

An exploration of the changing understandings of physical impairment and disability in early medieval England: a bioarchaeological, funerary, and historical approach

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Appendix A

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Table 1

Summary of the palaeopathological analysis, possible diagnoses, functional restrictions, grave goods, and notable funerary treatment for the individuals with physical impairment from the pre-Christian cemeteries.

SK no. ^a	Age/ sex ^b	Physical impairment + possible diagnoses ^c	Possible functional restrictions ^c	Notable funerary treatment ^d	Grave goods ^d
Apple Down¹					
AD-7B	35–40, F	Ankylosis of L3 + L4 via reactive bone formation; four cloacae within bone formation → TB or vertebral osteomyelitis ²	- Tenderness, pain, swelling, limited movement, + neurological deficit if leakage into spinal canal (sensory loss, weakness) ³ - If TB: fever, malaise, + weight loss ⁴	Normative	None
AD-39	20–25, M	Well-healed, mis-aligned fracture of proximal R femur ⁵	- Abnormal/restricted gait	Normative	None
AD-60	16–17 ⁶ , US	Gracile, shortened long bones (more marked in lower limbs); increased FNAs; length of L tibia provides age estimate of 10–11 years ⁷ (extreme stunting) → para/quadruplegia (various possible causes: neuromuscular disease? poliomyelitis? cerebral palsy? stroke? spinal tumour? etc) ⁸	- Paralysis of lower limbs → restricted movement - Urinary/anal incontinence, muscle spasms, + pressure ulcers ⁹ - Visible disuse atrophy of arms + legs - Possible mental impairment ¹⁰ (depending on condition) - May have required long term external care to ensure survival ¹¹	L side (7.8%); flexed (16.8%); legs bent L (10.8%); stone packing (12.0%) indicative of the presence of a coffin (21.6%)	None
AD-111	45+, F?	Severe osteophytic lipping of R femoral head resulting in medial rotation of femur → OA ¹²	- Adduction deformity ¹³ → probable restriction of movement + abnormal gait - Pain with radiation to buttocks, knee, shin + difficulty with long periods of walking ¹⁴	R side (10.3%); flexed (16.8%); S margin	Pottery rim (3.2%)
AD-152	20–25, M	Diffuse porous + smooth PNB throughout appendicular skeleton; destruction of central/L frontal bone (some lytic, some taphonomic) → treponemal disease ¹⁵ ? HOA ¹⁶ ?	- <u>Treponemal disease</u> ¹⁷ : bone pain, soft tissue swelling, fever, tenderness, rash, syphilitic meningitis (confusion, deafness, ocular deficiencies), gummatous syphilis, + late neurosyphilis (vertigo, seizure, dementia, etc.) - <u>HOA</u> ¹⁸ : deep, aching/burning pain in affected areas, joint swelling, restricted movement, possible cutaneous involvement, + secondary HOA associated with severe internal illness	Normative	Knife (40.8%) Spear (12.8%) Shield (2.4%)
Butler's Field¹⁹					
BF-6	30–35, F	Bilateral pseudarthroses on posterior surfaces of both scapulae → posterior subspinous glenohumeral joint dislocation ²⁰	- Pain, swelling, limitation of shoulder movement, + abnormal upper body posture ²¹ - May have been caused by epileptic seizure ²²	Unphased; R leg bent, L leg straight (3.7%); narrow grave; buried away from main burial concentration (c.24 m)	None

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)	Grave goods ^d (continued)
BF-65	45+, M	Well-healed trauma to R frontal/zygomatic with displacement; anteroposterior shortening of R side of face with asymmetrical orbits	<ul style="list-style-type: none"> - Possible neurosensory disturbance → lock jaw + double vision²³ - Possible blindness from damage to orbit/eyeball - Possible brain damage from trauma to cranium²⁴ - Facial asymmetry + probable noticeable scarring 	5 th – 6 th century ('Migration phase'); NW/SE (3.3% of 'Migration phase' burials); supine (78.2%); flexed (32.4%); stone lining (8.1%); multiple consecutive burial (2.7%)	Buckle (18.1%) Knife (33.0%) Spear (11.3%) Shield (5.0%)
BF-75	30–35, M	Fusion + kyphosis of T11–L2 with smoothed out lytic lesions on T6–T10 + large, smoothed out cavity between L1 + L2; lytic lesions with smoothed out interiors on superior aspects of 3 rib heads → TB ²⁵	<ul style="list-style-type: none"> - Gibbus deformity → hunched over appearance - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait²⁶ - Pulmonary TB: fatigue + persistent cough²⁷ - General symptoms of TB: weakness, fatigue, weight loss, + fever²⁸ 	7 th – early 8 th century ('Final Phase'); skull propped up against side of grave (0.7%); lower half of skeleton absent; directly in line with (+ oppositely oriented to) burials forming clear SW margin of 'Migration phase' cemetery	Knife (33.0%)
BF-134	14–16, US	Distal + posterior displacement of L proximal humeral epiphysis + shortening of L humerus; angulation of L radial head → lateral angulation of L forearm; some flattening of R humeral head; deformation of R radial head + swelling of proximal diaphysis → lateral angulation of R forearm → traumatic injuries ^{29?} multiple epiphyseal dysplasia ^{30?}	<ul style="list-style-type: none"> - Shortening of L humerus + abnormality of L shoulder joint → restricted or abnormal L arm movement + possible pain³¹ - Abnormality of R elbow → possible restricted or abnormal R arm movement 	5 th – 6 th century ('Migration phase'); buried in row of similarly oriented burials near SE margin	Brooch (21.3%) Pin (20.8%) Bronze balance pan (0.5%)
Edix Hill³²					
EH-42B (Grave 18)	17–25, F	Rounding of nasal aperture margins, resorption of nasal spine + porosity of interior of nasal aperture; bilateral tibial periostitis [observed in Malim and Hines, 1998] → lepromatous leprosy ³³	<ul style="list-style-type: none"> - Rhinomaxillary syndrome → nasal discharge, clogged airway, lips/tongue/palate nodules, + saddle nose deformity³⁴ - Pain, loss of sensation in extremities, muscular paralysis, probable infection of foot via plantar ulcer, + difficulty with some activities involving feet³⁵ - Possible: skin lesions, hair loss, lagophthalmos, + blindness³⁶ 	Bed burial (1.5%) including wooden planks, metal cleats + eyelets; long grave; vertical sequential multiple burial (8.1%) → incomplete remains of 2 further individuals overlying grave	Unique grave goods → see below*
*Grave goods for EH-42B: 2 knives (39.2%); bead (26.4%); rod (25.0%); comb (6.1%); 2 necklace silver necklace rings (4.7%); sheep astragalus (0.7%); spindle whorl (2.0%); key (0.7%); iron bucket hoops + handle from oakwood bucket (0.7%); iron weaving batten (modified sword, 0.7%); sea urchin fossil (0.7%); funerary bed (11 iron eyelets, 6 iron cleats, 2 iron headboard stays)					

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)	Grave goods ^d (continued)
EH-130 (Grave 40)	15-16, US	Diffuse, irregular porous PNB across R ilium, ischium, + pubis → non-specific infection/inflammation or osteomyelitis?	- Pain in hip + buttocks, weakness, fever/chills, difficulty walking, + abnormal gait ³⁷	Prone (2.1%); flexed (25.6%)	Pot sherds (4.1%)
EH-146 (Grave 46)	23-59, M	Irregularly shaped lytic lesions with sharp edges throughout axial skeleton → metastatic carcinoma ³⁸	- Possible bone pain, cranial nerve palsy, + headache ³⁹ - Pain in neck, back, + lower legs ⁴⁰ → abnormal gait? - Hypercalcaemia → fatigue, deterioration of mental functioning, dysfunction of gastrointestinal, kidney, rectal, + central nervous systems ⁴¹ - May have required short term external care to ensure survival ⁴²	Normative; long/wide grave	Knife (39.2%) Buckle (30.4%) Spear (14.2%) Shield (10.8%)
EH-322A (Grave 66)	Adult, M	Collapse of anterior L5 + ankylosis with S1 through smooth bony bridging; large oval cloacae within bony bridging → TB ⁴³	- Hypolordosis → back pain ⁴⁴ - General symptoms of TB: weakness, fatigue, weight loss, + fever ⁴⁵	Normative; long grave	Buckle (26.4%) Spear (14.2%) Shield (10.8%) Vessel mounts (2.0%)
EH-440A (Grave 84)	25-35, F	Deformation of R elbow joint surfaces → OA + possible infection of R elbow ⁴⁶ + fixed pronation of R forearm	- Restricted use of R arm due to pronation fixation ⁴⁷	Skull resting on neonate (EH-440B); possible marker post (7.4%); stone inclusions (6.8%) around pelvic area	Buckle (30.4%) Beads x32 (26.4%) Nail (12.8%)
Finglesham ⁴⁸					
FS-94	30-40, M	Medial + posterior angulation of distal ends of L radius + ulna, + smooth bony ankylosis through proximal 1/3 of the diaphyses → traumatic fracture ⁴⁹	- Supination fixation → difficulty performing everyday tasks ⁵⁰	Buried in coffin (28.6%); W margin in area of females + non-adults; buried adjacent to FS-93's ring ditch (indicates burial mound)	None
Norton East Mill ⁵¹					
NEM-91	c.20, M	Posterior + medial bowing of distal half of R femur + shortening of R femur → traumatic fracture ⁵²	- Limb length discrepancy + abnormal angle of articulation with knee → abnormal gait + restricted ⁵³ use of R leg	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 ⁵⁴					
SAH-111 (Grave 110)	26-45, M	Amputation of distal ends of L ulna + radius with evidence of healing ⁵⁵	- Absence of L hand → restricted use of L upper limb ⁵⁶ - Fixation of L forearm in partial pronation - Unlikely to have worn prosthesis ⁵⁷	Normative	Spear (9.9%) Knife (41.1%)

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)	Grave goods ^d (continued)
SAH-346 (Grave 345)	Adult, M??	Midshaft swelling of L femur; enlargement + macroporosity of L acetabulum + contour change of L femoral head → bone tumour ^{58?} (osteoid osteoma, osteoblastoma, simple bone cyst) or healed fracture + osteitis ⁵⁹ + primary or secondary hip OA ^{60?}	<ul style="list-style-type: none"> - Possible pain mid femur⁶¹ - Possible abnormal gait leading to secondary OA of L hip 	Adjacent to circular empty area of cemetery → possibly used as a social 'arena' for funerary activities or communal gatherings ⁶² ; probable non-normative leg position but cannot be confirmed due to poor preservation	None
SAH-481 (Grave 472)	Adult, M	Flattening/rounding of margins of nasal aperture + some resorption of anterior nasal spine; porous PNB on R/L MCs + distal resorption of 3 proximal manual phalanges + 1 distal manual phalanx; PNB on fragments of tibiae + fibulae → probable lepromatous leprosy ⁶³ (limited by poor preservation)	<ul style="list-style-type: none"> - Rhinomaxillary syndrome → nasal discharge, clogged airway, lips/tongue/palate nodules, + saddle-nose deformity⁶⁴ - Hand deformity⁶⁵ → restricted use? - Pain, loss of sensation in extremities, muscular paralysis, probable infection of foot via plantar ulcer, + difficulty with some activities involving feet⁶⁶ - Possible: skin lesions, hair loss, lagophthalmos, + blindness⁶⁷ 	Buried away from main burial concentration; L side (2.1%); 'other' body position (2.7%) → between flexed + crouched; both legs bent L (2.7%) → R leg bent severely up towards body	Copper intaglio (incised peacock decoration, late 4 th -5 th C) for a bezel (finger ring) (0.5%)
SAH-1049 (Grave 1048)	18-25, M??	Collapse + kyphosis of 3 TV → TB ⁶⁸	<ul style="list-style-type: none"> - Gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait⁶⁹ - General symptoms of TB: weakness, fatigue, weight loss, + fever⁷⁰ 	W margin in a group of similarly oriented burials	None
Watchfield ⁷¹					
WF-5 (Grave 5)	40-45, M	Deformation of R humeral head/glenoid cavity + R humerus 76 mm shorter than L; R ulna 15 mm shorter than L → traumatic fracture ⁷²	<ul style="list-style-type: none"> - Shortening + abnormal shoulder joint → restricted use of L arm⁷³ 	SW-NE orientation (5.1%)	Spear (9.5%) Buckle (23.8%) Knife (42.9%)
WF-312 (Grave 315)	20-25, F	Probable fractures to proximal R radius/ulna + distal R humerus → deformation of R elbow (not examined by lead author) → traumatic injury + secondary OA	<ul style="list-style-type: none"> - Limited range of motion, instability, + nerve damage⁷⁴ - Restricted use of R elbow → possible fixation of elbow joint 	SW corner	Saucer brooch x2 (28.6%) with evidence of repair Knife (42.9%) Pin (11.9%) Toilet pick + scraper (2.4%) Brush casing (2.4%) Pierced Roman coin (4.8%)

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)	Grave goods ^d (continued)
Windmill Hill ⁷⁵					
WMH-10	35-45, F??	Ankylosis + kyphosis of 6 or 7 TV→ TB ⁷⁶	<ul style="list-style-type: none"> - Gibbus deformity - Disruption of spinal cord→ possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait⁷⁷ - General symptoms of TB: weakness, fatigue, weight loss, + fever⁷⁸ 	Funerary information not available	?Buckle (9.4%)
WMH-18	21-28, F	Slender, gracile upper + lower limb long bones (not as severe in upper limbs) + increased FNA→ para/quadruplegia (various possible causes: cerebral palsy? neuromuscular disease? poliomyelitis? stroke? spinal tumour? etc) ⁷⁹	<ul style="list-style-type: none"> - Lower limb paralysis→ restricted movement, urinary/anal incontinence, muscle spasms, + pressure ulcers⁸⁰ - If there was paralysis of arms→ restricted use of upper limbs - Possible mental impairment (depending on condition)⁸¹ - May have required long term external care to ensure survival⁸² 	Flexed (31.0%); probably L side (20.0%) but cannot confirm; stone inclusion (20.8%)→ possible stone lining?	?Pin (2.4%)
WMH-54	35-45+, M	Posterior angulation of distal R radius + cloaca; non-union fracture of distal R ulna→ traumatic injury + osteomyelitis ⁸³	<ul style="list-style-type: none"> - Pain, tenderness, + chronic/intermittent drainage of fistulae⁸⁴ - Abnormal angle of R wrist + restricted use of R forearm 	R side (12.7%); flexed (31.0%); 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	21-25, F	Asymmetry in size of forearms→ R radius considerably more slender than L + R ulna somewhat more slender than L→ some form of paralysis (stroke? brachial plexus palsy? monomelic amyotrophy? direct trauma? neuromuscular disease?) ⁸⁵	<ul style="list-style-type: none"> - Weakness of R forearm→ restricted use of R upper limb⁸⁶ 	Normative	Brooch x3 (14.7%) Beads x87 (16.5%) Coin pendant (1.2%) Coin (2.4%) Ceramic pot x2 (9.4%)
WMH-75	40+, M??	Fusion of L radius + ulna in distal 1/3 of diaphysis via smooth, compact bone→ traumatic injury ⁸⁷	<ul style="list-style-type: none"> - Supination fixation→ decreased forearm functionality⁸⁸ - Abduction + internal rotation of shoulder necessary to use forearm in pronated position→ fatigue⁸⁹ 	Oriented E-W (8.2%); stone inclusion (20.8%)→ possible stone lining?	None
WMH-89	14-17, US	Bilateral, diffuse woven bone (+ smoother striated compact bone) throughout skeleton→ mandible, pectoral girdles, ribs, upper/lower limbs, pelvic girdle, + hands/feet→ HOA ⁹⁰	<ul style="list-style-type: none"> - Secondary HOA associated with severe internal illness⁹¹ - Deep aching or burning pain in affected areas + joint swelling⁹²→ restricted movement - Possible cutaneous involvement⁹³ 	R side (12.7%); crouched (17.2%); NE margin	Ceramic pot base (9.4%) Knife (15.3%) Unidentified bronze object

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)	Grave goods ^d (continued)
Worthy Park ⁹⁴					
WP-2	50+, F	Anterior collapse of L3 + ankylosis of L3 + L4 → traumatic injury ⁹⁵	<ul style="list-style-type: none"> - Kyphosis + right-side angulation of lumbar spine → hunched over appearance + abnormal gait - Forward-facing gaze restricted, pain, + fatigue⁹⁶ 	Both legs bent inward (1.3%) → possibly buried with both knees projecting vertically above horizontal plane of body which then collapsed inward upon decay ⁹⁷ ; buried in grave that was too small; buried in cluster	Pin (12.4%)
WP-14	40+, M	Severe malalignment of R forearm → distal 2/3 radius + ulna displaced medially; R forearm shorter than L → traumatic injury ⁹⁸	<ul style="list-style-type: none"> - Visually distinctive R forearm - Restricted use of R forearm due to abnormal angulation⁹⁹ 	Normative; buried in cluster	Knife (54.6%)
WP-39	40–50, F	Fusion + deformation of T1–T6 (not examined by lead author) → TB ¹⁰⁰	<ul style="list-style-type: none"> - Gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait¹⁰¹ - General symptoms of TB: weakness, fatigue, weight loss, + fever¹⁰² 	Normative; buried in cluster	Pin (12.4%) Knife (54.6%) Tweezers suspended from ring (7.2%)
WP-45	18–30, M	L upper limb long bones more slender than R → some form of paralysis (stroke? brachial plexus palsy? monomelic amyotrophy? direct trauma? neuromuscular disease?) ¹⁰³	<ul style="list-style-type: none"> - Weakness of L arm → restricted use of L upper limb¹⁰⁴ 	Normative; buried in cluster	Spear (16.3%) Knife (54.6%)
WP-73	35–45, M	Four oval perforating lesions with rounded edges on distal end of L MT5 → osteomyelitis (diabetes? gangrene?) ¹⁰⁵	<ul style="list-style-type: none"> - Localised inflammation, discharging fistula, + pain¹⁰⁶ - Difficulty with ambulation → abnormal gait 	Normative	None

^a AD= Apple Down; BF= Butler's Field; EH= Edix Hill; FS= Finglesham; NEM= Norton East Mill; SAH= St Anne's Hill; WF= Watchfield; WMH= Windmill Hill; WP= Worthy Park

^b M/F (male/female); M?/F? (probable male/female); M??/F?? (possible male/female); US (unsexed); age range is provided in years

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

^d E (east); L (left); NE (northeast); NW (northwest); R (right); S (south); SE (southeast); SW (southwest); W (west); ? (possible); Parenthetical percentages indicate the percent of the entire burial assemblage in which a specific funerary variable occurred.

Table 2

Summary of the palaeopathological analysis, possible diagnoses, functional restrictions, and notable funerary treatment for the individuals with physical impairment from the Christian cemeteries (based on new osteological analysis).

SK no. ^a	Age/ sex ^b	Physical impairment + possible diagnoses ^c	Possible functional restrictions ^c	Notable funerary treatment ^d
Black Gate ¹⁰⁷				
BLG-442	25–35, M	Upper/lower limb long bones very gracile + slender with few muscular attachments → para/quadruplegia; volar grooves on 5 proximal manual phalanges ¹⁰⁸ ; severe asymmetry in TV + LV; asymmetrical curvature of R/L ribs + deformation of rib necks → scoliosis ¹⁰⁹ ; slightly increased R/L FNAs + elongation of femoral necks ¹¹⁰ ; hypoplastic R fibula (shorter/more slender than L) ¹¹¹ ; deformation of R calcaneus with increased angle of articulation with talus, extra lateral facet on R/L calcanei, elongation of R talus with inferior + medial displacement of talar head → possible club foot ¹¹² Overall: Probable neuromuscular disease ¹¹³ → muscular dystrophy? poliomyelitis? cerebral palsy?	<ul style="list-style-type: none"> - Disuse atrophy of arms/legs → restricted movement - Possible flexion deformity¹¹⁴ → restricted use of hands - Severe scoliosis → abnormal gait, pain, + incontinence¹¹⁵ - Definite inversion of R foot (club foot?) + probable but lesser inversion of L foot → abnormal gait, restricted movement¹¹⁶ - Possible mental impairment (depending on condition)¹¹⁷ 	Normative
BLG-587	35–45, F	Lateral bowing of distal halves of both radii; eburnation on distal R radius + R scaphoid; short tibiae in comparison to femora; stature of 151 cm (4'11") → Léri-Weill dyschondrosteosis ¹¹⁸ with bilateral Madelung's deformity ¹¹⁹	<ul style="list-style-type: none"> - Pain, fatigue, + restricted movement¹²⁰ - Short stature¹²¹ → visually distinctive 	Supine, extended (but no information about head/limbs)
Elstow Abbey ¹²²				
EA-17	25–35, F	Hypertrophy of proximal L tibia; 11 perforations with rounded edges (cloacae) on all aspects of proximal end → osteomyelitis ¹²³	<ul style="list-style-type: none"> - Pain, tenderness, + chronic/intermittent drainage of fistulae¹²⁴ - Probable abnormal gait 	Completely disturbed → no funerary information available
EA-25	35–59, M	Indentation proximal to capitulum of L humerus for articulation with convex, eburnated radial head; posterior + medial angulation + hypertrophy of proximal L ulna; bony outgrowth on midshaft of L ulna + L radius (early ankylosis or pseudarthrosis?) → Monteggia fracture-dislocation ¹²⁵	<ul style="list-style-type: none"> - Limited range of motion → restricted use of L arm¹²⁶ - Ankylosis in progress? → possibly fixed in partial pronation → difficulty performing some tasks¹²⁷ 	Probably supine/extended (100%/100%)*, legs probably extended (100%)*
EA-37	30–40, M	Anterior collapse of L2 → kyphosis of LV; crescentic lipping on superior border of L2 with possible perforation; scalloped osteophytosis on inferior L2 + superior L3 → traumatic injury with osteomyelitis ¹²⁸	<ul style="list-style-type: none"> - Kyphosis of lumbar → forward-facing gaze restricted, pain, fatigue, + hunched over appearance¹²⁹ → abnormal gait - If vertebral osteomyelitis → tenderness, pain, swelling, limited movement, + neurological deficit if leakage into spinal canal (sensory loss, weakness)¹³⁰ 	Only lower half of skeleton present → legs probably extended (100%)*

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
EA-52	23-32, M	Two instances of severe ankylosis + kyphosis → upper TV + thoraco-lumbar junction; porous, visceral PNB deposition on several ribs; diffuse PNB deposition (long bones of both upper limbs, lower limbs, + right MCs) → TB ¹³¹ with secondary HOA ¹³²	<ul style="list-style-type: none"> - Double gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait¹³³ - General symptoms of TB: weakness, fatigue, weight loss, + fever¹³⁴ - Pulmonary TB: fatigue + persistent cough¹³⁵ - From HOA → deep aching or burning pain in affected areas + joint swelling¹³⁶ 	Truncated mid femur → supine (100%); R arm bent slightly + L arm unknown [†]
EA-310	45+, M	Complete ankylosis of R SIJ + probable ankylosis of L SIJ; fusion of L1-L5 via smooth syndesmophytes; fragments of c.5 probable TV fused via smooth osteophytic growth; fusion of at least 6 TV + 8 ribs → ankylosing spondylitis ¹³⁷	<ul style="list-style-type: none"> - Stiffness, pain in back, pain radiating to lower limbs, tenderness, fatigue, restricted movement, + limited chest expansion¹³⁸ 	Only upper half of skeleton present → supine (100%) with arms extended (59.4%)
EA-360	25-35, M	Anterior collapse, ankylosis, + kyphosis of L2 + L3 → TB ¹³⁹	<ul style="list-style-type: none"> - Gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait¹⁴⁰ - General symptoms of TB: weakness, fatigue, weight loss, + fever¹⁴¹ 	Only upper half of skeleton present → R arm unknown + L arm bent across abdomen [†]
* % is based only on individuals that could be definitively categorised; † % not calculated for category but note that 21.9% of burial assemblage had both arms bent; NB: stoness/coffins absent (99.0%/99.7%) in graves of all individuals with physical impairment at Elstow Abbey.				
Priory Orchard ¹⁴²				
PO-1049	32-45, M	Severe disruption in proximal L femoral diaphysis resulting in a proximal segment which does not connect with medullary cavity; medial displacement of L femoral head; L femur is 54 mm shorter than R → subtrochanteric femoral fracture ¹⁴³	<ul style="list-style-type: none"> - Limb length discrepancy → abnormal gait + restricted use of L leg¹⁴⁴ 	Normative; buried near N margin (c.1.25 m)
PO-1074	OA, M?	Large, oval perforation (2 lobes) in trabecular bone of R ischium + evidence of smoothed out trabecular remodelling → aneurysmal bone cyst ¹⁴⁵	<ul style="list-style-type: none"> - Local pain, increased temperature, swelling, limited movement of hip, + possible abnormal gait¹⁴⁶ 	Normative
PO-1079/ 3123	40-60, M	Complete fusion of L femur + tibia in the flexed position with posterior angulation of tibia → tuberculous arthritis? ¹⁴⁷ septic arthritis? ¹⁴⁸ traumatic injury?	<ul style="list-style-type: none"> - Abnormal flexion of L knee → visually distinctive - Fatigue, pain, + abnormal ('crouch') gait¹⁴⁹ → restricted use of L leg 	L knee bent + raised above the horizontal plane containing the remainder of the body; buried near W margin (c.2.5 m)
PO-3169	35-45, M	Severe deformation of distal L humerus → no articular surface on anterior aspect of distal humerus; deformation of L radial head (loss of concavity) + severe deformation of proximal L ulna (coronoid process severely flattened + eburnation) → traumatic injury	<ul style="list-style-type: none"> - Articulation requires slight flexion of elbow, but full flexion probably not possible - Joint stiffness + restricted use of L arm¹⁵⁰ 	Stone included (14.9%) as part of grave lining (3.3%); only upper half of skeleton present

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
Raunds ¹⁵¹				
RD-5046	18–25, M	A) Rhinomaxillary syndrome (diffuse porous bone deposition on oral/nasal surfaces of hard palate + rounding of inferior + lateral margins of nasal aperture); diffuse PNB on R/L tibiae + fibulae → lepromatous leprosy ¹⁵² B) Significant hypertrophy of distal R femur + slight lateral angulation → traumatic injury + infection/osteitis? ¹⁵³	<ul style="list-style-type: none"> - Rhinomaxillary syndrome → nasal discharge, clogged airway, lips/tongue/palate nodules, + saddle nose deformity¹⁵⁴ - Pain, loss of sensation in extremities, muscular paralysis, probable infection of foot via plantar ulcer, + difficulty with some activities involving feet¹⁵⁵ → abnormal gait? (possibly exacerbated by lateral angulation of distal R femur) - Possible: skin lesions, hair loss, lagophthalmos, + blindness¹⁵⁶ 	SE corner (on the S margin, c.3 m from E margin); c.21.5 m from church
RD-5062	36–45, M	A) Deformation of L humeral head (concavity, eburnation, porosity, posterior rotation) + L glenoid cavity (flattening, osteophytes, porosity); L humerus 99 mm shorter than R → traumatic injury ¹⁵⁷ B) Inferior displacement of R femoral head; femoral head conical in shape with thick osteophytes, macroporosity, + eburnation → SCFE ¹⁵⁸	<ul style="list-style-type: none"> - Shortening of humerus + abnormal shoulder joint¹⁵⁹ → restricted use of L arm - Reduction in abduction + internal rotation of R hip, abnormal gait, + pain in hip, knee, + thigh¹⁶⁰ 	SE corner (c.2.5 m from S margin; c.2.5 m from E margin); c.20 m from church; pillow stones beneath/behind/on sides (8.0%)
RD-5074	26–35, M	Multiple lytic lesions with evidence of trabecular remodelling in proximal end of L tibia; PNB on proximal + midshaft of L tibia + on fragments of L fibula → tuberculous arthritis? ¹⁶¹ septic arthritis? ¹⁶²	<ul style="list-style-type: none"> - Swollen, hot, + painful knee¹⁶³ → abnormal gait + restricted use of L leg 	Knee supported by stones; clay layer over most of body (3.3%); stone over face (3.3%); L hand at pelvis, R hand at side (4.4%), feet apart (7.5%); near W margin; c.9.5 m from church
RD-5218	18–25, M	<u>L upper limb</u> : Flattening of L humeral head, diaphyseal bowing + 95 mm shortening → traumatic injury ¹⁶⁴ <u>Thorax</u> : PNB on visceral surface of ribs, irregular osteoblastic + osteoclastic activity on T9–T12, destruction of inferior T11 + superior T12 → probable TB ¹⁶⁵ <u>R lower limb</u> : A) atrophy of femur/tibia/fibula + deformation of R ankle joint → secondary to destruction of R knee? ¹⁶⁶ poliomyelitis? ¹⁶⁷ ; B) flexion fixation of tibia, patella fused to tibia → tuberculous arthritis? ¹⁶⁸ septic arthritis? ¹⁶⁹	<ul style="list-style-type: none"> - Shortening of humerus + abnormal shoulder joint¹⁷⁰ → restricted use of L arm - No evidence of kyphosis; pulmonary tuberculosis → fatigue + persistent cough¹⁷¹ - General symptoms of TB: weakness, fatigue, weight loss, + fever¹⁷² - Hot, swollen, + painful knee¹⁷³ - Abnormal flexion of R tibia + atrophy/shortening of R lower limb long bones → abnormal gait + restricted use of R leg¹⁷⁴ 	On N margin; c.7.5 m from church; buried with stone in mouth; pillow stones beneath/behind/on sides (8.0%)

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
St Peter's Church ¹⁷⁵				
SPC-585	45+, M	Large, oval perforation with sharp margins in R side of occipital + R parietal; smoothed out cavities in R pelvis; x-rays of humeral head, manubrium, + ilium (not available) confirm appearance of metastases or multiple myeloma ¹⁷⁶ → metastatic carcinoma ¹⁷⁷	<ul style="list-style-type: none"> - Skull: possible bone pain, cranial nerve palsy, + headache¹⁷⁸ - Pain in lower back + legs + functional instability¹⁷⁹ - Hypercalcemia→ fatigue, deterioration of mental functioning, dysfunction of gastrointestinal, kidney, rectal, + central nervous systems¹⁸⁰ - May have required short term external care to ensure survival¹⁸¹ 	L side (2.3%); flexed (3.7%); L arm bent over chest (3.8%); R arm bent over abdomen (13.6%); legs bent L (2.7%); nails present (5.7%); wooden grave furniture present (55.0%)→ possible coffin; adjacent to church
SPC-893	AD, US	Complete ankylosis of R (+ probably L) talus, calcaneus, + cuboid via spiky, reactive bone growth + PNB on R/L distal tibiae→ ankylosing spondylitis? ¹⁸² Reiter's syndrome? ¹⁸³ trauma + non-specific infection?	<ul style="list-style-type: none"> - Variable symptoms for tarsal fusion→ chronic pain, restricted mobility, peroneal muscle spasm, + limited inversion/eversion of ankle¹⁸⁴ - Ankylosing spondylitis→ stiff back, pain in back + limbs, tenderness, restricted movement, + limited chest expansion¹⁸⁵ - Reiter's syndrome→ tenderness, back pain, stiffness, limited motion of spine/joints, chronic diarrhoea, + ocular/genital/cardiac/cutaneous issues¹⁸⁶ - Non-specific→ possible foot deformity causing gait alteration + swelling/pain in lower legs¹⁸⁷ 	No grave drawing available
SPC-976	45+, M	Diffuse, spiculated + HOE PNB formation (scapulae, sternum, ribs, pelvis, sacrum, proximal femora); perforating holes (dorsal ribs, laminae of CV + TV)→ metastatic carcinoma (probably of the prostate) ¹⁸⁸	<ul style="list-style-type: none"> - Pain in lower back + legs + functional instability¹⁸⁹ - Hypercalcemia→ fatigue, deterioration of mental functioning, dysfunction of gastrointestinal, kidney, rectal, + central nervous systems¹⁹⁰ - If due to prostate→ fatigue, bone/nerve pain, urinary incontinence, blood in urine, problems urinating, constipation, diarrhoea, faecal urgency/incontinence, bowel obstruction¹⁹¹ - May have required short term external care to ensure survival¹⁹² 	?R side (1.8%); ?truncated mid femur

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
SPC-1068	45+, F	<u>R upper limb</u> : complete ankylosis of carpals + MC2; macroporosity + lytic lesions on proximal end of fused unit; severe osteophytic lipping of distal radius → RA ¹⁹³ septic arthritis ¹⁹⁴ trauma + infection ¹⁹⁵ <u>Spine</u> : fusion of T11-L1 with minor collapse of T11 + reactive PNB → early TB ¹⁹⁶ RA ¹⁹⁷ trauma + infection? <u>R lower limb</u> : inferomedial squishing/displacement of R femoral head (mushroom-shaped) + thick osteophytic lipping + eburation; severe enlargement of R acetabulum with diffuse lytic destruction → Legg-Calvé-Perthes ¹⁹⁸ disease or SCFE ¹⁹⁹	<ul style="list-style-type: none"> - R wrist: only possible impairment²⁰⁰ → possible restricted range of motion + stiffness - Spine: only possible impairment → pain + restricted movement possible - R leg: pain, limited range of motion (abduction + internal rotation), + abnormal gait²⁰¹ 	Normative; truncated at knee; wooden grave furniture present (55.0%) → possible coffin/charred board
SPC-1103	45+, M	Severe indentation (internal displacement) + tilting of ulnar notch of L radius creating sharp ridges; flattening of L ulnar head → traumatic injury	<ul style="list-style-type: none"> - Rotation around ulnar notch probably impossible due to sharp ridges - Fixation in partial pronation → difficulty with some daily tasks²⁰² 	Normative (only L side present)
SPC-1109	AD, M	Hypertrophy of distal R fibula + ovalar lesion with rounded edges on lateral distal end (cloaca) → osteomyelitis ²⁰³	<ul style="list-style-type: none"> - Pain, tenderness, + chronic/intermittent drainage of fistulae²⁰⁴ - Probable abnormal gait 	Only R leg present; wooden grave furniture present (55.0%) → possible coffin
SPC-1268	45+, M	Diffuse PNB in R/L humeri, sacrum, lower limbs (mixture of compact + porous) → non-specific systemic infection? HOA? ²⁰⁵	<ul style="list-style-type: none"> - Secondary HOA associated with severe internal illness²⁰⁶ - Deep aching or burning pain in affected areas + joint swelling²⁰⁷ → restricted movement - Possible cutaneous involvement²⁰⁸ 	Normative; wooden grave furniture present (55.0%) → coffin
SPC-1309	25-34, M	Large, smoothed out lesion on anterosuperior aspect of L femoral head + 2 smaller lesions on inferior aspect → considerable deformation of shape of femoral head; flattening of L acetabulum + macroporosity + eburation; diaphysis of L femur slimmer than R → unicameral bone cyst? ²⁰⁹ giant cell tumour? ²¹⁰	<ul style="list-style-type: none"> - Pain, swelling, + restricted range of motion²¹¹ - Some disuse atrophy of L leg → suggests abnormality of gait + restricted use of L leg 	Normative; wooden grave furniture present (55.0%) → coffin
SPC-1766	AD, M	Osteophytic lipping on all present tarsals; irregularly shaped, erosive, somewhat scooped out lesions on distal + proximal ends of several R/L MTs → gout ²¹²	<ul style="list-style-type: none"> - Foot pain, abnormality of gait, + periods of inability to move independently²¹³ 	?Marginal (NW corner); normative; only skeleton below neck present
SPC-1870	25-34, M	Large, scooped-out, scalloped lesions on R/L posterior calcanei + scooped-out lesions on distal ends of R/L MTs → gout ²¹⁴	<ul style="list-style-type: none"> - Foot pain, abnormality of gait, + periods of inability to move independently²¹⁵ 	Stones included (8.8%) → stones at side of skull (6.2%); wooden grave furniture present (55.0%) → coffin
SPC-1876	16-20, F?	L tibia/fibula: hypertrophy of diaphyses + nodular PNB; same alterations but less severe on R tibia/fibula → non-specific inflammation/infection/osteitis ²¹⁶ (lack of skull prevents investigation of leprosy or treponemal disease)	<ul style="list-style-type: none"> - Pain + swelling²¹⁷ → possible abnormality of gait + restricted use of both legs 	?L side (2.3%); only skeleton below mid chest present; wooden grave furniture present (55.0%) → coffin

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
SPC-1910	45+, M	Severe hypertrophy of R tibia + grooving, eburnation, + flattening of distal articular surface; flattening of superior surface of R talus + grooving/ridging on R talar head; long exostosis from R fibula; x-ray (not available) suggested chronic osteomyelitis ²¹⁸ → traumatic injury? non-perforating osteomyelitis? ²¹⁹ osteitis? ²²⁰	- Chronic or intermittent pain + malaise ²²¹ , abnormal articulation of R ankle/foot → abnormality of gait	Contemporary horizontal multiple grave (2.6%) containing 4 other individuals with intertwined limbs (older adult male, two older children, + an adolescent)
SPC-2389	AD, M	Asymmetry in shape/size/angle of zygapophyseal joints + transverse processes of LV + ?upper TV; wedging of LV + ?upper TV bodies; R zygapophyseal joint absent on S1 → scoliosis (congenital?, idiopathic?, neuromuscular?) ²²²	- Possible pain, restricted movement, + gait abnormality ²²³	Normative (but R leg, L arm, upper chest + skull absent)
SPC-2427	17–25, F	Dysplasia of R femoral head, non-existent acetabulum, thinning of proximal R femoral diaphysis, + asymmetrical ankylosis of R SIJ → developmental dysplasia of the hip ²²⁴	- Abnormal articulation of R hip → abnormal gait - Restricted use of R leg due to possible pain, + probably abnormality in range of motion + general functionality ²²⁵	Buried on E margin; wooden grave furniture present (55.0%) → coffin
SPC-2583	45+, M	Displacement of R glenoid cavity onto anterior surface of scapula; enlargement of glenoid cavity with macroporosity; eburnated area of articulation on inferior aspect of coracoid process + eburnation on R humeral head where articulation usually would not occur → subcoracoid anterior dislocation of R humerus ²²⁶	- Pain, limited use of R shoulder → reduced elevation + rotation ²²⁷	Adjacent to church; wooden grave furniture present (55.0%) → coffin
SPC-2616	35–44, M	Severe OA of L elbow → flexion + partial pronation fixation (not analysed by lead author) ²²⁸ → primary or secondary OA ²²⁹	- Pain, joint contracture/impingement, + restricted use of L forearm → difficulty performing some daily tasks ²³⁰	?R side (1.8%); wooden grave furniture present (55.0%) → coffin
SPC-2799	35–44, M	Hypertrophy of R radius; hypertrophy of R tibia with occlusion of medullary cavity + extreme thinning of cortical surface → fibrous dysplasia? ²³¹	- Pain in affected areas (R forearm + lower leg) ²³² → restricted use of R arm + R leg	Normative
SPC-2801	25–34, F	R femoral head: thick, irregular osteophytic lipping on inferior + posterior margins; eburnation, macroporosity, + furrows of bone with ridging on anterior; R acetabulum: enlargement, flattening, eburnation, macroporosity, + grooving → OA ²³³	- When femur + acetabulum articulated → hip movement not possible in all directions - Limited range of motion, diffuse pain through groin, buttocks, knee, + shin → possible restricted use of leg ²³⁴	Normative

^a BLG= Black Gate; EA= Elstow Abbey; PO= Priory Orchard; RD= Raunds; SPC= St Peter's Church

^b M/F (male/female); M?/F? (probable male/female); US (unsexed); AD (adult); OA (older adult)

^c CV (cervical vertebrae); FNA (femoral neck angle); HOA (hypertrophic osteoarthropathy); HOE (hair-on-end); L (left); L# (lumbar vertebra #); LV (lumbar vertebrae); MC (metacarpal); MT (metatarsal); OA (osteoarthritis); PNB (periosteal new bone); R (right); RA (rheumatoid arthritis); S# (sacral vertebra #); SCFE (slipped capital femoral epiphysis); SIJ (sacroiliac joint); T# (thoracic vertebra #); TB (tuberculosis); TV (thoracic vertebrae)

^d E (east); L (left); N (north); NW (northwest); R (right); S (south); SE (southeast); W (west); ? (possibly); Parenthetical percentages indicate the percent of the entire burial assemblage in which a specific funerary variable occurred.

Table 3

Summary of the palaeopathological analysis, possible diagnoses, functional restrictions, and notable funerary treatment for the individuals with physical impairment from the Christian cemeteries (based on extant osteological analysis). NB: All diagnoses are based on previous palaeopathological analysis, but sources are included where relevant.

SK no. ^a	Age/ sex ^b	Physical impairment + possible diagnoses ^c	Possible functional restrictions ^c	Notable funerary treatment ^d
Cherry Hinton²³⁵				
CH-2012 (Grave 1)	15–25, M	Fracture of R ankle (alterations not discussed), considerable swelling of L MT1, + swelling of R MT1 + another R MT → non-suppurative osteomyelitis ²³⁶	- Continuous or intermittent episodes of pain + swelling ²³⁷ → possible abnormality of gait	Normative body/limb positioning; feet turned inwards*; near E margin (c.3 m)
CH-2018 (Grave 3)	15–18, M	Swelling of ?R tibia/fibula + RMT1; x-ray reveals no cloacae → chronic, non-suppurative osteomyelitis ²³⁸	- Continuous or intermittent episodes of pain + swelling ²³⁹ → possible abnormality of gait	Normative body/limb positioning; feet turned to R*; probable coffin (1.4%); near E margin (c.3.25 m)
CH-2077 (Grave 17)	45+, M	L humerus 79 mm shorter than R; flattening, dysplasia, + erosion of L humeral head + glenoid cavity → traumatic fracture of L humerus ²⁴⁰ + abnormality of L shoulder joint	- Shortening + abnormal shoulder joint → restricted use of L arm ²⁴¹	Normative body/limb positioning; near E margin (c.3 m)
CH-2136 (Grave 36)	45+, M	Diffuse, thick, disorganised PNB on cranial base, pelvis, distal radii, femora, tibiae, fibulae, + calcanei; focal concentrations of sclerosis in TV, LV, pelvis, femora, calcanei → metastatic carcinoma (probably of the prostate?) ²⁴²	- Skull: possible bone pain, cranial nerve palsy, + headache ²⁴³ - Pain in lower back + legs, + functional instability ²⁴⁴ - Hypercalcemia → fatigue, deterioration of mental functioning, dysfunction of gastrointestinal, kidney, rectal, + central nervous systems ²⁴⁵ - If due to prostate → fatigue, bone/nerve pain, urinary incontinence, blood in urine, problems urinating, constipation, diarrhoea, faecal urgency/incontinence, bowel obstruction ²⁴⁶ - May have required short term external care to ensure survival ²⁴⁷	Normative body/limb positioning; stone inclusion (3.6%); skull propped up by large stone (pillow stone= 2.9%); in SE corner (c.2.5 m from E margin of burials; c.2.25 m from probable S margin of burials)
CH-2498 (Grave 145)	45+, F	Deformation + resorption of L distal humerus + proximal ulna/radius → comminuted fracture of L elbow resulting in joint abnormality	- Abnormal L elbow joint → joint stiffness, + abnormal or restricted use of arm ²⁴⁸	R lower arm turned inwards, R hand over pelvis*; L hand on top of pelvis* ?truncated below pelvis
CH-2506 (Grave 148)	45+, F	L femur: posterior displacement/angulation of distal end + 5 cm shortening + multiple, small cloacae within callus; considerable striated + irregular PNB on fragments of L tibia + fibula → partially healed, midshaft spiral fracture + osteomyelitis ²⁴⁹	- Lower limb length discrepancy → abnormal gait, possibly restricted movement ²⁵⁰ - Cloacae not large (possibly mostly healed) but possibility of chronic pain + malaise ²⁵¹ → abnormal gait	Normative body/limb positioning; c.5 m from church

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
CH-2843 (Grave 197)	45+, M	Severe deformation of R radial head with medial/posterior angulation of proximal end; abnormal articulation with distal humerus resulting in fixed pronation → fracture/dislocation of R radial head	- Abnormal R elbow joint + pronation fixation → difficulty performing everyday tasks ²⁵²	Normative body/limb positioning; hand beneath pelvis*; c.5 m from church; skull, R lower leg, + feet absent
CH-3044 (Grave 229)	17–25, F	Widespread, bilateral PNB (porous + partially remodelled) in ribs, lower arms, pelvis, + legs → probable HOA ²⁵³ related to pulmonary or extra-pulmonary disease/condition	- Secondary HOA associated with severe internal illness (probably pulmonary) ²⁵⁴ - Deep aching or burning pain in affected areas + joint swelling ²⁵⁵ → restricted movement - Possible cutaneous involvement ²⁵⁶	Normative body/limb positioning; lower arms turned inwards, hands crossed over pelvis*; c.2.5 m from church
CH-3208 (Grave 284)	45+, M	L tibia 60 mm shorter than R; L fibula 47 mm shorter than R → well-healed fracture of distal tibia/fibula with lateral displacement + secondary OA of ankle + patella-femoral joint	- Lower limb length discrepancy → abnormal gait (evidenced by OA of ankle) + possibly restricted movement ²⁵⁷	c.5 m from church; R side of skeleton truncated (body/limb positioning not available)
CH-3270 (Grave 305)	35–45, M	Severe dysplasia + flattening of R/L humeral heads + glenoid fossae; considerable shortening of R/L humeri (humerus length → R: 243 mm; L: 200 mm); varus deformity of R/L femoral necks with mushroom appearance of R/L femoral heads + osteophytosis, eburnation, + porosity; extant R acetabulum is shallow, dysplastic, with eburnation + pitting; absence of kyphosis or lordosis in spine → probable multiple epiphyseal dysplasia ²⁵⁸	- Pain ²⁵⁹ - Abnormalities of both shoulder joints + limb shortening → pain, limited joint use ²⁶⁰ , + restricted use of arms - Abnormalities of both hip joints → abnormal gait +/or restricted lower limb use ²⁶¹	Stone inclusion (3.6%) → classified as 'pillow grave' (2.9%), 6 stones identified as small finds but arrangement unclear; normative body/limb positioning; R arm ?extended, slightly behind pelvis*; legs classified as 'together'*; c.3.5 m from church
CH-3956 (Grave 50)	25–35, F	Collapse/destruction of L2–3 + associated ankylosis of L1–4 with >90° kyphosis → TB ²⁶²	- Gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait ²⁶³ - General symptoms of TB: weakness, fatigue, weight loss, + fever ²⁶⁴	c.2.25 m from church; no body or leg position available but arms extended*; legs truncated just below pelvis
CH-4195 (Grave 591)	35–45, F	Severe destruction of T11 + ankylosis of T10–11, T12–L1 with 90° kyphosis → TB ²⁶⁵	- Gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait ²⁶⁶ - General symptoms of TB: weakness, fatigue, weight loss, + fever ²⁶⁷	Normative body/limb positioning; c.3 m from church (exact location not shown on map)

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
CH-4307 (Grave 625)	8-10, US	Smooth, rounded cavity within L hard palate; abnormal positioning of first + second lateral maxillary incisors + socket for L canine merges with cavity; considerable asymmetry of L facial bones (maxilla, zygomatic, nasal septum) with supero-inferior shortening of L maxilla; hooked bony protrusion from L zygomatic extending inferiorly + medially → possible dentigerous cyst ²⁶⁸	- Cyst itself probably benign but would have resulted in pain if infected + facial asymmetry ²⁶⁹ that was probably noticeable in most interactions	Normative body/limb positioning
CH-4337 (Grave 635)	10-12, US	Destruction + collapse of T11-12 + ankylosis of T10-L1 with >90° kyphosis → TB ²⁷⁰	- Gibbus deformity - Disruption of spinal cord → possible paraparesis/paraplegia, urinary/anal incontinence, pain, sensory impairment, + abnormal gait ²⁷¹ - General symptoms of TB: weakness, fatigue, weight loss, + fever ²⁷²	Normative body/limb positioning (R leg displaced over L*)
CH-4411 (Grave 660)	45+, F	Large spherical mass attached to postero-medial surface of proximal R humerus + 2 smaller masses of dense bone with irregular 'walnut' appearance ²⁷³ ; postero-medial displacement of R humeral head; spiculated, reactive bone growth on proximal diaphysis → parosteal osteosarcoma ²⁷⁴	- Probable restricted of movement of R shoulder ²⁷⁵ → abnormal or restricted arm movement - Pain associated with large mass ²⁷⁶	Normative body/limb positioning but L arm + leg truncated
* Extra descriptions added by excavator, but percentage cannot be calculated as recording was not consistent. Most of these hand/arm/feet positions were probably normative.				
Jarrow ²⁷⁷				
JA-69/15	55-75, M	Angulation + significant medial rotation of distal L femur; abnormal bowing of R/L ulnae, radii, tibiae, R femur, + L humerus; thickening of skull → probable Paget's Disease with pathological midshaft fracture of L femur ²⁷⁸	- Limb abnormalities + fracture of L femur → gait/movement abnormalities ²⁷⁹ - Pain of affected elements ²⁸⁰	Away from main burial concentration (c.3 m, c.4.5 m, c.5.75 m from nearest burials to the N, W, + S respectively), marginal status cannot be confirmed
JA-70/140	42-48, M	Extra articulation for R humeral head on anterior aspect of R scapula → chronic anterior dislocation of shoulder ²⁸¹	- Pain, limited use of R shoulder → reduced elevation + rotation ²⁸²	Normative (no body position data); within main burial concentration
Monkwearmouth ²⁸³				
MK-66/12	55-70, M	Inferior displacement of R humeral head with flattening, eburnation, + porosity + corresponding deformation of R glenoid cavity → slipped proximal epiphysis? trauma? severe OA changes?	- Abnormality of R shoulder joint → restricted use ²⁸⁴ + abnormal movement of R arm	Stone inclusion (16.5%) → stones by side; coffin nail (11.7%) = probable coffin (17.5%)
MK-66/20	20-23, M	Hypertrophy of proximal + distal L tibia; deformation + hypertrophy of distal L fibula; smooth, rounded cloaca on lateral aspect of distal L fibula → osteomyelitis ²⁸⁵	- Pain, tenderness, + chronic/intermittent drainage of fistulae ²⁸⁶ - Probable abnormal gait	Double grave with 66/21

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
MK-66/31	50-65, M	<u>Fracture of R pelvis</u> : overall deformation in shape of ilium; severe fracture and partial dislocation (in superior direction) of lateral aspect of ilium; evidence for a sinus; deformation of GSN; callus formation inferoanterior to GSN; fracture line runs through acetabulum; possible fracture/displacement of R sacral ala <u>Fracture of L femur</u> : 38.5 mm shorter than R + posterior angulation of distal end → likely traumatic incident that resulted in fracture + healing of R pelvis + L femur	<ul style="list-style-type: none"> - L side lower limb length discrepancy → abnormal gait + restricted movement²⁸⁷ - Due to deformation of pelvis, likely that R hip was in abnormal articulation → abnormal gait + restricted movement²⁸⁸ 	Coffin nails (11.7%) = probable coffin (17.5%)
MK-66/59	24-28, M	Hypertrophy of distal R tibia + small cloaca at distal end → osteomyelitis ²⁸⁹ (possibly result of fracture)	<ul style="list-style-type: none"> - Pain, tenderness, + chronic/intermittent drainage of fistulae²⁹⁰ - Probable abnormal gait 	Coffin nail (11.7%) = probable coffin (17.5%)
MK-69/18	50-75, M?	Periostitis + thickening of R/L tibiae/fibulae; atrophy of distal manual phalanx + ankylosis/angulation of proximal + intermediate phalanges of first digit of R foot → probable lepromatous leprosy ²⁹¹	<ul style="list-style-type: none"> - Possible hand deformity²⁹² → restricted use - Pain, loss of sensation in extremities, muscular paralysis, possible infection of foot via plantar ulcer, + difficulty with some activities involving feet²⁹³ - Possible: skin lesions, hair loss, lagophthalmos, + blindness²⁹⁴ 	Prone (8.1%); stone inclusion (16.5%) → feet on or below stones
North Elmham ²⁹⁵				
NE-2	30-50, F	L humerus much thinner than R + gracility of L ulna fragment; poor preservation of distal L humerus + proximal L ulna → some form of paralysis (stroke? brachial plexus palsy? monomelic amyotrophy? direct trauma? neuromuscular disease?) ²⁹⁶ or septic arthritis ²⁹⁷	<ul style="list-style-type: none"> - Underdevelopment/weakness of the L arm + abnormality of L elbow joint → abnormal +/or restricted movement of L upper limb possible²⁹⁸ 	Near boundary ditch (c.1.5 m)
NE-10	Adult, M	Jagged osteophytosis + numerous sinuses within proximal end of L tibia; similar involvement of proximal L fibula, L patella, + L femoral condyles; osteitis of L tibial + fibular diaphyses → tuberculous arthritis ²⁹⁹ septic arthritis ³⁰⁰	<ul style="list-style-type: none"> - Swollen, hot, + painful knee³⁰¹ → abnormal gait + restricted use of L leg 	Beyond boundary ditch; only individual with head to the E
NE-26	Adult, M	Complete ankylosis of bodies of T5-L5 + some ankylosis through neural arches; complete ankylosis of at least seven ribs to TV → ankylosing spondylitis ³⁰²	<ul style="list-style-type: none"> - Stiffness, pain in back, pain radiating to lower limbs, tenderness, fatigue, restricted movement, + limited chest expansion³⁰³ 	Near boundary ditch (c.2 m)
NE-74A	35-40, F	Cloaca surrounded by periostitis on superior aspect of lateral end of R clavicle; large, single cloaca on proximal half of L fibula (apparently also present on L tibia) → osteomyelitis ³⁰⁴	<ul style="list-style-type: none"> - Pain, tenderness, + chronic/intermittent drainage of fistulae³⁰⁵ - Probable abnormal gait (L leg) + possibly restricted use of R arm 	Normative

SK no. ^a (continued)	Age/ sex ^b (continued)	Physical impairment + possible diagnoses ^c (continued)	Possible functional restrictions ^c (continued)	Notable funerary treatment ^d (continued)
NE-176	30-40, M	L radius is 38.7 mm shorter than R + much more gracile; proximal L ulna much more gracile than proximal R ulna → some form of paralysis (stroke? brachial plexus palsy? monomelic amyotrophy? direct trauma? neuromuscular disease?) ³⁰⁶	- Underdevelopment/weakness of the L forearm → abnormal +/- or restricted movement of L upper limb possible	Not marginal, but not in central burial cluster
NE-197	30-35, F	L femoral circumference is 28.5 mm thicker than R → x-ray suggests chronic, non-perforating osteomyelitis? ³⁰⁷	- Continuous or intermittent episodes of pain + swelling ³⁰⁸ → possible abnormality of gait	Not marginal, but not in central burial cluster

¹ CH= Cherry Hinton; JA= Jarrow; MK= Monkwearmouth; NE= North Elmham

² M/F (male/female); M?/F? (probable male/female); US (unsexed); AD (adult)

³ GSN (greater sciatic notch); HOA (hypertrophic osteoarthropathy); L (left); L# (lumbar vertebra #); LV (lumbar vertebrae); MT (metatarsal); OA (osteoarthritis); PNB (periosteal new bone); R (right); T# (thoracic vertebra #); TB (tuberculosis); TV (thoracic vertebrae)

⁴ E (east); L (left); N (north); R (right); S (south); SE (southeast); W (west); Parenthetical percentages indicate the percent of the entire burial assemblage in which a specific funerary variable occurred.

Endnotes

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- ³ Lehovsky (1999); Resnick (2002); Zimmerli (2010)
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- ⁵ Resnick (2002)
- ⁶ AlQahtani *et al.* (2010)
- ⁷ Scheuer and Black (2000)
- ⁸ Selection of sources: Weinstein *et al.* (1952); Stallings *et al.* (1993); Ihkkan and Yalçin (2001); Morell *et al.* (2002); Resnick (2002); Sussman (2002); Rodrigues dos Santos *et al.* (2003); Shevell *et al.* (2003); Biggar (2006); Krigger (2006); Novak *et al.* (2012, e1285); Mughal (2014); Shah (2015); Armour *et al.* (2016)
- ⁹ Blanes *et al.* (2009)
- ¹⁰ Fink (2003); Krigger (2006); Nardes *et al.* (2012)
- ¹¹ Bohling (2020, Section 10.2)
- ¹² Waldron (2009, 33–34)
- ¹³ Lloyd-Roberts (1953); Jeffery (1975)
- ¹⁴ Doherty *et al.* (2005)
- ¹⁵ Hackett (1981); Aufderheide and Rodríguez-Martín (1998, 156, 160); Resnick (2002); Ortner (2003, 286, 274); Cole and Waldron (2010)
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- ¹⁷ Kent and Romanelli (2008, 228); Resnick (2002); Farnsworth and Rosen (2006)
- ¹⁸ Golding (1985); Martínez-Lavín (1997); Resnick (2002); Nahar *et al.* (2007); Yap *et al.* (2017)
- ¹⁹ Boyle *et al.* (1998; 2011)
- ²⁰ Resnick (2002)
- ²¹ Resnick (2002); Roberts *et al.* (2014, 958)
- ²² Poigenfürst (1986)
- ²³ Balle *et al.* (1982); Rončević (1983); Kovács and Ghahremani (2001)
- ²⁴ DeKosky *et al.* (2010)
- ²⁵ Roberts *et al.* (1998); Resnick (2002); Ortner (2003, 230–1); Canci *et al.* (2005); Waldron (2009, 95); Holloway *et al.* (2011)
- ²⁶ Turgut (2001); Resnick (2002); Roberts and Buikstra (2003, 95); Owolabi *et al.* (2010)
- ²⁷ Leung (1999)
- ²⁸ Hopewell (1994)
- ²⁹ Baxter and Wiley (1986); Steele and Graham (1992); Resnick (2002); Resnick and Goergen (2002)
- ³⁰ Ingram (1991); Unger *et al.* (2008)
- ³¹ Henrikson (1969); Ingram (1991); Zyto *et al.* (1995); Unger *et al.* (2008)
- ³² Malim and Hines (1998)
- ³³ Møller-Christensen (1961); Andersen and Manchester (1992); Lewis *et al.* (1995); Roberts and Manchester (2010, 197); confirmed via aDNA analysis by Pfrengle *et al.* (2021)
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- ⁴⁵ Hopewell (1994)
- ⁴⁶ Resnick (2002); Ortner (2003, 222); Waldron (2009, 33–34)
- ⁴⁷ Simmons *et al.* (1983)
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- ⁵⁰ Simmons *et al.* (1983); Hankins *et al.* (2006)
- ⁵¹ Sherlock and Welch (1992)
- ⁵² Resnick (2002)
- ⁵³ Khamis and Carmeli (2017)
- ⁵⁴ Forsyth and Seaman (2015); Doherty and Greatorex (2016)
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- ⁵⁷ Mays (1996); Kirkup (2007, 158)
- ⁵⁸ Resnick (2002)
- ⁵⁹ Ortner (2003, 54–5)
- ⁶⁰ Waldron (2009, 33–4)
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- ⁶⁵ Resnick (2002); Roberts (2020, Chapter 2)
- ⁶⁶ Golding (1985); Resnick (2002); Roberts and Manchester (2010, 197); Slim *et al.* (2011); Roberts (2020, Chapter 2)
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- ⁶⁸ Resnick (2002); Ortner (2003, 230–1); Waldron (2009, 95); Holloway *et al.* (2011)
- ⁶⁹ Turgut (2001); Resnick (2002); Roberts and Buikstra (2003, 95); Owolabi *et al.* (2010)
- ⁷⁰ Hopewell (1994)
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- ⁷² Baxter and Wiley (1986); Resnick (2002); Resnick and Goergen (2002)
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- ⁷⁵ Bishop and Mordan (nd)
- ⁷⁶ Resnick (2002); Ortner (2003, 230–1); Waldron (2009, 95); Holloway *et al.* (2011)
- ⁷⁷ Turgut (2001); Resnick (2002); Roberts and Buikstra (2003, 95); Owolabi *et al.* (2010)
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- ⁷⁹ Selection of sources: Weinstein *et al.* (1952); Minear (1956); Stallings *et al.* (1993); Ihkkan and Yalçin (2001); Morell *et al.* (2002); Resnick (2002); Sussman (2002); Rodrigues dos Santos *et al.* (2003); Shevell *et al.* (2003); Biggar (2006); Jan (2006); Krigger (2006); Novak *et al.* (2012, e1285); Mughal (2014); Shah (2015); Armour *et al.* (2016)
- ⁸⁰ Blanes *et al.* (2009)
- ⁸¹ Fink (2003); Krigger (2006); Nardes *et al.* (2012)
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- ⁸³ Resnick (2002); Ortner (2003, 199)
- ⁸⁴ Waldvogel *et al.* (1970); Lerner *et al.* (1993); Lew and Waldvogel (2004); Haztenbuehler and Pulling (2011); Baldan *et al.* (2014); Lima *et al.* (2014); Panteli and Giannoudis (2017)
- ⁸⁵ Selected sources: Weinstein *et al.* (1952); Kattan and Spitz (1968); Singh *et al.* (1980); Parker *et al.* (1986); Hirayama *et al.* (1987); Waters *et al.* (1998); Broeks *et al.* (1999); Resnick (2002); Gordon *et al.* (2004); Talbot (2004); Jan (2006); Shah (2015); Armour *et al.* (2016)
- ⁸⁶ Broeks *et al.* (1999); Gourie-Devi and Nalini (2003); Nalini *et al.* (2014)
- ⁸⁷ Resnick (2002)
- ⁸⁸ Simmons *et al.* (1983)
- ⁸⁹ Simmons *et al.* (1983); Hankins *et al.* (2006)
- ⁹⁰ Ali *et al.* (1980); Pineda *et al.* (1987); Mays and Taylor (2002); Ortner (2003, 354–7); See the following research for examples of HOA in archaeological skeletons: Martínez-Lavín *et al.* (1994); Assis *et al.* (2011); González-Reimers *et al.* (2011); Masson *et al.* (2013); Binder and Saad (2017); Flohr *et al.* (2018)
- ⁹¹ Martínez-Lavín (1997); Yap *et al.* (2017)
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- ⁹⁸ Resnick (2002)
- ⁹⁹ Högstrom *et al.* (1976)
- ¹⁰⁰ Resnick (2002); Ortner (2003, 230–1); Waldron (2009, 95); Holloway *et al.* (2011)
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- ¹⁰⁴ Broeks *et al.* (1999); Gourie-Devi and Nalini (2003); Nalini *et al.* (2014)
- ¹⁰⁵ Ashman *et al.* (2001); Boffeli *et al.* (2015)
- ¹⁰⁶ Tennvall and Apelqvist (2000); Ashman *et al.* (2001); Price (2004)
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- ¹⁰⁸ Andersen and Manchester (1987)
- ¹⁰⁹ Ortner (2003, 466–7); Waldron (2009, 216)
- ¹¹⁰ Resnick (2002)
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- ¹¹³ Selected sources: Colonna and Saal (1941); Weinstein *et al.* (1952); Minear (1956); Ratliff (1959); Madigan and Wallace (1981); Zancolli *et al.* (1983); Fulford (1990); Tonkin and Gschwind (1992); Cornell (1995); Emery (2002); Ozonoff (2002); Resnick (2002); Sussman (2002); Shevell *et al.* (2003); Sees and Miller (2013); Shah (2015); Armour *et al.* (2016)
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- ¹¹⁸ Cummings and Rega (2008)
- ¹¹⁹ Resnick (2002)
- ¹²⁰ Fagg (1988); Schmidt-Rohlfing *et al.* (2001); Zebala *et al.* (2007)
- ¹²¹ Resnick (2002)
- ¹²² Baker (2014; 2016); unpublished archive held by David Baker
- ¹²³ Resnick (2002); Ortner (2003, 199)
- ¹²⁴ Waldvogel *et al.* (1970); Lerner *et al.* (1993); Lew and Waldvogel (2004); Haztenbuehler and Pulling (2011); Baldan *et al.* (2014); Lima *et al.* (2014); Panteli and Giannoudis (2017)

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- 125 Cohn (1942); Resnick (2002)
- 126 Soni *et al.* (2019)
- 127 Simmons *et al.* (1983)
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- 132 Ali *et al.* (1980); Pineda *et al.* (1987); Mays and Taylor (2002); Ortner (2003, 354–7); See the following research for examples of HOA in archaeological skeletons: Martínez-Lavín *et al.* (1994); Assis *et al.* (2011); González-Reimers *et al.* (2011); Masson *et al.* (2013); Binder and Saad (2017); Flohr *et al.* (2018)
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- 134 Hopewell (1994)
- 135 Leung (1999)
- 136 Golding (1985); Martínez-Lavín (1997); Resnick (2002); Nahar *et al.* (2007); Yap *et al.* (2017)
- 137 Resnick (2002)
- 138 Ward (1999); Resnick (2002); Bostan *et al.* (2003)
- 139 Resnick (2002); Ortner (2003, 230–1); Waldron (2009, 95); Holloway *et al.* (2011)
- 140 Turgut (2001); Resnick (2002); Roberts and Buikstra (2003, 95); Owolabi *et al.* (2010)
- 141 Hopewell (1994)
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- 143 Resnick (2002); Loizou *et al.* (2010)
- 144 Khamis and Carmeli (2017)
- 145 Aufderheide and Rodríguez Martín (1998, 390–1); Resnick (2002)
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- 147 Kim *et al.* (1999); Resnick (2002); Malaviya and Kotwal (2003); Ortner (2003, 222)
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- 149 Klatt and Stevens (2008)
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