unsexed 14–16-year-old; BF-66B: 25–30-year-old female) who were buried on top of Butler's Field 65 in a contemporaneous double burial.

At Butler's Field, two individuals without physical impairment (BF-18: 25–30-year-old female; BF-81A: 18–20-year-old female) were buried with elaborate jewellery in stone-lined tombs that were also covered with stones. These stones may have been included to protect the body (physically or spiritually) or to enhance the visual aesthetic of the grave. However, a less positive interpretation of this burial rite should also be considered. It is possible that the covering of the body had a superstitious element, and the stones were meant to prevent the deceased from returning to harm the living (Reynolds 2009, 194). In the case of Butler's Field 65, the stones were not placed on top of the body, but were used to line the grave, although this may still have been considered some form of spiritual containment. However, the inclusion of weaponry (see 'Weapon burial' below) indicates a higher status, while the enlargement of their grave supports the idea that burial in association with Butler's Field 65 was desirable, perhaps because they were of importance to the community. It is also interesting that their grave was oriented NW/SE (3.3% of 5th- to 6th-century burials) which may have further distinguished their grave from the remainder which were generally oriented SW-NE.

The physical and possible functional abnormalities experienced by this individual may have influenced or reinforced their apparent higher social standing. It is possible that the severe facial trauma observed in Butler's Field 65 was caused by a weapon, possibly during a military endeavour, although other situations which might give rise to traumatic injuries should not be ignored (eg small-scale interpersonal violence or accident). Perhaps the very visual reminder of this individual's military prowess and ability to survive violence was not perceived negatively, but rather as a reason to respect and glorify them. Could involvement

and survival of a battle bestow upon this individual the respect and status that is suggested by their funerary treatment, or were they born into it with the injury happening after they were already socially established? It is important to note that a similar injury to someone of a different sex or social class, or facial alterations due to another condition (eg leprosy) might have been perceived differently by the community.

Edix Hill 42B

Edix Hill 42B (17–25-year-old female) had leprosy, which has been confirmed by aDNA analysis (Pfrengle et al 2021). Osteological alterations consistent with rhinomaxillary syndrome (Fig 12) suggest that Edix Hill 42B experienced clogged nasal airways, excess production of nasal discharge, and soft tissue deformity (Andersen and Manchester 1992), while periostitis in the leg bones may have caused pain and tenderness (Resnick 2002) and potentially an abnormal gait. Despite their visible illness and possible functional restrictions, Edix Hill 42B was one of two individuals in this cemetery to be afforded a bed burial (1.5%) (Fig 11B). Bed burial was a rare 7th-century funerary rite primarily found in southern England, which was usually reserved for females who were also richly adorned with grave goods (Speake 1989; Malim and Hines 1998; Egging Dinwiddy and Stoodley 2016).

The inclusion of an entire bed within a grave would have required increased effort from those burying Edix Hill 42B. If the bed was built specifically for burial, materials (wooden planks, metal cleats, and eyelets) would need to be gathered and the bed constructed. If the bed was repurposed for burial, it had to be transported from its original location, permanently removing a functioning household item, which would have required time and resources to build, from the world of the living. Next, an appropriately sized grave had to be dug (which was more than one standard deviation longer than the site average), the bed lowered into the grave, the body placed upon the bed and properly positioned, and the grave goods appropriately arranged on top of and around the body. This process would have been elaborate and prolonged, suggesting invested involvement by the family and/or community in a ritual that clearly set the individual apart from the rest of the burial population.

It is possible that Edix Hill 42B was buried on a bed because they were ill, with the bed symbolising comfort and care in the afterlife that the survivors wished to provide or ensure. However, the other individual at Edix Hill buried on a bed (EH-183, 25–32-year-old female) did not have evidence of skeletal physical impairment. Additionally, Edix Hill 42B was buried with a very unusual array of grave goods (see ‘Curated and unique objects’ below) that hint at a special communal role important enough to reflect in death. Regardless of the specific motivations for the bed burial, the fact that those burying Edix Hill 42B invested so much effort in the funerary process suggests that they were an individual of importance in the community. The extent to which this related to their chronic, disfiguring disease is difficult to say.

Windmill Hill 54

Windmill Hill 54 (30–44-year-old male) had a fracture of the right forearm and subsequent osteomyelitis of the radius which probably restricted them functionally due to chronic pain, swelling, tenderness, and persistent drainage through fistulae (holes in the skin which help relieve the body of the pressure caused by pus) (Waldvogel et al 1970; Panteli and Giannoudis 2017). Windmill Hill 54 was buried in a neatly cut rectangular grave that was more than one standard deviation wider than the site average (Fig 11C), and was one of four individuals in the cemetery to be buried within a ring ditch with a probable barrow mound over the grave (4.7%). The construction of a barrow mound and resulting ring ditch would have required the involvement of more people and more time and effort on the part of those performing the burial. The barrow mound over Windmill Hill 54 would have been very visible and distinctive in the cemetery landscape, suggesting that whoever buried Windmill Hill 54 wanted them to remain prominent in the social memory and living landscape of the community. Previous researchers suggest that it is possible that Windmill Hill 54’s grave actually served as the initial focal burial at the cemetery, with the rest of the cemetery spreading out around it (Bishop and Mordan nd, 66). All of these factors suggest this individual was well respected and of elevated social importance within the community, despite their functional restrictions (see also ‘Weapon burial’ below).

Apple Down 60

Apple Down 60 (unsexed 16–17-year-old) had probable para- or quadriplegia (paralysis of the lower limbs and probably the upper limbs) which could have been caused by numerous diseases or conditions including, but not limited to, stroke, trauma, poliomyelitis, muscular dystrophy, and cerebral palsy (Weinstein et al 1952; Emery 2002; Jan 2006; Armour et al 2016). Paralysis of the limbs would have severely restricted normal participation in social and economic activities, and because Apple Down 60 probably could not walk independently, it is likely that they required a carer for the acquisition of food, water, and shelter, and to help maintain their personal hygiene, temperature, and personal security (see Bohling 2020, section 10.2.2.9).

Apple Down 60 was probably buried in a coffin (21.6%) as evidenced by the stone packing on the right side of the body (Fig 11D). The regular and tight stone packing observed would have required increased effort on the part of those performing the burial: they would have had to dig a grave large enough to accommodate both the coffined body and the stone packing, acquire the correct size stones, lower the coffin into the grave, then pack the stones neatly up against its sides.

In some graves at Apple Down, stone packing was used to line all four sides of the body (AD-4B: 45+ year old female; AD-175A: 35–40-year-old female who was buried with foetus AD-175B), or both long sides of the body (AD-69: 7–8-year-old child; AD-169 and AD-170B: both 45+ year old females). These individuals did not have evidence of skeletal impairment. Because more elaborate stone packing was afforded to adult females (a majority of whom were older) and a non-adult, all of whom *may* have been considered socially or physically vulnerable due to their age and/or sex, it is reasonable to suggest that stone packing around a body may have had protective symbolism at Apple Down, and was meant to keep the deceased safe in the afterlife. This suggests that those who buried Apple Down 60 cared for and respected this individual, and wanted to keep them safe even after death, despite their visual distinctiveness and the fact that they may have required external care and/or incurred a familial or communal cost.

From the various examples provided, it is clear that in many early medieval societies, having a physical impairment, which may have been perceived as a disability, did not exclude an individual from interacting in positive relationships or holding a socially significant role within their community. Of course, how an individual is treated in death by their friends, family, and community may not directly reflect how they were treated in life (Parker Pearson 1993). However, it is more likely that expending more time, effort, and person power on someone's burial indicates that the deceased was considered worthy and personally deserving of such treatment.

GRAVE GOODS

Early medieval burials were frequently accompanied by grave goods, including, but not limited to, dress fasteners and jewellery (eg brooches, beads, pendants, buckles, girdle items), weapons (eg spears, shields, swords), personal equipment (eg knives, toilet sets, tweezers), and grave furnishings (eg pots, buckets, boxes) (Stoodley 2000). While there was a strong, but not exclusive, correlation between weapon burials and males and between jewellery burials and females, a large portion of adults were buried with grave goods indicative of neither sex, and in rare cases females were accompanied by weapons, and males with jewellery (Lucy 1997; Stoodley 1999).

The grave good assemblages accompanying individuals with physical impairment were extremely variable. Almost equal percentages of individuals with and without impairment were buried with and without grave goods (Tab 6). No specific pattern within or between the sites could be detected; instead, individuals with physical impairment could be buried with weapons, jewellery, other grave goods, or with no grave goods at all (Lucy 1997), just as was observed in the remainder of the burial population.

Weapon burial

Eight male individuals with physical impairment (AD-152, BF-65, EH-146, EH-322A, SAH-111, WF-5, WMH-54, and WP-45; see Tab 4) were buried with items typical of an early medieval weapon burial (spears, shields, swords, axes, seaxes).

One female from Edix Hill (EH-42B) was buried with a modified sword that was interpreted as a weaving batten (Malim and Hines 1998, 255), and therefore their grave was not recorded as a weapon burial. Weapon burials were more frequent in the burials of male individuals *with* physical impairment than male individuals without physical impairment, but this pattern was determined not statistically significant with a Chi-squared test ($p=0.30$) (Tab 7).

In some instances, weapon burials were interpreted as 'warrior graves' and assumed to contain individuals who were warriors in life (as cited by Härke 1990), however this widespread, traditional assumption has largely been dispelled. Heinrich Härke (1990) examined weapon burials from 47 early medieval cemeteries and suggested that the weapon burial rite was not correlated with the intensity of warfare (ie more battles did not lead to an increase in weapon burials), that the weapons included in these 'warrior graves' were not always typical of a truly functional kit that would have been used in battle, that probable participation in battle (ie evidence of battle trauma) did not necessitate burial with weapons, and that burial with weapons was correlated with increased burial wealth and labour investment in the burial. Therefore, while it is certainly possible that an individual buried with weapons was a warrior in life, this is not the only explanation for the inclusion of weaponry.

Härke's (1990) use of osteological data (stature, non-metric traits) to differentiate between Germanic immigrants and native Britons has been questioned due to an over-exaggeration of stature differences and inappropriate use of non-metric traits to create ethnic categories (see Lucy 2000, 74; Tyrrel 2000). Instead, interpretations that consider the agency and motivations of those performing the burial and the symbolic and mnemonic functionalities of weaponry are more applicable (eg Williams 2006, 55–62; Brunning 2017; 2019; Sayer et al 2019). Weapons may have functioned as heirlooms with their own biographies, carrying with them the memories of past owners, and there is evidence that some weapons, specifically swords, may have taken on anthropomorphic qualities and served as an extension of their owner's identity or personhood (Malafouris 2008; Brunning 2017; 2019, 158; Sayer et al 2019). Perhaps there was actually more incentive to include weapons in the burials of those individuals who were *not* warriors to construct a desired post-mortem identity which might not have been attainable or available in life (Brunning 2013, 31–2). No single interpretation is necessarily correct, and it is likely

that the motivations behind weapon burials varied within and between communities, and were dependent on personal and community specific beliefs and the lifeway contexts of the deceased and their survivors (Sayer 2020, 191–2).

The current results support previous research that has recognised the importance of symbolic and personal motivations behind weapon burials. Weapons were still buried with many individuals who may have had physical impairment to the extent that participation as a warrior was probably not possible. It is evident that physical impairment and/or disability did not exclude an individual from occupying a social, familial, political, or economic position that warranted their association in death with a symbolically charged weapon.

Curated and unique objects

Edix Hill 42B

In addition to being afforded a rare bed burial (see ‘Evidence of increased effort’ above), Edix Hill 42B (17–25-year-old female with leprosy, Figs 11A, 12) was buried with various unusual grave goods (Tab 4) including a key, weaving batten — a trimmed down sword with a modified tip (Malim and Hines 1998, 255), spindle whorl, sea urchin fossil, and sheep astragalus (foot bone). There are several other examples of early medieval female burials with similarly ‘unusual’ grave goods that were often contained within a bag or box (Meaney 1981, 249–50; Geake 2003). These types of grave good assemblages were variable, but could include Roman coins, animal teeth (or other objects of animal substance), broken glass, cowrie shells, linked bronze/iron rings, discs of various materials, miniature bucket pendants, and more (Meaney 1981, 249–50; Dickinson 1999; Geake 2003). Audrey Meaney (1981, 249–55) ascribes amuletic function to these objects and proposes that females associated with these unusual grave goods might have been ‘cunning’ women who were involved in divination or healing activities within their community. This idea is echoed by Tania Dickinson (1999) who argues that these peculiar grave goods may have had spiritual functions that reflected the special role of their owner, which might have involved magical powers, healing, or protection. Helen Geake (2003) notes that because these grave good assemblages were so different from the normative assemblages observed, we must interpret these females as being

decidedly 'different'. Geake (2003, 264) also proposes that because they received peculiar burial treatment and were buried with unusual objects, perhaps these females were 'death-midwives' who were responsible for providing the appropriate funerary ritual for deceased community members.

In the case of Edix Hill 42B, it seems likely that the sea urchin fossil and sheep astragalus had amuletic functions, while the weaving batten might have been symbolic of protection. Although the weaving batten could have been reflective of an economic role usually associated with women such as cloth-making (Crawford 2022, 76), the fact that a once functional sword was removed from circulation to be associated with this female in death (and perhaps in life) has more ritualistic undertones. Despite their illness and visible differences, could Edix Hill 42B have had some sort of spiritual or religious role in the protection of their family or the community as suggested by previous researchers? An individual who was considered capable of spiritually guarding the community would certainly have been an important social figure, which might also explain why Edix Hill 42B was buried on a funerary bed. Although we can only speculate about the special role or occupation of Edix Hill 42B, the decidedly different and amuletic nature of their grave good assemblage suggests that they possessed a socially important status or identity within their community despite any potential visual differences or functional impairments.

Watchfield 312 and Windmill Hill 71

Watchfield 312 (20–25-year-old female with traumatic injury to the right elbow) was buried with a pierced Roman coin near their neck. Although brooches were commonly found at Watchfield (27.9%), this individual was buried with two, both of which showed evidence of repair in Antiquity. Similarly, Windmill Hill 71 (18–29-year-old female with an atrophied right forearm indicative of an underlying weakness) was buried with a worn-down Roman coin that had been altered to function as a necklace pendant.

Roger White (1988, 60) proposes that some of the Roman objects sometimes included in early medieval burials might represent heirlooms passed on from one generation to the next, carrying with them the 'acquired status' of those who had

previously owned them. Because these Roman coins tended to be pierced for reuse as pendants or kept in bags, they may have had 'amuletic' properties (White 1988, 101), a view shared by Meaney (1981, 220). Hella Eckhardt and Howard Williams (2003) argue that some re-used Roman objects would have lacked a known biography, and their mysterious connections with both the unknown past and the location of their discovery (eg hoard, abandoned settlement) may have imbued these objects with a spiritual, magical aura.

The piercing of the coins (WF-312, WMH-71) and repair of the two brooches (WF-312) suggests that these objects were personally valuable to the individuals who owned them, as they were worth either repairing or repurposing. While the wearing down of the coin buried with Windmill Hill 71 may have occurred during the coin's use as currency, it is also possible that this object was an important 'trinket' for an early medieval person who physically interacted with it consistently enough to wear down the metal. The pierced coins and repaired brooches may have acquired personally or socially meaningful object biographies through their associations with specific people and activities (Gosden and Marshall 1999; Devlin 2007). Therefore, the removal of such mnemonic objects from circulation in daily life for the permanent inclusion in these graves has undertones of a positive relationship between the deceased and those who buried them, despite their movement limitations or altered participation.

St Anne's Hill 481

Along with being buried away from the main burial concentration with nonnormative body positioning (see 'Burial location'), St Anne's Hill 481 (adult male with probable leprosy) was also buried with a rare 4th- to 5th-century AD late-Roman period copper intaglio, engraved with a peacock and dot pattern, that would have been part of a bezel finger ring (Fig 13). It seems likely that people from St Anne's Hill would have been aware that such an object was ancient (or at least special if they did not know when it was made), as the stylistic aspects and imagery used were distinctive from what was commonly found in early medieval objects. It is possible that this bezel ring had religious or magical qualities (Meaney 1981, 174; White 1988, 111), or that it held personal significance to the interred because it had been in

their family for generations. With each new owner, the bezel ring would have acquired and modified its own biography based on who wore it, their actions in life, and their relationships to other individuals in the community or region (Gosden and Marshall 1999; Devlin 2007). Therefore, it seems likely that this ring was imbued with mnemonic, symbolic, and personal significance, and its removal from circulation as a curated object for burial suggests that those burying this individual wished to honour their personal connection to the object.

As discussed above, St Anne's Hill 481's burial away from the main burial concentration may have been motivated by perceived 'deviance' or otherness, potentially influenced by their visible illness. It is therefore noteworthy that, although it was considered appropriate to separate this burial from the rest of the community in death, the emotional connections between the deceased and those performing the burial were still expressed with the inclusion of a personally significant object.

CONCLUSIONS

In general, throughout the early medieval period, there were no obvious, universal attempts by those burying individuals with physical impairment or potential disability to differentiate them in death. Of course, these individuals' experiences would have varied both functionally and socially and would have been dependent on the way in which their self or social identities intersected with their physical impairment or disability. However, it is notable that the funerary treatment observed does not indicate pervasive negative opinions towards individuals who looked, moved, or behaved differently. Instead, individuals with physical impairment and potential disability could be afforded normative or nonnormative burial treatment, which could have positive (increased effort, socially significant grave goods) or *possibly* negative connotations (prone burial, burial at a distance from the cemetery). A trend involving the spatial association between individuals with potential disability, possibly pregnant women, and nonadults was identified at multiple cemeteries. In some communities, the liminal social spaces occupied by these groups of people (in between health and sickness, birth and death, belonging and not belonging) might have afforded them a perceived social or physical vulnerability that required physical association in death, perhaps as a protective act. No strong patterns relating to type

of physical impairment (congenital, acquired, traumatic, etc) were observed, emphasising that both the type of disability and the experiences of each individual were not homogenous; rather physical impairment must be considered at an individual level even within a population scale study.

The variability of the funerary treatment of individuals with physical impairment and potential disability in the early medieval period highlights the fact that attitudes about what constituted a disability probably differed between communities. It is well-known that mortuary treatment in the early medieval period varied widely within and between communities, indicating disparate understandings of death. As identified through funerary treatment, different people and communities had diverse opinions about many things including the significance of specific funerary rites, which factors of identity were most important to reflect in death, and who should be respected or considered 'deviant' and why. It is therefore not unexpected that these same communities understood physical impairment and disability in somewhat different ways, and it is important that people who looked, moved, or behaved differently were not necessarily excluded from the social statuses, identities, and occupations that were available to people who did not experience (osteologically recognisable) physical impairment or disability.

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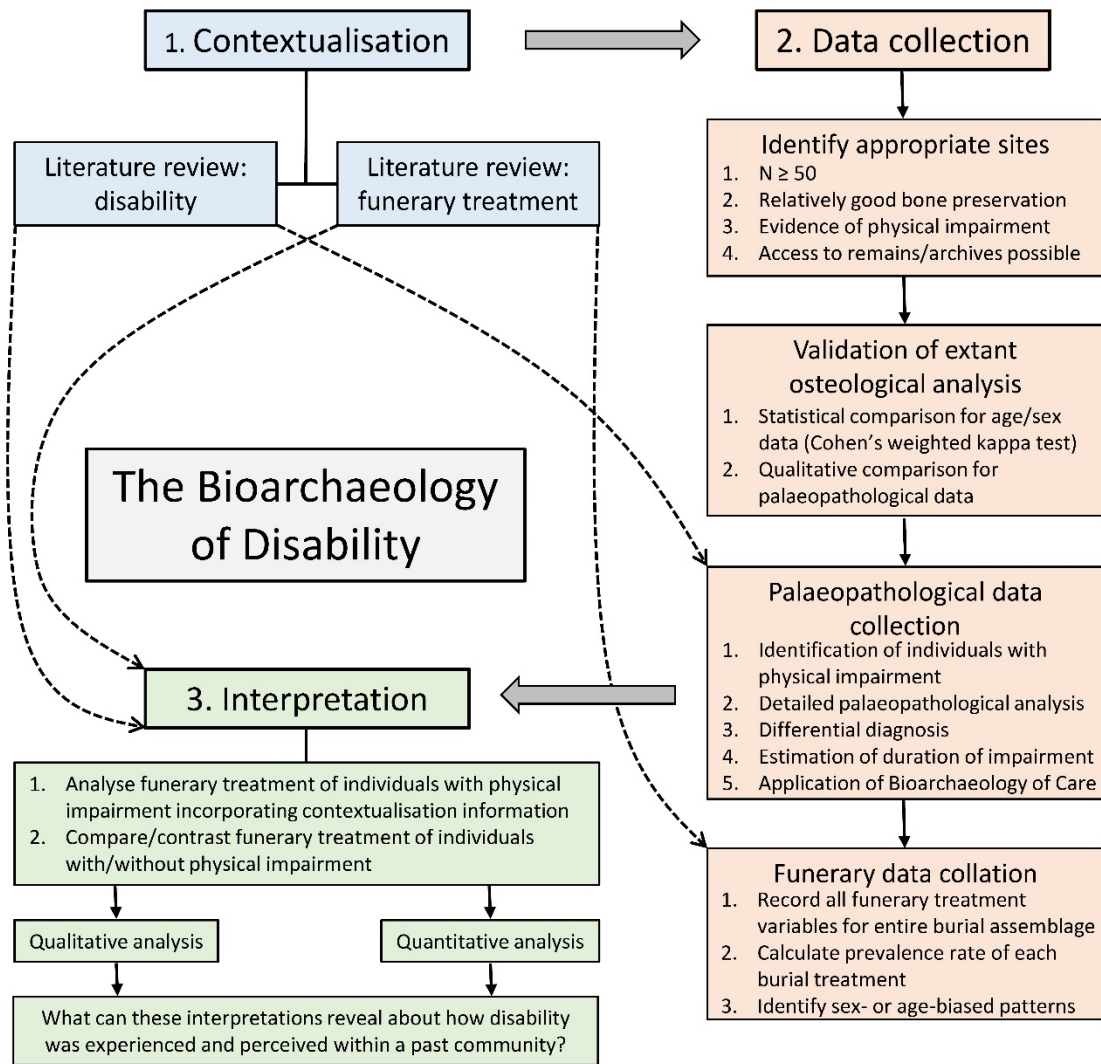


FIG 1
Flowchart outlining the three phases of the bioarchaeological approach used in this research.

Image by S Bohling.

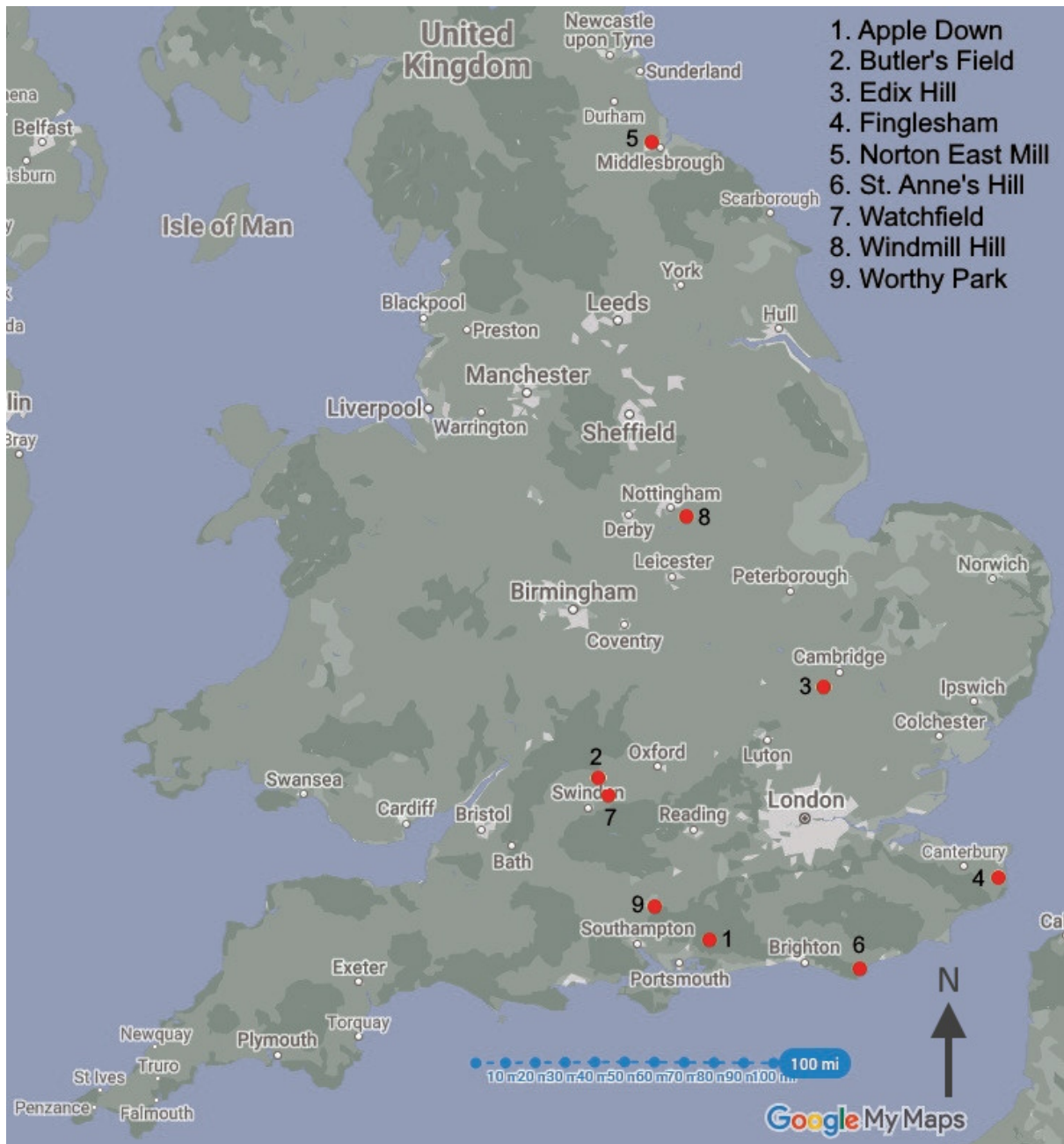


FIG 2

Map identifying the locations of the nine early medieval cemeteries included in this research.

Source: Google My Maps [online] Base map: Light Landmass; Map data © 2022 GeoBasis-DE/BKG (© 2009), Google.



FIG 3

Butler's Field 6.

Pseudarthroses on the posterior surfaces of the right and left scapulae of BF-6 as a result of bilateral posterior dislocation of both shoulders.

Photograph by S Bohling with permission of the Corinium Museum.

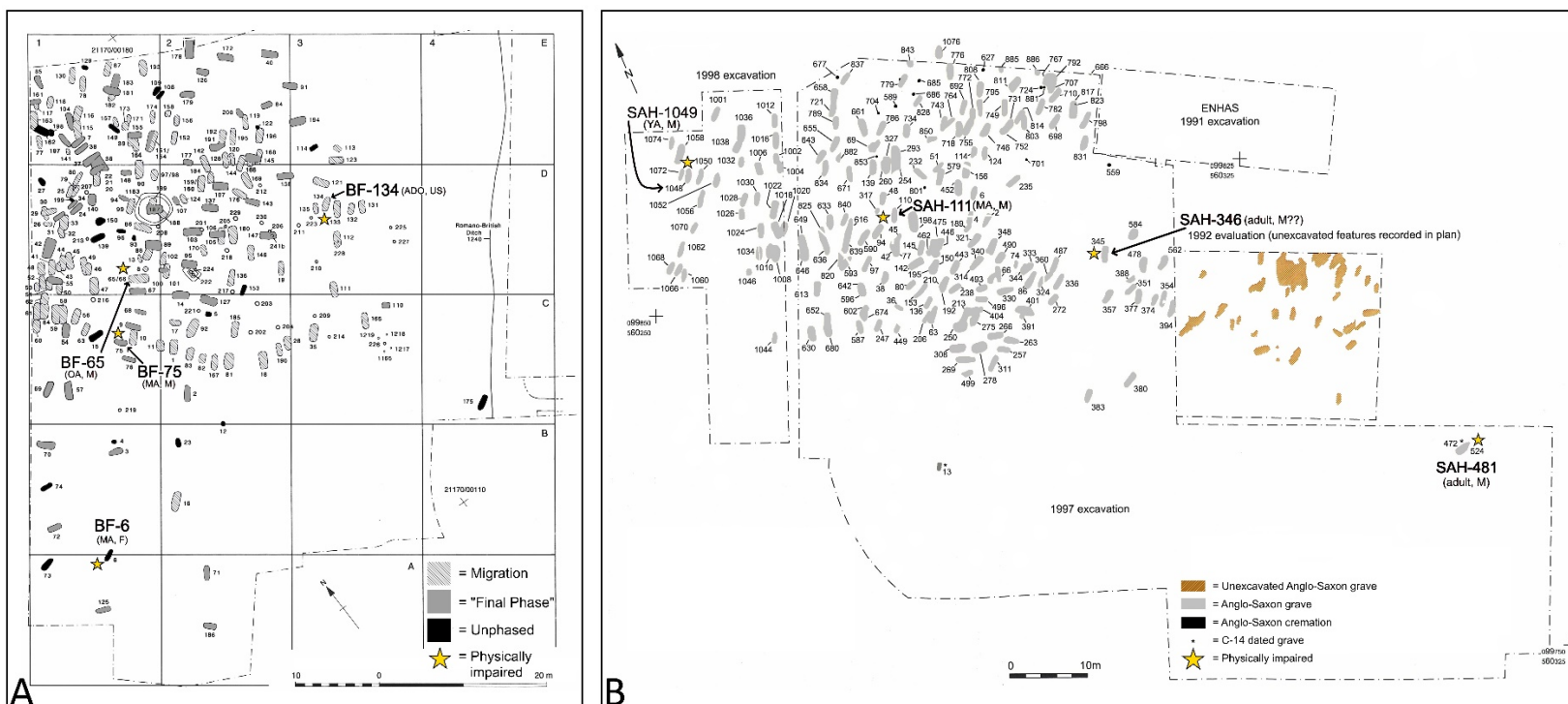


FIG 4

Maps to illustrate the burial locations of individuals with physical impairment.

(A) Butler's Field cemetery. Note that BF-6 is at a considerable distance from the main burial concentration. (B) St Anne's Hill

cemetery. Note that SAH-481 is away from the main burial concentration. *Image A reproduced from Boyle et al 2011, fig 6.4, and modified by lead author, © Oxford Archaeology. Image B reproduced from Doherty and Greatorex 2016, fig 3.1, and modified by lead author, included with permission of UCL Archaeology South-East, © UCL Archaeology South-East.*



SAH-481
Grave 472

FIG 5

St Anne's Hill 481.

Grave drawing of SAH-481 demonstrating nonnormative leg positioning. Not drawn to scale. *Image reproduced from Doherty and Greatorrex 2016, fig 4.20, and modified by lead author, included with permission of UCL Archaeology South-East, © UCL Archaeology South-East.*

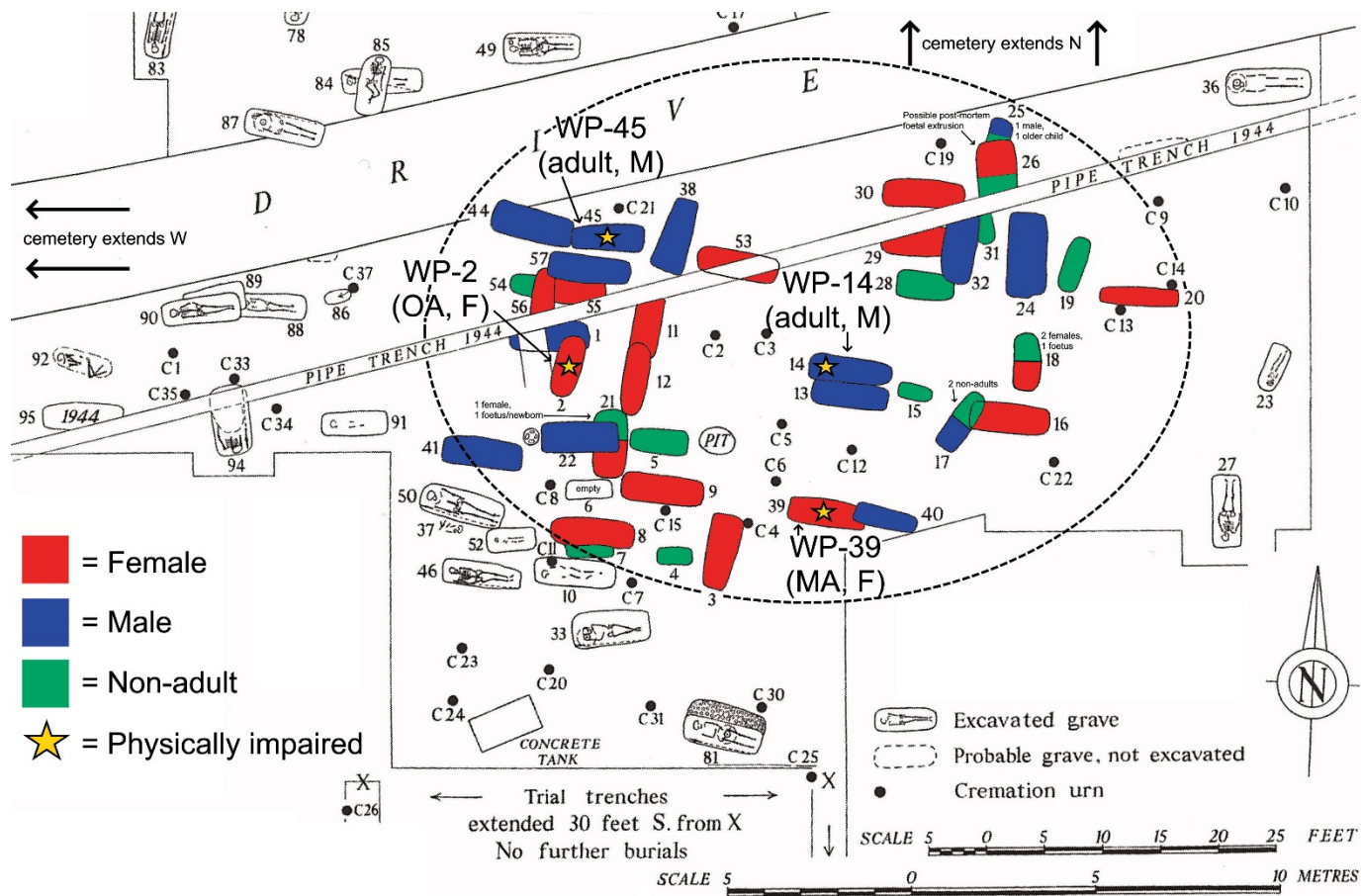


FIG 6

Worthy Park cemetery.

Detail of the cluster of individuals with physical impairment, also demonstrating the location of males, females, non-adults, and double burials containing females and non-adults. Image reproduced from Hawkes and Grainger, 2003, fig 1.5, and modified by lead author, © Oxford University School of Archaeology.

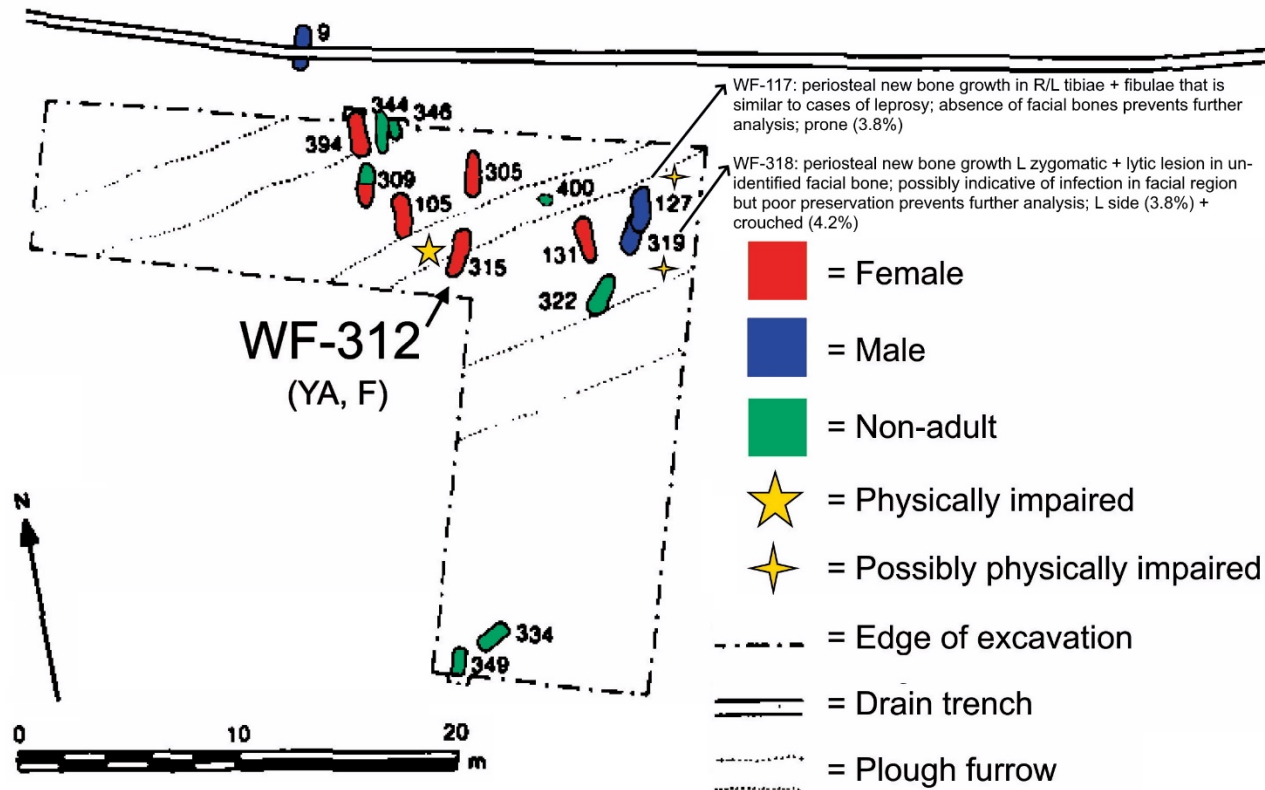


FIG 7

Detail of the south-western corner of the Watchfield cemetery.

Identifying the location of females, non-adults, and the individual with physical impairment. Note that the only two males in this area are considered *possibly* physically impaired (WF-117 in Grave 127; WF-318 in Grave 319), but fragmentation and poor preservation prevented further analysis (see Bohling 2020, section 7.8 for further details). NB: small, black numbers represent grave context numbers. *Image reproduced from Scull et al 1992, fig 25, drawn by C Scull and modified by lead author, © Royal Archaeological Institute.*

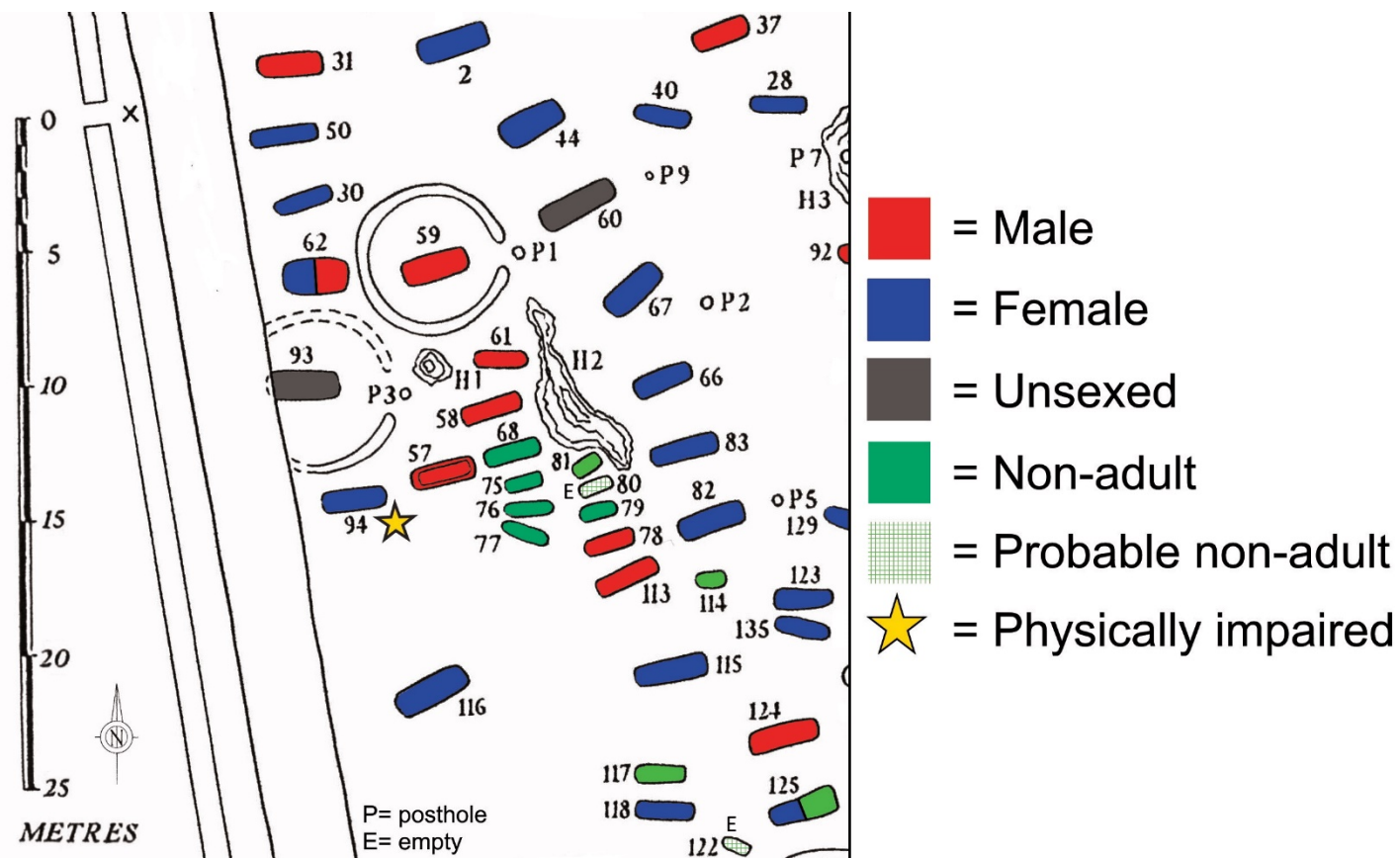


FIG 8

Detail of area surrounding FS-94 in the Finglesham cemetery.

Image reproduced from Hawkes and Grainger 2006, 29, fig 1.3, and modified by lead author, © Oxford University School of Archaeology.



FIG 9

Norton East Mill 91.

Fracture and consequent shortening of the right femur of NEM-91 (in comparison to left) which probably resulted in an abnormal gait. *Photograph by S Bohling with permission of Tees Archaeology.*



FIG 10

Butler's Field 65.

Well-healed trauma to the right side of the viscerocranium of BF-65 resulting in asymmetrical eye orbits and possible soft tissue abnormalities that would have been noticeable in many social interactions. Scale in centimetres. *Photograph by S Bohling with permission of the Corinium Museum.*

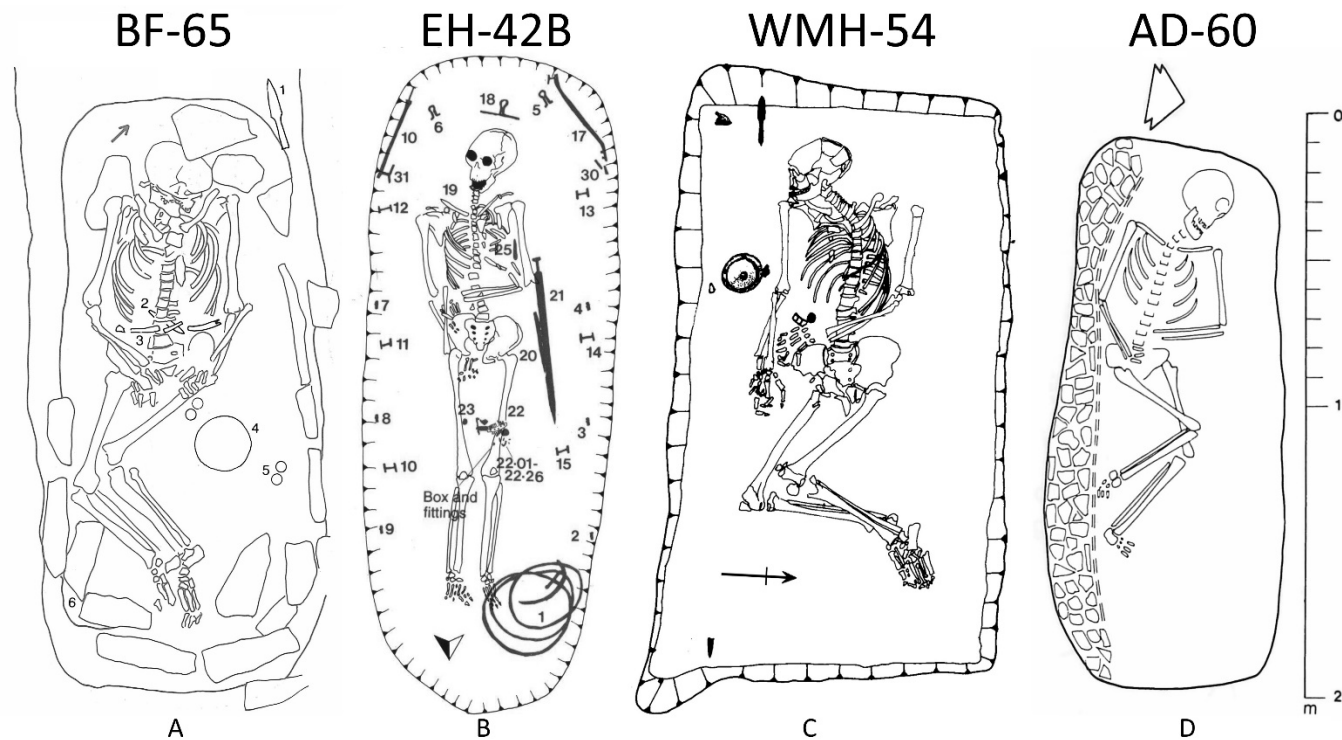


FIG 11

In situ grave drawings for individuals with evidence of increased burial effort.

(A) BF-65, shown at 1:20 scale; (B) EH-42B, shown at 1:20 scale; (C) WMH-54, shown at 1:20 scale; (D) AD-60. Images reproduced from: (A) Boyle et al 1998, fig 5.12, © Oxford Archaeology. (B) Malim and Hines 1998, fig 3.71, reprinted with permission of the authors, © Council for British Archaeology. (C) Drawing by Mark Bennet in Bishop and Mordan no date, 69, fig 14, © Nottinghamshire County Council. (D) Down and Welch 1990, fig 2.54, © Chichester District Council. All rights reserved.



FIG 12

Edix Hill 42B

Bilateral rounding of the nasal aperture margins and resorption of the nasal spine of EH-42B indicative of rhinomaxillary syndrome which would have caused soft tissue abnormalities. Scale in centimetres. *Photograph by S Bohling with permission of Cambridgeshire County Council.*

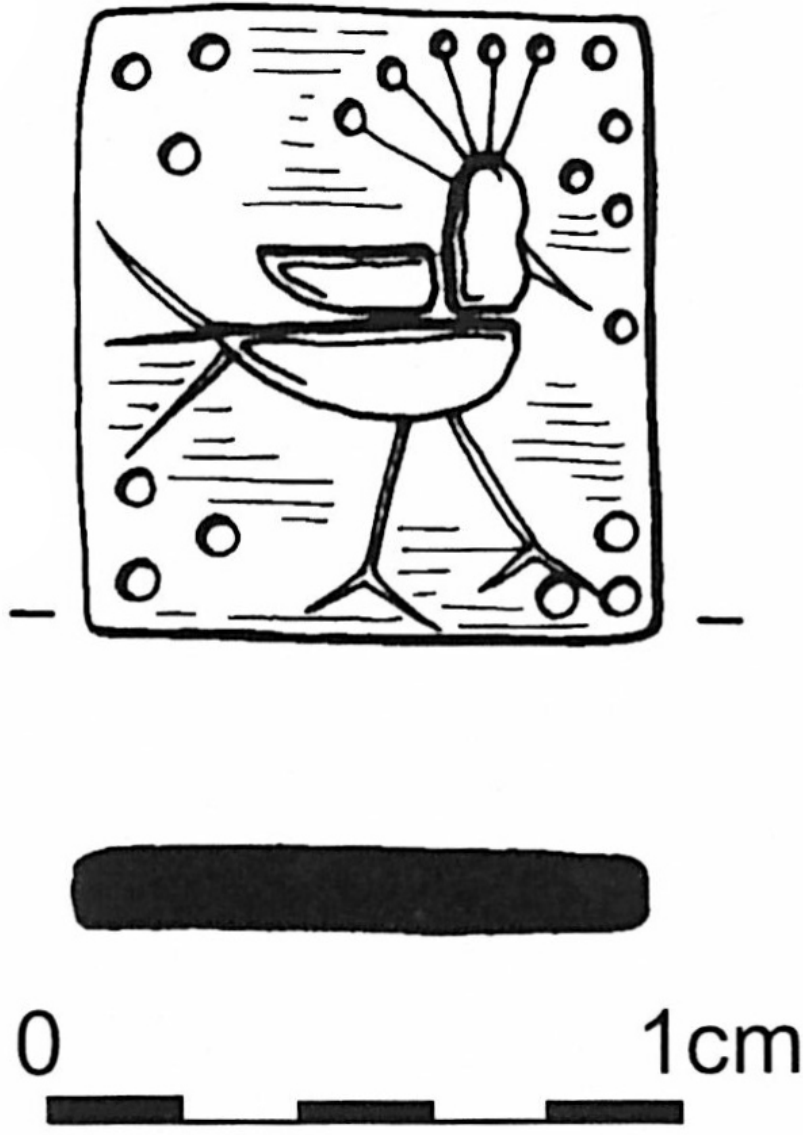


FIG 13

Late-Roman copper intaglio for a bezel ring buried with St Anne's Hill 481.

Image reproduced from Doherty and Greatorex 2016, fig 4.20, included with permission of UCL Archaeology South-East, © UCL Archaeology South-East.

TABLE 1

Summary of some of the physical and personal factors that can affect an individual's experience of life with physical impairment or disability. *Source: Roush 2017, with additions by current authors.*

Influencing factor	Description
Disability features	
Time of onset	<ul style="list-style-type: none"> • In general, individuals with congenital conditions cope better with their resultant disabilities than those with acquired conditions (Fresher-Samways et al 2003) • Individuals with congenital conditions are accustomed to differences from birth; their way of life is normative to them • An individual who acquires a disability may compare their old and new qualities of life and perceive life with a disability as a loss of normal function or status
Type of onset	<ul style="list-style-type: none"> • Rapid: life adjustments are made and stay relatively stable • Gradual: time to prepare for changing lifestyle, but continual accommodation will be required and re-adjustments might be necessary if impairment worsens
Visibility	<ul style="list-style-type: none"> • A visible disability is obvious to the community and they will be aware of the individual's abilities • A non-visible disability may not be visually distinctive and the extent of their abilities may not be clear to the community • In some communities, there may also be social consequences that accompany a visually distinctive impairment; could be influenced by bodily location of impairment (eg facial vs lower limb abnormality)
Individual differences	
Occupation	<ul style="list-style-type: none"> • An occupation can provide financial security, social interactions, and an element of identity

	<ul style="list-style-type: none"> • Disability might prevent an individual from partaking in a specific occupation, or an acquired disability might disrupt an individual's ability to continue partaking in an occupation to which they are accustomed • For someone who was required to participate in an active, manual occupation in order to provide for their family/community, a fractured leg which resulted in painful, abnormal, and restricted locomotion may have been more disabling than for someone with a sedentary occupation
Gender, sex, age	<ul style="list-style-type: none"> • Females and males may respond differently to the same disability • Reaction to a disability will also differ depending on age (eg restricted ambulation in a young adult might be more disabling than in an older adult who is possibly expected to have limited locomotion due to their age) • Congenital or acquired conditions may affect aspects of an individual's gendered or age-related identity (eg participation in certain activities, social concepts of beauty, femininity, masculinity) • Gender/age roles (if there were any) and gender- or age-based identities will affect an individual's experience of disability • Certain disabilities may impact or prevent activities or behaviours expected for certain genders/sexes or age groups, potentially minimising a person's association with that role/identity or influencing their adoption of a non-normative or less expected role/identity
Financial circumstances or social status	<ul style="list-style-type: none"> • State of finances will influence conception of disability and if a disability prevents financial income, physical impairment will be considered more disabling unless the individual does not need to acquire own financial assets (family/community support, hierarchical role, etc)

<p>Character or personality</p>	<ul style="list-style-type: none"> • Individual's personality (optimistic, pessimistic, extroverted, introverted, etc) can affect self-perception and reaction to disability • A person's character or personality may affect the mental health consequences associated with a disability • Personality can also affect interactions with members of society which will influence external perceptions
<p>Family/community support</p>	<ul style="list-style-type: none"> • How an individual perceives or reacts to their disability will be affected by their access to support from family or community members, eg direct support or accommodation of difference (Tilley 2012) • A family/community that is familiar with a certain disease or condition and is aware of the symptoms and the personal and/or communal consequences will react differently to disability than a family/community that is unfamiliar with that disease or condition

TABLE 2

Demographic summary of the nine early medieval cemeteries included in this research.

Site name	Location	Curation	N	Age [†]			Sex [‡]			N (impaired)	References
				NA	AD	UA	M	F	US		
Apple Down	West Sussex	Novium Museum	125	36 (28.8%)	89 (71.2%)	0 (0.0%)	41 (46.1%)	44 (49.4%)	4 (4.5%)	5	Down and Welch 1990
Butler's Field	Gloucestershire	Corinium Museum	223	86 (38.6%)	136 (61.0%)	1 (0.4%)	49 (36.0%)	84 (61.8%)	3 (2.2%)	4	Boyle et al 1998; 2011
Edix Hill	Cambridgeshire	Cambridgeshire County Council	148	44 (29.7%)	103 (69.6%)	1 (0.7%)	48 (46.6%)	40 (38.8%)	15 (14.6%)	5	Malim and Hines 1998
Finglesham	Kent	Duckworth Laboratory, Uni of Cambridge	223	46 (20.6%)	161 (72.2%)	16 (7.2%)	79 (49.1%)	73 (45.3%)	9 (5.6%)	1	Hawkes and Grainger 2006
Norton East Mill	County Durham	Tees Archaeology	118	35 (29.7%)	69 (58.5%)	14 (11.9%)	13 (18.8%)	28 (40.6%)	28 (40.6%)	1	Sherlock and Welch 1992
St Anne's Hill	East Sussex	Eastbourne Borough Council	192	42 (21.9%)	145 (75.5%)	5 (2.6%)	39 (26.9%)	25 (17.2%)	81 (55.9%)	4	Forsyth and Seaman 2015; Doherty and Greatorex 2016
Watchfield	Oxfordshire	Oxfordshire Museums Service	43	15 (34.9%)	27 (62.8%)	1 (2.3%)	12 (44.4%)	11 (40.7%)	4 (14.8%)	2	Scull et al 1992
Windmill Hill	Nottinghamshire	Nottingham City Museums and Galleries	85	24 (28.2%)	61 (71.8%)	0 (0.0%)	20 (32.8%)	22 (36.1%)	19 (31.1%)	6	Bishop and Mordan nd; Green 2016
Worthy Park	Hampshire	Hampshire Cultural Trust, Duckworth	104	29 (27.9%)	72 (69.2%)	3 (2.9%)	32 (44.4%)	38 (52.8%)	2 (2.8%)	5	Hawkes and Grainger 2003

Laboratory, Uni
of Cambridge

† Age categories: non-adult (NA), adult (AD), un-aged (UA)

‡ Sex categories: male (M), female (F), unsexed (US); only adults included in analysis

TABLE 3

Cohen's weighted κ values for sex and age comparison for each site.

Site	N (sex)	κ value (sex)	Agreement (sex)	N (age)	κ value (age)	Agreement (age)
Apple Down	21	0.77	Substantial	30	0.80	Substantial
Butler's Field	16	0.82	Almost perfect	26	0.81	Almost perfect
Edix Hill	22	0.84	Almost perfect	23	0.89	Almost perfect
Finglesham	20	0.71	Substantial	24	0.77	Substantial
Norton East Mill	19	0.29	Fair	22	0.78	Substantial
St Anne's Hill	22	0.77	Substantial	21	0.78	Substantial
Watchfield	19	0.78	Substantial	22	0.83	Almost perfect
Windmill Hill	24	0.74	Substantial	27	0.87	Almost perfect
Worthy Park	18	0.83	Almost perfect	25	0.77	Substantial

TABLE 4

Brief palaeopathological summaries and descriptions of funerary treatment for the individuals with physical impairment.

Individual	Age/sex [†]	Physical impairment [‡] and possible diagnoses	Notable funerary treatment	Grave goods
Apple Down				
AD-7B	MA, F	Ankylosis of L3 and L4 via reactive bone formation and four cloacae within the bone formation; as a result of TB or vertebral osteomyelitis	Normative	None
AD-39	YA, M	Well-healed, mis-aligned fracture of proximal R femur as a result of traumatic injury	Normative	None
AD-60	ADO, US	Gracile, short long bones (more marked in lower limbs); increased FNAs; length of L tibia provides age estimate of 10–11 years (extreme stunting)→ para/quadruplegia with various possible causes: neuromuscular disease, poliomyelitis, cerebral palsy, stroke, spinal tumour, etc; may have required long-term external care to ensure survival — see Bohling 2020, section 10.2	L side (7.8%); flexed (16.8%); legs bent L (10.8%); stone packing (12.0%) indicative of coffin (21.6%)	None
AD-111	OA, F?	Osteophytic (bony) lipping of R femoral head resulting in medial rotation of femur; consistent with OA that has altered joint anatomy enough to potentially alter gait	R side (10.3%); flexed (16.8%); S margin of cemetery	Pottery rim (3.2%)
AD-152	YA, M	Diffuse porous and smooth PNB throughout appendicular skeleton; destruction of central/L frontal bone (some lytic, some taphonomic); alterations possibly due to treponemal disease? HOA?	Normative	Knife (40.8%) Spear (12.8%) Shield (2.4%)

Butler's Field				
BF-6	MA, F	Bilateral pseudarthroses on posterior surfaces of both scapulae due to posterior subspinous glenohumeral joint dislocation	Unphased individual; R leg bent, L leg straight (3.7%); narrow grave; buried at a distance from main burial concentration	None
BF-65	OA, M	Well-healed trauma to R frontal/zygomatic with displacement causing anteroposterior shortening of R side of face with asymmetrical orbits	5th- to 6th-century individual ('Migration phase'); NW/SE orientation (3.3% of 5th- to 6th-century individuals); stone lining (8.1%); multiple consecutive burial (2.7%); grave enlarged to include two further individuals	Buckle (18.1%) Knife (33.0%) Spear (11.3%) Shield (5.0%)
BF-75	MA, M	Fusion and kyphosis of T11–L2 with smoothed out lytic lesions on T6-T10 and large, smoothed out cavity between L1 and L2; consistent with TB	7th- to early 8th-century individual ('Final Phase'); skull propped up against side of grave (0.7%); directly in line with (and oppositely oriented to) burials forming clear SW margin of 5th- to 6th-century cemetery	Knife (33.0%)
BF-134	ADO, US	Distal and posterior displacement of L proximal humeral epiphysis and shortening of L humerus; angulation of L radial head causing lateral angulation of L forearm; deformation of R radial head and swelling of proximal shaft causing lateral angulation of R forearm; alterations as a result of traumatic injuries? multiple epiphyseal dysplasia?	5th- to 6th-century individual ('Migration phase'); buried in row of similarly oriented rows near E margin of cemetery	Brooch (21.3%) Pin (20.8%) Bronze balance pan (0.5%)
Edix Hill				
EH-42B	YA, F	Rounding of nasal aperture margins, resorption of nasal spine, and porosity of interior nasal aperture; bilateral tibial periostitis; alterations	Bed burial (1.5%) including wooden planks, metal cleats and eyelets; long grave; vertical sequential multiple burial (8.1%)	Unique grave goods → see below*

		indicative of leprosy (confirmed with aDNA analysis)	with incomplete remains of two further individuals overlying grave	
EH-130	ADO, US	Diffuse, irregular porous PNB across R ilium, ischium, and pubis indicative of non-specific infection/inflammation? osteomyelitis?	Prone (2.1%)	Pot sherds (4.1%)
EH-146	MA, M	Irregularly shaped lytic lesions with sharp edges throughout axial skeleton as a result of metastatic carcinoma; may have required short term external care to ensure survival — see Bohling 2020, section 10.2	Normative; long/wide grave	Knife (39.2%) Buckle (30.4%) Spear (14.2%) Shield (10.8%)
EH-322A	Adult, M	Collapse of anterior L5 and ankylosis with S1 through smooth bony bridging; large oval cloacae within bony bridging; alterations consistent with TB	Normative; long grave	Buckle (26.4%) Spear (14.2%) Shield (10.8%) Vessel mounts (2.0%)
EH-440A	MA, F	Not analysed by lead author; deformation of R elbow joint surfaces resulting in fixed pronation of R forearm; potentially as a result of traumatic injury and secondary OA or traumatic injury and possible infection of elbow joint	Skull resting on neonate; possible marker post (7.4%); stone inclusions (6.8%) around pelvic area	Buckle (30.4%) Beads (26.4%) Nail (12.8%)
*Grave goods for EH-42B: knives x 2 (39.2%); bead (26.4%); rod (25.0%); comb (6.1%); silver necklace ring x 2 (4.7%); ovine astragalus (0.7%); spindle whorl (2.0%); key (0.7%); iron bucket hoops and handle from oakwood bucket (0.7%); iron weaving batten (modified sword, 0.7%); sea urchin fossil (0.7%); funerary bed (iron eyelets x 11, iron cleats x 6, iron headboard stays x 2)				
Finglesham				
FS-94	MA, M	Medial and posterior angulation of distal ends of L radius and ulna and smooth bony ankylosis through proximal third of shafts; consistent with traumatic fracture	Buried in coffin (28.6%); W margin of cemetery in area of females and non-adults; buried adjacent to another individual's ring ditch suggesting FS-94 was near a burial mound	None

Norton East Mill				
NEM-91	YA, M	Posterior and medial bowing of distal half of R femur and shortening of R femur consistent with traumatic fracture	Prone (12.7%); R leg straight, L leg bent (2.7%); R elbow projecting vertically out of grave; deep grave	None
St Anne's Hill				
SAH-111	MA, M	Amputation of distal ends of L ulna and radius with evidence of healing	Normative	Spear (9.9%) Knife (41.1%)
SAH-346	Adult, M??	Midshaft swelling of L femur; enlargement of L acetabulum and contour change of L femoral head; potentially indicative of osteomyelitis? osteoid osteoma? osteoblastoma? simple bone cyst? and primary or secondary OA of the hip	Adjacent to circular empty area of cemetery; probable non-normative leg position	None
SAH-481	Adult, M	Flattening/rounding of margins of nasal aperture and some resorption of anterior nasal spine; porous PNB on R/L MCs and distal resorption of 3 manual proximal phalanges and 1 distal phalanx; PNB on fragments of tibiae and fibulae; alterations consistent with probable leprosy	Buried at a distance from main burial concentration; L side (2.1%); 'other' body position (2.7%) between flexed and crouched; both legs bent L (2.7%) with the R leg bent severely up towards body; buried with stones on inside edges of grave (3.1%)	Copper intaglio (incised peacock decoration, late 4th–5th century) for a bezel (finger ring) (0.5%)
SAH-1049	YA, M??	Collapse and kyphosis of 3 TV consistent with TB	W margin of the cemetery in a group of similarly oriented burials	None
Watchfield				
WF-5	MA, M	Deformation of R humeral head; R humerus 76mm shorter than L; R ulna 15mm shorter than L; alterations consistent with traumatic fracture	Normative	Spear (9.5%) Buckle (23.8%) Knife (42.9%)

WF-312	YA, F	Deformation of proximal/distal joint surfaces of R elbow (not examined by lead author) as a result of traumatic injury and secondary OA of the elbow joint	SW margin of cemetery; buried near female interred with a foetus in area almost exclusively reserved for females and non-adults	Saucer brooch x 2 (28.6%) with evidence of repair Knife (42.9%) Pin (11.9%) Toilet pick and scraper (2.4%) Brush casing (2.4%) Pierced Roman coin (4.8%)
Windmill Hill				
WMH-10	MA, F??	Ankylosis and kyphosis of 6 or 7 TV due to TB	N/A	?Buckle (9.4%)
WMH-18	YA, F	Slender gracile upper and lower limb long bones and increased FNA probably due to para/quadruplegia (various possible causes: cerebral palsy, neuromuscular disease, poliomyelitis, stroke, spinal tumour, etc); may have required long term external care to ensure survival — see Bohling 2020, section 10.2	Stone inclusion (20.8%)→ possible stone lining?	?Pin (2.4%)
WMH-54	MA, M	Posterior angulation of distal R radius and non-union fracture of distal R ulna; cloaca in distal R radius; consistent with traumatic injury and osteomyelitis	Buried within ring ditch (4.7%) indicative of burial mound; neat, wide, rectangular grave; possibly initial focal burial of cemetery; only individual buried with weaponry	Spear (1.2%) Shield (1.2%) Tweezers (1.2%) Buckle (9.4%) Knife (15.3%) Ceramic cup (1.2%)
WMH-71	YA, F	Asymmetry in size of forearms with R radius and ulna considerably more slender than L; potentially indicative of paralysis?	Normative	Brooch x 3 (14.7%) Beads x 87 (16.5%) Coin pendant (1.2%)

				Coin (2.4%) Ceramic pot x 2 (9.4%)
WMH-75	OA, M??	Fusion of L radius and ulna in distal third of shaft via smooth, compact bone as a result of traumatic injury	Oriented E/W (8.2%); stone inclusion (20.8%)→ possible stone lining?	None
WMH-89	ADO, US	Bilateral, diffuse, woven bone (and some smoother, striated, compact bone) throughout skeleton involving mandible, pectoral girdles, ribs, upper/lower limbs, pelvic girdle, and hands/feet; consistent with HOA	NE margin of cemetery	Ceramic pot base (9.4%) Knife (15.3%) Unidentified bronze object
Worthy Park				
WP-2	OA, F	Anterior collapse of L3 and ankylosis of L3 and L4 probably as a result of traumatic injury	Both legs bent inward (1.3%); buried in grave that was too small; buried near other individuals with physical impairment	Pin (12.4%)
WP-14	Adult, M	Severe malalignment of R forearm with distal two thirds of radius and ulna angled medially; R forearm shorter than L; indicative of traumatic injury	Normative; buried near other individuals with physical impairment	Knife (54.6%)
WP-39	MA, F	Fusion and deformation of T1-T6 (not examined by lead author); consistent with TB	Normative; buried near other individuals with physical impairment	Pin (12.4%) Knife (54.6%) Tweezers suspended from ring (7.2%)
WP-45	YA, M	L upper limb long bones more slender than R probably as a result of paralysis; possible causes include stroke, brachial plexus palsy, monomelic amyotrophy (type of motor neuron disease), direct trauma, neuromuscular disease, etc	Normative; buried near other individuals with physical impairment	Spear (16.3%) Knife (54.6%)

WP-73	MA, M	Four oval perforating lesions with rounded edges on distal end of L MT5 caused by osteomyelitis (diabetes? gangrene?)	Normative	None
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† ADO (adolescent; 13–17 years); M/F (male/female); M?/F? (probable male/female); M??/F?? (possible male/female); MA (middle adult; c 26–49 years); OA (older adult; c 50+ years); US (unsexed); YA (younger adult; c 18–25 years)

‡ FNA (femoral neck angle); HOA (hypertrophic osteoarthropathy); L (left); L# (lumbar vertebra number); MC (metacarpal); MT (metatarsal); OA (osteoarthritis); PNB (periosteal new bone); R (right); S# (sacral vertebra number); T# (thoracic vertebra number); TB (tuberculosis); TV (thoracic vertebrae)

TABLE 5

Comparisons between the frequencies of prone, flexed, and crouched burials at the nine cemeteries analysed.

Cemetery	% prone	% flexed	% crouched
Apple Down	0.9	16.8	7.1
Butler's Field	1.6	32.6	4.3
Edix Hill	2.1	25.6	1.2
Finglesham	0.7	5.1	1.9
Norton East Mill	12.7	42.3	31.0
St Anne's Hill	0.0	10.9	1.4
Watchfield	3.8	12.5	4.2
Windmill Hill	3.6	31.0	17.2
Worthy Park	2.4	12.0	3.6

TABLE 6

Comparison of grave good presence between the individuals with and without physical impairment in the nine cemeteries analysed.

Cemetery	% prone	% flexed	% crouched
Apple Down	0.9	16.8	7.1
Butler's Field	1.6	32.6	4.3
Edix Hill	2.1	25.6	1.2
Finglesham	0.7	5.1	1.9
Norton East Mill	12.7	42.3	31.0
St Anne's Hill	0.0	10.9	1.4
Watchfield	3.8	12.5	4.2
Windmill Hill	3.6	31.0	17.2
Worthy Park	2.4	12.0	3.6

TABLE 7

Comparison of weapon inclusion between the adult male individuals with and without physical impairment in the nine cemeteries analysed.

	With physical impairment		Without physical impairment	
	N	%	N	%
Weapons present	8	50.0	117	37.0
Weapons absent	8	50.0	199	63.0
Total	16	100.0	316	100.0

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