7

Disability, gender and old age in the Industrial Revolution: cultural historical and osteoarchaeological perspectives

Sophie L. Newman and David M. Turner

Bringing together theoretical perspectives from disability studies, the history of ageing and osteoarchaeology, this chapter blends textual, cultural and skeletal evidence to examine the ways in which working bodies aged during Britain's industrial expansion of the late eighteenth and early nineteenth centuries. What can a combination of skeletal and documentary evidence tell us about experiences of ageing and living with bodily impairment in the early Industrial Revolution? What insights does the material body provide that are missing from written historical sources? And how can we enhance our understanding of archaeological material by examining cultural narratives of disability and ageing, to provide more nuanced analyses of how these bodies were perceived at the time?

The form, pattern and cause of osseous changes in skeletal remains provides, in Joanna R. Sofaer's words, a 'way of knowing' about the body that reveals the embodied experiences of people in the past (2006: 45; Craig-Atkins and Harvey, this volume: introduction). This is particularly important for understanding the lives of industrial workers or people living on the margins of society, who might otherwise leave few written records of their own, or whose life experiences might be mediated through visual representations or social commentary produced for polemical purposes (Byrnes and Muller, 2017; Southwell-Wright, 2013). Although it is important not to reduce individuals to medical case studies (Sofaer, 2006: 46), or to make assumptions about quality of life from pathological indicators alone (Metzler, 1999; Shuttleworth and Meekosha, 2017), skeletal evidence can inform of the progress of diseases or impairment, of the breaking and remaking of fractured bones, and of the changes in bodily capacity over time associated with ageing. According to Rebecca Gowland, the skeleton of an older person 'represents a life lived, containing skeletal and biographical echoes of a person's childhood as well as later phases of their life' (2017: 239). Using the cross-disciplinary, collaborative approach exemplified by several contributions collected in this volume, this chapter aims to demonstrate the ways in which the study of skeletal remains alongside – and in dialogue with – textual historical evidence can enrich our understanding of populations that have, until recently, been marginalised in studies of industrialisation.

After a brief discussion of the conceptual and methodological issues raised by exploring histories of ageing and disability, we present a detailed analysis of three skeletons recovered during archaeological excavations at Hazel Grove, Stockport and St Hilda's, South Shields to identify skeletal changes that might have signified physical limitations that were disabling or required care. However, embodied experiences during this time period were not simply determined by the presence or absence of pathological features – they occurred within a wider social context of meanings (Harvey, 2020). The chapter proceeds to explore the skeletal evidence in relation to social, cultural and political debates about the body and industrialisation, and what this meant for individualised experiences of debility. Our purpose is not just to *compare* skeletal and documentary evidence, but to explore how archaeological and social historical methodologies can be more fully integrated to understand ageing and disability in this period.

Approaching disability and old age in the Industrial Revolution

Older people are a relatively neglected demographic within the broader discipline of archaeology. Current skeletal age estimation techniques make it difficult to accurately identify older adults beyond what we now consider middle age (45–50 years) (Appleby, 2018). While there is a growing body of historical scholarship on old age, there have been few studies that explore ageing as an embodied experience, or which explore the relationship between old age and physical impairment (Ottaway, 2007; Pelling and Smith, 1991; Thane, 2000). Old age is not synonymous with disability, but ageing is associated with a multitude of degenerative biological changes leading to potentially debilitating conditions, such as osteoporosis, osteoarthritis and loss of hearing and/or sight. Biological ageing brings on physical changes such as greying and loss of hair, development of wrinkles, stooping of the posture, loss of teeth, weakening of immune response and susceptibility to falls. Injuries can take longer to heal, and periods of illness become difficult to overcome. Chronic pain and impairment can lead to increased frailty, a loss of independence, social isolation and disempowerment in later life (Appleby, 2018). Since impairments in older people are often seen as normal, and somewhat expected, they are much less likely to be framed as 'disability' in the cultural sense compared to impairments in children or working-age adults (Woodward, 2015). What constitutes ‘disability’ is closely connected to understandings of temporality, ageing and how a particular culture or society conceives of a normative life course (Ljuslinder *et al.*, 2020: 36). In modern Western societies, the construction of ‘normal’ bodies as able and predominantly youthful or middle-aged means that in younger people disabled bodies are considered ‘anomalous and extraordinary’, whereas ‘visibly marked aged bodies are typically considered so ordinary that they recede from view becoming invisible’ (Woodward, 2015: 33).

Ageing and disability are social and biological phenomena and understandings of both the ‘process’ of ageing and the ‘condition’ of disability are contextual and change over time (Appleby, 2018: 145; Woodward, 2015: 34). As Gowland points out, the meaning of disablement is not only culturally specific, but also dependent on a range of factors including the construction of particular disease states, the class, gender, age, religious and racial identity of the person concerned, expectations of that person’s performance of capabilities pertinent to their identity or stage of their life course, and social, cultural and familial factors influencing the provision of care (2017: 248). Indeed, as work in disability history has shown, the category of ‘disability’ as a status that entitles a person to particular services and statutory benefits, or pertaining to a person’s identity, is itself a relatively modern phenomenon and cannot easily be transposed onto people in the past (Cooter, 2003).

Older and ‘disabled’ people in the late eighteenth and early nineteenth centuries faced a multitude of adverse social factors, such as a lack of systematic welfare provision, and the reliance on spouses, family or the workhouse for care and support (Ottaway, 2007). The social and economic changes associated with industrialisation have been seen as contributing to increasing marginalisation both of working-age disabled people and of older people. It is argued that the shift from household to factory production, increasing standardisation of the hours of work in relation to an abstract able-bodied ideal, and mechanisation, eventually displaced slower and weaker workers from the labour force, leading to increasing neglect and institutionalisation (Gleeson, 1999; Kuskey, 2016; Oliver and Barnes, 2012: 52–73; Quadagno, 1982: 20). Yet, until recently these assumptions had not been tested by detailed historical or archaeological research. What is emerging from new scholarship on disability and the Industrial Revolution is a more complex picture, which shows that disability was a ubiquitous working-class experience in this period, that ‘disabled’ people were visible in industrial communities and that the notion of older or disabled people as economically unproductive citizens does not do justice to the diversity of experience (Rose, 2017; Turner and Blackie, 2018).

Aged and disabled bodies were culturally and politically significant during the eighteenth and nineteenth centuries. Fears of widespread worker injury or deformity, especially among younger sections of the workforce, were a major driver of campaigns for regulation of labour in factories and coalmines in the early nineteenth century. Furthermore, as we shall see, during the Industrial Revolution images of bodies becoming 'worn out' or prematurely aged became an important means of conceptualising and critiquing social and economic change. Rather than being marginal to the story of economic progress, older and disabled bodies were important means of understanding its broader implications. The onset of old age was not simply determined by reaching a particular chronological milestone, but by class, occupation and gender. In this context, the history of old age and the history of disability are inextricably linked, not simply because older people were more susceptible to reduced functionality or chronic conditions, but because disablement was itself conceptualised as a form of ageing in working-class communities.

Case studies

The chapter uses three skeletal case studies from Hazel Grove, Stockport and St Hilda's, South Shields, to examine how the bodily stresses imparted by industrialised society, and the processes of ageing, manifested themselves in individual skeletal biographies.

Skeleton 15 from Hazel Grove, Stockport was one of thirty-nine skeletons recovered during an archaeological excavation of a former Wesleyan Chapel in 2016 (Newman and Holst, 2016). The cemetery associated with the chapel was in use from 1794 to 1910 (Jessop and Beauchamp, 2015), and name plates recovered during the excavation are suggestive of the skeletons dating to the early to mid-nineteenth century (Newman and Holst, 2016). Prior to 1836, Hazel Grove was known as Bullock Smithy, and this rebranding may have been an attempt to overturn the poor reputation of the area (Jessop and Beauchamp, 2015: 16). Throughout the nineteenth century, Hazel Grove continued to grow, and inhabitants were also employed in a number of varying occupations, such as the expanding cotton and silk industries, brickworks, timber yards, a glue works, the hatting trade and nearby coal mines (Jessop and Beauchamp, 2015: 16). Based on the grave goods, coffin fittings and decorative name plates seen in the burials excavated at the former Wesleyan Chapel, it is likely that they are representative of a mix of individuals from working class and wealthier backgrounds (Newman and Holst, 2016).

Skeleton 235 and Skeleton 502 were two of 204 burials recovered during the excavation of the burial ground of St Hilda's Parish Church South Shields between 2006 and 2007 (Raynor *et al.*, 2011). While the cemetery had been in use since *c.*1402, the excavation area relates to the southern section of the burial ground and is split into three burial horizons that date to the eighteenth and nineteenth centuries (Raynor *et al.*, 2011). South Shields was a manufacturing and shipbuilding town that developed in parallel to North Shields across the River Tyne (Hodgson, 1903). The individuals of this population are said to have been representative of a working-class population, employed in local industries, such as the shipyards and port, gas works, salt-works, a glass factory, chemical works and in nearby collieries (Green, 2010; Raynor *et al.*, 2011).

While it has not been possible to identify the individuals concerned via preserved coffin plates and record linkage, the skeletal evidence alone poses questions about embodied experiences of disability, ageing and work in the context of the social and economic development of regions which, although occupationally diverse, were synonymous with key elements of industrial expansion: the cotton textile manufacturing area around Manchester, and the coalfield of North East England (Griffin, 2006; King and Timmins, 2001). A Bioarchaeology of Care approach will be taken for each case study, as proposed by Tilley and Schrenk (2017), in which the skeletal evidence is assessed for the presence of disability requiring care. Ultimately this will enable broader discourse relating to provision of care (or lack thereof) for all three individuals, and connect them to discussions surrounding the cultural intersections between ageing, disability and occupational identity in the eighteenth and nineteenth centuries.

Skeleton 15, Hazel Grove, Stockport

Skeleton 15 from Hazel Grove, Stockport was likely male, and aged between 36–45 years at death (Newman and Holst, 2016). As can be seen in Figure 7.1, the majority of their skeleton was preserved, allowing for the analysis of a suite of skeletal changes potentially indicative of debility experienced during life.

Their spine exhibited severe curvature in the thoracic (torso) region, likely a form of scoliosis termed kyphoscoliosis (see Figure 7.1b). Significant distortions to the shape of the rib cage were evident (see Figure 7.1c), and extensive joint changes and osteoarthritis were seen throughout the vertebral column, in some cases leading to the fusion of ribs to the vertebrae, and between vertebrae. The eleventh right rib (towards the bottom of the ribcage) had fractured at some point in their life, but had failed to heal, instead leaving

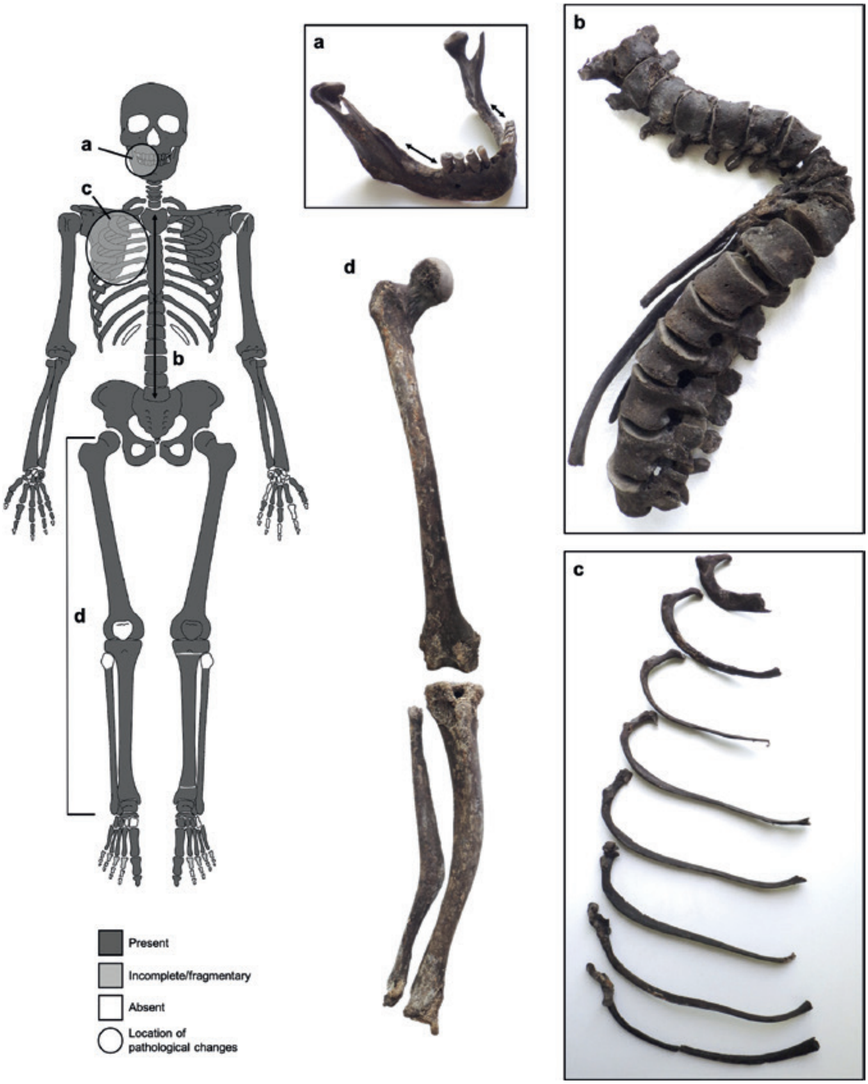

Figure 7.1 Skeletal elements present and pathological changes seen in Skeleton 15, Hazel Grove, Stockport. a) Antemortem tooth loss of the left and right lower molars of the mandible (arrows); b) thoracic and lumbar vertebrae of the spine, demonstrating kyphoscoliosis and fusion of the 9th–11th ribs on the right side; c) remaining right ribs (1st–8th) showing straightening of the shafts and degenerative changes to the heads (point of articulation with the vertebrae); d) bowing of the right femur, tibia and fibula.

a pseudoarthrosis (false joint) between the two sections. Skeleton 15 also demonstrated severe bowing of the right and left lower limbs (see Figure 7.1d). The femora had notable anterior (forward) curvatures, and the tibiae and fibulae were bowed laterally (outward).

The majority of cases of kyphoscoliosis in the modern day are classed as idiopathic, with no clear causative factors (Issac and Das, 2020). It may also result from congenital conditions and vertebral anomalies occurring during development, continuing to increase in severity throughout the growth period and even after skeletal maturity (McMaster and Singh, 1999; Zeng *et al.*, 2013: 372). Kyphoscoliosis can also develop secondary to other disease factors, such as degeneration of the spine due to age (for example, resulting from osteoporosis and/or osteoarthritis), or following trauma (Issac and Das, 2020). Tuberculosis was also prevalent during the eighteenth and nineteenth centuries, and in a small percentage of individuals destructive lesions on the vertebral bodies can lead to collapse and resultant deformity of the vertebral column (Roberts, 2012: 435). However, no other potential indicators of infectious processes like tuberculosis, such as evidence of inflammatory response on the visceral surfaces of the ribs or destructive lesions on the vertebrae, were present in Skeleton 15. In addition, while gross alterations to vertebral body morphology were evident in the regions of tightest curvature in the spinal column, these had more of a wedged and 'folded' appearance (see Figure 7.1b). When observed alongside the severely bowed lower limbs of this individual, this may be more consistent with an underlying vitamin D deficiency leading to deficient mineralisation and subsequent buckling of the vertebrae under the weight of the body (Brickley *et al.*, 2005).

Deficiencies in vitamin D result from insufficient skin exposure to ultraviolet radiation from sunlight and/or from dietary deficiency (Ives and Brickley, 2014). In the nineteenth century, vitamin D deficiency rickets was found to be particularly abundant in the industrial regions of London, Newcastle and Gateshead, Lancashire, Yorkshire, Cheshire, Derbyshire and Nottingham (Owen, 1889). Its high incidence among urban children is attributed to the thick coal smoke and fogs that diminished sunlight in the cities, rapid urbanisation leading to an abundance of dark and narrow alleyways, nutritionally deficient diets and working indoors (Hardy, 2003; Ives and Brickley, 2014; Roberts and Cox, 2003). Kyphosis and scoliosis of the spine can result from vitamin D deficiencies experienced during the growth period (rickets) and may be retained into adulthood along with bowing of the long bones as indicators of healed vitamin D deficiency rickets (Brickley and Ives, 2008; Holick, 2006; Pettifor, 2003). Such changes have also been associated with vitamin D deficiencies experienced following the cessation of growth (osteomalacia), with significant bending and buckling of weight bearing bones linked to insufficient mineralisation during remodelling. However, a large-scale study of vitamin D deficiency experienced in adulthood has revealed the rarity of such severe skeletal deformities as seen in Skeleton 15 in post-medieval archaeological assemblages (Ives and Brickley, 2014). They are instead seen more frequently in later nineteenth- and twentieth-century pathology museum collections, having been selected for retention as exceptional examples of pathological changes (Ives and Brickley, 2014). The extent of the skeletal changes seen in this individual are perhaps suggestive of severe and chronic episodes of vitamin D deficiency, potentially experienced both in childhood (rickets) and adulthood (Brickley *et al.*, 2005; Ives and Brickley, 2014).

A contemporaneous example of an adult male with severe kyphoscoliosis and lower limb bowing deformities was identified in the skeletal assemblage from St Bride's Church vaults, London (Conlogue *et al.*, 2017: 153). While it was suggested by Conlogue *et al.* (2017) that the changes seen in the bones of the lower limbs of this individual may be related to residual rickets, and exacerbated by the biomechanical implications of the changes seen in their spine, a suggested diagnosis of neurofibromatosis was given (2017: 159). This congenital condition can in some severe cases lead to skeletal abnormalities, including scoliosis and tibial dysplasia.

Whether the severe skeletal changes seen in Skeleton 15 arose due to a congenital condition, such as neurofibromatosis, or due to susceptibility to chronic and recurring vitamin D deficiencies imparted by their physical/social environments, or a combination of the two, this individual lived with them to a relatively advanced age (being approximately 36–45 years of age at the time of death). Spinal curvatures can lead to a hunched appearance and can result in back pain and neurological consequences from compression of the spinal cord, including paralysis (McMaster *et al.*, 1999; Zeng *et al.*, 2013: 372). An increased risk of respiratory failure (often as a result of susceptibility to pulmonary infection) has also been reported in patients with kyphoscoliosis, along with functional impairment, leading to limitations in day-to-day activity (Fuschillo *et al.*, 2015: 96; Zeng *et al.*, 2013: 372). Ability to perform activities such as the lifting and carrying of loads and mobility akin to climbing stairs may have been difficult, and they would have been susceptible to falls and injuries due to changes in gait and bodily imbalance (Conlogue *et al.*, 2017: 169; Issac and Das, 2020). However, as also seen in the individual from St Bride's, the long bones of Skeleton 15 were reasonably robust, and thus presented no evidence of atrophy from lack of use (Conlogue *et al.*, 2017: 158–9). While the presence of extensive degenerative changes in the spine of Skeleton 15, and the ununited rib fracture, are indicative of the additional bodily strains and risks of injury that can accompany cases of severe scoliosis, they too are suggestive of a degree of continued mobility.

It was suggested by Conlogue *et al.* (2017) that the skeletal changes and resultant restrictions on respiratory and cardiac function seen in the individual from St Bride's, and likely too in Skeleton 15, probably had some long-term implications for functionality (Conlogue *et al.*, 2017). However, the authors rightly state that commenting on specific activities associated with daily life that these individuals may have been able, or unable, to undertake is not feasible in the absence of further lines of evidence, and functionality too is dependent on support mechanisms available to them, personal motivation and the specific circumstances in which they lived (Conlogue *et al.*, 2017: 170).

Skeleton 235, St Hilda's Churchyard, South Shields

Skeleton 235 from St Hilda's Churchyard, South Shields, shows evidence of multiple injuries sustained during life, whether during one event, or recurrent episodes. As can be seen in Figure 7.2, only half of their skeleton was preserved for analysis, but they were likely a male individual aged 36+ years (using methods by: Brooks and Suchey, 1990; Bruzek, 2002; Buckberry and Chamberlain, 2002; Lovejoy *et al.*, 1985; Mays and Cox, 2000; Phenice, 1969). This individual was likely physically active during life, with mild degenerative changes starting to develop in the spine and in both hips and knees.

The glenoid fossa of their right scapula had undergone extensive remodelling leading to loss of the original joint surface, and formation of a pseudoarthrosis on its anterior (front facing) surface (see Figure 7.2a). The proximal end of the right humerus was also grossly altered, with the formation of a new articular surface on its posterior (back) surface (see Figure 7.2b). A large projection of bone had formed on the posterolateral surface (back and outer edge) of the right humerus, perhaps indicative of bone tissue formation following soft tissue damage (termed *myositis ossificans*). This may have been incurred during the original traumatic event, or in response to the unreduced dislocation.

The location of the new articular surfaces evident on the right scapula and humerus suggest that the head of the right humerus had slipped in front of the right scapula, consistent with an unreduced subcoracoid anterior shoulder dislocation. Due to the relatively shallow joint surface of the glenoid fossa, and the reliance on ligaments and musculature to maintain integrity, the highly mobile shoulder is one of the most commonly dislocated joints (Miles, 2000; White *et al.*, 2016: 146). Today, this most frequently occurs in young adult men engaging in riskier activities, such as contact sports, skiing and cycling, leading to high-energy falls onto an outstretched arm (White *et al.*, 2016: 146). The importance of swift treatment of dislocations was recognised in the nineteenth century, and techniques for reduction included pulling on the arm while holding a knee in the armpit of the patient

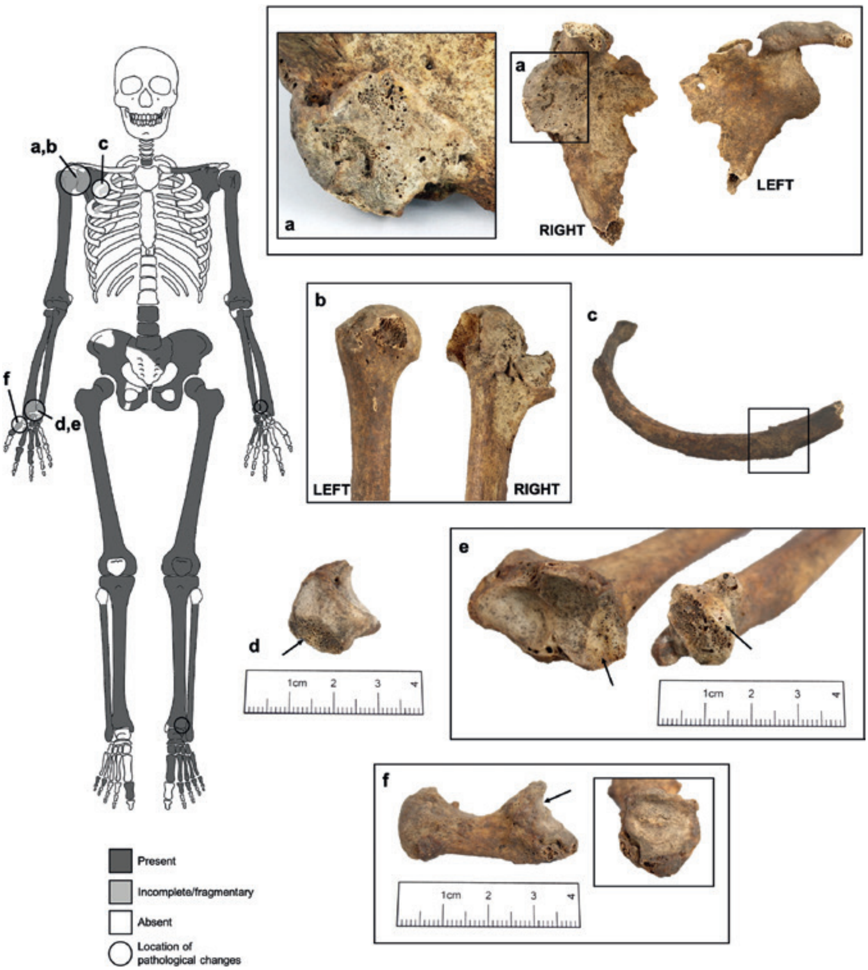

Figure 7.2 Skeletal elements present and pathological changes seen in Skeleton 235, St Hilda's Churchyard, South Shields. a) Anterior view of the left and right scapulae, highlighting evidence of dislocation of the right glenohumeral (shoulder) joint; b) posterior view of the left and right humeri, demonstrating extensive changes seen on the joint surface of the right proximal humerus; c) well-healed fracture seen on the midshaft of the right 3rd rib; d) evidence of possible trauma (arrow) on the right lunate; e) possibly associated osteoarthritic changes seen on the distal joint surfaces of the right radius and ulna, leading to eburnation (arrows); f) medial view (left image) of the right 1st metacarpal (associated with the thumb) showing a well-healed fracture of the proximal joint surface (arrow), and proximal view (right image) of the fractured joint surface of the right 1st metacarpal.

and then finer manipulation of the joint with the arm bent at the elbow, followed by placing the arm in a sling for a few weeks (Cooper, 1822; Miles, 2000). The more time that elapsed following the original injury, the more difficult it became to resolve it satisfactorily due to the fixation of the humerus in its new position and the infilling of the original articular surface (Bowlby, 1887: 189; Cooper, 1822: 1). In addition, modern clinical cases report that the mechanism of the anterior dislocation, whereby the humeral head externally rotates in the joint and slips forward under the force of the fall, can lead to fragmentation of the anterior rim of the glenoid fossa, resulting in a Bankart lesion (White *et al.*, 2016: 147). Continued movement of the humeral head against this Bankart lesion following an unreduced anterior shoulder dislocation could have led to formation of the pseudoarthrosis seen on the right scapula in Skeleton 235 (Walker, 2012: 120).

Skeleton 235 showed evidence of additional healed injuries. A healed fracture was seen on the midshaft of an upper right rib (see Figure 7.2c). Rib fractures may be associated with falls or blows to the torso (Roberts and Manchester, 2010), and the location of this isolated rib fracture in close proximity to the anterior dislocation of the right shoulder could suggest that this injury occurred during the same traumatic event. Also affecting the right upper limb, possible evidence of Kienböck's disease was seen in the right lunate (wrist bone that articulates with the radius), whereby a reduction of blood supply to the lunate following a compression fracture leads to osteonecrosis (see Figure 7.2d; Walker, 2012: 232). This condition is frequently associated with repetitive trauma to the wrist, and typically affects the dominant hand of those aged 20–40 years undertaking manual labour (Walker, 2012: 232). It can lead to pain and swelling, and the development of osteoarthritis (Walker, 2012: 232), such as the extensive secondary osteoarthritis seen at the right distal radioulnar joint in Skeleton 235 (see Figure 7.2e). Evidence of osteoarthritis was also seen in the distal radioulnar joint on the left side, but to a lesser extent. Dysfunction of the distal radioulnar joints can result from trauma, degenerative arthritis, inflammatory conditions such as rheumatoid arthritis, and developmental conditions such as Madelung's deformity (Weiss and Rodner, 2007). No other evidence for the two latter aetiologies were seen in Skeleton 235, so it is likely that the degenerative changes seen in the wrists related to the development of osteoarthritis due to lifestyle or occupational activities, or secondary osteoarthritis resulting from abnormal joint loading following trauma.

A healed fracture was also recorded on the right first metacarpal (bone in the palm associated with the thumb), affecting the proximal joint surface (see Figure 7.2f). Fractures in this location are referred to as Bennett's fractures or Rolando fractures, depending on severity (Carlsen and Moran, 2009). They have been reported following sporting injuries, falls from a standing height, road traffic accidents and assaults (Middleton *et al.*, 2015). They are most commonly seen in males, and predominantly in the dominant hand (Leclère *et al.*, 2012).

Finally, a possible healed avulsion fracture was seen on the distal left tibia, evident as a slight ridge across the posterolateral joint surface. Termed pilon fractures, this type of injury can occur when the talus is pushed up into the articular surface of the tibia, such as following a fall from a height (White *et al.*, 2016: 506). Intra-articular fractures affecting the posterior area of the distal tibial joint surface typically occur when the foot is in plantarflexion (pointed downward) (Sitnik *et al.*, 2017).

It is clear that Skeleton 235 had experienced at least one significant traumatic event during life that may have led to impairment of their right arm. As it is challenging to differentiate between timing of healed fractures in skeletal remains (Mant, 2019), it is not possible to determine whether the additional healed injuries and potential secondary osteoarthritis all resulted from a single traumatic event, or reflect multiple episodes of injury. Whether the injuries and secondary osteoarthritis seen in this individual impacted on their functionality is difficult to determine in the absence of further evidence. The fractures appear to be well healed without added complications, and cases of chronic unreduced or recurrent shoulder dislocations, such as that seen in Skeleton 235, do not necessarily signal permanent functional impairment. Bowlby found that following initial significant impairment of use of the affected limb '… it becomes less painful and stiff, and, after many months, the part i[s] frequently restored to much of its former power', attributing this recovery to the ability of the soft tissue structures of the shoulder to adapt to the newly formed joint (1887: 189). However, Cooper noted a loss of mobility and function of the affected limb in some patients and reported that 'numbness of the fingers is frequently occurring from the pressure of the head of the bone upon a nerve, or the nerves of the axiliary plexus' (1822: 418). Thus, while Skeleton 235 may have experienced difficulty in performing occupational tasks and certain activities associated with daily life during the healing process, permanent significant functional impairment was unlikely.

Skeleton 502, St Hilda's Churchyard, South Shields

Skeleton 502 shows evidence of a significant injury experienced during life alongside more commonplace degenerative changes associated with ageing. Approximately 75% of their skeleton was preserved for analysis (see Figure 7.3), and they were likely a female aged 46+ years (using methods by: Buckberry and Chamberlain, 2002; Bruzek, 2002; Lovejoy *et al.*, 1985; Mays and Cox, 2000).

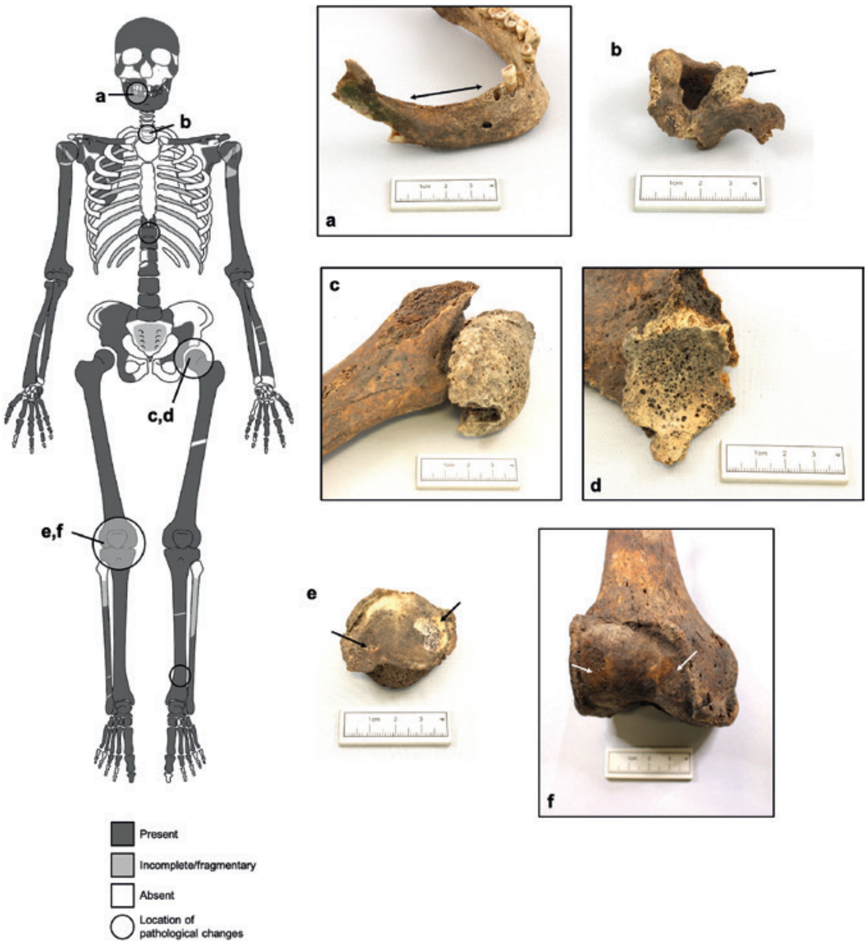

Figure 7.3 Skeletal elements present and pathological changes seen in Skeleton 502, St Hilda's Churchyard, South Shields. a) Antemortem tooth loss of the right 2nd premolar and molars; b) evidence of osteoarthritis in the right superior articular facet of the second thoracic vertebra, showing porosity and eburnation of the joint surface (arrow); c) posterior view of the left proximal femur, with mushroom-like deformity of the femoral head, and osteoarthritic changes to the joint surface; d) posterior view of the left acetabulum (hip joint) showing extensive secondary osteoarthritic changes; e) posterior view of the right patella, showing patches of eburnation (arrows) indicative of osteoarthritis; f) anterior view of the right distal femur with patches of eburnation (arrows) matching that seen on the posterior surface of the patella.

Their bones were light in weight compared to the norm for an adult individual, a feature tentatively suggestive of a decrease in bone mass and density associated with osteopenia or osteoporosis. Progressive loss of bone tissue leading to a heightened risk of fracture in response to minimal force is characteristic of osteoporosis, and fragility fractures tend to occur in load-bearing regions, such as compression fractures in the vertebrae, and in areas vulnerable to injury from trips and falls, such as the ribs, distal radius and the femoral neck (Brickley and Ives, 2008: 151). While it can result from trauma, disease or poor diet, it is most frequently associated with advancing age for males and females, and post-menopausal changes in women (Brickley and Ives, 2008: 151; Morgan *et al.*, 2020). There was only one fracture evident in Skeleton 502 that may be associated with osteoporosis (see below), but due to the multifactorial nature of this type of injury, this cannot be confirmed.

Skeleton 502 had a healed fracture of the left femoral neck (associated with the left hip joint) that had led to extensive secondary osteoarthritic changes to both the femoral head and acetabulum (articular socket on the pelvis for head of the femur; see Figure 7.3c, d). Femoral neck fractures occurring within the capsule of the hip joint (intracapsular fractures) can disrupt blood supply to the femoral head, resulting in avascular necrosis and subsequent collapse, as also seen in Skeleton 502 (Raynor *et al.*, 2011: 74–5; White *et al.*, 2016: 353). Hip fractures are a common injury, with older women being at particular risk, typically as a result of advancing age, osteoporosis or other chronic disease factors (Morgan *et al.*, 2020; White *et al.*, 2016: 352). Hip fractures in older people frequently occur in response to low impact falls from standing height and are associated with a high risk of further morbidity and mortality (Ives *et al.*, 2017; Morgan *et al.*, 2020). Hip fractures in non-elderly patients are rarer, and as such gain less attention in modern clinical literature, but considering the relatively broad age-at-death estimation for Skeleton 502 their aetiology must also be considered. These are more frequently associated with high energy trauma, but can also include those with risk factors for severe injury following falls due to preexisting diseases, or being of 'biologically advanced age' due to osteopenia or osteoporosis (Rogmark *et al.*, 2018). Osteopenia and osteoporosis in younger patients can stem from factors such as malnutrition, medications and excessive alcohol intake or tobacco usage (Rogmark *et al.*, 2018). The fracture to the left femoral neck in Skeleton 502 was well healed, indicating their survival beyond the injury. This is likely due to the fracture location conferring more stability, as has been noted in a large-scale study of hip fractures in post-medieval England (Ives *et al.*, 2017). Despite potential mobility issues that may have occurred during the healing process of the hip fracture seen in Skeleton 502, the evidence of secondary osteoarthritic changes suggests the joint continued to be used.

Degenerative joint changes and osteoarthritis are some of the most common pathologies seen in archaeological skeletal assemblages (Waldron, 2012). While degenerative joint changes and osteoarthritis can arise in response to trauma or disease processes, as seen in the left hip of Skeleton 502 and the previous case studies, they can also be indicative of the cumulative effects of everyday wear and tear on the body during life. While there was no evidence for joint changes or degeneration in the right hip joint of Skeleton 502, their right knee joint did demonstrate extensive osteoarthritic changes (see Figure 7.3e, f). Evidence of osteoarthritis and degenerative joint changes was also seen in the spine (see Figure 7.3b). Degenerative disc disease, whereby the intervertebral discs of the spine begin to deteriorate, was also present in the spine, and may have led to anterior disc herniation in a lower thoracic vertebra (T11). Osteoarthritis was also seen in the left and right pisiform bones (small bones in the wrists), and in the right and left first metatarsals (where the big toe articulates with the foot).

Skeleton 502 had also lost three posterior teeth on the right side of the mandible during life (see Figure 7.3a). Antemortem tooth loss, also seen in Skeleton 15 (see Figure 7.1a), can result from generally poor dental health associated with periodontal disease and dental caries, but also severe tooth wear and trauma (Lukacs, 2012: 560). Antemortem tooth loss is typically seen in increasing frequency in older individuals, perhaps related to the accumulation of dental health risks over time due to poor dental hygiene practices and the finite nature of dental enamel (Roberts and Manchester, 2010).

In summary, degenerative processes affecting spine, wrists and lower limbs were seen in Skeleton 502, alongside a healed hip fracture, ante-mortem tooth loss and tentative evidence for osteoporosis. Some of these skeletal pathologies may be attributable to the ageing process, or may have simply arisen from the advancement of general wear and tear of the body due to differing lifestyles of working-class eighteenth- to nineteenth-century populations. Attributing evidence of degenerative joint changes and osteoarthritis to lived experiences of pain and reduced mobility in past populations can be problematic (Waldron, 2012: 518). A weak correlation exists between joint changes seen in radiological examinations and actual lived symptoms, although some locations may be more liable to cause pain than others, such as the base of the thumb, the medial compartment of the knee and the hip (Waldron, 2012: 518). However, the traumatic event resulting in a hip fracture likely left them requiring assistance with activities associated with daily life during the healing and rehabilitation process, and potential implications for functional changes in gait and mobility beyond this. While the extensive eburnation seen on both the femoral and acetabular joint surfaces of the left hip of Skeleton 502 does suggest continued mobility, large bony outgrowths on the joint margins and the altered morphology of the femoral and acetabular joint surfaces may indicate restrictions to the normal range of movement, and may have resulted in altered gait. In older patients today, ability to live independently and undertake activities of daily living following a femoral neck fracture is reliant on their ease of mobility within the home and support from their wider community (Reuling *et al.*, 2012; Schiller *et al.*, 2015). Such outcomes too are largely dependent on factors such as age, pre-fracture health status of the individual (Reuling *et al.*, 2012) and self-determination (Schiller *et al.*, 2015). Hip fractures in older people are often seen as life-changing events, and modern studies of patients' perspectives of recovery following hip fracture reveal experiences of loss of independence and mobility and a sense of transformation from the normality of their pre-fracture lives, with one older female stating 'Suddenly I feel old' (Bruun-Olsen *et al.*, 2018: 5). Like that seen for older people, younger patients too can face longer-term implications of hip fractures, such as pain, barriers to return to work and reduction in mobility (Rogmark *et al.*, 2018). While more research is needed to determine whether these injuries produced the same feelings of vulnerability in older patients in the past, in the eighteenth and nineteenth centuries medical professionals viewed hip fractures (especially those in the intra-capsular region) as particularly problematic, due to difficulties in promoting union and healing (Degeling, 2009). This was further complicated by the difficulty in identifying such injuries prior to the development of radiography, and approaches to treating older individuals could take the form of 'treat the patient and let the fracture go' (Degeling, 2009: 128). As such, individuals recovering from hip fractures during this time likely faced additional barriers to recovery without the level of treatment seen within modern interventions.

Reading older and disabled bodies in the Industrial Revolution

In summary, the three case studies are connected by evidence of bodily decline and potential debility experienced during life. This ranged from relatively minor and to some degree invisible indicators of daily wear and tear in the form of degenerative joint changes and antemortem tooth loss, to severe impairments and injuries that likely demarcated their bodies and influenced ability to varying degrees. Within a Bioarchaeology of Care perspective, only one case study (Skeleton 15) exhibited skeletal changes suggestive of long-term care requirements in terms of activities of daily living. However, while Skeleton 235 and Skeleton 502 had likely recovered to some extent prior to their death, evidence of healed injuries gives insight into the impact of periods of rehabilitation experienced during their life course in which they may have been more reliant on their wider communities. How the spinal and limb deformities seen in Skeleton 15, the permanent shoulder dislocation in Skeleton 235 and the healed hip fracture in Skeleton 502 were sustained can only be speculated on in the absence of documentary evidence. However, their susceptibility to the development of these skeletal conditions and their subsequent perception in eighteenth and nineteenth century society was likely influenced by the intertwining of social and biological influences aligned to status, occupation and gender. All three individuals were estimated to be over approximately 35 years of age at the time of death and had persisted alongside their impairments, albeit for an unknown period of time. As will be discussed, in the late eighteenth and early nineteenth centuries, health and appearance were probably more important than chronological factors in determining age; thus, to consider the impact of such bodily changes on their lives requires discussion regarding our interpretation of debility and ageing in this context.

As Pat Thane has argued, there was a long tradition in European history of viewing the onset of old age as beginning in a person's 60s, with more advanced old age beginning at 70 (2020: 389). But ageing was not simply measured in terms of chronological milestones, it was (and is) also a biologically, psychologically and socially influenced process (Appleby, 2018: 146). In eras where people may not have known their exact chronological age, such factors may have been even more significant in determining perceptions of ageing (Western and Bekvalac, 2020: 175). Despite the consistency in defining when old age began, there has been a 'notable disjuncture between the standardisation implied by chronological age and the varied experience of old age' (Thane, 2020: 395). Adult age estimation in human skeletal remains relies on observations of the extent of joint degeneration of key stable joints in the skeleton (notably those of the pelvis). Such methods have been found to systematically underage older adults, in part due to mimicry of reference samples, leading to their relative 'invisibility' in studies of past populations (Buckberry, 2015; Gowland, 2007). No one person ages the same way as the next, and someone's chronological age may differ considerably from their biological or 'functional' age due to the influence (or conversely absence) of chronic illness or bodily degeneration, the nature of which may in turn be influenced by a person's social background, gender, occupation or living conditions (Appleby, 2018). In this way, we may not only lose valuable nuanced information regarding ageing, health and social identity over time, but also risk misattributing individuals to specific age categories and by proxy 'social groups'. In addition, the efficacy of how we apply age estimations on the individual and population level in archaeological skeletal samples becomes further confounded when we consider that ageing is not simply a chronological nor biological phenomenon. On a cultural level, age boundaries become further obfuscated by the temporally and geographically changeable perception of social 'expectation' of a person's role in society and how this aligns to their biological and chronological age (Gowland, 2007). Although official concern with precise age increased during the nineteenth century, thanks to the growth of state bureaucracies and increasing government intervention in aspects of life, perceptions of age continued to depend on physical characteristics (Armstrong, 2003; Thane, 2020: 390).

Physical debility had traditionally been seen as ushering in old age, but as industrialisation developed concerns were increasingly raised that new modes of production were hastening physical decline making people 'old' before the customary 60 or 70 years (Ottaway, 2007: 17). Mechanistic views of the body became prevalent in discussions of the impact of factory work in particular, with workers described as faceless parts of an industrial 'machine'. Debilitated workers, argued factory reformer William Dodd, were liable to be 'cast off as useless lumber; just as a cylinder, or any other piece of machinery would be laid aside when worn out, and with as little remorse' (1968: 106). Similarly, Dr James Kay observed of factory operatives in 1830s Manchester that their labour must 'rival the mathematical precision, the incessant motion, and the exhaustless power of the machine' (1832: 10). Long hours of repetitive or arduous labour in heated environments appeared to speed up the life cycle of workers, with claims made (albeit on shaky empirical foundations) that it brought forward stages such as puberty in factory girls, and the physical signs of old age in adult workers (Gaskell, 1833: 69; Gray, 1991: 38).

This becomes particularly pertinent when considering the skeletal changes seen in Skeleton 15. It was recognised in the early nineteenth century that those working in confined spaces, requiring poor postures, or placing heavy loads on the spine, were at greater risk of developing spinal deformities (Weiner and Silver, 2008). For individuals undertaking manual labour from a young age and into adulthood, such pressures combined with deficiencies in bone quality from vitamin D deficiency could result in the severe pathological changes. In 1831, the Leeds surgeon Charles Turner Thackrah commented that '[t]he limbs consequently, and especially in the growing youth, take the form which is induced by the weight of the body and the posture required in the employ. The spine evidently suffers' (1831: 112). Witnesses before official enquiries into factory work reported that the lower limb deformities presented by Skeleton 15 were prevalent in factory districts. In 1832, Abraham Wildman, a supporter of limiting the hours of labour in factories, reported that there were large numbers of 'ricketty crooked legged children' in Keighley (Yorkshire), and he estimated that about one in ten children were left permanently deformed due to the nature of their work (Report from the Committee, 1832: 156). Accounts of worker 'debility' became central to critiques of the factory 'system' during this period. After a visit to Stockport in November 1841, Dodd observed that factory people were generally 'superannuated before they are forty', compared to 60 in the general population (Dodd, 1968: 173). Dodd's own body appeared to offer living proof of this accelerated decline. Deformed in his arms and legs after spending his early years employed in a factory, fellow reformer Richard Oastler described him at age 37 in 1841 as a 'weak, infirm cripple, even in Nature's prime' (1841: 73). Rather than presenting as an anomalous body, in appearance Skeleton 15 represented a common type of deformity observable in textile factory districts such as Stockport during this period.

As a corollary, the idea that workers in certain industries constituted distinctive 'races' whose size, physical features and life cycles deviated from an idealised pre-industrial agrarian norm, took hold in early nineteenth century England (Turner and Blackie, 2018: 56–9). In *The Manufacturing Population of England* (1833), Manchester social reformer Peter Gaskell argued that industrial manufacture brought about a 'vast deterioration in personal form'. The average height of male factory workers was, he claimed, only five feet six inches. Both sexes had a 'very general bowing of the legs', with 'great numbers of girls and women walking lamely or awkwardly'. Men's hair was often 'thin and straight', and they trudged around with a 'spiritless and dejected air' (1833: 162). Workers in particular trades were instantly recognisable by their bodily peculiarities, and accounts of premature ageing, disease and debility were ubiquitous in descriptions of certain occupations. For example, gaunt features, sallow skin, pale complexion and sunken eyes were all seen as trademark features of ironworkers (Ginswick, 1983: 38). Of coalminers, Thackrah remarked that most 'do not generally exceed age of fifty' due to occupational diseases such as asthma, weakness of vision caused by long hours of working in darkness and 'by the injury which their health has sustained' through arduous labour in cramped, dirty conditions (1831: 28). Many observers of coalmining noted signs of ageing in apparently young men. In 1842, Dr Elliot, who had experience in treating the 'limbs and health' of coalminers and their families in Thornley and South Hetton, County Durham, observed that in 'middle and advanced life' miners usually succumbed to 'articular, muscular, and neuralgic pains'. He remarked that 'premature old age in appearance' was common in coalminers and 'men of 35 or 40 years may often be taken for 10 years older than they really are' (Children's Employment Commission, 1842a: 668).

In addition to the high risks to health that accompanied detrimental domestic and workplace environmental conditions, accidental injury due to occupational hazards and urban overcrowding was a common occurrence, and could lead to significant impairment (Mant, 2019). The multiple healed injuries seen in Skeleton 235 likely occurred due to one or more accidental falls of unknown aetiology. Studies of individuals with multiple injuries within skeletal assemblages are complicated by our inability to differentiate between timings of healed fractures, and loss of visibility of soft tissue injuries in skeletonised individuals, leading to their underestimation in skeletal assemblages (Mant, 2019). As such, an important differentiation must be made between evidence of injury recidivism in the past, whereby an individual exhibits evidence of a combination of healed/healing/unhealed injuries, and an individual with multiple healed injuries (Mant, 2019), such as Skeleton 235. In a study of low-status individuals with multiple fractures and injury recidivism in London (*c.*1666–1837) males were at greater risk of fractures and soft tissue trauma (seen skeletally as ossified soft tissue termed *myositis ossificans*) than females, but frequency of dislocations was not significantly different between the sexes (Mant, 2019). However, those with dislocations were more likely to be over the age of 36 years (Mant, 2019). While instances of multiple injury in the aforementioned study had some association with intentional violence (particularly for male individuals), based on fracture location and type, and comparisons with contemporaneous archival and modern clinical data, the majority were likely accidental in nature and related to hazards presented by living and working in an urban environment (Mant, 2019).

The multiple injuries experienced in life by Skeleton 235 suggest a history of the male body common in industrial societies in this period. In her study of skeletons excavated at the Eerie County Poorhouse in Buffalo, New York, Byrnes (2017) similarly found a high degree of trauma in males from this period, suggesting that poor men were often liable to become injured through work. While we cannot ascertain Skeleton 235's occupation, the potential evidence for Kienböck's disease in their right wrist was suggestive of them undertaking some form of repetitive manual labour. Their multiple injuries too are typical of those experienced by coalminers in the north-east of England and elsewhere in this period. At Haswell Colliery in County Durham, there were twenty-eight reported cases of lower limb injuries in 1849, resulting from rock falls or boys and men being run over by coal trucks (Second Report, 1854: 24–6). Shoulder injuries were a regular, but more infrequently reported, feature of coalmining too, occasioned by 'misadventures in the [mine] shafts, falling of the roof of the mines, and the minor effects of explosions' (Black 1844: 555). The severity of shoulder injuries varied: at Haswell, John Smith a hewer of coal had nine days off work in 1849 with a shoulder injury by a fall of coal, but others needed several weeks to recover, or longer (Second Report, 1854: 24–6). The incomplete healing of the shoulder fracture may indicate the difficulties faced by surgeons in treating these injuries, but it might also reveal a need to get back to work as soon as some degree of functionality began to return. Numerous accounts of workers 'lamed' in industrial accidents but returning to work attest to the importance of 'working through' injuries (Riley, 1997: 135). In Skeleton 235 there are signs that the joints and muscles were still being used after the injury, albeit with reduced functionality. This suggests that individuals may have considered themselves healed enough if they were able to resume earning a living (Turner and Blackie, 2018).

Accounts of workers 'worn out' prematurely by their exposure to industrial capitalism served a political purpose in this period, contributing to gathering calls for workplace regulation. Experiences of older workers varied greatly, but there is evidence to suggest that in occupations involving repetitive or physically demanding work, employment declined significantly above the age of 40. As one Welsh coalmining official reported in 1842, miners were not necessarily 'shorter lived' than other men, but they were 'sooner disabled, and frequently leave underground work at 40 to 45' (Children's Employment Commission, 1842b: 576). Similarly, in Scotland, Dr S. Scott Alison noted that above the age of 30 'it is rare to find a perfectly healthy collier'; by 40 the fast decline of muscular strength meant that many men were capable of no more than two or three days work a week. If a miner survived beyond his 50th year 'by dint of greater strength of constitution, of temperate habits, and attention to the preservation of health', he was still often left 'broken down and decrepit' (Children's Employment Commission, 1842a: 412). Though less dramatic, a similar decline is visible in male factory workers. Table 7.1, which shows men's employment in nineteen Manchester textile factories in 1832, indicates a comparatively large number of sick days taken by youths and young men entering the spinning trade, perhaps in part due to accidents caused by inexperience. During mature adulthood, workers appeared to be at their healthiest, but after age 40 the number of men employed declined and those who remained spent more time off sick, suggesting physical decline. By 40, Engels wrote, male spinners suffered from 'general enfeeblement of frame' and failing eyesight making it difficult to continue their work (1969: 187).

Discussion of worker debility and premature ageing in the early nineteenth century took place in the context of campaigns that were framed in terms of the protection of the persons of 'vulnerable' children and women, while also seeking to extend these protections to adult men by safeguarding their 'property' – their physical ability to work and provide for their families (Gray, 1996: 31). The rhetoric of premature ageing was applied overwhelmingly

Table 7.1 Spinners employed in Nineteen Fine Spinning Mills in Manchester, 1832 (Shuttleworth, 1842: 270–1).

Age group	Total employed	Number of sick days	Average number of sick days per worker
Under 21	8	195	24.38
21 to 25	184	1833	9.96
26 to 30	198	1031	5.2
31 to 35	153	860.5	5.62
36 to 40	154	592	3.84
41 to 45	89	787	8.84
46 to 50	33	488	14.79
51 to 55	12	235	19.58
55 to 60	5	270	54
Above 60	1	14	14

to the male body, although some female workers, such as women employed in Scottish coalmines, also described the impact of labour in these terms. Forty-year-old Jane Peacock Watson, a carrier of baskets of coal at West Linton in Peebleshire, testified that the employment of women in coalmines was 'horse-work, and ruins the women; it crushes their haunches, bends their ankles and makes them old women at 40' (Children's Employment Commission, 1842a: 458). Women and young children were banned from working underground by legislation of 1842, and following restrictions on child labour introduced in the 1833 Factory Act, legislation of 1844, 1847 and 1850 further limited the hours of work for women and young persons in factories (Gray, 1996; John, 1984).

Regulation of the hours worked by women and the young served to construct the 'male breadwinner' ideology (Gray, 1996: 8). However, the inclusion of Skeleton 502 reminds us that women were essential agents in industrial society, and due to biological predisposition to conditions such as osteoporosis, may have been burdened with invisible susceptibilities to injuries within domestic and occupational spheres. Physical impairment, combined with visual indicators of age such as tooth loss, could influence employment opportunities. Documentary sources reveal accounts of working-class single women expressing concern for themselves and others associated with the loss of teeth, and by proxy an aged appearance, on employment prospects and perception of redundancy (Vickery, 2013: 884). Historical clinical observations of causes of hip fractures reveal that they occurred due to accidental falls that varied in severity, including trips and falls within the home or on the street, and falls from horses and carts (Ives *et al.*, 2017:

271). Cooper noted in 1822 that in cases of intra-capsular hip fractures 'Women are much more liable to this species of fracture than men; we rarely in our hospitals observe it in the latter, but our Wards are seldom without an example of it in the aged female' (1822: 122). He states that this type of fracture rarely occurred in those under 50 years of age, and that in London they frequently occurred due to accidental falls from elevated footpaths (Cooper, 1822: 124–5).

Contemporary social commentators imagined a bleak future for older people such as Skeleton 502. Industrial urban settlements were, argued Gaskell, no place to grow old. Elderly relatives brought with migrants from rural areas to industrial towns 'who have hitherto lived in open and healthy situations, favourable to the prolongation of life' were apt to 'sink at once beneath the depressing influence of their new abodes', succumbing to chronic diseases brought on by insanitary living conditions (1833: 235). Mid-Victorian census data indicate that industrial towns had lower proportions of older age individuals compared to rural communities, due to the influx of younger migrants and lower life expectancy (Western and Bekvalac, 2020: 187). Nevertheless, older people were still present in these industrial communities, albeit only forming a small minority of the population. For example, in the census of 1861, 3.8% of the population of Hazel Grove, 3% of the population in Manchester, and 4.6% of the population of England and Wales were aged over 65 years (GB Historical GIS, 2018a; 2018b; 2018c). Despite gloomy accounts of older or disabled people being 'cast off as useless lumber', such people remained economically productive if possible. Older women played an important role in providing childcare, allowing their adult daughters to return to work in textile mills or by supplying the domestic labour that serviced heavily 'masculine' industries like coalmining (Jones, 1991; Thane, 2000: 273, 294–5). While we cannot determine the quality of life that Skeleton 502 led from their bones alone, we should not automatically assume that they were devalued, even if their economic role was circumscribed.

Ultimately, debility was a marker of social class. Again, in 1831, Thackrah noted that a 'really fine figure' was rare among urban 'artisans', in contrast to the elite. Although wealthy 'young ladies' were often 'deformed from the want of proper exercise, their brothers are generally well-proportioned' due to their freedom to engage in manly sports and exercises, which gave them a 'decided advantage' 'not only over the sedate sex, but also over the factory boys and apprentices of sedentary artisans' (113). Engels put it more bluntly: 'In Manchester … premature old age among the operatives is so universal that almost every man of forty would be taken for ten to fifteen years older, while the prosperous classes, men as well as women, preserve their appearance exceedingly well if they do not drink too heavily' (1969: 188). Middle-class descriptions of working-class bodies as a separate 'race', notable for their ‘unhealthy’ features, premature ageing and deformity, othered physical characteristics that would have been viewed as normal within industrial communities. The anonymous skeletons examined in this chapter all indicate hardships faced by working-class people in industrialising England. The heightened risk of morbidity and mortality alongside general bodily wear and tear were experiences from which others were buffered through their wealth and status.

Conclusions

In industrialising England, function, health status and appearance were more important than chronological age in shaping perceptions of working-class bodies. Large proportions of the working population were at risk of impairment by occupational injury, disease and poor living conditions and this was frequently conceptualised as premature ageing. These impairments can be seen skeletally, alongside otherwise relatively hidden indicators of wear and tear of the body over time in the form of joint degeneration and tooth loss, as exemplified by the three case studies presented in this chapter. Social status and gender were key factors determining experiences – and perceptions – of debility. The skeletal evidence has revealed the bodily consequences of living with impairment, whether arising from potentially congenital or environmentally mediated conditions such as that seen in Skeleton 15, bodily injury in Skeleton 235, or injury and decline associated with the ageing process in Skeleton 502. While impaired bodies have often been viewed as marginal or ‘othered’, evidence from a range of official reports, medical sources and social and political commentary suggests that physical difference was an expected and ‘normal’ feature of nineteenth-century working-class experience. As we have shown in this chapter, by exploring the material body in relation to wider discourses around ageing, disability and debility, we can go beyond viewing the three skeletons as exceptional pathological case studies and see them instead as the remains of people whose experiences were shaped both by their physical characteristics and by the wider culture that gave them meaning (Craig-Atkins and Harvey, this volume: introduction; Harvey, 2020).

Although skeletal evidence cannot inform us of the quality of life experienced by these people or nuances in (in)ability, it instead reveals hidden histories of bodily damage and repair that indicate a need to adapt and ‘work through’ injury and impairment – a process dependent not simply on the availability of medical care, but also on an individual’s wider network of economic support (Turner and Blackie, 2018). If campaigners for industrial regulation used the deformed body to highlight the vulnerability of workers, the skeletal evidence conversely may be more indicative of the resilience of people living with impairment and bodily difference. In turn, documentary evidence can also advocate caution in how we apply and interpret age estimation data within our archaeological analyses of past populations. Much like the wearing down of machinery, industrial society of the early nineteenth century wore down the bodies of its working-class inhabitants, skewing our – and their – perception of who was 'old' in such societies on a social, chronological and, ultimately, biological level.

Acknowledgements

The authors would like to thank Martin Lightfoot at CFA Archaeology and Malin Holst at York Osteoarchaeology Ltd for permission to publish the case study from Hazel Grove, Stockport in this chapter. We are also grateful to the Department of Archaeology, University of Sheffield for access to the St Hilda's Churchyard, South Shields skeletal collection and associated archive.

References

Appleby, J. (2018). 'Ageing and the body in archaeology', *Cambridge Archaeological Journal*, 28(1): 145–63.

Armstrong, D. (2003). 'The temporal body' in R. Cooter and J. V. Pickstone (eds), *Companion to Medicine in the Twentieth Century* (London: Routledge), pp. 247–59.

Black, J. (1844). 'Lectures on public hygiene and medical police', *Provincial Medical and Surgical Journal*, 8(36): 551–7.

Bowlby, A. A. (1887). *Surgical Pathology and Morbid Anatomy* (London: J&A Churchill).

Brickley, M., Mays, S. and Ives, R. (2005). 'Skeletal manifestations of vitamin D deficiency osteomalacia in documented historical collections', *International Journal of Osteoarchaeology*, 15: 389–403.

Brickley, M. and Ives, R. (2008). *The Bioarchaeology of Metabolic Bone Disease* (London: Academic Press).

Brooks, S. T. and Suchey, J. M. (1990). 'Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods', *Human Evolution*, 5: 227–38.

Bruun-Olsen, V., Bergland, A. and Heiberg, K. E. (2018). '"I struggle to count my blessings": recovery after hip fracture from the patients' perspective', *BMC Geriatrics*, 18: 18.

Bruzek, J. (2002). 'A method for visual determination of sex, using the human hip bone', *American Journal of Physical Anthropology*, 117: 157–168.

Buckberry, J. (2015). 'The (mis)use of adult age estimates in osteology', *Annals of Human Biology*, 42(4): 323–31.

Buckberry, J. L. and Chamberlain, A. T. (2002). 'Age estimation from the auricular surface of the ilium: a revised method', *American Journal of Physical Anthropology*, 119: 231–9.

Byrnes, J. F. and Muller, J. L. (eds). (2017). *Bioarchaeology of Impairment and Disability: Theoretical, Ethnohistorical, and Methodological Perspectives* (New York: Springer).

Byrnes, J. F. (2017). 'Injuries, impairment, and intersecting identities: The poor in Buffalo, NY 1851–1913' in J. F. Byrnes and J. L. Muller (eds), *Bioarchaeology of Impairment and Disability: Theoretical, Ethnohistorical, and Methodological Perspectives* (New York: Springer), pp. 201–22.

Carlsen, B. T. and Moran, S. L. (2009). 'Thumb trauma: Bennett fractures, Rolando fractures, and ulnar collateral ligament injuries', *Journal of Hand Surgery*, 34A: 945–52.

Children's Employment Commission (1842a). *Appendix to the First Report of the Commissioners. Mines. Part 1. Reports and Evidence from the Sub-Commissioners* (London: W. Clowes for HMSO).

Children's Employment Commission (1842b). *Appendix to the First Report of the Commissioners. Mines. Part 2.* (London: W. Clowes for HMSO).

Conlogue, G., Viner, M., Beckett, R., Bekvalac, J., Gonzalez, R., Sharkey, M., Kramer, K. and Koverman, B. (2017). 'A post-mortem evaluation of the degree of mobility in an individual with severe kyphoscoliosis using direct digital radiography (DR) and multi-detector computed tomography (MDCT)', in L. Tilley and A. A. Schrenk (eds), *New Developments in the Bioarchaeology of Care. Further Case Studies and Expanded Theory* (New York: Springer), pp. 153–73.

Cooper, A. (1822). *A Treatise on Dislocations, and on Fractures of the Joints* (London: Longmans).

Cooter, R. (2003). 'The disabled body' in R. Cooter and J. Pickstone (eds), *Companion to Medicine in the Twentieth Century* (London: Routledge), pp. 367–84.

Degeling, C. (2009). 'Fractured hips: surgical authority, futility and innovation in nineteenth century medicine', *Endeavour*, 33(4): 129–34.

Dodd, W. (1842, 1968). *The Factory System Illustrated in a Series of Letters to the Right Hon. Lord Ashley* (London: Frank Cass).

Engels, F. (1892, 1969). *The Condition of the Working Class in England* (London: Panther).

Fuschillo, S., De Felice, A., Martucci, M., Gaudiosi, C., Pisano, V., Vitale, D. and Balzano, G. (2015). 'Pulmonary rehabilitation improves exercise capacity in subjects with kyphoscoliosis and severe respiratory impairment', *Respiratory Care*, 60(1): 96–101.

Gaskell, P. (1833). *The Manufacturing Population of England, Its Moral, Social, and Physical Conditions and the Changes which have arisen from the use of Steam Machinery* (London: Baldwin and Craddock).

GB Historical GIS (2018a). 'University of Portsmouth, Hazel Grove SubD through time. Age and sex structure to age 85 and up' [Online]. Available at:

www.visionofbritain.org.uk/unit/10542212/cube/AGESEX_85UP (accessed 20 May 2018).

GB Historical GIS (2018b). 'University of Portsmouth, Greater Manchester Met.C through time. Age and sex structure to age 85 and up' [Online]. Available at: www.visionofbritain.org.uk/unit/10056925/cube/AGESEX_85UP (accessed 20 May 2018).

GB Historical GIS (2018c). 'University of Portsmouth, England Dep through time. Age and sex structure to age 85 and up' [Online]. Available at: www.visionofbritain.org.uk/unit/10061325/cube/AGESEX_85UP (accessed 20 May 2018).

Ginswick, J. (ed.). (1983). *Labour and the Poor in England and Wales 1849–1851: the Letters to the Morning Chronicle from the Correspondents in the Manufacturing and Mining Districts, the towns of Liverpool and Birmingham, and the Rural Districts: Vol. 3 South Wales-North Wales* (London: Frank Cass).

Gleeson, B. (1999). *Geographies of Disability* (London: Routledge).

Gowland, R. (2007). 'Age, ageism and osteological bias: the evidence from late Roman Britain', *Journal of Roman Archaeology, Supplementary Series*, 65: 153–69.

Gowland, R. (2017). 'Growing old: Biographies of disability and care in later life', in L. Tilley and A. A. Schrenk (eds), *New Developments in the Bioarchaeology of Care: Further Case Studies and Expanded Theory* (New York: Springer), pp. 237–51.

Gray, R. (1991). 'Medical men, industrial labour and the state, 1830–50', *Social History*, 16(1): 19–43.

Gray, R. (1996). *The Factory Question and Industrial England, 1830–1860* (Cambridge: Cambridge University Press).

Green, A. (2010). 'Heartless and unhomely? Dwellings of the poor in East Anglia and north-east England' in J. McEwan and P. Sharpe (eds), *Accommodating Poverty: The Housing and Living Arrangements of the English Poor, c.1600–1850* (Basingstoke: Palgrave MacMillan), pp. 69–101.

Griffin, E. (2006). *A Short History of the British Industrial Revolution* (Basingstoke: Palgrave-Macmillan).

Hardy, A. (2003). 'Commentary: Bread and alum, syphilis and sunlight: rickets in the nineteenth century', *International Journal of Epidemiology*, 32: 337–40.

Harvey, K. (2020). 'One British thing: A history of embodiment: Ann Purvis, ca. 1793–1849', *Journal of British Studies*, 59(1): 136–9.

Hodgson, G. B. (1903). *The Borough of South Shields from the Earliest Period to the Close of the Nineteenth Century*. (Newcastle-upon-tyne: Andrew Reid & Company, Ltd).

Holick, M. F. (2006). 'Resurrection of vitamin D deficiency and rickets', *The Journal of Clinical Investigation*, 116(8): 2062–72.

Issac, S and Das, J. M. (2020). *Kyphoscoliosis*. StatPearls Publishing LLC [Online]. Available at: www.ncbi.nlm.nih.gov/books/NBK562183/ (accessed 17 November 2020).

Ives, R. and Brickley, M. (2014). 'New findings in the identification of adult vitamin D deficiency osteomalacia: Results from a large-scale study', *International Journal of Paleopathology*, 7: 45–56.

Ives, R., Mant, M., De La Cova, C. and Brickley, M. (2017). 'A large-scale palaeo-pathological study of hip fractures from post-medieval urban England', *International Journal of Osteoarchaeology*, 27: 261–75.

Jessop, O. and Beauchamp, V. (2015). '11–16 Chapel Street, Hazel Grove, Stockport, Gt. Manchester. An archaeological desk-based assessment', Document No: TJC2015.17 (Sheffield: The Jessop Consultancy, unpublished report).

John, A. V. (1984). *By the Sweat of their Brow: Women Workers at Victorian Coal Mine*. (London: Routledge and Kegan Paul).

Jones, D. (1991). 'Counting the cost of coal: Women's lives in the Rhondda, 1881–1911', in A. V. John (ed.), *Our Mother's Land: Chapters in Welsh Women's History 1830–1939* (Cardiff: University of Wales Press), pp. 109–34.

Kay, J. P. (1832). *The Moral and Physical Condition of the Working Classes Employed in the Cotton Manufacture in Manchester* (London: James Ridgway).

King, S. and Timmins, G. (2001). *Making Sense of the Industrial Revolution: English Economy and Society, 1700–1850* (Manchester: Manchester University Press).

Kuskey, J. (2016). 'The working body: Re-Forming the factory body', *Victorian Review*, 42(1): 4–9.

Leclère, F. M. P., Jenzer, A., Hüsler, R., Kiermeir, D., Bignion, D., Unglaub, F. and Vögelin, E. (2012). '7-year follow-up after open reduction and internal screw fixation in Bennett fractures', *Archives of Orthopaedic and Trauma Surgery*, 132: 1045–51.

Ljuslinder, K., Ellis, K. and Vikström, L. (2020). 'Cripping time – Understanding the life course through the lens of ableism', *Scandinavian Journal of Disability Research*, 22(1): 35–8.

Lovejoy, C. O., Meindl, R. S., Pryzbeck, T. R. and Mensforth, R. (1985). 'Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of skeletal age at death', *American Journal of Physical Anthropology*, 68: 15–28.

Lukacs, J. R. (2012). 'Oral health in past populations: Context, concepts and controversies' in A. L. Grauer (ed.), *A Companion to Paleopathology* (Chichester: Blackwell Publishing Ltd), pp. 513–30.

Mant, M. (2019). 'Time after time: individuals with multiple fractures and injury recidivists in long eighteenth-century (c.1666–1837) London', *International Journal of Osteoarchaeology*, 24: 7–18.

Mays, S. and Cox, M. (2000). 'Sex determination in skeletal remains', in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London: Greenwich Medical Media), pp. 117–30.

McMaster, M. J. and Singh, H. (1999). 'Natural history of congenital kyphosis and kyphoscoliosis', *The Journal of Bone and Joint Surgery*, 81-A(10): 1367–83.

Metzler, I. (1999). 'The palaeopathology of disability in the Middle Ages', *Archaeological Review from Cambridge*, 15(2): 55–67.

Middleton, S. D., McNiven, N., Griffin, E. J., Anakwe, R. E. and Oliver, C. W. (2015). 'Long-term patient-reported outcomes following Bennett's fractures', *The Bone & Joint Journal*, 97-B(7): 1004–6.

Miles, A. E. W. (2000). 'Two shoulder-joint dislocations in early 19th century Londoners', *International Journal of Osteoarchaeology*, 10: 125–34.
Morgan, B., Mant, M., de la Cova, C. and Brickley, M. B. (2020). 'Osteoporosis, osteomalacia, and hip fracture: A case study from the Terry collection', *International Journal of Paleopathology*, 30: 17–21.
Newman, S. and Holst, M. (2016). '*Osteological Analysis, Chapel Street, Hazel Grove, Greater Manchester*', No.2116 (York: York Osteoarchaeology, unpublished report).
Oastler, R. (1841). *The Fleet Papers; Being Letters to Thomas Thornhill, Esq. of Riddlesworth in the County of Norfolk; from Richard Oastler, His Prisoner in the Fleet*. vol.1 no. 10, 6 March.
Oliver, M. and Barnes, C. (2012). *The New Politics of Disablement*. (Basingstoke: Palgrave-Macmillan).
Ottaway, S. (2007). *The Decline of Life: Old Age in Eighteenth Century England*. (Cambridge: Cambridge University Press).
Owen, I. (1889). 'Geographical distribution of rickets, acute and subacute rheumatism, chorea, cancer, and urinary calculus in the British islands', *The British Medical Journal*, 1464(1): 113–16.
Pelling, M. and Smith R. M. (eds) (1991). *Life, Death and the Elderly: Historical Perspectives* (London: Routledge).
Pettifor, J. M. (2003). 'Nutritional rickets', in F. H. Glorieux, J. M. Pettifor and H. Jüppner (eds), *Pediatric Bone. Biology and Diseases* (San Diego: Academic Press), pp. 541– 65.
Phenice, T. W. (1969). 'A newly developed visual method of sexing the os pubis', *American Journal of Physical Anthropology*, 30: 297–301.
Quadagno, J. (1982). *Aging in Early Industrial Society: Work, Family, and Social Policy in Nineteenth-Century England* (New York: Academic Press).
Raynor, C., McCarthy, R. and Clough, S. (2011). '*Coronation Street, South Shields, Tyne and Wear. Archaeological Excavation and Osteological Analysis Report*' (Oxford: Oxford Archaeology North, unpublished report).
Report from the Committee (1832). *Report from the Committee on the 'Bill to regulate the Labour of Children in the Mills and Factories of the United Kingdom'* (London: House of Commons).
Reuling, E. M., Sierevelt, I. N., van den Bekerom, M. P., Hilverdink, E. F., Schnater, J. M., van Dijk, C. N., Goslings, J. C. and Raaymakers, E. L. (2012). 'Predictors of functional outcome following femoral neck fractures treated with an arthroplasty: limitations of the Harris hip score', *Archives of Orthopaedic and Trauma Surgery*, 132(2): 249–56.
Riley, J. C. (1997). *Sick, Not Dead: The Health of British Working Men during the Mortality Decline* (Baltimore and London: Johns Hopkins University Press).
Roberts, C. (2012). 'Re-emerging infections: Developments in bioarchaeological contributions to understanding tuberculosis today', in A. L. Grauer (ed.), *A Companion to Paleopathology* (Chichester: Wiley-Blackwell Ltd), pp. 434–57.
Roberts, C. A. and Cox, M. (2003). *Health and Disease in Britain* (Gloucester: Sutton Publishing).

Roberts, C. and Manchester, K. (2010). *The Archaeology of Disease*, 3rd edn (Stroud: The History Press).

Rogmark, C., Kristensen, M. T., Viberg, B., Rönnquist, S. S., Overgaard, S. and Palm, H. (2018). 'Hip fractures in the non-elderly – Who, why and whither?', *Injury, International Journal of Care of the Injured*, 49(8): 1445–50.

Rose, S. F. (2017). *No Right to be Idle: the Invention of Disability, 1840s–1930s* (Chapel Hill: University of North Carolina Press).

Schiller, C., Franke, T., Belle, J., Sims-Gould, J., Sale, J. and Ashe, M. C. (2015). 'Words of wisdom – patient perspectives to guide recovery for older adults after hip fracture: a qualitative study', *Patient Preference and Adherence*, 9: 57–64.

Second Report (1854). *Second Report from the Select Committee in Accidents in Coal Mines* (London: House of Commons).

Shuttleworth, J. (1842). 'Vital statistics of the spinners and piecers employed in the fine spinning mills of Manchester', *Journal of the Statistical Society of London*, 5(3): 268–73.

Shuttleworth, R. and Meekosha, H. (2017). 'Accommodating critical disability studies in bioarchaeology', in J. F. Byrnes and J. L. Muller (eds), *Bioarchaeology of Impairment and Disability Theoretical, Ethnohistorical, and Methodological Perspectives* (New York: Springer), pp. 19–38.

Sitnik, A., Beletsky, A. and Schelkun, S. (2017). 'Intra-articular fractures of the distal tibia. Current concepts of management', *EFORT Open Rev*, 2(8): 352–61.

Sofaer, J. R. (2006). *The Body as Material Culture: A Theoretical Osteoarchaeology*. (Cambridge: Cambridge University Press).

Southwell-Wright, W. (2013). 'Past perspectives: What can archaeology offer disability studies?', in M. Wappett and K. Arndt (eds), *Emerging Perspectives on Disability Studies* (Basingstoke: Palgrave-Macmillan), pp. 67–96.

Thackrah, C. T. (1831). *The Effects of the Principal Arts, Trades, and Professions, and of Civic States and Habits of Living, on Health and Longevity* (London: Longman, Rees, Orme, Brown & Green).

Thane, P. (2000). *Old Age in English History: Past Experiences, Present Issues* (Oxford: Oxford University Press).

Thane, P. (2020). 'Old age in European cultures: A significant presence from antiquity to the present', *The American Historical Review*, 125(2): 385–95.

Tilley, L. and Schrenk, A. A. (2017). *New Developments in the Bioarchaeology of Care. Further Case Studies and Expanded Theory* (New York: Springer).

Turner, D. M. and Blackie, D. (2018). *Disability in the Industrial Revolution: Physical Impairment in British Coalmining 1780–1880* (Manchester: Manchester University Press).

Vickery, A. (2013). 'Mutton dressed as lamb? Fashioning age in Georgian England', *Journal of British Studies*, 52: 858–86.

Waldron, T. (2012). 'Joint disease', in A.L. Grauer (ed.). *A Companion to Paleopathology*. (Chichester: Blackwell Publishing Ltd), pp. 513–30.

Walker, D. (2012). *Disease in London, 1st–19th centuries. An Illustrated Guide to Diagnosis*. MOLA Monograph 56 (London: Museum of London Archaeology).

Weiner, M.-F. and Silver, J. R. (2008). 'Edward Harrison and the treatment of spinal deformities in the nineteenth century', *The Journal of the Royal College of Physicians of Edinburgh*, 38: 265–71.

Weiss, K. E. and Rodner, C. M. (2007). 'Osteoarthritis of the wrist', *Journal of Hand Surgery*, 32: 725–46.

Western, G. and Bekvalac, J. (2020). *Manufactured Bodies: The Impact of Industrialisation on London Health* (Oxford: Oxbow Books).

White, T. O., Mackenzie, S. P. and Gray, A. J. (2016). *McRae's Orthopaedic Trauma and Emergency Fracture Management*, 3rd edn (Edinburgh: Elsevier).

Woodward, K. (2015). 'Aging', in R. Adams, B. Reiss and D. Serlin (eds), *Keywords for Disability Studies* (New York: New York University Press), pp. 33–4.

Zeng, Y., Chen, Z., Qi, Q., Guo, Z., Li, W., Sun, C. and Liu, N. (2013). 'The posterior surgical correction of congenital kyphosis and kyphoscoliosis: 23 cases with minimum 2 years follow up', *European Spine Journal*, 22: 372–8.