Archaeologia Historica Polona
vol. 31, 2023, pp. 297–323, ISSN 1425–3534, DOI: 10.12775/AHP.2023.011

Institute of Archaeology
Nicolaus Copernicus University in Toruń
Faculty of History
Adam Mickiewicz University in Poznań
magdalena.matczak@amu.edu.pl
ORCID ID: 0000-0003-2934-0036

MAGDALENA MATCZAK

The bioarchaeology of disability in medieval times: an overview of current perspectives and future directions

Abstract. Since the 1970s, archaeological research into disability has evolved into a distinct and mature field known as the bioarchaeology of disability, characterised by specialist methodologies and theoretical approaches. Particularly, research on disability within medieval bioarchaeology has developed more extensively compared to other periods of time. This article seeks to offer a comprehensive and critical review of the literature on the bioarchaeology of disability with a focus on the Middle Ages. It examines the range of topics, methodologies, theories, and definitions of disability, as well as the methods used for investigating disability. Key research themes include various aspects of daily life, such as care, diet, the use of prosthetics, punishment, emotional experiences, and burial practices. The theoretical bioarchaeology of care framework has become dominant, leading to a focus on how disabled individuals were treated in the Middle Ages with an emphasis on care-centred studies. Osteobiography is another significant approach, often used in conjunction with the bioarchaeology of care. Social and multifactorial models are commonly employed to define disability. The field has advanced significantly through the application of new methods and techniques from medicine and biogeochemistry. The paper outlines further directions in research on medieval disability. Future investigations are expected to broaden the scope of the above-mentioned topics, encompassing population-level studies and comparative analyses across Europe. Another challenge is to improve the integration of osteological analysis with historical texts to clarify which diseases and conditions were considered disabilities in the Middle Ages. A table providing examples of disability cases from the medieval period is included for reference.

Keywords: impairment, care, Middle Ages, history of science, interdisciplinary research.

Historical overview of disability studies in medieval period

Disability studies in social and historical sciences have developed since the 1980s (e.g., Kudlick 2003; Battles 2011). They were created in parallel to the growing political awareness of people with disabilities, and the need to alter western policies to recognize their challenges and the accommodations necessary to support them, thus both increasing their access to the workforce and their quality of life (Barnes, Mercer 2010). Archaeological research on disability started in the 1970s and has since flourished and become mature, with its own methodology and theories developing a new field of study which is the bioarchaeology of disability. Bioarchaeology as a research field emerged in the 1970s as combining archaeology with physical anthropology in the study of human life (Buikstra 1977). In this sense, this knowledge is used to reconstruct the identity and various spheres of life of people from the past, including those related to disability. A unique feature of bioarchaeological research is that it provides direct insight into what diseases or pathological conditions significantly impaired functioning and made individuals "disabled" or "impaired". Therefore, the main subject of this research is cultural and social contextualization and reconstruction of the lives of these individuals. This approach is different to palaeopathology which focuses on diseases and reconstruction of biological aspects of human life. Research on architecture or artifacts related to disability although very valuable does not provide archaeologists with such a direct opportunity to learn about disabilities as bioarchaeology (e.g., Sneed 2020). Therefore, bioarchaeological research is a dynamically developing field related to understanding disability in the past. Over the decades, studies on disability have developed significantly and have a wide time and geographical scope; therefore, they cover the times from the Palaeolithic to the 19th century, through Europe, Africa, Asia to North and South America (e.g., Solecki 1971; *Disability and archaeology* 1999; *Bioarchaeology of impairment* 2017; *Disability and care* 2024)[1].

Meanwhile, the interest in researching disability in the Middle Ages has also grown, with early work suggesting that disabled individuals were buried in prone position, an indicator of an anti-vampire burial in Poland (Miśkiewicz 1969). Research from the 1990s onwards has examined individuals with unique diseases, often with exceptional social status dating back to the Middle Ages in England (Knüsel *et al.* 1992; Knüsel, Göggel 1993; Knüsel 1999; Molleson 1999; Roberts 1999). Further studies brought a more comprehensive approach to the burial customs of people with impairment in later Anglo-Saxon England (Hadley 2010) and also contributed information and a new perspective resulting from the analysis of written sources (Crawford 2010). These were initial and contributing studies

[1] Lorna Tilley provides a relatively up-to-date overview of general (i.e., not specifically medieval) bioarchaeological research into disability and care (Tilley 2022).

that signalled reflection on the problem of disability in the Middle Ages. Their undoubted contribution was laying the foundations for the definition of disability and research methods in archaeology.

A significant turning point in disability studies was the emergence of the bioarchaeology of care as a new theoretical perspective (Tilley, Oxenham 2011). Research has begun to focus on the interpretation of care shown to disabled people (Šlaus *et al.* 2012; Novak *et al.* 2014; Micarelli *et al.* 2018) including application of the bioarchaeology of care as a theoretical framework in the medieval period (Matczak, Kozłowski 2017; Roberts 2017). The research also covered other topics such as burial customs (Zakrzewski *et al.* 2017). The third decade of the 21st century marked a new horizon in this research and brought the greater development of population studies on disability (Matczak *et al.* 2021; 2023; Bohling *et al.* 2022a; 2022b; 2023) and new approaches such as application of the analysis of stable isotopes to study diet of impaired individuals (Drtikolová Kaupová *et al.* 2020). The *International Journal of Paleopathology's* Special Issue on *Disability and care in Western Europe during Medieval Times: a bioarchaeological perspective* has further enriched this area of research (*Disability and care* 2024).

So far, the research spans from the 5th to the 15th century across Europe, including Ireland, Great Britain, France, Italy, Poland, Croatia, Romania, Lithuania, and Russia (Table 1). Decades of research have brought many new interpretations and research approaches. Currently, studies on disability in medieval period are one of the most intensively developed topics among studies on disability in all bioarchaeology, including those relating to other periods of time. Disability studies in medieval period represent a rapidly developing segment within bioarchaeology, showcasing a plethora of new interpretations and methodological approaches. The progress made makes this research field worthy of full and critical evaluation in terms of methods, theories, definitions and research directions. The aims of this study are: (i) to evaluate definitions and models of disability in medieval bioarchaeology, (ii) to discuss theories and methodologies of investigation of disability applied in this field, (iii) to overview the interpretations of attitudes of society towards disabled individuals in the Middle Ages, (iv) to outline further research directions, (v) to provide a table with exemplary cases of disability from the Middle Ages as a useful reference. These will help in future research on disability estimation in the archaeological record from medieval period of time. This is the first such extensive synthesis for the bioarchaeology of disability in medieval period, which evaluates years of research on this topic and offers insights concerning the future of this field. This article explores the bioarchaeology of disability as a theorized, systematic approach to identifying, analysing, and interpreting evidence of disability. It emphasises situating such evidence within the context of lifeways and encompasses all studies focused on disability, including those that identify "disability" during palaeopathological analyses of human remains. This represents a broad framework for studying disability in bioarchaeology.

Table 1. Archaeological exemplary reports identifying case studies of disability in the medieval period in the chronological order. Dates in the table reflect original dating protocols

Date and site	Individual, age and sex	Pathology	Social position and treatment during life and after death	References
mid 5th– early 7th century; Worthy Park, UK	burial 38 (B38), 50, male	congenital complete absence (amelia) of the left upper limb; scoliosis; asymmetries of rib cage and pelvis; osteoarthritis; exostosis at the right talonavicular ligament attachment site	care; standard burial with two anomalous features: right forearm placed diagonally across the chest with finger bones of the right hand on the left side of the neck, the head set on a pillow of earth	Tilley, Cave 2023
6th–the 8th century; Povegliano Veronese, Italy	tomb US 380, 40–50, male	healed amputation of the right forearm; osteoarthritis; dental modification of RI[2]	care; family compassion; a male adjusted very well to his condition using a culturally-derived device (prosthesis); different burial than others: the right arm bent over the pelvis, the D-shaped buckle and the presence of organic material (bindings), a knife	Micarell *et al.* 2018
7th – the 9th century; Velim, Croatia	grave 85, 40–50, male	ankylosing spondylitis; osteoarthritis; three healed antemortem fractures of the ribs: on the 7th and 8th right ribs, and on the 8th left rib	help and care	Šlaus *et al.* 2012
8th century; Rome, Italy	T7A, 50, female	ankylosis of multiple joints; probable rheumatoid arthritis; degenerative joint disease; cervical and thoracic vertebrae show lipping and osteophytes on the body; Schmorl's nodes; antemortem loss of teeth	care	Cilione, Gazzaniga 2023
10th/11th–1st half of the 11th century; Kałdus, Poland	burial 52/00, 30–40, male	osteomyelitis on the tibia; linear enamel hypoplasia	middle social status; normative burial: W–E orientation, grave constructions: traces of a frame, skeleton in the supine position	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume
40s of the 11th–11th/12th century; Kałdus, Poland	burial 41/00, 40–50, male	healed amputation of distal parts of the left tibia and fibula; degenerative joint disease; osteophytes on vertebrae; porotic hyperostosis indicating anaemia; antemortem crown fracture of the upper right medial incisor	middle social status; atypical burial: W–E orientation, grave constructions: traces of a frame, skeleton on the right side in a strongly huddled position	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume
2nd half of the 11th–2nd half of the 12th century; Kałdus, Poland	burial 5/03, 30–40, female	post-paralytic lesions that might be connected with poliomyelitis; degenerative joint disease; osteophytes on vertebrae; periosteal reactions; linear enamel hypoplasia; antemortem loss of teeth	high social status; normative burial: NW–SE orientation, grave constructions: traces of a coffin, skeleton in the supine position, iron knife	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume

Table 1 (continued)

Date and site	Individual, age and sex	Pathology	Social position and treatment during life and after death	References
2nd half of the 11th–2nd half of the 12th century; Kałdus, Poland	burial 31/04, 50–60, male	osteomyelitis on the left tibia; periosteal reactions; degenerative joint disease; osteophytes on vertebrae; osteoma on the right parietal bone; complete sacralisation of L5; dental caries; antemortem loss of teeth	middle social status; normative burial: NW–SE orientation, skeleton in the supine position, a horn frame was uncovered, but it is not certain whether it is related to the burial	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume
11th–the 14th century; Buje, Croatia	45–55, male	ankylosing spondylitis; osteoarthritis	help and care	Šlaus *et al.* 2012
2nd half of the 12th–12th/13th century; Kałdus, Poland	burial 42/00, 7, unknown	Pott's disease (spinal tuberculosis); *cribra orbitalia* possibly indicating anaemia	middle social status; normative burial: W–E orientation, grave constructions: traces of a frame, lack of anatomical order of bones	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume
12th century or later; Rigny, France	burial 1437, 50, female	Treacher Collins syndrome; osteoarthritis; enthesopathy; Schmorl's nodes	care; integrated into the population; her diet did not differ from that of the rest of the community; buried with care, possibly in a shroud, and with the head propped up by two stones	Miclon *et al.* 2021
12th–1st half of the 13th century; Kałdus, Poland	burial 56/98, 35–45, female	osteomyelitis of the diaphysis with cloacae in the left femur; periosteal reactions; degenerative joint disease; dental caries; antemortem loss of teeth; linear enamel hypoplasia	high social status; normative burial: NWW–SEE orientation, grave constructions: streak of darker charcoal marker along the edge of the grave pit (frame), skeleton in the supine position, bronze ring, four temple rings	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume
12th–1st half of the 13th century; Kałdus, Poland	burial 101/98, 25–30, female	leprosy; morphological deformation of the left tibia shaft probably caused by healed fracture; massive periosteal reaction and remodelling are present; systemic osteoperiostitis on both tibias and fibulas; Schmorl's nodes; congenital fusion of the C2 and C3 vertebrae; *cribra orbitalia* and porotic hyperostosis indicating anaemia	middle social status; care; normative burial: W–E orientation, skeleton in the supine position, iron knife, bronze ring	Matczak, Kozłowski 2017; Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume
12th–1st half of the 13th century; Kałdus, Poland	burial 122/99, 25–30, female	neoplasm; probably multiple myeloma; the inflammatory reaction of the periosteum of multiple bones; a healed fracture of the right ulna; degenerative joint disease; antemortem loss of teeth; root abscess	middle social status; anti-vampire burial: SWW–NEE orientation, skeleton in the supine position, skull outside the anatomical order: the skull laid crosswise to the skeleton's axis, at the height of the right humerus, iron knife	Matczak *et al.* 2023; see also M. Matczak, T. Kozłowski, W. Chudziak in this volume

Table 1 (continued)

Date and site	Individual, age and sex	Pathology	Social position and treatment during life and after death	References
12th–15th century; Chichester, UK	Chichester 115, 45, male	leprosy; fractures to the nose; Colles' fracture to the right radius and subluxation of the distal right ulna; a Galeazzi fracture-dislocation of the left ulna at the radio-ulnar joint; plateau fracture of the right tibia; mid-diaphyseal, comminuted fracture of the right femur; soft tissue injuries present in the form of a traumatized blood supply and secondary osteoarthritis; scoliosis; lines of arrested growth in the right femur and both radii; hypertrophied right pectoral girdle and upper limb bones and hand; enamel hypoplastic defects; short stature	social stigma; burial segregated from other burials	Knüsel 1999
12th century (Knüsel 1999), 14th–15th century (Knüsel *et al.* 1992); Brough, UK	burial 1423, mature adult, male	slipped proximal femoral epiphysis; secondary osteoarthritis; osteophytes on vertebrae; lordosis; scoliosis	possibly a male was a master of the hospital of Saint Giles; possible usage of a crutch; prestigious burial; buried within the chapel serving the hospital, beneath the high altar with a chalice, paten of lead and tin alloy	Knüsel *et al.* 1992; Knüsel 1999
*c.*1200–*c.*1600 CE; Ballyhanna, Co. Donegal, Ireland	SK 606, 35–50, male	unilateral maxillary sinusitis; fractured left clavicle; small avulsion fracture or cortical defect in the left scapula; enlarged radial fossa; rib fracture; obturator fracture dislocation at left hip joint; enlarged radial fossa; cortical defect in pubic symphysis; osteoarthritis and musculature stress in the right hip; periosteal reactive new bone formation	care; considered as part of the community; atypical burial: included in the communal burial ground at Ballyhanna, buried in the standard extended supine position, the head orientated to the north	McKenzie *et al.* 2022
13th–14th century; Koprivno, Croatia	grave 7, 45–55, male	ankylosing spondylitis	help and care	Šlaus *et al.* 2012
13th–14th century; Cambridge, UK	PSN 335, 45–65, female	a healed intracapsular fracture of the right femoral neck; multiple well-healed rib fractures; a healed fracture to the right forearm resulting in detachment of the styloid process on the ulna and a shelf-like projection on the distal end of the radius; a healed fracture on the inferior aspect of the body of the fourth lumbar vertebrae; a healed hairline fracture on the posterior aspect of the right patella; a chronic respiratory condition; subperiosteal new woven bone formation on the anterior aspect of the sacrum and on the right iliac wing; osteoarthritis	a female was a member of the labouring class in a medieval market town; care, likely an inmate of the hospital; buried within a hospital burial ground	Dittmar *et al.* 2023

Table 1 (continued)

Date and site	Individual, age and sex	Pathology	Social position and treatment during life and after death	References
the beginning of the 13th –the mid--14th century; Fishergate, UK	Sk 251, 45–60+, male	a severe fracture dislocation of the right knee (twist-fracture); secondary septic arthritis; scoliosis; osteoarthritis; hypertrophy or increased development of the bone and muscle of the left lower limb; the right limb shows atrophy or bone decrease; right humerus and radius are more robust than the left ones	burial in a special area of the cemetery; wealthy and prestigious burial; buried in a shroud with two tin-bronze alloy plates and a crutch or support of some type	Knüsel 1999
13th–15th century; Vilnius, Lithuania	321, 20–35, male	a healed amputation on the distal third of the right tibia and fibula	city dweller; Christian; care; common cemetery burial	Kozakaitė *et al.* 2022
14th –15th century; Mikhali 3/Mininskoye, Russia	grave 13, 35–44, female	multiple osteomas on the parietal and frontal bones; vascular reaction and resorptive lesions on the thoracic vertebrae; poor dentition; small stature	the female was regarded as an ordinary and full community member; care; buried in the graveyard alongside other members of the community; the grave had no specifically unique features	Fedorina *et al.* 2022[1]
14th –15th century; Mikhali 3/Mininskoye, Russia	grave 15, 35–44, male	healed rib fractures; *cribra femoralis*; periosteal reactions on both tibiae; right lower limb is 17.5 mm longer than the left one; skeletal abnormalities; severe dental disease; enamel linear hypoplasia; small stature	care; buried as ordinary villager?	Fedorina *et al.* 2022[2]
15th century; Rijeka, Croatia	grave 39, 55+, female	ankylosing spondylitis; osteoarthritis	help and care	Šlaus *et al.* 2012
cal AD 1450 and AD 1640; Székely, Romania	burial 195, a middle-aged or older adult, male	a well-healed penetrating cranial injury on the left parietal bone; a well-healed depression fracture on the anterior surface of the cranial vault	care; normative burial	Bethard *et al.* 2021

The case studies summarised here are from English language sources. A survey of non-English language literature might well prove productive. Extensive studies presenting a large number of disabled individuals can be found in Bohling *et al.* 2022a; 2022b; 2023; Tilley, Cave 2023.

[1] Individual indicated as a disabled in personal communication by Anastasiya Fedorina.

[2] Individual indicated as a disabled in personal communication by Anastasiya Fedorina.

Definitions and models of disability

A major challenge in the field of the bioarchaeology of disability, particularly within medieval studies, is defining the concept of disability itself. Historically, researchers in their early works, have employed terms like "cripple", "impairment", and "disability" to categorize disabled individuals and their physical conditions (e.g., Knüsel *et al.* 1992; Knüsel, Göggel 1993). Christopher Knüsel initially adopted a definition from *The concise Oxford English dictionary*, which describes disability as "thing or lack which prevents one from doing something; legal disqualification; physical incapacity caused by injury or disease" (Knüsel 1999, p. 32). The terms "disability" and "impairment" were sometimes used synonymously (Knüsel 1999). In contrast, other studies exclusively used "impairment" to refer to physical deviations or omitted a precise definition of "disability" (e.g., Hadley 2010; Šlaus *et al.* 2012; Novak *et al.* 2014).

In both the social sciences and bioarchaeology, researchers have identified three primary approaches to understanding disability: the medical model, the social model, and the multifactorial model. The medical model, which emerged in the 19th century, posits that disabilities are primarily the result of physical or mental impairments that hinder "normal" functioning (Barnes, Mercer 2010). This perspective, prevalent in early academic literature, persists in contemporary studies (e.g., Miclon *et al.* 2021). However, critics argue that the medical model overlooks the significant social dimensions of disability, limiting its explanatory power.

In contrast, the social model of disability offers a perspective that diverges significantly from the medical model by emphasizing the societal expectations of what it means to be "able-bodied". This approach was notably articulated by the Union of the Physically Impaired Against Segregation (UPIAS) in the UK in 1976, which offered distinct definitions for impairment and disability. Impairment is defined as "lacking part or all of a limb, or having a defective limb, organ or mechanism of the body" while disability, on the other hand, is described as "the disadvantage or restriction of activity caused by contemporary social organization which takes no or little account of people who have physical impairments and thus excludes them from participation in the mainstream of social activities" (*Fundamental principles of disability* 1976, p. 14). This delineation by UPIAS underscores impairment as a physiological condition and disability as a consequence of societal structures that fail to accommodate those with physical impairments, effectively marginalizing them from full societal participation. The model suggests that societal norms and infrastructures are designed with only the "able-bodied" in mind, thereby creating barriers that "disable" those with impairments (Barnes, Mercer 2010). Consequently, disability is perceived as a social construct layered upon impairment, a viewpoint supported by various scholars in medieval bioarchaeology (e.g., Brownlee 2017; Zakrzewski *et al.* 2017; Dittmar *et al.* 2023; Cilione, Gazzaniga 2023). Some

researchers who embrace the social model in their studies express scepticism about the feasibility of investigating disability within historical contexts, such as the medieval period. They refrain from using the term "disability" when interpreting the osteological evidence, remaining only using the term "impairment" even when they reconstruct the functional implications and social consequences of the disease such as care (Baker, Bolhofner 2014; Redfern, Austin 2020). However, the social model, especially its more extreme varieties, is criticized for not recognizing the role of impairment as an objective basis for the classification and source of a person's disadvantage (Wasserman, Aas 2023).

Jonas-Sébastien Beaudry calls both models reductionist and emphasizes that they have fallen out of favour among theorists and political discourses as they tend to neglect the diversity of causes and experiences of disability (Beaudry 2020). This observation is echoed by some bioarchaeologists (Matczak *et al.* 2021; 2023; Bohling *et al.* 2022a; 2023), who point out that the medical and social model have their limitations related to narrowing the phenomenon of disability to only the biological or only social aspect. Especially in bioarchaeology, which studies both the physical dimension of disability based on osteological analyses of skeletons and reconstructs the perception of disabled people based on archaeological context and historical texts, the biological and social aspects of disability should be taken into account. Therefore, the best solution to the problem is to use a multifactorial model of disability offered, for example, by the World Health Organisation (WHO; e.g,. Micarelli *et al.* 2018; Matczak *et al.* 2021; 2023; Tilley, Cave 2023). The WHO biopsychosocial model (*Towards* 2002, pp. 9–10) defines disability and functioning "as the result of the interaction between health states (diseases, disorders and injuries) and contextual factors". Multifactorial models (usually medico-social) are the most influential and mainstream because they are a compromise between medical knowledge and activist postulates, offer descriptively better perspectives compared to reductionist models, and useful criteria (Beaudry 2020).

There are also sceptical voices about the possibility of interpreting disability based on bone material. Charlotte Roberts refrains from making a final conclusion regarding disability, like many other researchers dealing with this topic in relation to other periods of time (Roberts 2017; see also e.g., Cormier, Buikstra 2021). Some scholars concentrate exclusively on researching impairment, sidestepping the broader concept of disability (Drtikolová Kaupová *et al.* 2020).

As demonstrated, the concept of disability encompasses a multitude of definitions, leading to cultural polysemy and challenges in reaching a unified, consistent definition across both social sciences and bioarchaeology (Beaudry 2020).

It is also worth mentioning the various models of disability constructed and used by researchers of medieval history. In 2006, Irina Metzler introduced the social model of disability to the medieval history (Metzler 2006; 2013). Since then, new theoretical frameworks for a discussion of disability in the Middle Ages have been

developed. They include the ecclesiastical/religious model, the cultural model, the environmental model, parallel diagnosis, information streams and variability while some scholars do not use any model but rather rely on the terms and definitions from textual sources (Turner 2022). It is also emphasized that medieval people saw disability through multiple lenses. It is worth paying attention to these models because they may be useful in reconstructing the treatment of disabled people, especially since bioarchaeologists rely on medieval texts in their interpretations.

Theoretical and methodological approaches

One of the most important aspects of disability research in bioarchaeology is the estimation of disability in osteological material. Over the years, several methodological approaches and research protocols have been developed to address this, both in the evaluation of individual case studies and within population-based frameworks. Several theoretical frameworks for studying disability have emerged: osteobiography, the bioarchaeology of care, the bioarchaeology of personhood, the lived experience framework, "The bioarchaeology of disability", "A historical-osteological protocol for identifying disability" and the World Health Organization's Disability-Adjusted Life Years (DALYs) (Tilley, Oxenham 2011; Boutin 2016; Cormier, Buikstra 2021; Robb *et al.* 2021; Bohling *et al.* 2022a; Matczak *et al.* 2023). Osteobiography, the bioarchaeology of care, "The bioarchaeology of disability", "A historical-osteological protocol for identifying disability" and WHO DALYs have been notably applied to materials from the medieval period. Below, the research methodologies used in bioarchaeological studies focused on the medieval period are discussed.

Introduced in 1961, osteobiography examines an individual's life history through osteological materials, archaeological contexts, and written sources (Saul 1972; Saul, Saul 1989; see also Robb 2002). Osteobiography is a very good way of examining the lives of disabled people, because modern advanced research methods allow for obtaining a lot of data about the individual and thus reconstructing his or her life. Therefore, osteobiography is often used to study disabled individuals. Osteobiographies present lives of exceptional and functionally different individuals and very often are combined with the bioarchaeology of care framework in general and also with reference to the medieval period (e.g., Matczak, Kozłowski 2017; Roberts 2017; *Disability and care* 2024).

The bioarchaeology of care can arguably be regarded as the first methodological framework for a "bioarchaeology of disability" (Tilley 2015). The bioarchaeology of care, conceptualized by Lorna Tilley, offers a sophisticated methodology for evaluating the care provided to sick and disabled individuals in past contexts (Tilley, Oxenham 2011; Tilley, Cameron 2014; Tilley 2015). Care may have concerned people with disabilities, so a part of the research protocol may be used to assess

disability. To assess the likelihood of caregiving, this approach begins by establishing the probable presence of disability. It does so through a systematic evaluation of the clinical implications of identified pathologies, followed by an analysis of the potential functional consequences within the broader sociocultural and economic lifeways context. The bioarchaeology of care emphasizes obtaining information from research in many disciplines, which makes these studies very interdisciplinary. Within the bioarchaeology of care the research protocol is composed of four steps (Tilley, Oxenham 2011; Tilley 2015; 2017). The first step documenting the individual involves a detailed record of the individual's pathology, along with the context of their lifeways. The second step establishing the case for care focuses on the clinical and functional implications of the pathology to ascertain the necessity for care. The third step developing a model of care conceptualizes care, considering both direct support and accommodation for the individual. The fourth step interpretation of group agency and individual identity involves analysing how care reflects on the agency of the group and the identity of the individual. The comprehensive synthesis of insights gathered at each stage facilitates the development of an osteobiography, which narrates the life history of an individual. "The Index of Care", published in 2014, is an online tool (app) developed to facilitate the application of the bioarchaeology of care approach (Tilley, Cameron 2014). While it faithfully reflects and operationalizes the methodology, it is not synonymous with it. The close relationship between the "Index of Care" and the "bioarchaeology of care" might lead to confusion between the two. Lorna Tilley and Marc Oxenham's seminal use of the bioarchaeology of care to analyse the remains of a Neolithic Vietnamese man with quadriplegia exemplifies its application (Tilley, Oxenham 2011). Subsequent research has expanded the use of this theoretical framework to various periods and regions, including the Middle Ages, thereby demonstrating its adaptability and utility in bioarchaeological studies (e.g., Matczak, Kozłowski 2017; Roberts 2017; *Disability and care* 2024). For instance, this methodology was applied in a phenomenological study of the lived experience of an individual with an acquired disability in medieval Ireland, further illustrating its breadth (McKenzie *et al.* 2022). The methodology, as described above, primarily focuses on the study of individuals within the framework of osteobiography, making its application to population-level studies challenging. However, there have been proposals to expand this approach to include analyses of communities of care and broader population-level studies (*Bioarchaeology* 2022). Further extending this approach to explore groups of disabled individuals at the population level holds considerable promise.

"The bioarchaeology of disability" outlines a comprehensive methodology for examining disability at a population level (Bohling *et al.* 2022a; 2022b; 2023). This methodology unfolds in three distinct phases. First, contextualisation which involves a thorough review of literature pertinent to the period under study, setting a foundational context for subsequent analysis. Second, data collection focuses on

the systematic palaeopathological analysis or re-analysis of all individuals identified with physical impairments. It also involves the aggregation of data concerning mortuary treatments, providing a holistic view of the individuals' burial rites and societal perceptions of disability. Third, analysis integrates the collected data with the literature review and theoretical frameworks to delve into contemporary views of disability. This approach applies the bioarchaeology of care framework (Tilley, Oxenham 2011; Tilley 2015). Special attention is given to individuals who osteologically deviate from the "average" human due to visible or functional abnormalities, or conditions causing physically impairing symptoms not necessarily visible to others. This approach is both intriguing and comprehensive, promising to encapsulate all critical facets that influence the definition and perception of disability. Nevertheless, the criteria for assessing disability remain somewhat ambiguous, particularly regarding the reliance on contemporary medical clinical literature versus historical texts. This lack of clarity could benefit from further elucidation to enhance understanding of the methodological underpinnings and analytical rigor of the study.

In her interdisciplinary study, Magdalena Matczak devised and implemented an interdisciplinary protocol for identifying disability in past populations through textual and osteological evidence across historical periods called "A historical-osteological protocol for identifying disability" (Matczak *et al.* 2023). The protocol comprises the following steps. First, review of the textual sources to understand which physical conditions were perceived as disabilities during the periods in question. Textual sources may include materials from the same time as osteological materials, or ethnohistorical or ethnographic materials from later times. Second, identification of pathological conditions in individuals' skeletons and evaluation of their impact on daily life, drawing on modern clinical, ethnomedical, and palaeopathological studies. Third, analysis of which pathological lesions found in skeletons correspond with disabilities described in the textual sources, thereby identifying skeletons of individuals who lived with disabilities. This way, those skeletons that belonged to people with disabilities are identified. This comprehensive analysis synthesizes information on the definitions of disability and identifies afflictions present in both textual and osteological materials that may be considered disabilities. This is a more socio-cultural approach than the ones mentioned above because it integrates data from historical sources at an earlier level of analysis, i.e. at the level of disability identification. The findings provide a foundation for further research into the social status, care, and burial customs of individuals with disabilities (Matczak *et al.* 2021)[2].

In their paper, John Robb *et al.* examine the concept of disability burden in late medieval England rather than the lived experience of disability itself (Robb *et al.* 2021). To this end, a modified version of the World Health Organisation's

[2] See also M. Matczak, T. Kozłowski, W. Chudziak in this volume: "The social status of disabled individuals in early medieval Culmen in Poland".

Disability-Adjusted Life Years (DALYs) methodology was applied. Their analysis draws on a combination of modern WHO data on disease in the contemporary developing world, historical sources such as post-medieval Bills of Mortality, and prevalence rates derived from palaeopathological studies.

Other research protocols and methodologies developed for studying disability in periods outside the medieval era may also be applicable. For example, Jennifer F. Byrnes proposed a systematic approach for the bioarchaeological assessment of impairment – or disability – resulting from trauma (Byrnes 2017). This methodology integrates palaeopathological analysis of skeletal remains, orthopaedic assessment guides, and historical data, employing statistical methods to enhance interpretation.

While each methodology shares similarities, "A historical-osteological protocol for identifying disability" notably emphasises integrating data from both the analysis of written sources on disability and osteological material analysis. It as well as other approaches includes contextualization and broader understanding of life of individuals. Many researchers who occupy themselves with the bioarchaeology of care focus their studies on constructing a care model, which is an interesting and illuminating approach. However, it lacks a closer integration of the results from the analysis of written texts with archaeological sources and osteological materials in the definition of disability in the past even if textual sources are extensively discussed (e.g., Cilione, Gazzaniga 2023; Dittmar *et al.* 2023). The baseline for assessing functional implications of disease and possible disability within the bioarchaeology of care, "The bioarchaeology of disability" and "A historical-osteological protocol for identifying disability" is an in-depth and broad review of medical clinical literature. For instance, integrating established neuroscience literature aids in elucidating the probable neurological impacts of injuries in medieval Romania (Bethard *et al.* 2021). Additionally, incorporating ethnomedical literature enriches the research. The incorporation of clinical and ethnomedical literature enhances the understanding of past disabilities, yet further interdisciplinary integration is essential to fully grasp the lived experiences of individuals in historical contexts.

Case study: a female with poliomyelitis

"A historical-osteological protocol for identifying disability" was used to identify disability in a female from Culmen (Matczak *et al.* 2023). The skeleton was excavated in the village of Kałdus, situated in northern Poland. The early mediaeval that is from the 10th to the 13th century settlement complex was named Culmen in Latin. Culmen was initially located outside the borders of the Gniezno state (the first Polish state), but later was one of the main centres of the Polish state, to eventually become a castellany in the 12th century. It was strategically located on the border

between the Polish state and the Prussian lands, and at the crossroads of two main routes linking Rus' with the Baltic Sea and Scandinavia. The settlement complex consisted of a stronghold with the remains of a stone basilica (site 3), a settlement (site 2) and a cemetery (sites 1, 2, and 4) with up to 1,500 graves – one of the largest in Early Mediaeval Central Europe. The skeleton of a female is dated back from the 2nd half of the 11th century to the 2nd half of the 12th century.

Vita sanctae Hedwigis, the 14th century hagiography of Saint Hedwig, the duchess of Silesia, provides numerous descriptions of people with various ailments. The source mentions a man, 18 years old, with all his limbs stiff, who was regarded as a "cripple". He could not feed himself unassisted and was completely bedridden. Siostromił, Racław and Więcymił were paralysed, and the last two were called "cripples". Racław, who suffered from cramps, was called "a cripple" and was a beggar in Wrocław. Based on this it was assumed that paralysis was considered disability in medieval Poland (Matczak *et al.* 2023).

The skeleton of a female, 30–40 years old at death, from grave 5 form Culmen presents atrophy of bones in lower limbs associated with paralysis-induced changes (probably poliomyelitis). The female's shorter and more fragile left lower limb indicates poliomyelitis was contracted in childhood. Based on descriptions of people with paralysis perceived as disabled in medieval chronicles, we can assume that the female of Culmen was also considered disabled.

A palaeopathological analysis of her skeleton suggests also degenerative joint disease manifesting as slight marginal osteophytic lipping visible in both temporomandibular joints, the left shoulder, and the right wrist and hand. Osteophytic formations are present in the thoracic and lumbar vertebral bodies. The lateral surface of the proximal end and the shaft of the atrophic side of the tibia displays signs of periosteal reactions, which are partially healed and probably not directly associated with the atrophy. Periosteal reactions manifest as markedly accentuated longitudinal striations, with moderate involvement of the periosteum, but affecting less than one-half of the long bone surface, and as slight, discrete patches of reactive bone affecting less than one quarter of the long bone surface. Mandibular and maxillary canines and a mandibular incisor have one hypoplastic line, while a maxillary incisor has two hypoplastic lines. An antemortem loss of six teeth was also observed.

Poliomyelitis is an acute viral infection characterised by fever, hypersensitivity, irritation of the gastrointestinal tract, headaches and muscle aches, paralysis of single muscles or muscle groups, muscle weakness, or permanent paralysis. This condition leads to complications such as instability and contracture of the joints, limb growth disorders, muscle balance disorders, and muscle cramps and distortions. Poliomyelitis causes also a decrease in muscle tone, abolition of reflexes in the affected limb, muscle fasciculations, or atrophy of denervated muscles. Therefore, the person is unable to move without support and assistance, or without special

equipment (e.g., crutches). Nowadays, it leads to disability and in the past, it could also have a significant impact on someone's life. The female from Culmen probably experienced the above-mentioned symptoms of poliomyelitis. Her shorter limb prevented her from walking and restricted her mobility. Both palaeopathological and historical data indicate that the female from Culmen may have been disabled.

If a female contracted poliomyelitis in childhood (which is probable), she would have experienced difficulties in performing various tasks from an early age. She needed assistance of others to move due to possible paralysis. It could be difficult or even impossible for her to perform duties such as collecting honey, plants, and fungi, or ploughing and working in the fields. She could sit and help with cooking, craftwork, and looking after small children. She lived until she was in her 30s–40s, so she required help and care for a considerably long time. A female who contracted the disease in childhood and passed away in adulthood, experienced a prolonged period of disability. If she survived long enough to develop the advanced stage of disease, she probably received support and care. She required varying levels of assistance and care in terms of basic, domestic, economic needs and mobility, as she was unable to live fully independently. She was the only individual in Culmen to be diagnosed with paralysis, which probably also had an impact on her perception in society.

The female was laid in a normative grave with NW–SE orientation, grave constructions in the form of traces of a coffin and an iron knife. The skeleton was set in the supine position. This indicates the proper commemoration of a female after death according to the standard burial practices in this community at that time.

The osteobiographical analysis of the female from Culmen provides compelling evidence of long-term disability likely resulting from poliomyelitis contracted in childhood. The palaeopathological features, such as lower limb atrophy, support the diagnosis of paralysis, which aligns with historical accounts of disability in medieval Poland. The integration of archaeological context, burial practices, and historical texts allows us to better understand how individuals with disabilities were perceived and treated in early medieval societies. Despite her physical limitations, the female from Culmen lived into adulthood, suggesting she was a recognized and cared-for member of her community, and was buried in accordance with normative practices. Her case not only illustrates the lived experience of disability in the past but also underscores the value of interdisciplinary approaches in reconstructing the lives of individuals with challenging conditions.

Interdisciplinary research

The above overview of various methodologies applied to study disability leads to several reflections. Disability studies in bioarchaeology have a very interdisciplinary dimension, combining data and methods from palaeopathology, biological anthropology, medicine, biogeochemistry and cutting-edge technologies, archaeology as well as history.

The most common methods used include age and sex assessment and palaeopathological analysis which are basic for this kind of research. Palaeopathological analyses have proved invaluable because they provide insight into the diseases, pathological conditions and injuries people have suffered in the past (e.g., Aufderheide, Rodríguez-Martín 1998; Roberts, Manchester 2010; *Ortner's identificaton* 2019). Therefore, macroscopic analysis using standard osteological methods and radiographic analysis are a classic approach and first step to study disease. The standardization of osteological and anthropological methods is crucial for facilitating comparative research in disability studies (Brownlee 2017). The palaeopathological assessment of the severity of skeletal pathological changes, differential diagnosis, and evaluation of the disease's impact on an individual's functioning is a crucial component of the research process. In many studies – particularly those focused on prehistoric periods – this serves as the starting point. The physical effects of pathology, which shape the experience of disability to varying degrees, manifest along several axes: a condition may be temporary or permanent, acute or chronic, congenital or acquired. The type and extent of caregiving required will vary accordingly. The origins and characteristics of a pathology, as experienced within a specific lifeways context, can significantly influence how it is understood and how others respond to it. As such, the biological dimension of disability plays a central role in bioarchaeological analysis. Clinical medical and ethnomedical studies are used to estimate the impact of diseases on the functioning of an individual in the past.

Moreover, advancements in technology have led to the adoption of highly specialist techniques such as CT scanning (e.g., Micarelli *et al.* 2018). Jenna Dittmar used techniques involving plain X-rays to determine the degree of malunion, rotation, and overlap of fracture (Dittmar *et al.* 2023). She analysed cortical bone architecture of the injured individuals and uninjured controls using micro-computed tomography (μCT) and examined clinical and functional consequences using the bioarcheology of care framework. Sylva Drtikolová Kaupová and Valentin Miclon have presented a new approach related to new topics and methods in the study of people with disabilities not only in relation to medieval period but for the whole field of the bioarchaeology of disability (Drtikolová Kaupová *et al.* 2020; Miclon *et al.* 2021). They conducted research of the diet of people with impairments and disabilities using carbon and nitrogen stable isotope analysis, which revealed broader aspects of their

care and treatment. Additionally, 3-D reconstruction techniques provide illustrative visualisations of individuals' skeletons, serving both analytical and visual purposes (Bethard *et al.* 2021; Miclon *et al.* 2021; Fedorina *et al.* 2022).

However, cultural data derived from the analysis of the archaeological context also play a significant role. Mortuary treatments – including grave goods, constructions, the situation of a grave within the cemetery, and the arrangement of the skeleton inside the grave – are pivotal for establishing the cultural context surrounding the burial of individuals with disabilities (e.g., Matczak, Kozłowski 2017). The relationship between mortuary archaeology and the extent to which grave contexts reflect social relationships is a complex and much-debated issue (e.g., Parker Pearson 2011). Burial customs are multifaceted, conveying social status, identity, memory, and care for the deceased, as well as beliefs about the afterlife. It is important to note that any interpretations regarding the life and social perception of a disabled individual based on grave goods or burial context should be approached with caution.

Just as crucial is the incorporation of the information derived from the analysis of written sources, whenever available. A variety of medieval texts can be used to explore disability. Particularly valuable are hagiographies and miracle catalogues, which offer some of the most detailed descriptions of individuals suffering from illnesses considered incurable at the time – many of which resulted in disability. Chronicles also serve as important sources, providing insights into the diseases and disabilities of the upper classes. Court documents reveal punishments, including physical mutilations, that often led to permanent disability. Each type of source has its own particular context shaped by its intended audience and purpose, and therefore requires a tailored interpretive approach. For instance, chronicles were often composed for royal courts and frequently reference earlier national or classical texts. They tend to include comparisons between contemporary and ancient figures, making their interpretation complex and layered. Conversely, saints' lives and miracle catalogues were typically written to support the process of canonisation. The abundance of miracles and healings reported in these texts was intended to serve as evidence of a candidate's sanctity. Historical texts have been frequently employed to improve the understanding of conditions recognised as disabilities in the past (e.g., Crawford 2010; Matczak *et al.* 2023). The interdisciplinary strategy, which combines palaeopathology, archaeology, and history, extends beyond the realm of bioarchaeology to include biohistory, too (Fedorina *et al.* 2022; Matczak *et al.* 2023). The use of ethnographic and ethnohistorical materials through analogical reasoning offers valuable insights. These sources can inform research on the perception, care, emotional responses, and treatment – including mortuary practices – of individuals with disabilities (Matczak, Kozłowski 2017; Matczak *et al.* 2021; McKenzie *et al.* 2022). Since ethnographic sources also contain information dating back to times later than the Middle Ages, their use requires prior appropriate

criticism. A compelling analysis emerges only through a meticulous amalgamation of insights from historical, palaeopathological and archaeological data, and an extensive evaluation of clinical implications.

Themes and findings

Over the years, extensive research has explored various facets of life related to disability, encompassing aspects of medieval community life such as caregiving, social status, diet, the use of prosthetics, punishment, and emotional responses to physical otherness. These studies also extend to cover death and mortuary treatment.

As mentioned above, the field of disability studies in the medieval period has evolved significantly, largely influenced by the theoretical framework of the bioarchaeology of care, leading to a predominant focus on caregiving practices (e.g., Matczak, Kozłowski 2017; *Disability and care* 2024). For example, Anastasiya Fedorina presented research from Mikhali 3/Mininskoye in Suzdal Opolie, a historic princely centre in north-eastern Rus' (Fedorina *et al.* 2022). This study reveals that disabled individuals from the 14th and 15th centuries were provided organised social and economic support by rural communities. Most likely, these communities did not isolate individuals with disabilities, nor stripped them of their social status. The survival of numerous individuals with long-term illnesses suggests a community network of mutual aid, home-based healthcare, and traditional medicine practices. Providing a disabled person with the same diet as other members of society can be considered a form of care, as demonstrated by the case of a woman over 50 years old at the time of her death in the 12th century in Rigny, France (Miclon *et al.* 2021). Despite suffering from a severe form of Treacher-Collins syndrome, which resulted in deafness, her diet did not differ from that of her community peers, indicating inclusivity despite her physical differences.

Additionally, exploring the identification of health practitioners and medicinal tools presents intriguing research avenues within the study of care and disability (Knüsel 2021). One method for demonstrating care could involve medical treatment following an amputation, including the potential use of a prosthesis, as observed in the case of a male living from the 6th to the 8th century in Italy (Micarelli *et al.* 2018). The morphology of the forelimb stump and dental modifications in individual's RI^{2}, evidenced by a considerable wear and smoothing on the occlusal surfaces, suggest the use of a prosthesis for the limb. Furthermore, amputations conducted as judicial punishments could result in disability and impairment across various European regions (e.g., Kozakaitė *et al.* 2022). A separate research topic is the social position

and status of individuals with disabilities indicated by their burial location and grave goods (Knüsel 1999)[3].

In pre-industrial societies, the lack of advanced medical knowledge led to various interpretations of the origins of diseases and disabilities. One of these interpretations was the Slavic belief that demons, including vampires, were responsible for such afflictions. It was also believed that, over time, afflicted individuals could transform into these very demons. A study conducted in early medieval Culmen, Poland, found that among eight individuals identified as having disabilities only one was buried using methods designed to prevent vampirism (Matczak *et al.* 2021). This finding suggests that within this community, there was no widespread fear of disabled or diseased individuals being associated with vampirism, indicating a separation between the perception of physical otherness and the fear of vampirism.

Mortuary treatment of disabled people is an extensive research topic in medieval bioarchaeology (e.g., Brownlee 2017; Bohling *et al.* 2022b; 2023). Solange Bohling reveals that during the early medieval period in England, there were no consistent efforts to distinguish individuals with physical impairments or disabilities in burial practices (Bohling *et al.* 2023). Comparative studies of the pre-Christian and Christian periods have shown that the conversion to Christianity – and the accompanying spread of Christian morals and doctrine – contributed to a reduction in mortuary variability among individuals with physical impairments and/or disabilities in England (Bohling *et al.* 2022b).

As above mentioned, the theoretical model of the bioarchaeology of care significantly influenced disability research in medieval bioarchaeology, as many studies portray care as a societal response to disability (Table 1). Therefore, it should be considered whether such a large number of studies devoted to the care of disabled individuals result from the fact that they were actually cared for, or rather from the adopted research model, which assumes that if someone lived to an advanced stage of the disease, he or she had to be cared for.

Emma Brownlee pointed out that survival of disabled individuals to adulthood must not indicate a caring and compassionate community because survival is not evidence of compassion and acceptance, merely tolerance (Brownlee 2017). The assumption that disabled people would have automatically needed care is based on the supposition that they could not have contributed enough to society to support themselves. Additionally, it prompts reconsideration of whether long-term survival with a disability genuinely signifies received care or if it points to other survival mechanisms. For instance, begging outside churches was common in the Middle

[3] See also M. Matczak, T. Kozłowski, W. Chudziak in this volume: "The social status of disabled individuals in early medieval Culmen in Poland".

Ages, yet it is problematic to equate this practice with care, unless one interprets almsgiving as societal support for the poor and disabled. There is an imperative to reconstruct the treatment of disabled individuals avoiding the projection of modern perceptions of disability treatment and the imposition of contemporary disability definitions and expectations onto past societies (Wrzosek 1995; also see Roberts 1999). Bioarchaeologists often apply the social model of disability and rely on definitions provided by institutions such as the WHO or *The concise Oxford English dictionary* in their studies. These frameworks impose a contemporary conceptual lens – primarily informed by the social sciences – onto the medieval period. This raises important questions, specifically, what kind of knowledge do we gain by approaching past disabilities through modern perspectives? It is challenging to fully distance ourselves from present-day conceptual categories without inadvertently projecting them onto the past. In this context, the work of historians becomes especially valuable, as it can help identify which conditions were understood as disabilities in their own time, without relying solely on modern definitions. Sally Crawford references numerous written sources from the Anglo-Saxon era detailing accounts of individuals with disabilities and mutilations (Crawford 2010). One early medieval Irish text narrates the plight of a Uí Néill child born blind, whom his mother condemned to death. The child was taken to the swamps, but it was miraculously saved and given to Saint Colmán mac Luacháin. Another account, the life of St. Swithun (the 9th century bishop of Winchester) written by Lantferd tells the story of a man falsely accused of theft. As punishment, he was subjected to mutilation – his eyes gouged out and his ears, feet, and hands severed – and left in the wilderness to die. These narratives highlight that the medieval period witnessed the ostracization of some individuals with disabilities and mutilations, not only by their families but also by society at large, particularly those who deviated from or were suspected of contravening social norms. Attitudes to disability in the Middle Ages were manifold and oscillated from positive to negative ones (e.g., Skinner 2017). Consequently, any interpretation of the treatment of people with disabilities in this period of time must be approached with caution.

Population-level studies

Disability studies within medieval bioarchaeology have traditionally focused on case studies, either examining unique individuals across various populations or individuals sharing specific pathological lesions across multiple sites (e.g., Šlaus *et al.* 2012; Matczak, Kozłowski 2017; Cilione, Gazzaniga 2023). However, in recent years, there has been a notable shift toward population-based approaches. This paradigm shift is crucial for gaining more comprehensive insights into the lived experiences of individuals with disabilities. It marks the current frontier of research challenges

within the field, aiming to construct a more holistic understanding of disability in the medieval period (Brownlee 2017; Matczak *et al.* 2021; 2023; Bohling *et al.* 2022a; 2022b; 2023; Fedorina *et al.* 2022; Tilley, Cave 2023).

Population-level studies investigate aspects such as care, emotional experiences, societal perceptions, and burial practices of individuals with disabilities and physical impairments in regions including England, Poland, and Russia. These studies either employ established theoretical frameworks – such as the bioarchaeology of care (Fedorina *et al.* 2022; Tilley, Cave 2023) – or introduce new approaches, such as the "Bioarchaeology of disability" (Bohling *et al.* 2022a) and "A historical-osteological protocol for identifying disability" (Matczak *et al.* 2023), all discussed earlier in this article.

A significant issue in relation to population-based research is the need for standardisation in methods – particularly in the assessment of age, sex, and pathological changes (Bohling *et al.* 2022a). While it is well understood that bioarchaeology and biological anthropology offer numerous methods for such assessments, meaningful comparative studies require that populations be analysed using consistent methods to ensure the highest standards of research integrity.

As population-level research into medieval disability progresses, there is also a growing need for comparative studies across different European regions. Such comparisons can help identify broader patterns in how individuals with disabilities were perceived and treated. The medieval period, while unified in certain aspects – such as shared religious frameworks and the use of Latin among educated elites – was also marked by considerable cultural, social, educational, and political diversity across social strata and geographic regions. Consequently, approaches to disability likely varied: from the early to late Middle Ages, and from one region or country to another, as has already been demonstrated in historical scholarship (e.g., Wheatley 2010). The databases of disabled individuals, which cover finds from various eras including the Middle Ages, might be a useful source for population-level studies in bioarchaeology (Colleter *et al.* 2023).

Comparative bioarchaeological studies, particularly when combined with historical data on the perception and treatment of disabled individuals, can offer a more expansive and nuanced picture of disability in the Middle Ages. While case studies of individuals with disabilities remain valuable and compelling, they are limited in their ability to provide insight into how such individuals were treated as a broader social group within the population. This wider perspective can only be achieved by means of population-level studies, particularly those that incorporate big data approaches and statistical analyses. As such, population-based research represents a promising and future-oriented direction for the continued development of disability studies in bioarchaeology.

Conclusions and future directions

The above considerations lead to several important conclusions regarding the research on disability in medieval bioarchaeology. Research on disability within medieval period is currently one of the most rapidly evolving topics across all bioarchaeological studies of disability, encompassing various time periods. The field generally adopts the same conceptual frameworks for understanding disability that are prevalent in the broader bioarchaeology of disability research. The social model and the multifactorial model are the most commonly employed by researchers. The bioarchaeology of care has emerged as the predominant theoretical framework and methodological approach, making care one of the most frequently explored subjects. This focus has shaped interpretations of how disabled individuals were treated in the Middle Ages, with a significant number of studies highlighting caregiving practices. Therefore, there is a need to expand research methods and topics regarding various aspects of the lives of disabled people such as social status and origin, among others.

The significant advancement in research is attributed to the application of innovative methods and techniques from medicine and biogeochemistry, facilitating studies on aspects such as diet. Future research is poised to enhance population-level studies and comparative analyses across various European regions. An additional challenge is to integrate analyses of osteological materials with written sources to a greater extent in order to determine what diseases and pathological conditions were actually considered disabilities in the Middle Ages. The coming years will bring further research developments that will expand the field of the bioarchaeology of disability in the Middle Ages.

Acknowledgements

I would like to thank the reviewers for the thoughtful comments and constructive suggestions.

References

Aufderheide A.C., Rodríguez-Martín C., 1998, *The Cambridge encyclopedia of human paleopathology*, Cambridge.

Baker B.J., Bolhofner K.L., 2014, *Biological and social implications of a medieval burial from Cyprus for understanding leprosy in the past*, International Journal of Paleopathology, vol. 4, pp. 17–24.

Barnes C., Mercer G., 2010, *Exploring disability. A. sociological introduction*, Cambridge.

Battles H., 2011, *Toward engagement: exploring the prospects for an integrated anthropology of disability*, Explorations in Anthropology, vol. 11 (1), pp. 107–124.

Beaudry J.-S., 2020, *Theoretical strategies to define disability*, [in:] *The Oxford handbook of philosophy and disability*, eds. A. Cureton, D.T. Wasserman, Oxford, pp. 2–21, https://academic.oup.com/edited-volume/28141/chapter-abstract/212902079?redirectedFrom=fulltext (access date: 18.07.2025).

Bethard J.D., Ainger T.J., Gonciar A., Nyárádi Z., 2021, *Surviving (but not thriving) after cranial vault trauma. A case study from Transylvania*, International Journal of Paleopathology, vol. 34, pp. 122–129.

Bioarchaeology, 2022, *Bioarchaeology of care through population-level analyses*, eds. A. Schrenk, L.A. Tremblay, 1st edition, Gainesville, FL.

Bioarchaeology of impairment, 2017, *Bioarchaeology of impairment and disability. Theoretical, ethnohistorical, and methodological perspectives*, eds. J. Byrnes, J. Muller, New York.

Bohling S., Croucher K., Buckberry J., 2022a, *The bioarchaeology of disability: a population-scale approach to investigating disability, physical impairment, and care in archaeological communities*, International Journal of Paleopathology, vol. 38, pp. 76–94.

Bohling S.N., Croucher K., Buckberry J., 2022b, *An exploration of the changing understandings of physical impairment and disability in early medieval England: a bioarchaeological, funerary, and historical approach*, Church Archaeology, vol. 22, pp. 3–44.

Bohling S., Croucher K., Buckberry J., 2023, *Understanding disability and physical impairment in early medieval England: an integration of osteoarchaeological and funerary evidence*, Medieval Archaeology, vol. 67 (1), pp. 73–114.

Boutin A.T., 2016, *Exploring the social construction of disability. An application of the bioarchaeology of personhood model to a pathological skeleton from ancient Bahrain*, International Journal of Paleopathology, vol. 12, pp. 17–28.

Brownlee E., 2017, *"In the resurrection, no weakness will remain": perceptions of disability in Christian Anglo-Saxon England*, Archaeological Review from Cambridge, vol. 32 (1), pp. 53–71.

Buikstra J.E., 1977, *Biocultural dimensions of archeological study: a regional perspective,* [in:] *Biocultural adaptation in prehistoric America. Proceedings of the Southern Anthropological Society*, vol. 11, ed. R.L. Blakely, Athens, pp. 67–84.

Byrnes J.F., 2017, *Injuries, impairment, and intersecting identities: the poor in Buffalo, NY 1851–1913*, [in:] *Bioarchaeology of impairment and disability. Theoretical, ethnohistorical, and methodological perspectives*, eds. J. Byrnes, J. Muller, New York, pp. 201–222.

Cilione M., Gazzaniga V., 2023, *Conceptualizing disabilities from antiquity to the Middle Ages: a historical-medical contribution*, International Journal of Paleopathology, vol. 40, pp. 41–47.

Colleter R., Delattre V., Le Forestier C., Baiet A., Blanchard P., Chenal F., Coupey A.-S., Desbrosse-Degobertière S., Duchesne S., Durin C., Gisclon J.-L., Gryspeirt N., La Rocca F., Lefebvre R., Livet J., Paresys C., Rouzic M., Souquet I., Tane F., Thomann A., Thomson I., Trébuchet E., Truc M.-C., Barreau J.-B., 2023, *Archeohandi: protocol for a national disabilities database in archaeology in France*, Virtual Archaeology Review, vol. 15 (30), pp. 56–79.

Cormier A.A., Buikstra J.E., 2021, *Thundering hoofbeats and dazzling zebras: a model integra-*

ting current rare disease perspectives in paleopathology, International Journal of Paleopathology, vol. 33, pp. 196–208.

Crawford S., 2010, *Differentiation in the later Anglo-Saxon burial ritual on the basis of mental or physical impairment: a documentary perspective*, [in:] *Burial in later Anglo-Saxon England, c. 650–1100 AD*, eds. J. Buckberry, A. Cherryson, Oxford, pp. 91–100.

Disability and archaeology, 1999, *Disability and archaeology*, ed. N. Finlay, Archaeological Review from Cambridge, vol. 15 (2), Cambridge.

*Disability and car*e, 2024, *Disability and care in Western Europe during Medieval times. A bio-archaeological perspective*, eds. I. Micarelli, L. Tilley, M. A. Tafuri, International Journal of Paleopathology, Special Issue, https://www.sciencedirect.com/special-issue/10CXGPJ3SQG (access date: 23.07.2025).

Dittmar J.M., Mulder B., Tran A., Mitchell P.D., Jones P.M., Inskip S.A., Cessford C., Robb J.E., 2023, *Caring for the injured: exploring the immediate and long-term consequences of injury in medieval Cambridge, England*, International Journal of Paleopathology, vol. 40, pp. 7–19.

Drtikolová Kaupová S., Schamall D., Cvrček J., Půtová L., Velemínský P., Teschler-Nicola M., 2020, *The dietary behavior of two early medieval individuals with temporomandibular ankylosis*, International Journal of Paleopathology, vol. 31, pp. 1–6.

Fedorina A., Dobrovolskaya M., Krasnikova A., Shpolyanskiy S., Guseva V., Korzhikova E., 2022, *Caring for the sick in a medieval rural community: a study based on paleopathological and archaeological data from Medieval Rus*', International Journal of Paleopathology, vol. 37, pp. 30–40.

Fundamental principles of disability, 1976, *Fundamental principles of disability*, Union of the Physically Impaired Against Segregation, https://disability-studies.leeds.ac.uk/wp-content/uploads/sites/40/library/UPIAS-fundamental-principles.pdf (access date: 18.07.2025).

Hadley D., 2010, *Burying the socially and physically distinctive in later Anglo-Saxon England*, [in:] *Burial in later Anglo-Saxon England, c. 650–1100 AD*, eds. J. Buckberry, A. Cherryson, Oxford, pp. 103–115.

Knüsel C.J., 1999, *Orthopaedic disability*, [in:] *Disability and archaeology*, ed. N. Finlay, Archaeological Review from Cambridge, vol. 15 (2), Cambridge, pp. 31–53.

Knüsel C.J., 2021, *The unwritten history of medical treatment. Evidence for ritual-healers and their activities in the pre-literate past*, International Journal of Paleopathology, vol. 34, pp. 206–216.

Knüsel C.J., Chundun Z.C., Cardwell P., 1992, *Slipped proximal femoral epiphysis in a priest from the medieval period*, International Journal of Osteoarchaeology, vol. 2, pp. 109–119.

Knüsel C.J., Göggel S., 1993, *A cripple from the medieval hospital of Sts. James and Mary Magdalen, Chichester*, International Journal of Osteoarchaeology, vol. 3, pp. 155–165.

Kozakaitė J., Ryčkov A., Ramonaitė M., Brindzaitė R., Jankauskas R., Piombino-Mascali D., 2022, *On some paleopathological examples of amputation and the implications for healthcare in 13th–17th century Lithuania*, International Journal of Paleopathology, vol. 37, pp. 68–76.

Kudlick C.J., 2003, *Disability history: why we need another „Other"*, American Historical Review, vol. 108 (3), pp. 763–793.

Matczak M.D., Kozłowski T., 2017, *Dealing with difference: using the osteobiographies of a woman with leprosy and a woman with gigantism from medieval Poland to identify practices of care*, [in:] *New developments in the bioarchaeology of care: further case studies and extended theory*, eds. L. Tilley, A. Schrenk, New York, pp. 125–151.

Matczak M.D., Kozłowski T., Chudziak W., 2021, *A multidisciplinary study of anti-vampire burials from early medieval Culmen, Poland: were the diseased and disabled regarded as vampires?*, Archaeologia Historica Polona, vol. 29, pp. 219–252.

Matczak M.D., Kozłowski T., Chudziak W., 2023, *A multidisciplinary assessment of disability in early mediaeval Culmen, Poland*, Sprawozdania Archeologiczne, vol. 75 (2), pp. 187–223.

McKenzie C.J., Murphy E.M., Watt I., 2022, *Considering care: a traumatic obturator fracture dislocation of the hip in a middle-aged man from Gaelic Medieval Ballyhanna, Co. Donegal, Ireland*, International Journal of Paleopathology, vol. 38, pp. 115–122.

Metzler I., 2006, *Disability in medieval Europe. Thinking about physical impairment during the high Middle Ages, c. 1100–1400*, New York.

Metzler I., 2013, *A social history of disability in the Middle Ages. Cultural considerations of physical impairment*, New York, London.

Micarelli I., Paine R., Giostra C., Tafuri M.A., Profico A., Boggioni M., Di Vincenzo F., Massani D., Papini A., Manzi G., 2018, *Survival to amputation in pre-antibiotic era: a case study from a Longobard necropolis (6th–8th centuries AD)*, Journal of Anthropological Sciences, vol. 96, pp. 185–200.

Miclon V., Bédécarrats S., Laure B., Zadora-Rio E., Gaultier M., Coqueugniot H., Herrscher E., 2021, *Disability in a medieval village community: a unique case of facial dysmorphism*, International Journal of Paleopathology, vol. 35, pp. 22–28.

Miśkiewicz M., 1969, *Wczesnośredniowieczny obrządek pogrzebowy na płaskich cmentarzyskach szkieletowych w Polsce*, Materiały Wczesnośredniowieczne, vol. 6, pp. 241–301.

Molleson T., 1999, *Archaeological evidence for attitudes to disability in the past*, Archaeological Review from Cambridge, vol. 15 (2), pp. 69–77.

Novak M., Cavka M., Šlaus M., 2014, *Two cases of neurogenic paralysis in medieval skeletal samples from Croatia*, International Journal of Paleopathology, vol. 7, pp. 25–32.

Ortner's identification, 2019, *Ortner's identification of pathological conditions in human skeletal remains*, ed. J.E. Buikstra, London, San Diego, Cambridge, Oxford.

Parker Pearson M., 2011, *The archaeology of death and burial*, 3rd edition, Stroud.

Redfern R.C., Austin A., 2020, *Ankylosis of a knee joint from medieval London: trauma, congenital anomaly or osteoarthritis?*, International Journal of Paleopathology, vol. 28, pp. 69–87.

Robb J., 2002, *Time and biography: osteobiography of the Italian neolithic lifespan,* [in:] *Thinking through the body: archaeologies of corporeality*, eds. Y. Hamilakis, M. Pluciennik, S. Tarlow, New York, pp. 153–171.

Robb J., Cessford C., Dittmar J., Inskip S.A., Mitchell P.D., 2021, *The greatest health problem of the Middle Ages? Estimating the burden of disease in medieval England*, International Journal of Paleopathology, vol. 34, pp. 101–112.

Roberts Ch., 1999, *Disability in the skeletal record: assumptions, problems and some examples*,

[in:] *Disability and archaeology*, ed. N. Finlay, Archaeological Review from Cambridge, vol. 15 (2), Cambrigde, pp. 79–97.

Roberts Ch., 2017, *Applying the 'Index of Care' to a person who experienced leprosy in late medieval Chichester, England,* [in:] *New developments in the bioarchaeology of care: further case studies and extended theory*, eds. L. Tilley, A. Schrenk, New York, pp. 101–124.

Roberts Ch. A., Manchester K., 2010, *The archaeology of disease*, 3rd edition, Stroud.

Saul F.P., 1972, *The human skeletal remains of Altar de Sacrificios: an osteobiographic analysis*, Papers of the Peabody Museum of Archaeology and Ethnology, vol. 63 (2), Cambridge, MA.

Saul F.P., Saul J.M., 1989, *Osteobiography: a Maya example*, [in:] *Reconstruction of life from the skeleton*, eds. M.Y. Iscan, K.A.R. Kennedy, New York, pp. 287–301.

Skinner P., 2017, *Living with disfigurement in early medieval Europe*, New York.

Sneed D., 2020, *The architecture of access: ramps at ancient Greek healing sanctuaries*, Antiquity, vol. 94 (376), pp. 1015–1029.

Solecki R.S., 1971, *Shanidar: the first flower people,* New York.

Šlaus M., Novak M., Cavka M., 2012, *Four cases of ankylosing spondylitis in medieval skeletal series from Croatia*, Rheumatology International, vol. 32, pp. 3985–3992.

Tilley L., 2015, *Theory and practice in the bioarchaeology of care*, Cham, Heidelberg, New York, Dordrecht, London.

Tilley L., 2017, *Showing that they cared: an introduction to thinking, theory and practice in the bioarchaeology of care*, [in:] *New developments in the bioarchaeology of care: further case studies and extended theory*, eds. L. Tilley, A. Schrenk, New York, pp. 11–43.

Tilley L., 2022, *Disability and care in the bioarchaeological record: meeting the challenges of being human*, [in:] *The Routledge handbook of paleopathology*, ed. A.L. Grauer, London, pp. 457–481.

Tilley L., Cameron T., 2014, *Introducing the Index of Care: a web-based application supporting archaeological research into health-related care*, International Journal of Paleopathology, vol. 6, pp. 5–9.

Tilley L., Cave C., 2023, *Helping to shine light on the Dark Ages: applying the bioarchaeology of care approach to remains from the early Anglo-Saxon cemetery at Worthy Park*, International Journal of Paleopathology, vol. 41, pp. 88–100.

Tilley L., Oxenham M.F., 2011, *Survival against the odds: modeling the social implications of care provisions to seriously disabled individuals*, International Journal of Paleopathology, vol. 1, pp. 35–42.

Towards, 2002, *Towards a common language for functioning, disability and health*, World Health Organization, https://cdn.who.int/media/docs/default-source/classification/icf/icfbeginnersguide.pdf (access date: 18.07.2025).

Turner W.J., 2022, *Models of disability: connecting the past to the present*, Zeitschrift Für Disability Studies. Zds Journal of Disability Studies, vol. 1, pp. 1–8.

Wasserman D., Aas S., 2023, *Disability: definitions and models*, [in:] *The Stanford encyclopedia of philosophy*, ed. E.N. Zalta, U. Nodelman https://plato.stanford.edu/entries/disability (access date: 18.07.2025).

Wheatley E., 2010, *Stumbling blocks before the blind: medieval constructions of a disability*, Ann Arbor.

Wrzosek W., 1995, *Historia – kultura – metafora. Powstanie nieklasycznej historiografii*, Wrocław.

Zakrzewski S., Evelyn-Wright S., Inskip S., 2017, *Anglo-Saxon concepts of dis/ability: placing disease at Great Chesterford in its wider context*, [in:] *Bioarchaeology of impairment and disability. Theoretical, ethnohistorical and methodological perspectives*, eds. J.F. Byrnes, J.L. Muller, New York, pp. 269–289.