Who cares? A thesis on the (osteo)archaeological evidence of care during the Dutch post-medieval period

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By Vita Schouten

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Chapter 1: Introduction

There is no denying that individuals with disabilities have existed throughout human history. Disabilities can occur at any time during one's life. Their causes can range from an accident to disease, and the symptoms can be chronic and degenerative or temporary and episodic. This raises questions about how disability was perceived in the past and on the impact of handicap on one's social position and status within a community and on their caregivers. Prior to the 19th century, disability studies experts produced a varied bag of work, frequently invoking possibly naive or broad generalizations about the positions of disabled people at various eras in human history (Sigurjónsdóttir & Rice, 2021).

Presently, there remains an inclination in paleopathological literature to perceive disabilities as a fixed state with unchanging social consequences. The focus lies on the afflicted or the disease process (Tilley, 2017).The narratives focus on the actual impairment rather than a narrative built on the interaction of the individual's identity, biography, and caregiver. One cannot survive on their own with a severe disability. Care and accommodation are necessary for impaired individuals to survive and thrive. These caregiver(s) are generally invisible in the archaeological record. Consequently, they are disregarded in current narratives on disabilities (Tilley, 2015).

Rather than the prevailing narrative of disability as an individual medical illness or weakness, this thesis will use an approach that recognizes the diverse and complex character of disability as ingrained in culture and power relations. This perspective is exemplified by Gowland (2017), who shows that disablement is dependent on several factors. First, the type of disease or condition causing the impairment and the culturally specific construction of that disease state. Second, the sufferer's identity, such as status, gender, stage of life, religion, and biography. Third, the performative or behavioral expectations are attached to the identity or life courses stage and to what degree the impairment affects these activities. Lastly, the social context is essential, such as the cultural and interpersonal norms that govern the provision of care for people at various phases of their lives and the ability and willingness to accommodate the impairment. Thus, to fully interpret and comprehend an impairment of mobility in the past, these factors should each be considered (Tilley, 2015).

To study this in the past can be difficult, as these aspects of life are not always well documented. Yet, human remains can reveal more insight into these factors. Fortunately, human biology has stayed similar over the past thousands of years (Tilley, 2012), which allows us to deduct clinical conditions and effects based on our current knowledge. Osteological remains, therefore, contain a treasure of information on disease and disability by themselves. Namely, there is an interesting duality in bones both as "actor" and as "artifact" (Tilley, 2012). First, as an actor, the skeletal elements are of an actual individual who has faced the challenges of disability. Second, the signs of handicap only exist on the basis that a level of care empowered the individual to live long enough for the pathology to record in the bone, thus deeming such osteological remains an artifact as well (Tilley, 2012). This shows that by researching osteological indicators, one does not just gain insight into a static biological state. Instead, it provides us with a plethora of information on the matter, much less tangible. Thus, through osteological analysis this research intends to add to previous accounts of past care.

In general, the past narrative of the Dutch physically impaired has largely been overlooked, as with other minorities. The research history of individuals with disabilities in the Netherlands has been dominated by three perspectives: educational history, institutional history, and medical history (van Trigt, 2014). A perspective on disability history that recognizes the diverse and complex character of disability has been lacking from archaeological research in the Netherlands (Brants et al., 2017). Before the 1960s, in The Netherlands, care for the impaired was mainly charity (mainly by the Christian church) and community-driven (Brants et al., 2017); making one curious about the quality of care and the lives of those involved.

Therefore, this research desires to shed light on the seldomly explored, hidden past lives of disabled people and their caregivers in the Netherlands. Furthermore, it aims to better understand the complete picture of physical disability within a Dutch community through gaining critical insight into the impact of disability on the individual and their caregiver(s). This way, it hopes to add to a completer image of past care in the Netherlands.

1.1 Research questions

For the scope of this research, the following research question is posed:

During the post-medieval period, how were disabled adults cared for in the Middenbeemster community?

This overarching question will be answered with the aid of multiple sub-questions. The sub-questions are suggested to investigate impairments and their inferred care.

- *What bone lesions indicate disease and/or disability that impairs mobility?*
- *What type of care can be inferred from these indicators?*
- *What information does this reveal about caregiver and recipient dynamics?*

1.2 Approach

This research examines a Dutch post-medieval skeletal collection to answer the research questions. The Middenbeemster collection (Lemmers et al., 2013) is an excellent starting point. First, this collection (most individuals dating between 1829 and 1866) is relatively large, counting over 500 individuals (Lemmers et al., 2013). This size will increase the chances of finding enough evidence to draw conclusions. Additionally, this collection is exceptionally well-preserved. This degree of preservation is necessary, as some care indicators are expected to be located on delicate, fragile bones, such as the shoulder blade.

Different skeletal indicators of disablement/immobility will be looked at to infer evidence of care. Indices of disablement can be highly diverse. For this reason, complete skeletons are preferred to research the entire picture as much as possible. For the scope of this research, individuals with indicators of disablement, such as pressure sores and with sign of severe disease. Using the various skeletal indicators, this research aims to determine whether an individual had an impairment that necessitated "direct support" or "accommodation" to survive by drawing on Tilley's (2021) ‘’The Bioarchaeology of Care Methodology’’. If

affirmative, then one can infer care. Accordingly, this thesis will then qualitatively identify what this care likely entailed. Finally, it will unpack and interpret what the evidence suggests about social practice and interactions, as well as care-recipient and group identity in the community of Middenbeemster.

1.3 Outline

The thesis will consist of six chapters. The theoretical foundation, which includes the current status of care reconstruction in archaeology and osteoarcheology, will be discussed in Chapter 2. The third chapter delves into the materials and methods utilized to collect the data. The fourth chapter presents and discusses the results, including the analysis and comparisons. Within their context, this study will analyze the findings so that the research questions are answered in chapter 5.

Chapter 2: The Archaeology of Care

Human societies relied and still rely on caregiving, medicine and medical interventions, to maintain human health. Unsurprisingly, many facets of everyday life are influenced by the ideas of caregiving and healthcare, and vice versa. This chapter will elaborate on the definitions, care reconstruction in archaeology, and the underlying theoretical framework.

2.1 Definition of terms

The term "care" refers to a variety of behaviors, from "direct support" to "accommodation," which involves using strategies to permit or promote a degree of economic, cultural, and/or social, involvement that else would be hindered. Direct support includes actions like provisioning, hygiene maintenance, nursing, and physical therapy among others.

Giving care is an intentional action involving caregivers and care recipients. This 'caregiving' does not happen in a vacuum; the response of care for the affected individual is impacted by a combination of factors. For example, social norms, values, beliefs, customs, a group's skills, and experiences, social, economic and political organization, in addition to external conditions and availability of resources for care (Bates & Linder-Pelz, 1990; Gilson, 2003; Hardey, 1998; Hofrichter, 2003).

When an impairment in body structure or function causes constraints for activities and/or participation, care is necessary, either temporary or long-term (Mendez-Tellez et al., 2012). Impairment of body function or structure is referred to as "disability". In extreme cases, an impaired physical function can lead to prolonged bed rest and immobilization (Mendez-Tellez et al., 2012). Both the individual and the society contribute meaning to this condition by the lifeways it is experienced. In addition to the care and attention they receive from others, how an affected person responds to a disability also is a reflection of their traits, attitudes, and actions within a socio-cultural setting (Bowling, 2009; Garro, 2000; Lieban, 1990).

2.2 Disease and Care Reconstruction in Archaeology

The skeletal remains can provide archaeologists with a wealth of knowledge. Skeletal anatomy serves as the body's framework, and teeth are a direct point of contact between humans and their surroundings. They carry the morphology of soft tissues in which they were enclosed during life - such as muscles, nerves, veins, and organs. These soft tissues vanish quickly after death, but their imprint is preserved in the skeleton, resistant to many types of decay. This way, it is possible to estimate age, sex, and stature, and often one can discern a variety of pathological conditions. Human remains that show survival with a disabling pathology can be used as evidence of health-related care. Inferring care is feasible from such remains with a debilitating pathology when the individual would not have reached the actual age of death if care had not been given (Tilley, 2015).

It should be noted that osteological research can only observe physical reactions from the bone to pathologies. Therefore, the psychological repercussions of the disease on the afflicted person cannot be predicted from skeletal remains. To illustrate, what one individual finds acceptable and tolerable may be quite stressful to another. In addition, the level of pain associated with a particular condition varies from person to person and is influenced by the individual's tolerance.

Moreover, the time between the beginnings of the disease or disability and visible skeletal modification may be considerable (Waldron 1994). At that point, the person may already be experiencing serious incapacitating disabling symptoms while there is no palaeopathological proof visible yet. Thus, skeletal assemblages only reflect a small portion of illness and disability within the deceased population, as the clinical prevalence of the disease will differ from the archaeological prevalence (Waldron 1994).

Nonetheless, human biology has stayed similar over thousands of years (Tilley, 2012). It allows us to deduct clinical conditions and effects based on our current knowledge from past human remains. The proxy of human biology opens an intangible world, where understanding of social interactions, customs, institutions, and even collective and personal identity can be gleaned through deduction.

Unfortunately, such research has been sporadic with little follow-through (Tilley, 2012). Discussions on the identification and diagnosis of palaeopathology have been at the forefront of human remains analysis (Grauer, 2012; Roberts & Manchester, 2007) or they have focused on unique examples of surgical intervention (Becker, 2014; Bernardini et al., 2012; Mogle & Zias, 1995). Insufficient focus has been placed on the intangible aspect of care. Research of care in archaeology tends to solely concentrate on explicit manifestations of care as unique actions taking place in specific locations rather than more general indicators of communal worldviews and attitudes. Indeed, compared to the study on care within the Medical Humanities, such as Medical History and Medical Anthropology, the archaeology of care is still in its infancy (Matczak & Chudziak, 2018). Such fields have research degrees, academic journals, and are well-defined.

In recent years, however, the archaeology of past care has been rapidly evolving, with some thorough publications, such as the British Archaeological Reports (BAR) which focusses on early medicine and care. Baker's (2010) book "*Archaeology of Medicine in the Greco-Roman World*" and other publications on archaeological care methods provide yet another illustration on archaeological care approaches (Powell et al., 2016; Tilley & Schrenk, 2017). Presentism and Eurocentric conceptions of medicine have tainted archaeological interpretations of ancient medicine and healthcare, leading to views not in line with the wealth of information from the medical humanities. The biomedical sciences and the medical humanities have a lot to offer archaeologists here.

It is here that this study aims to contribute by applying an approach that aims to move beyond the mere identification of pathological lesions and better understand disease and care within societies, and to do so, this study will use the Bioarchaeology of Care approach.

2.3 Bioarchaeology of Care

The ''Bioarchaeology of Care'' approach (Tilley, 2012) provides this study with a theoretical and practical framework to hypothesize on care based on human remains within their context that show survival with or recovery from a disability when, without this care, the person would not have lived to their age at death.

This approach aims to recognize and understand the offering and receiving of healthcare in the context of the lifeways of the individual.

The Bioarchaeology of Care technique consists of four rounds of evaluation, each building on the preceding one's facts, observations, and findings(s). These steps are arranged in a transitional fashion from the recording of osteological and archaeological data to interpretation, of which the latter involves progressively higher levels of inference.

Stage 1 entails the description of the individual's remains (see figure 1). Then, from this information, stage 2 commences. Stage 2 evaluates the pathology's potential clinical and functional effects to determine whether the individual has likely experienced an impairment that necessitated care. The care analysis starts with human remains that show proof of survival with or following disability. Simply put, to infer health-related care, it is necessary to establish the presence of an impairment significant enough to inhibit the individual in one or more ‘functional domains’ (see Chapter 3 for more information). From this, one can determine if the individual had a condition that necessitated "direct support" or "accommodation" to survive. If not, the Bioarchaeology of Care method cannot be continued. However, if the answer is affirmative, one can assume that the person received care and can continue to Stage 3. A fundamental model of the sort of care offered at this stage is designed based on the care requirements connected to the clinical and functional outcomes defined in Stage 2, all the while considering what is feasible and likely given the circumstances. It is critical to estimate the functional impact relative to the predicted demands, challenges, and opportunities in their contemporary environment. Even more so, in assessing the effects of pathological symptoms on a person's capacity to carry out daily duties or participate in their community. The third step of the model also takes into account the likely length of care and the "costs" of providing that care, such as labor requirements and resources. As a result, stage 4 discusses and evaluates the Stage 3 care strategy. It investigates what social practices, interpersonal relationships, group, and care-recipient identities among others, are revealed.

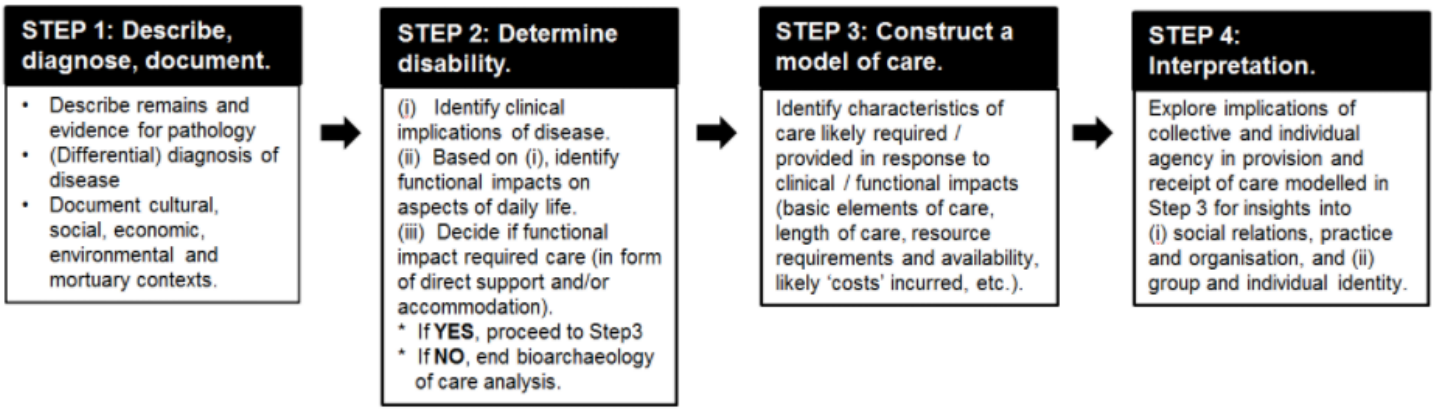


Figure 1 The Bioarchaeology of Care Model (Tilley, 2018)

To illustrate this approach and show the potential, this section will detail an example of a young man from Neolithic Vietnam, Man Bac (M9) (see figure 2). The analysis shows that individual M9, who had a highly disabling condition, was dependent on other people for both his bodily and social wellbeing (Tilley & Oxenham, 2011). Yet M9's long-term disability survival demonstrates a profound psychological adjustment, a self-esteem able to withstand loss of autonomy, strong willpower, and a character who can persuade others to provide years of costly, specialized care (Tilley & Oxenham, 2011). It is reasonable to suppose that the adoption and maintenance of care reduced the community's productive capacity over time and would have required the group's agreement and cooperation. Meeting M9's nutritional needs also calls for a wide knowledge of available food sources, time commitment necessary for skilled meal preparation and food processing skills that can overcome appetite and digestive limitations. Additionally, M9's lack of injuries reflects a sedentary lifestyle in the community. With the Bioarchaeology of Care, from just his bones and context, this type of intangible information and even clues about behaviors for which there is no material evidence yet can be deducted.

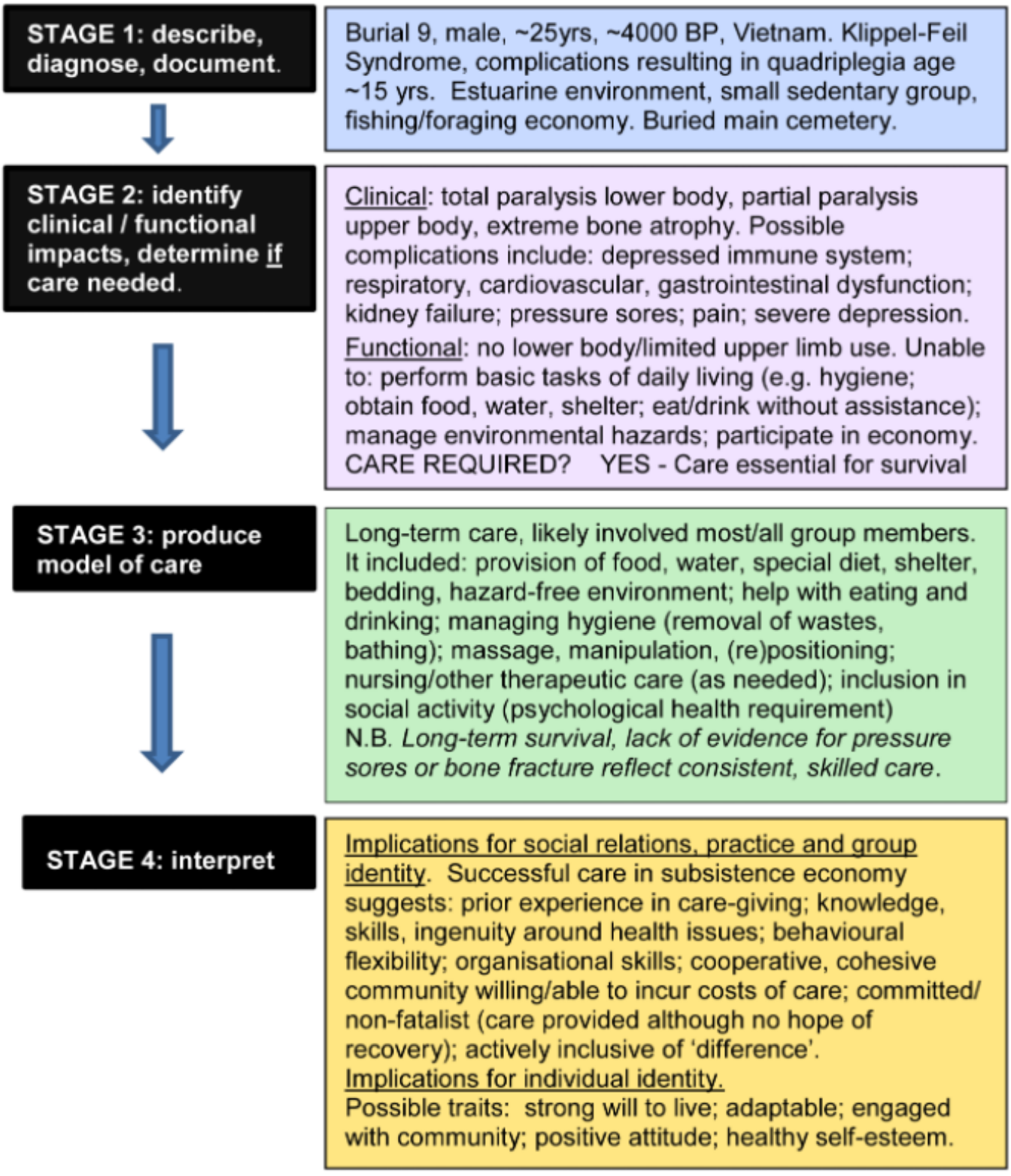


Figure 2. The Bioracheology of Care Approach applied to M9 (Tilley & Oxenham, 2011)

Chapter 3: Materials and Methods

The employed materials and methods are explained in this chapter. In addition, contextual information on the site, the excavation, and laboratory techniques used in this study will be provided. Finally, the steps taken to analyze care will be discussed in detail.

3.1 Materials

The research sample originates from an excavation near Middenbeemster's Keyser church (Hakvoort et al., 2013). Hollandia Archeologen, in collaboration with the University of Leiden, excavated this collection in the summer of 2011. In addition to skeletal material, archival data of Middenbeemster on the individuals of this collection were consulted as well. The archive contains written sources from Middenbeemster from 1795 to 1929. Since 1979, the archive has been maintained by the 'Waterlands Archief' in the Dutch town of Purmerend. The archive has legal records for births, marriages, and deaths dating back to 1812, hence these provided more contextual information necessary for the application of the Bioarchaeology of Care Approach.

3.1.1 Middenbeemster and its inhabitants

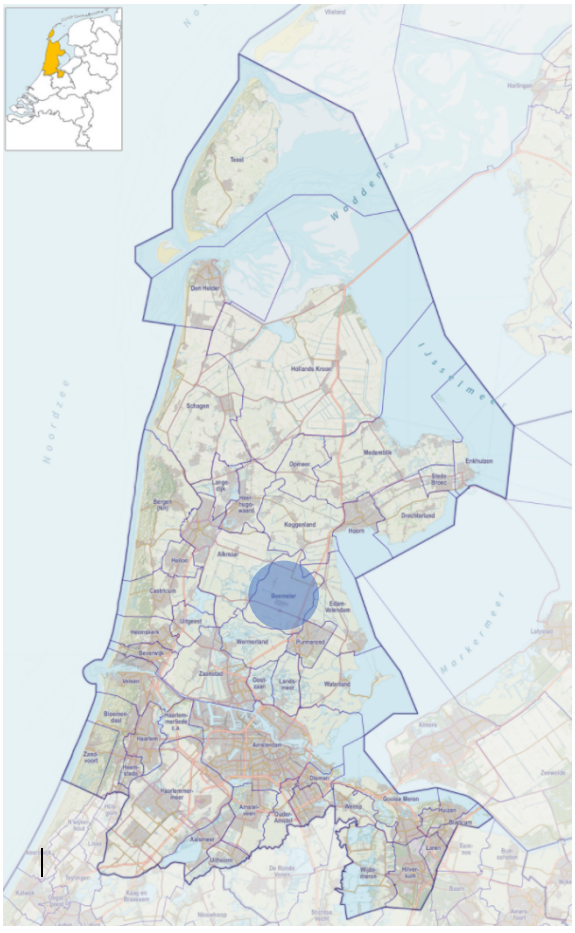
Middenbeemster is a settlement in the Beemster polder of North Holland, Netherlands. Within the Beemster polder there are four villages in total: Middenbeemster, Noordbeemster, Westbeemster and Zuidoostbeemster. Between 1607 and 1612, the Beemster polder was formed by the drainage of the Beemster lake. The area that resulted from this process was divided into squares, and because of this unusual design, the Beemster polder was inscribed on the UNESCO World Heritage List in 1999 (Aten et al., 2021). However, even though crop farming was the intended use for the polder, the soil turned out to be too moist for agriculture. As a result, most farmers started dairy or animal farms (Aten et al., 2021). Their dairy products became a popular export product, especially the dairy trade with the United Kingdom turned rather lucrative. Agricultural advancements and land reclamation boosted agricultural productivity to levels that rivaled that of portions of England. For the Middenbeemster, a period of economic prosperity dawned in the beginning of the1850s (Aten et al., 2021). As a result, a new elite emerged in the Beemster, led by affluent farmers. Other known occupations from Middenbeemster include baker, doctor, turf-skipper, carpenter, cooper, shopkeeper, day laborer, teacher, painter, postman,

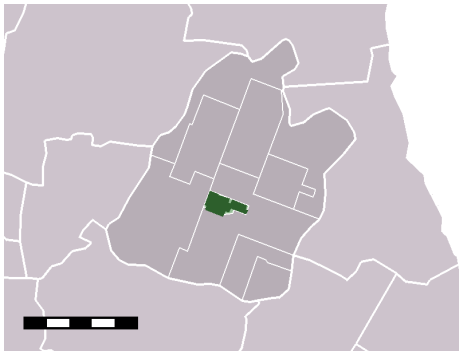
and priest (Falger et al., 2012). The residents of Middenbeemster were likely quite active, according to research on musculoskeletal indicators and bone morphology (Palmer et al., 2016). 2971 individuals made up the Beemster community in 1840, the majority of them lived on their farms and commuted daily between the farmhouses and the town of Middenbeemster, where there was a school and other essential facilities such as the main market (Falger et al., 2012). One family would occupy one dwelling, with extended family nearby or present. Similar homes and farms were constructed across the Beemster region in accordance with the customary "stolpboerderij" (bell jar) shape. During winter, this type of housing permitted for the storing of hay and living quarters that were shared with cattle. Heating was provided by charcoal burners, and smoke from the kitchen or the main room was carried via a single chimney (Falger et al., 2012). Such farm enterprises were based on kin relationships; the entire family worked together with specific parts of the production process designated by sex/age, usually starting at age five. Both men and women encountered a sex-based work division with changes to their bone morphology respective to their activity patterns throughout their lives (Chilcote, 2018). The daily agricultural tasks of men changed as they matured from an apprentice position to
milking cattle, to running the enterprise. Men participated in an activity that involved extreme leg flexion/extension and rotation while pushing/pulling something heavy (milking posture) (Chilcote, 2018).

Women's level of activity gradually reduced over the life cycle. Housekeeping and making dairy products. Daily scrubbing, polishing, scouring enormous pails, pans, and utensils. Scrubbing walls, woodwork, windows, rugs, boiling bleaching laundry, carrying large buckets of milk, shoulder yoke, or by hand. Churning or curd cutting, forming, and pressing cheese. Younger women are involved in the caretaking of the home and essential partakers in the dairy production process. Boys as early as four were expected to help with the herd and the twice-daily milking of each cow. Dutch dairy during this time included driving cattle, milking, feeding, washing, cleaning stalls, digging turf, fertilizing fields, and ditch dredging. It was not an option for women of lower classes to solely manage the house, so many worked in the family enterprise. Women would also work the fields during times of need, such as the month-long harvest.

3.1.2 The skeletal collection of Middenbeemster

The skeletal material researched in this study was found in a cemetery around the Reformed Church De Keyser in Middenbeemster. The location had already been used as a graveyard prior to the chapel's construction. It was agreed that amid this graveyard, the church would be constructed. From 1638 onwards, aside from the cemetery, people now could also be buried within the church if funds allowed. Due to the lack of alternative cemeteries in the municipality, this graveyard served as the final resting place for all residents of the Beemster community. After 1829, people were no longer buried inside the church, and the municipality purchased the cemetery in 1829. The older graveyard and its people were removed. The clay deposits were dug up and replaced with sand. Therefore, most of the burials discovered during the excavation in 2011 date from 1829 to 1867, as the graveyard was no longer in use after 1867 (Hakvoort et al., 2013).





1. Position of Middenbeemster within the municipality of Beemster (Centraal Bureau voor de Statistiek, 2006)

4. Position of Beemster in The Netherland (circle added by V. Schouten) (Janwillemvanaalst, 2017)

3.1.3 Excavation and skeletal analysis

Students from Leiden University investigated the Middenbeemster cemetery over the course of the summer of 2011 in collaboration with Hollandia Archeologen.
The human remains of approximately 450 individuals were then transferred to the University of Leiden, where DNA samples were extracted to ensure minimal contamination; afterwards, the crania were cleaned (Hakvoort et al., 2013). The skeletons were laid out in anatomical order in the lab, after which sex and age were estimated. The WEA-recommended procedures for estimating sex were used, including the os pubis approach of Phenice (1969), sacral morphology, and osteometric techniques. For adults, the length and a variety of indices are also calculated. The dental status, non-metric traits, and diseases are also recorded. The information was entered into a database that anyone working with the Middenbeemster collection could access (Hakvoort et al., 2013). Since their housing at Leiden University, over 80 studies have been conducted relating to the collection (University of Leiden, n.d.).

3.1.3 Sample selection

From the total sample of Middenbeemster, only a few were selected for this qualitative study into care. The patient's age at the time of impairment has a considerable impact on the care provided (Priestley, 2003). Adults, for example, are expected to bathe and feed themselves, while infants are not. As a result, caring for a disabled adult may be more 'acceptable' than caring for an impaired infant. Furthermore, compared to adults, children are not expected to participate in household or community economic activities like an adult is (Gowland, 2017). As a result, only adults were chosen from the entire Middenbeemster skeletal collection. In addition, only those that were complete (>75%) with good or excellent skeletal preservation were selected. Some bone lesions are predicted to be placed on delicate, fragile bones -such as the shoulder blade- therefore, this level of preservation and completeness is required. Additionally, only those with a definite sex estimation, M (male) or F (female), were selected. The context of gender and sex roles is crucial to the Bioarchaeology of Care Approach; thus, any uncertainty about the sex, such as I (indeterminate), PF (possibly female), or PM (possibly male), could warp our interpretation of the context of the individual. Accordingly, these individuals were disregarded.

Consequently, the first phase of the approach was applied to a total sample of 63 individuals.

When more contextual information is available for an individual, the Bioarchaeology of Care yields comprehensive results. The presence of historical documents and prior research thus also played a role in the sample selection, as this would provide the research with a more complete picture of the individual. Hence, individuals that existed in archival documents and have been analyzed before were preferred. Appendix 1 contains more detailed information on the selection status of the individuals.

3.2 Methods

3.2.1 Data collection

The gathered data was recorded in Microsoft Access. This software is a relational database management tool, which makes it possible to save data for later analysis, reporting, and reference. The program can help go beyond the constraints of using Excel or other spreadsheet programs to manage large volumes of data. In this program, a form was created for the initial recording of information, completeness, sex, age, description of pathologies, mobility implications, and any comments. This way, selection and record management were straightforward.

The Index of Care (Tilley & Cameron, 2018), an online application that supports the Bioarchaeology of Care approach, was used to conduct more in-depth analysis of skeletal indicators. The Index offers a structured process for examining human remains by using a set of worksheets to assist in organizing and collecting facts and ideas. It entails four stages that adhere to the steps of the Bioarchaeology of Care method, which will be described in chapter 2. The use of this web application aids this research so that no steps of analysis were skipped mistakenly.

3.2.2 Diagnosis and paleopathology

In case of pathologies or abnormalities, clinical implications, and possible diagnosis(es) were identified with current medical research and with the help of a medical doctor. Doctor Schouten is a surgeon specializing in hands and trauma with more than 20 years of experience. He is currently employed as a surgeon at the hospital Rivierenland Tiel. Additionally, this research was able to learn more about experiences at patient level thanks

to his knowledge. First, abnormalities were assessed by macroscopic analysis. These symptoms were then diagnosed with the aid of the *Human Bone Manual* (White & Folkens, 2005) and the *Cambridge Encyclopedia of Human Paleopathology* (Aufderheide & Rodríguez-Martín, 1998). Finally, pathological conditions were organized into categories based on a common etiology: disorders of growth and development, trauma, metabolic diseases, infectious diseases, and diseases of joints.

3.2.3 Operationalizing the Bioarchaeology of Care

The second chapter has discussed the theory for determining the provision of care: the *Bioarchaeology of Care approach*. With aid of the *Index of Care* (Tilley, 2015), each step was carefully applied for each individual. All information was organized and documented in Microsoft Access and the Bioarchaeology of Care Index (see *Data Collection* for more information). The following paragraph will elaborate on the operationalizing of the Bioarchaeology of Care.

Step 1

The first step of the Bioarchaeology of Care describes the skeletal remains and possible evidence for pathology. Accordingly, each individual was carefully laid out. Sex, age, and find number were checked. Then, based on thorough observations of the bones of the complete skeleton, pathological lesions and other abnormalities were described and photographed, which were then used to conclude on the most likely disease. Only those individuals with serious traumatic injuries or other disabling pathological illnesses that restrict movement

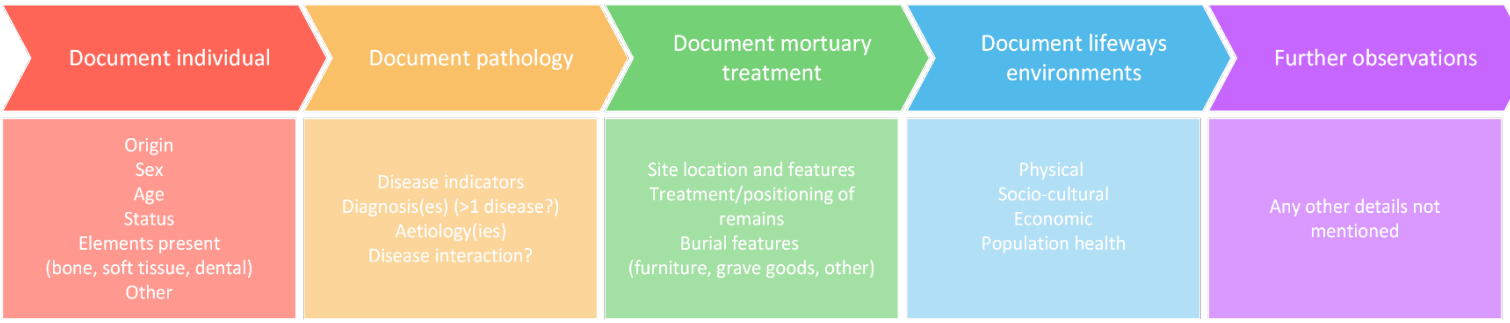


Figure 5. Step 1 of the Bioarchaeology of Care (information adapted from Tilley & Cameron, 2018)

and reduce self-sufficiency were chosen for step 2 since this study seeks to examine care and disability.

Step 2

Hereafter, in case of pathologies or abnormalities that could be associated with disability and immobility, clinical implications and possible diagnosis(es) were identified based on current medical research, paleopathological literature and Dr. Schouten's help.

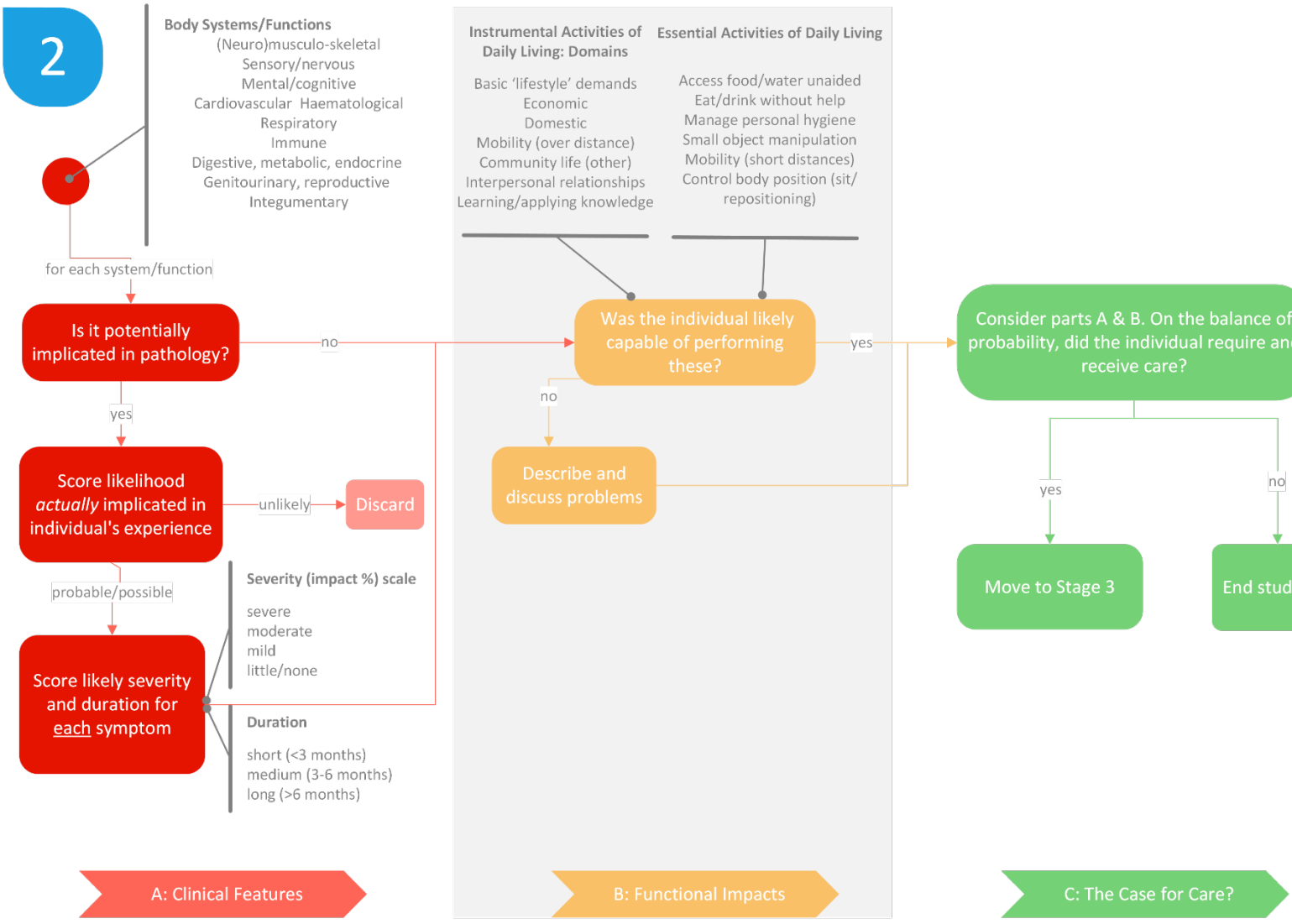


Figure 6. Step 2 of the Bioarchaeology of Care (information adapted from Tilley & Cameron, 2018)

First, the research took into account the pathology of the subject's potential clinical symptoms. Then for each individual, for each body system (see figure 7) (WHO, 2013), its function was assessed in relation to the pathology. Does the present pathological condition or lesions potentially impair its function?

Additionally, these impacts were evaluated on a scale of severity ranging from severe to minor/none. Tilley (2015) designed this scale, which she adapted from the WHO's ICF (2007) which documents how pathologies affect the body's structure and its functions. Thus, to assess the severity of a pathological condition or lesion, the following descriptors were used (Tilley 2015):

Table 1 Scale of Severity retrieved from Tilley (2015)

1. '*Little or no impact/impossible to tell*' – for the purpose of bioarchaeology of care analysis of the subject is considered as having no significant problem
2. '*Mild impact*' – signifies a problem that presents for less than 25 % of the time and/or presents with an intensity and/or in such a way that it can be easily tolerated and/or compensated for
3. '*Moderate impact*' – signifies a problem that presents for less than 50 % of the time and/or presents with an intensity and/or in such a way that it interferes with aspects (but not the totality) of day-to-day life
4. '*Severe impact*' – signifies a problem that presents for more than 50 % of the time and/or presents with an intensity and/or in such a way that it interferes with most or all aspects of day-to-day life

Additionally, the duration of this impact was estimated, defining three options (Tilley, 2015):

Short	<3 months
Medium	3-6 months
Long	>6 months

Table 2 Impact duration retrieved from Tilley (2015)

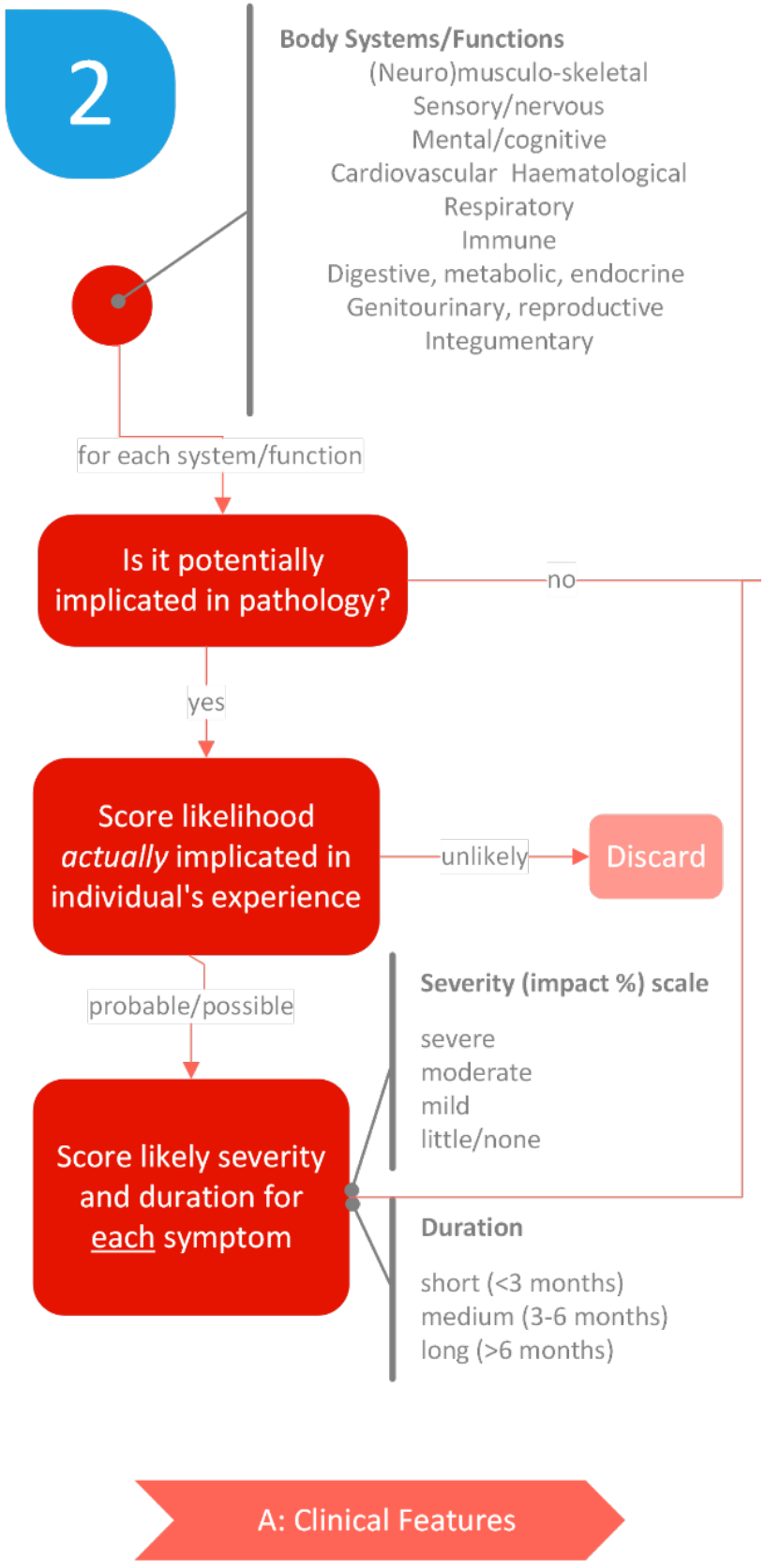


Figure 7. Part A of Step 2 of the Bioarchaeology of Care (information adapted from (Tilley & Cameron, 2018)

Based on this information, the functional impacts on the aspects of daily life could be identified. These were assessed in terms of ''essential activities of daily living'' (Katz et al., 1970, pp. 722) and ''instrumental activities of daily living'' (Tilley & Cameron, 2014, pp. 7).

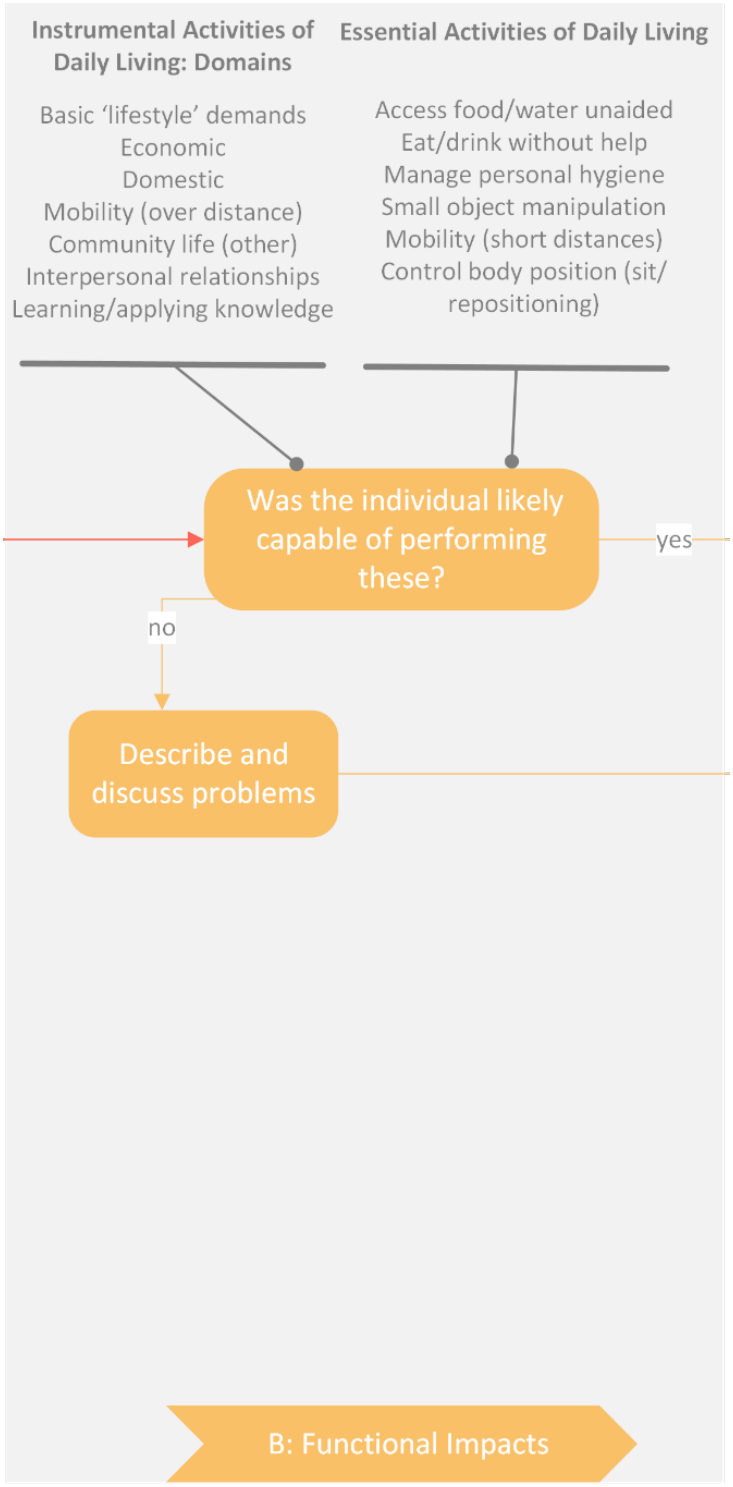


Figure 8. Part B of Step 2 of the Bioarchaeology of Care (information adapted from Tilley & Cameron, 2018)

It was considered whether the individual was likely capable of performing the activity for each essential activity. Next to this, it was the range of activities the individual could perform for the domains of instrumental activity of daily living evaluated and/or whether there were barriers to participating in these activities.

It then posed whether care was required and received on the basis of probability for this individual. When affirmative, the individual was selected for further analysis. In case of rejection, the study of care for this individual ceases. Again, this information was added to the database in Microsoft Access. After applying step 2, the final sample for care reconstruction was made.

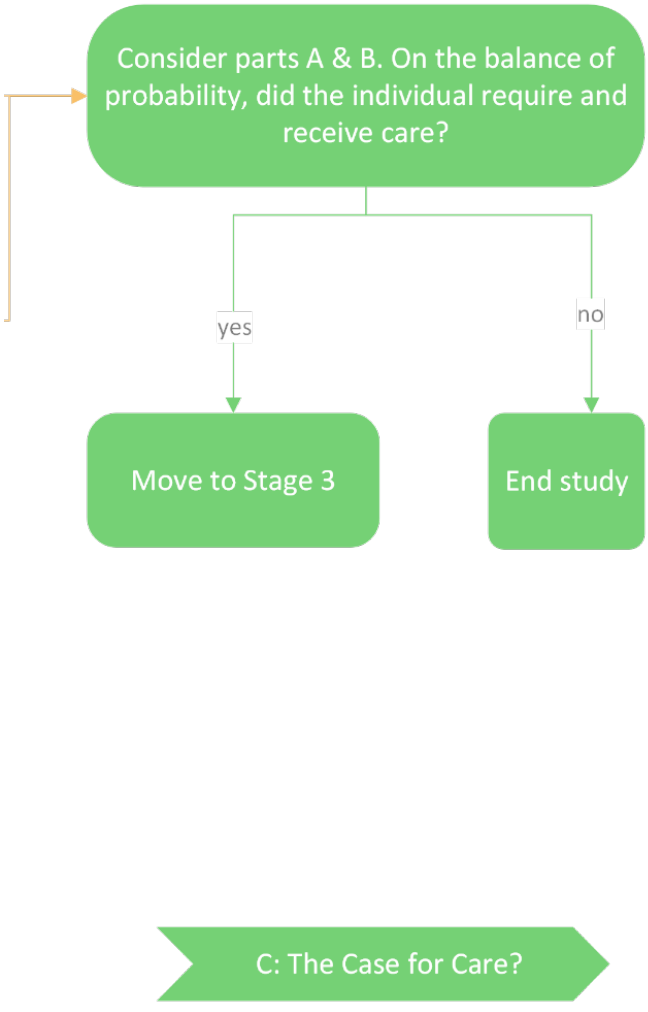


Figure 9. Part C of the Step 2 of the Bioarchaeology of Care

Step 3

The analysis continues on the individuals selected at the end of step 2. The likely characteristics of care provision concerning the clinical and functional impacts were established for each individual. Consequently, by using Tilley's (2015) 'The Bioarchaeology of Care Methodology', it was evaluated whether an individual had an impairment that demanded "direct support" or "accommodation" to survive (Tilley & Cameron, 2014, pp. 7).

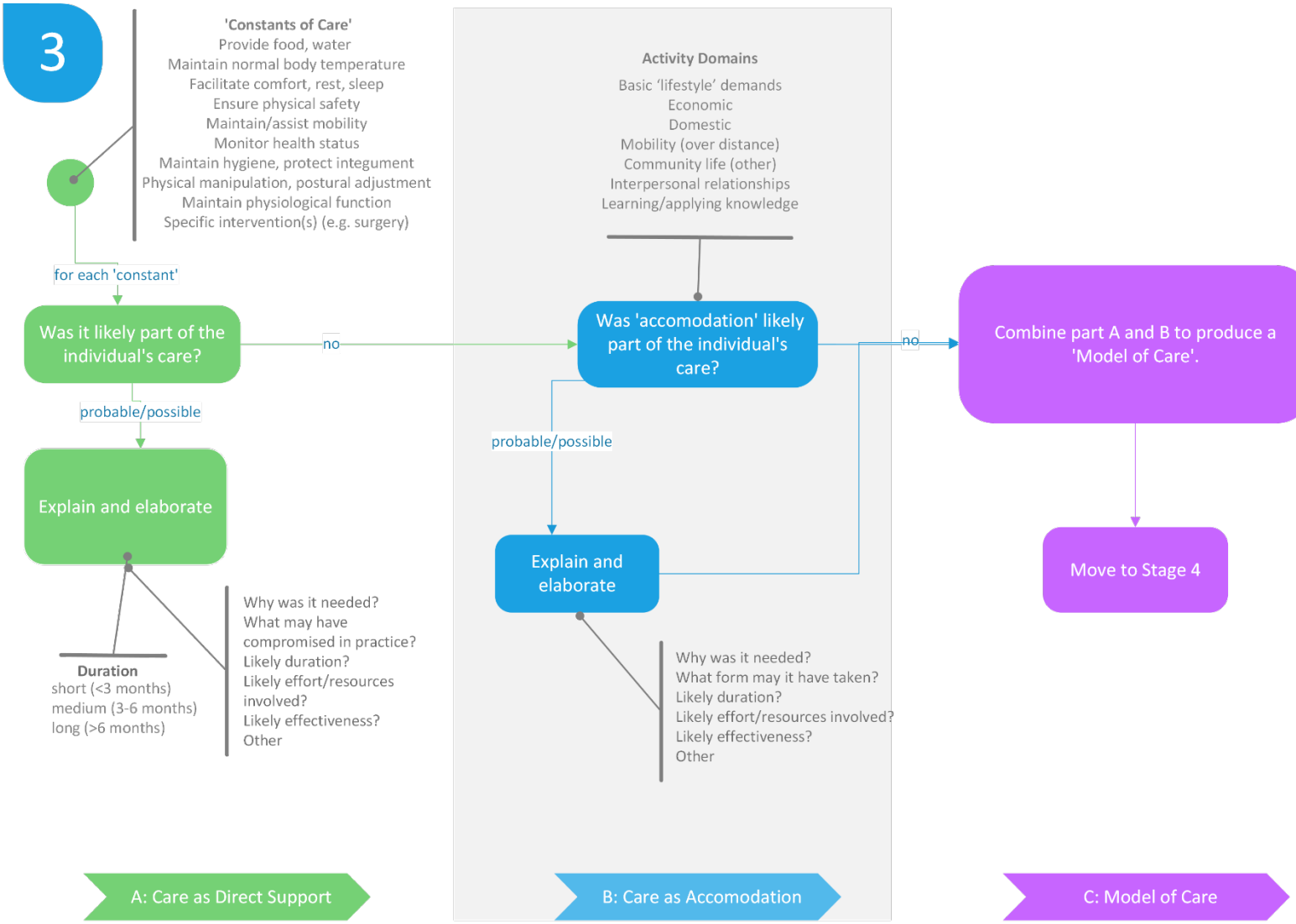


Figure 10. Step 3 of the Bioarchaeology of Care (information adapted from Tilley & Cameron, 2018)

The first part of Step 3 considers the ''Constants of Care'' (Henderson, 1964; Tilley & Cameron, 2014, pp. 7), in other words, the array of actions one can take to care for an individual. Each constant is to explore whether this type of care was likely part of the individual's care. Like in Step 2, these are assessed on the scale of duration (short/medium/long) (Tilley, 2015).

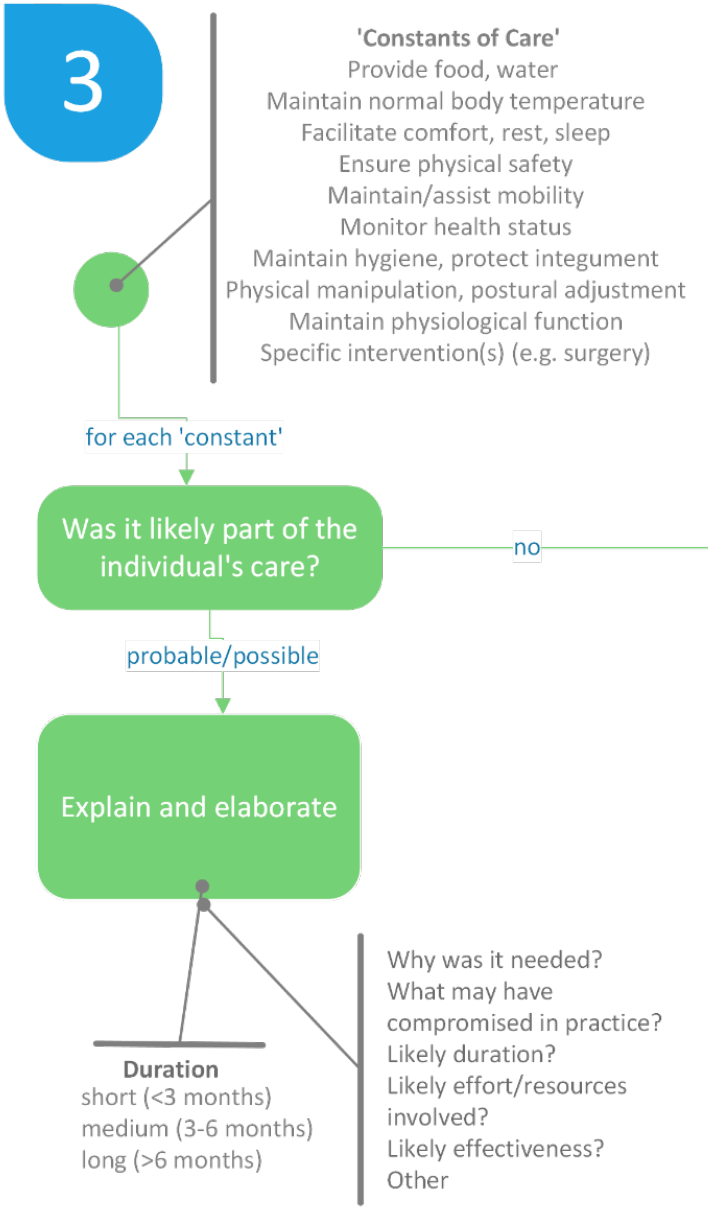


Figure 11. Part A of Step 3 of the Bioarchaeology of Care

A: Care as Direct Support

Second, Care as Accommodation considers the activity domains (Tilley, 2015; World Health Organization, 2013). It was identified whether 'accommodation' was likely part of the subject's care for each domain. If so, more detailed information on the accommodation was researched. In response, this step will build a model of the prospective care offered within the according context [Step 1] to answer the relevant clinical and functional implications. This 'Model of Care' (Tilley, 2015) considers the basic elements necessary to provide the individual with care and the length, resource- and skill requirements, and 'costs. It truly explores the implications of the provision and receiving of care.

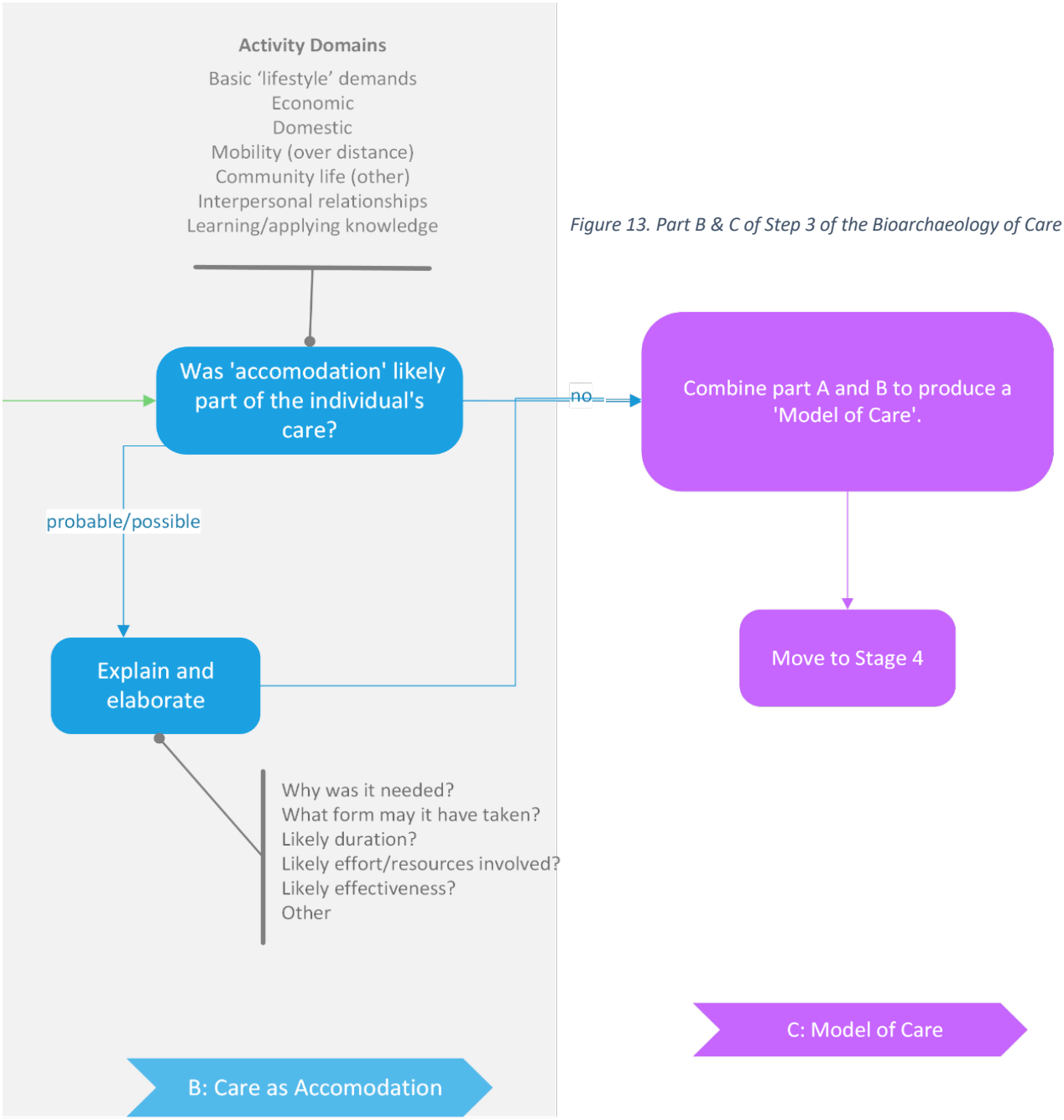


Figure 13. Part B & C of Step 3 of the Bioarchaeology of Care

Step 4

The significance of the described care [Step 3] in relation to community, social relationships, practice and structure, and identity are finally explored by this model of care. This step ends by proposing a generic care decision pathway (Tilley & Cameron, 2018), inviting one to hypothesize what motivates decisions at each stage and what these choices reveal about the community.

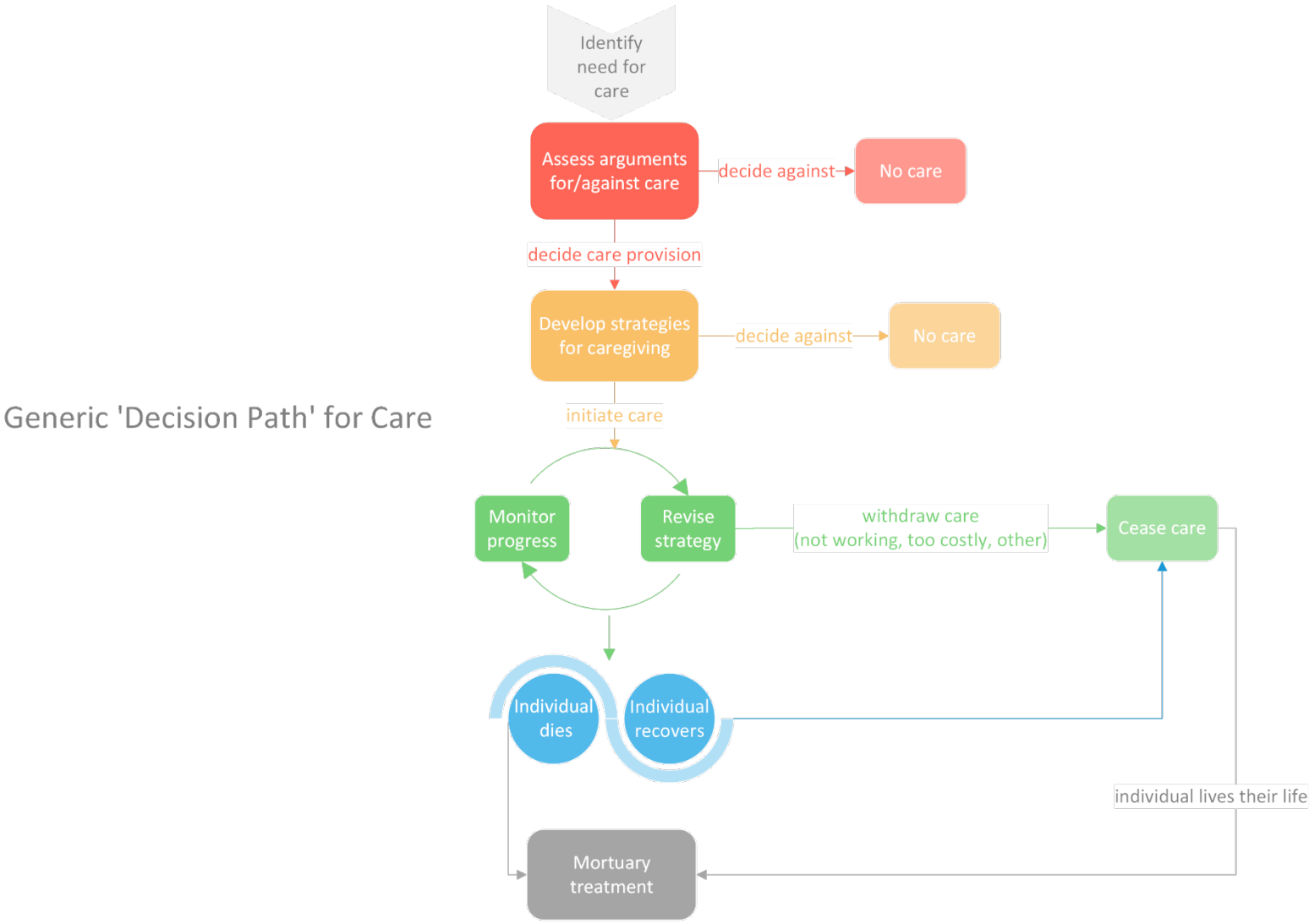


Figure 16. The Generic Decision Path for Care (information adapted from Tilley & Cameron, 2018)

Additionally, the osteobiography of the individual will be utilized to reveal what the generated information on care and disability may imply about the person's identity. These will be qualitatively explored and discussed to answer the research questions accordingly.

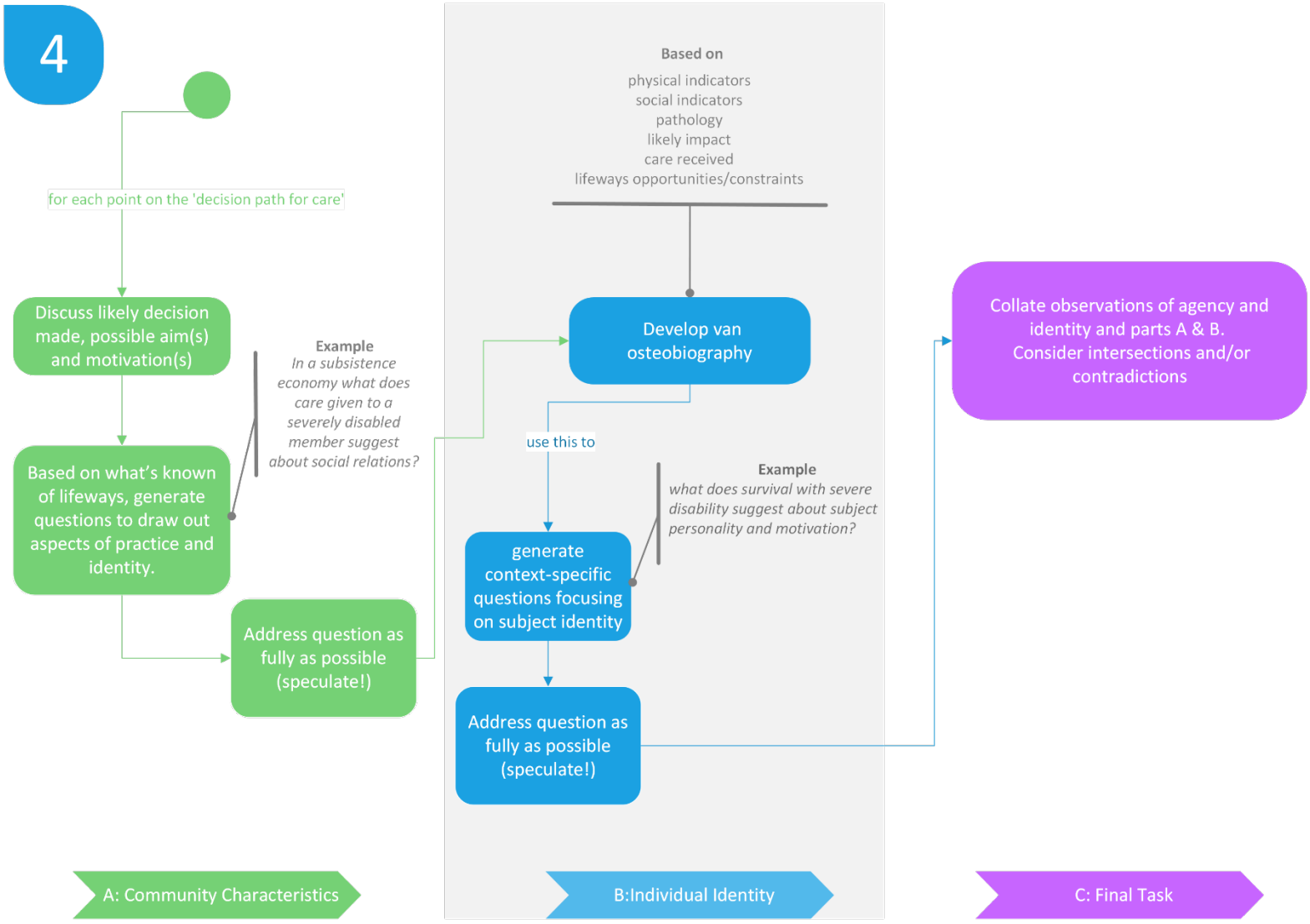


Figure 17. Step 4 of the Bioarchaeology of Care (information adapted from Tilley & Cameron, 2018)

Chapter 4: Results and Discussion

Each of the 84 skeletons was observed and marked with a code for their completeness. Six were marked with code 1 (>25%) or code 2 (25-50%). These were deselected prior to analysis due to incompleteness. See the red markings in Appendix 1 for more information.

Table 3 Assessment of skeletal completeness (V. Schouten).

'Missing' refers to the number of bones that were lacking for assessment.

Code	Percentage	Description
0	0-25%	> 9 missing
1	25-50%	6-9 missing
2	50-75%	3-6 missing
3	75-100%	< 3 missing
4	100%	0 missing

For another three individuals, preservation was not good enough either, and these were also disregarded for analysis. See the blue markings in Appendix 1 for more information.

Table 4 Assessment of sex (V. Schouten)

Code	Description
f	Female
i	Indeterminate
m	Male
pf	possible female
pm	possible male

Twelve individuals remained undetermined for their sex (PF, PM, I). Sex determination is crucial to the approach (Tilley, 2015) to create a detailed context; thus, these individuals were deselected.

Finally, this resulted in 63 individuals being selected for the initial stage of the approach. After analyzing the skeletons [Step 1], it then posed whether care was most likely required and received for this individual [Step 2]. Twelve individuals likely required and received care from this selection. Thus, 51 were disregarded as there is insufficient evidence to infer care and are therefore insufficient to address the study's research objectives. See the orange and green markings in Appendix 1 for more information.

The remaining twelve skeletons displayed the most diverse and expressive pathologies. This choice was made as such cases allow for a thorough, in-depth analysis for Step 3 of the Bioarchaeology of Care Approach.

ID	Sex	Age	Pathology	Findno.
61	f	middle adult	kyphosis cervical vertebrae, cause upper thoracic are collapsing. Green discoloration on leg.	V0233
73	f	late young adult	extreme Scoliosis.Ebumnation in vertebral facets, lipping.infection occipital? very well preserved.	V0131
80	f	old adult	OA all over. Eburnation. Scoliosis. Thoracic fused.	V0156
51	f	middle adult	Fracture of clavicle. Fracture of s3 (sacral v).	V0584
28	f	early young adult	severe scoliosis. Generelised microontia. Residual rickets/deformity. Developmental issue of left arm: fusing of the head is different and shorter than other.	V0591
46	f	middle adult	TB.OA of spine & acromioclavicular joint. Blunt force trauma on head between parietals and occipital. Sacrum short and different.	V0616
45	f	middle adult	Congenital hip displasia-disluxation. Caries + eaten away teeth. Slight scoliosis; fused L6+S1, crooked. femora heads deformed.	V0757
21	f	late young adult	Schmorl's nodes. Bowed tibiae & fibulae (rickets). Caries and granuloma. Possible scurvy. Indications for brace. Position of legs causing foot to point outwards.	V0876
26	f	old adult	Dwarfism. Ante-mortem tooth loss. Achondroplasia or hypochondroplasia. OA.	V0945
71	m	middle adult	Spinal OA. Spondylosis; IVD; Spina bifida occulate; RA ; bstructed hypogloassal/jugular/condylar canal; Left hemiatrophy; Dental ; TMJ; Fibrous/soft tissue mid facial mass.	V0222
48	m	old adult	OA of elbow;Edentulous; Severe OA on sacrum; Green stains (metal); Sacralization on L5; Foot injury	V0466
40	m	middle adult	Residual rickets;Scoliosis;Vertebral osteophytosis;Ryphosis;OA of spine + acromion- clavicular joint;R femur + tibia have green + talus; Horizontal discolourations indicative of metal brace	V0671
29	m	old adult	Healed cribra orbitalia. Osteomas. Bilateral fracture of fibula proximal shafts. Large callus. Healing. Tibiae unaffected by trauma.	V0766

Table 5. The individuals (12) selected. The individuals highlighted in green (3) were selected for further analysis.

For the scope of this research, these twelve individuals were condensed to three individuals. This choice was made based on the diversity of types of lesions (congenital, trauma, metabolic, infectious), diversity of age (young adult, middle adult, old adult), and the presence of archival information and prior research on the individual.

When more contextual information is available for an individual, the Bioarchaeology of Approach yields more detailed results. Hence, the presence of historical data and prior research played a role in the selection too. Considering all of these aspects, three individuals stood out and were selected for the third and fourth stages of the Bioarchaeology of Care Approach (see green color Appendix 1). Each individual stems from a different age group, and their lesions originate from diverse origins, ensuring a broad scope

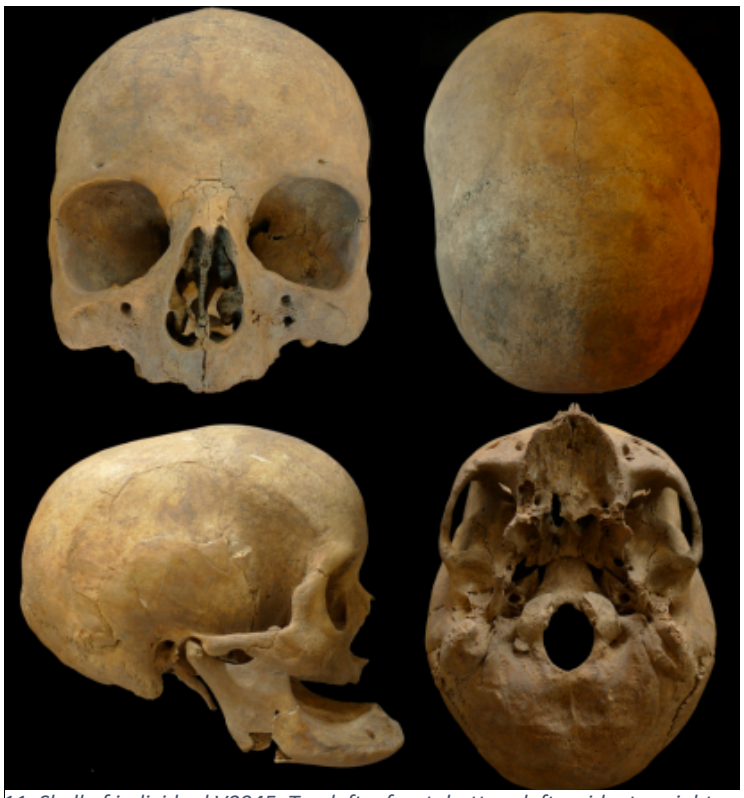
to draw conclusions. Accordingly, this chapter will elaborate on the results of each stage of the approach for the three selected individuals. In addition, it will unpack the implications of their care in terms of social ties, practice and organization, and collective and individual identity in the Middenbeemster.

4.1 V0945/Sara R.

Sara (V0945) is a female who died in 1863 at 66 years old. She was married to a carpenter; Brant O. Seven kids were born to Sara and Brant. Unfortunately, two were stillborn. Of the other children, one died within three days, two died between ages ten and twenty-one, and two survived into old age. Sara measured 130.0 ± 4.5 cm, significantly smaller than other individuals from the Middenbeemster (Waters-Rist & Hoogland, 2013). Her short stature results from significantly reduced long bones that display enlarged ends. The most obvious malformation and reduction may be seen in her forearm bones. In addition, the joint formation of the elbow constrains the forearm extension to ~130◦.

10. Skeleton of individual V0945 (Waters-Rist & Hoogland, 2013)

8 . Individual V0945's left femur and tibia (right) are shown next to an adult female who is average-sized from Middenbeemster (left) (Waters-Rist & Hoogland, 2013)



11. Skull of individual V0945. Top left = front; bottom left = side; top right = superior; bottom right = inferior (Waters-Rist & Hoogland, 2013)

Her skull has pronounced frontal and side (parietal) bossing, which produces a 'flattened' forehead and midface, overall, an infantile-like facial architecture. At the time of death, she was without any teeth (edentulous). In addition, new bone formation (osteophytes) was found around the edges of joints, such as the femur and along her spine suggesting the early stages of joint disease.

The most likely diagnosis for these symptoms is hypochondroplasia, a form of disproportionate (chondrodystrophic) dwarfism (Waters-Rist & Hoogland, 2013). People that are exceptionally short in stature are grouped under the condition 'Dwarfism' (Waldron, 2020). The condition is caused by genetic disruption of cartilage development at the epiphyses (ends) of the bones. There are numerous forms and mutations, the most prevalent non-lethal skeletal dysplasias being achondroplasia and hypochondroplasia. These are inherited types of dwarfism with short limbs, a small face, and relatively regular trunk and vault development. This kind of dwarfism is frequently accompanied by complications that impair the sensory (pain, hearing, vision), circulatory, pulmonary, endocrine, and reproductive systems (Waldron, 2020).

Sara's movement is hampered by her lower limb chondrodysplasia, which result in an irregular stride and mobility and endurance problems, particularly over long distances, and rough terrain. Her (early-onset) osteoarthritis and inherited and/or acquired spinal disease are related to lower limb joint instability and may worsen these effects. Osteoarthritis (joint degeneration) is one of the most frequently recorded joint illnesses in archaeological skeletons. It is a cartilage condition of the joint that causes the cartilage to break down as the disease progresses. The destruction of cartilage causes an inflammatory reaction, which can result in a variety of bone reactions, such as the formation of new bone at the joint's edges *(osteophytes*), new bone on the articulation plane of the joint, small holes on the articulation surface (*pitting*), and changes in normal function and contour of the joint. In the final stage, eburnation occurs, a polished, specular flat on the joint owing to bone-to-bone contact (White & Folkens, 2005).

Moreover, Sara's forearm extension is limited due to elbow joint abnormalities, a common complication in achondroplasia patients (Faivre et al., 2000). Her manual strength and dexterity would have been severely limited by the combination of her forearm and hand malformations.

According to the clinical literature, care would have been required in Sara's instance, and it would have been on a continuous basis, starting from birth. When a baby with this disorder is born or within the first few weeks, abnormalities in the limb and craniofacial traits are evident. (Faivre et al., 2000). Often, notor development is delayed. It may take up to six months to master head control and independent sitting, whereas learning how to walk can take 12–24 months (Faivre et al., 2000). Functional capacity issues in V0945's instance were probably noticeable as early as infancy (Faivre et al., 2000). Physical activity constraints would become increasingly important as children approached the age when they would ordinarily be required to participate in group economic activity - possibly late childhood. In order to deal with developmental delays in infancy and early childhood, Sara's care likely consisted of an extension of customary caring practices; this required more care but likely presented minimal problems. The family group was most likely dealing with an unknown condition with unclear prospects in assisting her as an infant. It is probable that she has missed crucial developmental milestones during infancy, which could have worried her family that she might never become able to move independently. The community's tolerance of her peculiarities in physical ability and appearance became more important as

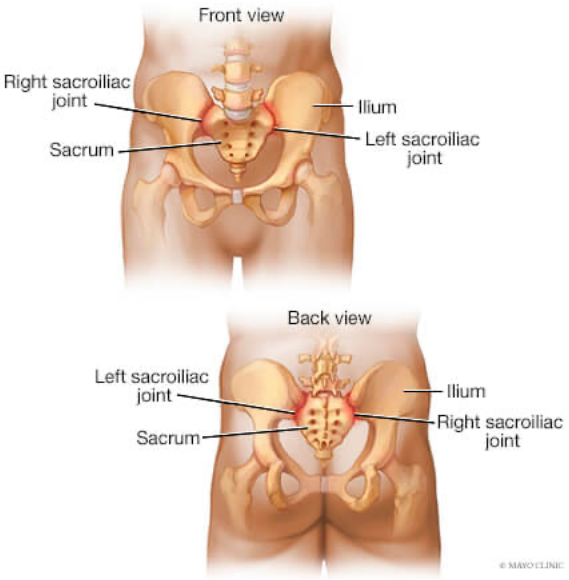
she approached puberty. However, it's crucial to remember that people with achondroplasia often have normal intelligence and communication abilities (Faivre et al., 2000). Moreover, it is important to recognize that persons with physical disabilities typically find efficient ways to work around constraints. Sara was most likely capable of making several contributions to her community. On the other hand, it is unlikely she could have adhered to her community's normative role demands — demands required by the realities of an active, permanently settled, agricultural lifestyle. This is further demonstrated by the fact that she was likely unable to shift large amounts of bulk or weight given the combination of her spinal disease, implications of gait, and physical limits in her upper extremities. Her survival signifies a modification to the typical Middenbeemster role expectations, as evidenced by both archaeological and osteological data (Chilcote, 2018). Sara's physical restrictions necessitated changes in group expectations and behaviors (read: accommodation), and these changes likely were what allowed her to live to the age of death. The requirement for her accomodation lasted from birth to death and even though this type of care may not require as much effort as "direct care," (Tilley & Oxenham, 2011), it was nonetheless long and constant.

Meeting her needs in a small family group would necessitate the participation of at least three economically productive and flexible members, demands increasing as her joint disease and subsequent immobility progressed with age. This demonstrates a strong sense of community with the readiness, adaptability, and organizational abilities needed to manage a continual demand for resources. Sara was buried like any other member of the Middenbeemster community. A northwest-southeast orientation, parallel to the church (Hakvoort et al., 2013). In a stretched stance, in an individual grave. Her legs were aligned in a straight line, and her hands were positioned on the pelvic region. Like other burials, she was interred in a regular-sized coffin even though Sara was not regular-sized (Lemmers et al., 2013). Her mortuary treatment and marriage suggest that she was socially well-integrated within the Middenbeemster community, even though Sara was suffering from a very visible disease which resulted in her being restricted across most areas of economic activity.

4.2 V0584

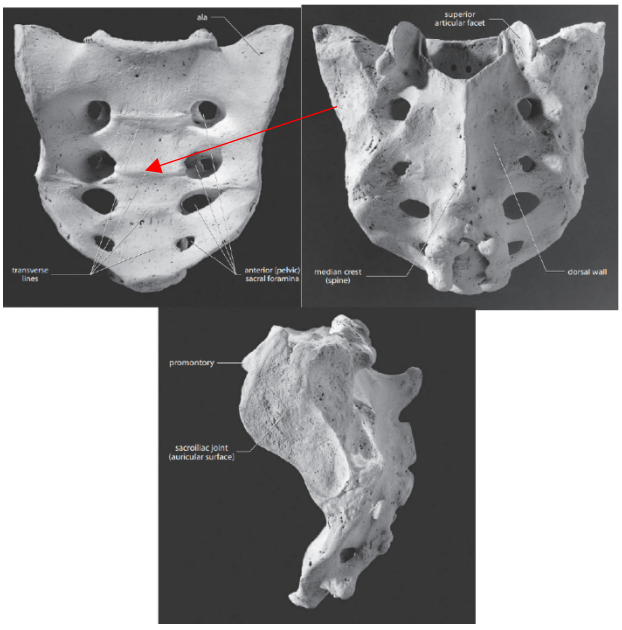
V084 is a female who died between 36 and 49 years old. Currently, no historical records can provide information about her life, such as marital status and offspring.

The majority of the skeletal elements indicate no anomalies, except for her pelvic area and clavicle (collar bone).

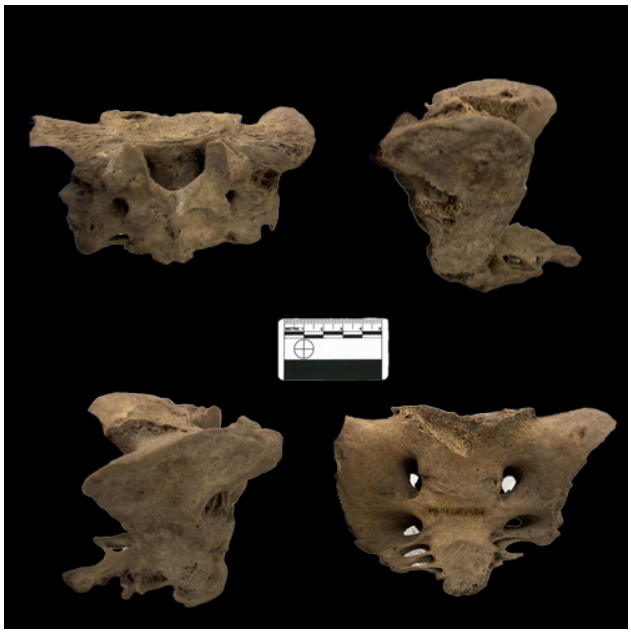


From the shape of the sacrum, it is evident that she fractured the bone transversely between the second and third sacral vertebrae, indicated by the red arrow in figure 17. However, there was still a misaligned union present after the fracture had fully healed at the time of death. Consequently, her sacrum was permanently deformed at an almost 90-degree angle. Moreover, her right collarbone (clavicle) also evidences a healed fracture. In addition, both hip joints show signs of pitting, likely due to osteoarthritis at an early stage, likely secondary to the trauma.

12 Location of the sacrum in the body (Mayo Clinic, n.d.)



13. The shape of a normal sacrum (White & Folkens, 2005)



14. Sacrum of V0584 (V. Schouten)

The fracture in the sacrum is consistent with severe and acute, high-energy trauma. Trauma can have all kinds of causes and often result in fractures or dislocations of joints. In the

present day, this type of sacral fracture is called a ‘suicide jumper’ fracture, as it often involves a fall from a serious height. The clavicle fracture may have happened around the same traumatic event; however, this cannot be concluded with certainty from the skeletal remains. In general, fracture healing is difficult to assess. Complete fracture healing can wholly remove all traces of a fracture, even on X-rays (Waldron, 2009). Fragment alignment, the amount of movement at the fracture site, as well as the person's health, age, food, and blood supply, all affect how quickly a fracture will mend. Additionally, as a result of continuous movement at the injured surface, certain fractures may never heal (Waldron 2009).

Essential treatment would involve emergency management at the moment of the traumatic incident, such as stabilizing her and alerting a doctor. In 75% of these fractures, the individual falls unconscious. In case of (correct) diagnosis by a doctor, she likely would have been immobilized for 9 to 12 weeks. After that, there may be a period of restricted weight-bearing that could extend for an additional four to six weeks. During this time, the damaged limb's muscles need to be worked (Gutierrez-Gomez et al., 2021). However, even with our current technologies, sacral fractures often go undiagnosed (Gutierrez-Gomez et al., 2021). She likely would have been immobile for a similar period whether she had been diagnosed or not. It would have been necessary to continuously evaluate their health, manage their pain, prevent infections, and provide them with food and drink throughout this period (Gutierrez-Gomez et al., 2021). During this period, intensive care would have to have been provided in all aspects of her life to ensure survival, such as an adapted diet and significant hygiene assistance to prevent infection. She would have needed rest and extra calories to recuperate from this serious trauma (Stefanski & Smith, 2006). This recovery would be a full-time job for at least one caregiver. The injury would proceed from an acute to a subacute to a chronic deformity, with varying degrees of discomfort throughout.

Sacral fractures can cause various complications in the long term, and the severity of these issues varies (Gutierrez-Gomez et al., 2021). It is significant to observe that the trauma has healed, although being severely disfigured. After surviving the initial and early stages of trauma, V0584's daily existence would grow more difficult. Daily, this person would have had to cope with chronic pain, gait changes (which may have resulted in the joint disease in

her hip joints), instability, and the possibility of obstetric issues due to bone malunion (Gutierrez-Gomez et al., 2021). These issues present a unique challenge to a woman within the Middenbeemster community, physically, emotionally, and mentally.

The sacral bone healed at an almost 90-degree angle, resulting in the malunion and deformation of the sacrum. As a result, it would cause a permanent disturbance to sit and stand and to her balance. Cultural activities such as dancing were likely not possible for her. Steps and ladders were often utilized in Middenbeemster to access several living and working spaces (Chilcote, 2018), which presented an additional barrier for this individual who was coping with pelvic instability. A vital component of accommodating difference would be changing the structure of these spaces or providing assistance for entering and exiting, allowing this impaired community member to continue to participate. There would have been a noticeable difference in how this woman walked and her posture, setting her apart. Although it is hard to predict how the community would have responded to this difference, social isolation is a possibility. Nonetheless, her mortuary treatment was similar to other burials in a regular coffin in a stretched stance with her hands positioned on the pelvic region. Future historical documents might shed light on the subject of social in/exclusion, as it did in the case of V0945/Sara R., where archival data clearly illustrated that she was socially included.

Aside from this, the sacrum's misaligned union and chronic instability were likely a cause of persistent pain (Hessmann et al., 2010). She was likely in pain for the rest of her life. Caretakers' ongoing efforts would be aimed at assisting the patient in regaining stability, strength, and mobility and managing her pain. This kind of disability calls for specialized care, if not several caretakers.

She would not be as capable of helping with the customary physical labor requirements, such churning and milking. She will, though, have taken part in (communal) activities in other ways. Perhaps by modifications that are specifically intended to accommodate this difference (‘’accommodation of difference'' – see Tilley & Cameron, 2014). Moreover, she would have been able to contribute by housekeeping. For example, daily scrubbing, polishing, scouring enormous pails, pans, utensils, and laundry. Nonetheless, these activities likely were more strenuous for her and painful compared to other women in her cohort.

She had a minimal chance of giving birth successfully, due to her chronic pain and ongoing mobility issues, combined with the consequence of pelvic deformation. Adding onto her

visible, physical difference, is sexual dysfunction. Sexual disfunction is common with her deformation, and she could have had difficulty to reshape her notions of a woman's role in this community. Such issues have a substantial influence on someone's life, including depression, social exclusion or isolation, poor hygiene, and adjustments to how they view themselves (Miller, 1975). Many emotional, physical, mental, and cultural aspects influence sexual health. Her ability to express her feminine identity may have been changed, or she may have changed into a nontraditional role. In any case, V0584 would experience a period of ambiguity and change regarding how she felt about herself, how she viewed herself in relation to the group, and how the community saw her role within the community. Whatever the case, she was cared for throughout her life by one or more people. As she learned to deal with the long-term ramifications of her trauma, this care would have taken the form of "direct assistance" during the early phases of her injuries and "accommodation of difference" in the later stages of her disability. A community's tolerance of disability and awareness of active caregiving is demonstrated by her ability to survive with restricted mobility and self-sufficiency.

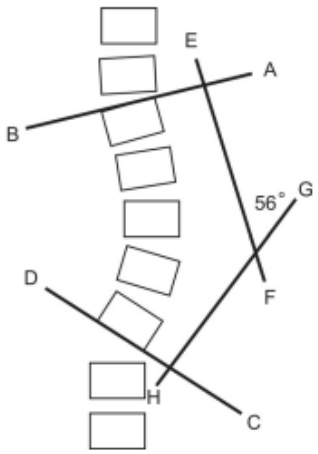
4.3 V0591 / Jantje W.

15. Complete skeleton of V0591 (Snaaijer et al., 2014)

Jantje W. was a 21-year-old woman who lived from 1836 to 1858. The average age-at-marriage in Middenbeemster was between 23 and 30, if one was to wed below the age of 22, it required the permission of parents in writing, and thus did not commonly happen (Blom, 2018). Hence, as expected, Jantje W was not married and did not have any children. She lived with her parents and had four brothers and a twin sister Jannetje. Additionally, she did not have any occupation indicated in the archival documents.

This young woman presents the most severe case of scoliosis, a horizontal curvature of the spine, found in the Middenbeemster collection. A variety of factors can cause scoliosis, but the most prevalent is idiopathic scoliosis (i.e., cause is unknown), accounting for up to 80% of all instances (Waldron, 2020). In addition, the most prevalent type of scoliosis is adolescent scoliosis, which affects more girls than boys. The Cobb method was used to define the degree of curvature (Snaaijer, 2014). After the vertebrae have been articulated and put in place, the Cobb angle may be easily calculated on skeletons with scoliosis. Using this technique, Snaaijer (2014) drew a simulated line from the upper proximal body to the lower distal body, which created the angle of interest.

16. r et al.,

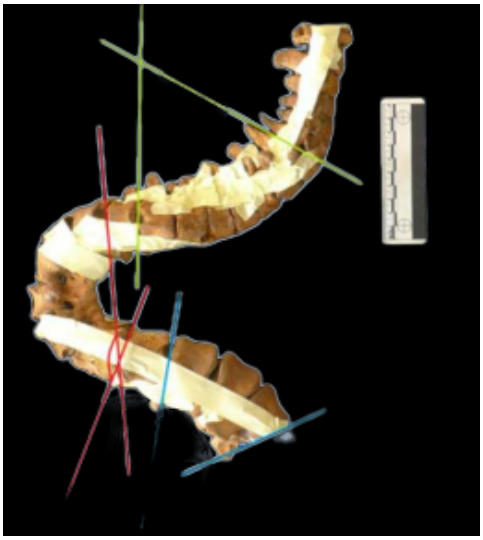


17 Schematic drawing on measuring the Cobb angle (Waldron, 2020)

19. Fused thoracic vertebrae & a single vertebra of individual V0951 (V. Schouten)

Scoliosis can range in severity from a modest, non-progressive curve which does not need treatment, persons who, using the Cobb approach, have a curvature that measures more than 40 degrees and would be operated on today (Waldron, 2020). Severe cardiac and respiratory issues can occur in people with significant deformities, and back pain is common.

Her spine's configuration would have caused her back to be distorted in an obvious S shape. The primary curve (see image 19: red) from T8-L1 has a Cobb angle of 155 degrees. The secondary curves (see image: green & blue) each measure 62 and 56 degrees (Snaaijer et al., 2014). Her sternum bends outwards (anteriorly), likely because her organs require more space as scoliosis affects her chest volume.

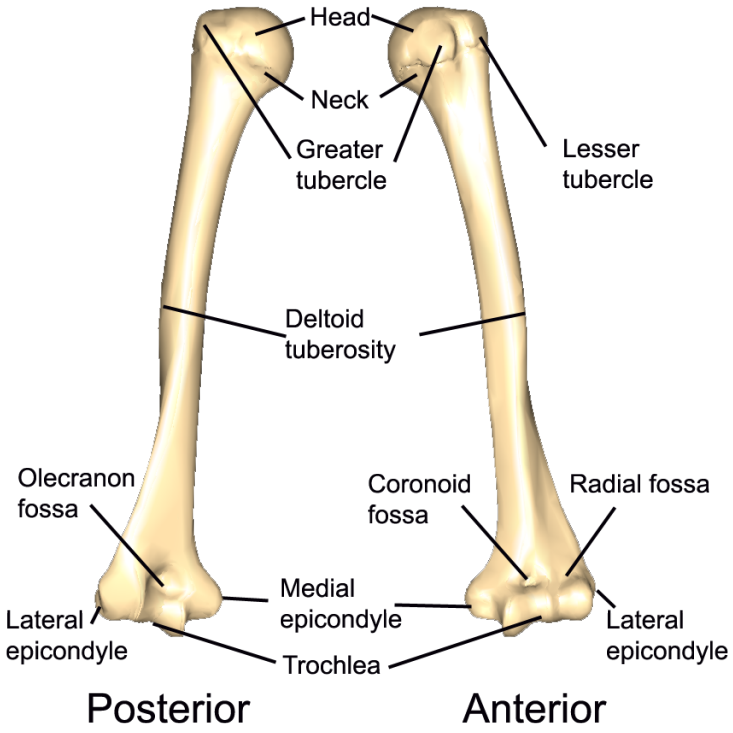


18. Cobb Angle measurements and articulation of the spine of V0951 (Snaaijer et al., 2014)

The left arm is 39 mm shorter and undeveloped compared to the right. This asymmetry continues to other areas. To illustrate, the ribs are very gracile on the left side, whereas the right ribs are more developed and thicker. Adding to this is also the asymmetry of the pelvis. The height of the right os coxa is 14.8 mm taller than the left os coxa. Both lower legs bend outwards. However, the bending is highly asymmetrical, and the right leg is more affected

than the left. She experienced at least three substantial episodes of stress during her childhood and adolescence, visible by the hypoplasia visible on her teeth (Snaaijer, 2014).

21. The right and left humerus of V0951. Note the asymmetry and underdevelopment of the left arm. (V. Schouten)



20. Drawing of the humerus (upper arm) (Drake et al, 2004)

At first glance, these skeletal lesions, of both the long bones and the scoliosis, can be related to rickets. A lack of vitamin D leads to long bones bending and deforming, which is the main cause of the pediatric disorder rickets. However, a calcium deficit can also result from a poor diet or from not getting enough short-wave UV sunexposure (Mays & Brickley, 2018). Vitamin D is required for bone mineralization; inadequate mineralization weakens the bones and results in distinctly bent bones. With rickets, the skeleton's bones deform easily due to the bearing of weight, movement, and muscle action, which also affects the vertebrae, ribs, and pelvis (Mays & Brickley, 2018). Weight on the softening bone can cause bowing deformities, displacement of long bone ends, and fracturing. The majority of children who have the condition will recover if exposed to sunlight again. However, if not, one can speak of *residual rickets,* in which the lesions are still visible into adulthood. One of the effects of residual rickets can be a pelvic deformity, leading to labor restriction later in life. If this

individual had restricted movement and also was constrained to reside inside, it would make them more susceptible to a vitamin D deficiency. This makes rickets is also a reasonable diagnosis. The postcranial skeleton does, however, exhibit asymmetric atrophy, especially in the left upper body and right lower body. A sole diagnosis of severe residual rickets does not account for this asymmetry. The bones of the left upper extremity are noticeably slenderer than the right. Both shoulder blades (scapula) have an excessive anterior curve, with atypical bowing along the scapular spine's plane. The right glenoid cavity is larger than the left: the right is 28 mm wide and the left4 mm wide (Snaaijer, 2014). The joint surface of the right humeral head appears to have moved from the medial to the lateral side, but all other anatomical traits of the arms are in order. This shift has likely created a new articular surface (a smoothed, flattened part) on the greater tubercle (see figure 23) The pelvis is also asymmetrical; the asymmetry of the sacroiliac joints can also be seen on the os coxa's auricular surfaces. The left auricular surface is C-shaped, has extensive pitting, and is nearly 1.5 times longer than the right.

Also, the legs' right diaphysis (midshaft diameter 21.7 mm) is significantly thinner than the left leg (midshaft diameter 23.8 mm). The asymmetry hints at atrophy due to the disuse of these limbs. Atrophied limbs and severe scoliosis suggest skeletal disuse due to a neurogenic origin. Several diseases or conditions can cause this neuromuscular damage (Iolascon et al., 2019; Takata & Yasui, 2001). These other findings, together with the asymmetry of V091's left and right limbs, provide evidence in favor of the hypothesis that the disease causing these was congenital and was most likely brought on by neuromuscular problems affecting her left side. The following paragraph will discuss likely diagnoses.

22. Right leg of V0951 (V. Schouten)

4.3.1 Polio

Paralytic poliomyelitis (Polio) is a possible disease that causes limb asymmetry and is consistent with neuromuscular problems. The left os coxa of the pelvis is far more curved and smaller than its equivalent, displaying asymmetry. The same goes for her arms, where

the left side is also smaller and undeveloped. V0591's gracile, femora, tibiae, and fibulae are the most persuasive evidence of this disorder in her bones. The most common kind of paralytic poliomyelitis, (partial) paraplegia, is known for these symptoms (Novak et al., 2014)

Scoliosis is one of the symptoms of paralytic poliomyelitis. Hip dysplasia, femoral neck anteversion, and foot malformations are additional symptoms (Colonna & vom Saal, 1941; Ebnezar, 2011); these are absent.

Moreover, she had significant, active caries at the time of death. which supports a case for paralytic poliomyelitis. Swallowing may be challenging during and after poliomyelitis when neck muscles are tight and paralyzed (Haberle et al., 2001). Issues with swallowing hamper the "clearing rate," or the time it takes to clear food. Salivary flow rate, which is correlated to how much is chewed and swallowed during meal intake, is a component in eliminating food particles and microorganisms from the mouth (Newbrun, 1995). The link between this and dental health is evident. Difficulties swallowing because of paralysis may lead to an increase in dental cavities. Carious lesions are caused by fermented carbohydrates in the mouth that remain uncleared, which cause a rise in acidity and the synthesis of proteolytic enzymes (Tayles et al., 2000). Moreover, in contrast to others in her cohort, her teeth do not show any signs of tooth-wear. This is not surprising, as she was still rather young when she passed. However, the high number of carious lesions in combination with the lack of dental wear do suggest an adapted diet, likely liquid and high in carbohydrates (Novak et al., 2014). The skeletal characteristics of V0951 do not exhibit the whole spectrum of polio symptoms, but the illness is varied in its individual manifestations, and thus polio remains a viable diagnosis. While other diagnoses cannot be ruled out, the combination of bone and dental abnormalities exhibited provide a convincing but not exclusive diagnosis of polio.

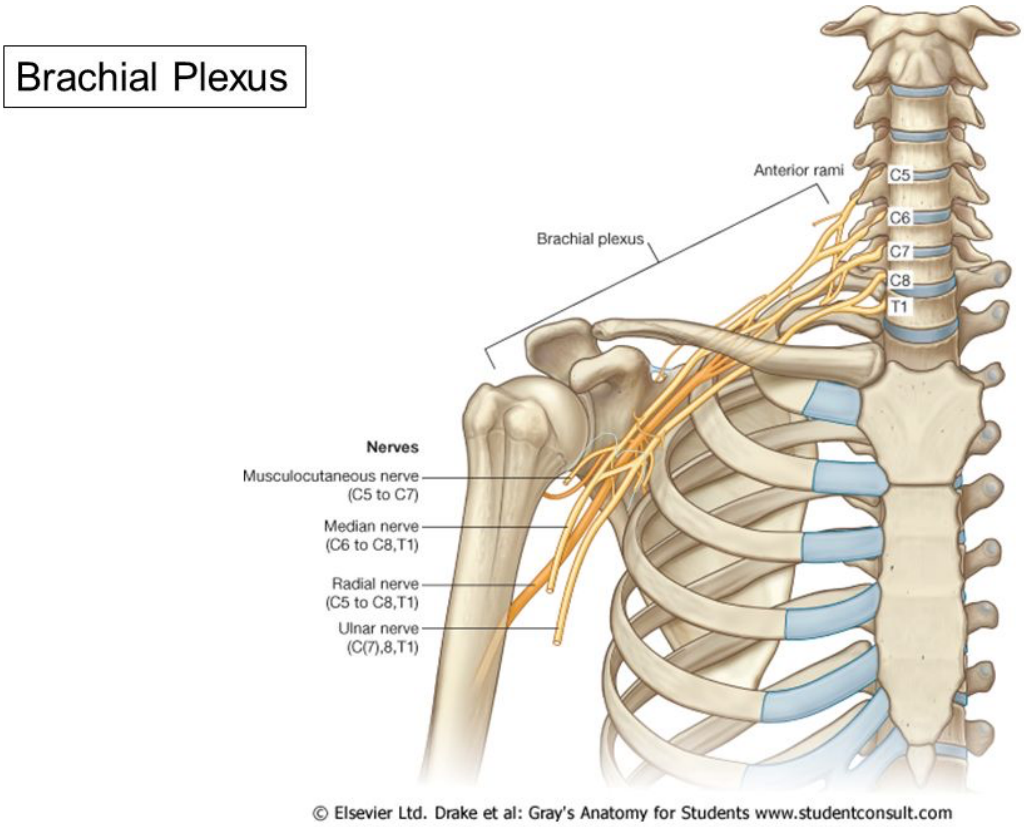
4.3.2 Cerebral palsy

Compression of the umbilical cord during childbirth can deprive the infant of oxygen, which frequently results in cerebral palsy (CP). The condition is influenced by (pre)natal/fetal trauma in general, such as intracranial injury, intrauterine growth, early birth, and low birth weight (Novak et al., 2014). In more extreme situations, both complete paralysis and serious mental health issues are observed. In around a quarter of the instances, the person has urine incontinence (Krigger, 2006). Muscle imbalance can result in

bone abnormalities, joint contracture, shortening of the limbs, and partial or total joint dislocation (Krigger, 2006). Neuromuscular- or paralytic scoliosis is also often associated with cerebral palsy and other neuromuscular diseases. Pelvic obliquity, which causes difficulty sitting upright without support, is a symptom of neuromuscular or paralytic scoliosis (Larsson et al., 2002), evident in the skeleton of Jantje. Paralytic scoliosis occurs when a patient with a neuromuscular illness is confined to a wheelchair or bed owing to paralysis of the lower limbs. On the other hand, neuromuscular scoliosis is diagnosed when individuals can still walk.

One out of four cerebral palsy patients are immobile. Diplegia is a commonly prevalent kind of paralysis in people with CP, which affects the legs more frequently than the arms (Novak et al., 2014). However, the body's left side is where hemiplegia (when just one side is affected) most frequently occurs (Koman et al., 2004; Novak et al., 2014). Several of these symptoms are consistent with V0591's remains. Given the asymmetry of the left half of V091's physique, one may argue that cerebral palsy induced hemiplegia. Supporting this diagnosis for cerebral palsy is her arm; a birth brachial plexus injury is most likely to blame for a partial dislocation (subluxation) of the joint, which has deformed her shoulder. A subluxation occurs when the bone is partially out of its socket-joint, whereas a dislocation occurs when the bone is entirely out of its socket. A network of nerves known as the brachial plexus emerges from the spinal cord and passes through the shoulder to reach the arm (Sumarwoto et al., 2021). When this is injured, the shoulder becomes unstable, which increases the risk of subluxation or dislocation of the joint. A subluxation of the right humerus early in childhood could explain the asymmetry and abnormal morphology of the right arm. The subluxation would have rendered the upper arm incapacitated, affecting the limb's growth (Waters et al., 1998). In addition, a new joint surface was generated because of internal rotation of the joint, as evidenced by the facet seen on the lateral section of the head. Brachial plexus palsy in newborns is characterized by this (van der Sluijs et al., 2003). The humeral head's morphology would be altered due to this internal rotation, causing the articular surface to shift from the left (medial) to the right (lateral) side.

Cerebral palsy with possible paraplegia and a brachial plexus injury is strongly connected to birth traumata. Brachial plexus birth palsy is associated with high birth weight, non-Caucasian ethnicity, older maternal age, and delivery in the breech position (Van der Sluijs 2003, 12; Wolf et al. 2000, 137). Given that Jantje's mother was 24 years old when she gave birth (Snaaijer, 2014), the population of Middenbeemster was Caucasian, and twins generally have a low birth weight, delivery in breech position might be a possible cause of the shoulder condition to consider. The general robustness of both humeri is similar, indicating that she continued to use the right arm despite her handicap. When the upper arm's movements are restricted in individuals with shoulder conditions like brachial plexus injuries, the lower arm's functions are often still, partially intact (van der Sluijs et al., 2003). Making it conceivable that, despite her disability, Jantje could execute limited manual tasks.



23. Anatomy of the shoulder with the brachial plexus (Drake et al. 2004)

4.3.3 A case for 'simply' scoliosis?

Nonetheless, although an extreme case, a straightforward diagnosis of congenital scoliosis cannot be disregarded. The partial fusion on the left side of the spine is typical for

congenital scoliosis (Snaaijer, 2014). In addition, compensation for this physical strain could result in morphological asymmetry, visible in the pelvic area. The other pathological changes are most likely a result of the spine bowing and rotating, resulting in osteoarthritis and degenerative disc disease: which both are evident in Jantje's case.

Hypodontia and congenital scoliosis are frequently cited in association. Hypodontia is a condition in which two to five teeth are missing, which is the case with Jantje (maxillary M3s and PM2s) (Snaaijer, 2014). However, the conditions are frequently described as symptoms of other syndromes (Kumar et al., 2009; Papagrigorakis et al., 2003). Therefore, finding out if Jantje had such a syndrome is an intriguing lead to following up on with genetic testing.

4.3.4 Tying it all together

It is difficult to establish a clear, unambiguous image of Jantje's paleopathological record due to the diverse morphological characteristics. Nonetheless, some diagnoses can be made with high certainty. One can be rather sure that a birth trauma caused the deformation of her shoulder. It is most likely that her other symptoms are also rooted in this birth trauma. This study argues for a differential diagnosis of birth trauma resulting in cerebral palsy with hemiplegia and a brachial plexus injury. During childhood, she was able to partially put weight on her right leg, causing it to deform more strongly than her left leg due to a vitamin D deficiency. As her scoliosis progressed with age, mobility became even more complicated and perhaps even impossible.

Although this is one of the diagnoses presented, the morphological changes on V0951's bones cannot be conclusive. In addition, various other (neuromuscular) conditions that are highly diverse in their expression remain possible.

Although the exact diagnosis might remain debated, the evidence does show that the condition was likely aggravated by a vitamin D deficiency (rickets), which contributed to her bone deformities. Although she may have lived until her 20s, she suffered several disabling conditions. The data suggests that Jantje had a serious impairment that was certainly painful. Walking would have been extremely difficult for this young woman, if not impossible. If Jantje could walk, she would have limped and carried a prominent spinal curvature. The limping, combined with a shift in the center of gravity (induced by the extreme bend in the spine), may have prompted her to need a crutch or a walking stick to get around, or perhaps not at all.

As her symptoms likely affected her from a young age, it is probable that her condition was part of her (social) identity. A characteristic of this identity made it more difficult or impossible for her to participate normally to the social and economic well-being of the community. She would have been unable to complete the majority of daily tasks, at least those involving eating and personal hygiene, much less strenuous physical activity that required frequent movement to prevent pressure sores (Dana & Bauman, 2015; Livesley & Chow, 2002). No evidence of pressure sores was found, suggesting that care to avoid pressure sores has pertained. Moreover, considering that she also suffered from multiple enamel hypoplasias, she would have undergone several systemic stress periods, contributing even more to general poor health.
However, how did this young female survive to early adulthood with apparent activity and movement limitations acquired from birth?

This study proposes two options: the household or the almshouse may have offered the essential support. In the 18th and 19th centuries, almshouses were places where the poor, old, sick, or disabled were taken care of if they lacked a support system in their communities (Frick, 2013). The former institutions only accepted those who were barely able to care for themselves; each resident must contribute in exchange for food, shelter, and care. For example, one could work on the land of the nearby farm or do other jobs like sewing, knitting, fluffing rope, or weaving mats. Unfortunately, there is no proof that almshouses provided long-term care for patients who were paralyzed (Kozakaitė et al., 2022).
The availability of such an almshouse is unlikely in the Middenbeemster, as these were located in cities rather than rural areas (van den Berg, 2013). Moreover, Jantje did not lack a support system and was not able to take care of herself in a way that she could minimally contribute. The most logical conclusion is that she was cared for by her family or close relatives. Family members likely provided the care in the privacy of the household. The young female's prolonged survival suggests that an extensive and well-planned effort was made to keep her alive. One can only imagine the daily demanding and complex schedule required to provide the bare necessities of those with significant physical disabilities. These responsibilities demanded a high degree of dedication from the family, which should not be disregarded as research by Davis et al. (2014) illustrates that those who care for paralyzed persons may have negative consequences on their health and social well-being as well as

their financial security. In order to meet her growing physical restrictions at an early age, her family and other community members would have had to provide her a distinctive social identity with unusual positions and limited duties. She may have needed nursing care and direct provisioning as her condition deteriorated for several years before she passed away as a young adult. Based on her tooth wear and caries, she was likely provided with an adapted diet high in carbohydrates and sustenance that required minimal chewing, such as oatmeal.

However, the fact that she was buried alongside others without evidence of discrimination or separation suggests that she was not treated differently in death at last. As a result, several essential everyday activities—like community involvement, interpersonal interactions, and learning and implementing new information—were unscathed. This implies that she received the care required to live, at the very least from her family, if not from the larger community that cared for her until her passing.

4.4 Conclusion

To sum up, the impacts and repercussions of the bone lesions were quite variable and diverse for the three individuals. Sara (V0945) had shortening of limbs and frontal bossing of her skull as bone markers. V0584's sacrum had been irreversibly damaged as a result of acute trauma. Finally, V0591 was hampered by severe deformities likely caused by a birth complication that resulted in (multiple) neuromuscular disorder(s). Each individual received care and would not have reached their age without it. Everyone had to deal with a noticeable handicap. The family and wider community would have been aware of the diseases. Specific information can be derived from these three individuals about the Middenbeemster community. They were all buried alongside the rest of the Middenbeemster population, with no evidence of selection, segregation, or mortuary treatment difference. This burial custom proves that they received the same treatment as the rest of the community, at least in terms of death. As a result, several essential tasks were not seen as being hindered by their physical limits, including communal life, interpersonal relationships, and learning/applying information. Their survival implies a change in the Middenbeemster's traditional role expectations, as confirmed by both archaeological and osteological evidence. Because of their physical limitations, modifications in social expectations and behaviors were necessary, and these adaptations

are likely what permitted them to live until the age of death. In each of these situations, the necessity for this care continued from the outset of the sickness until death. In a small family group, meeting their requirements would necessitate the cooperation of economically productive and flexible individuals. As the impairment worsens, the demand for care increases in certain circumstances. Continued care in this situation demonstrates a coherent community with the mental flexibility, organizational abilities, and desire to deal with a steady drain on resources. Despite limited self-sufficiency and mobility, their continued lives demonstrate the community's tolerance for handicap and active care support. Negative attitudes against people with disabilities were most likely motivated by their incapacity to work and support the local economy. The importance of family unity, which popular Christian notions of compassion may have affected, is demonstrated by the fact that the disabled were cared for in the household for years.

Chapter 5: Conclusion

This study significantly adds to existing research on the living circumstances of disabled individuals, in particular the kind of support they received, and the community's attitude(s) toward their physical impairment by combining bioarcheological research with data from the existing literature and context. Additionally, given the long - term nature of such conditions, this study underlines the impact of living with disability in a time before access to modern remedies. In particular, it highlights the need of understanding local and social care provision.

5.1 Inference of care

This research has demonstrated and explained the effects and consequences of disease markers on bone. The bone lesions were highly variable and present until death for the three individuals. For Sara (V0945) here, bone indicators were the shortening of her limbs and frontal bossing of her skull. For V0584, acute trauma had permanently deformed her sacrum. Finally, a birth trauma likely caused a birth injury and severe scoliosis, impairing V0591.

The study looks at the clinical and social repercussions of disability, both for the afflicted person and their family as well as for the community at large. All three individuals received care, as their ages would not have been reached without care, considering their disabilities. All individuals coped with a visible disability. The community would know they coped with a disability just by looking at them. Nevertheless, there was no indication of selection or exclusion; each of them was interred with the other members of the Middenbeemster community. This mortuary practice demonstrates that they were similarly to other members of the community, at least in terms of death. Therefore, several essential everyday activities—such as interacting with others, learning and applying new information, and participating in communal life—were not hindered by their physical limitations. In other areas, however, these individuals were impaired, which affected their ability to contribute to a normative role. These responsibilities demanded a significant investment from the household and should not be disregarded. Furthermore, it would have necessitated that their family and other community members adapt to their physical limits by giving them a

distinctive social identity with (atypical) duties and scaled-back/adapted responsibilities. Their continued survival signifies a modification to the typical Middenbeemster roles that have been inferred from both archaeological and osteological data. Their physical restrictions necessitated changes in group expectations and behaviors, and these changes likely were what allowed them to live to the age of death. Despite the fact that "direct care" may demand more energy than the act of ‘accommodating’ (Tilley & Oxenham, 2011), in each of these cases the necessity for accommodation persisted from the time the condition first manifested itself until death. Meeting their needs in a small family group would necessitate the participation of economically productive and flexible members to provide. In some cases, care demands increase as the impairment progresses over time. This demonstrates a coherent group with the readiness, mental openness, and management abilities needed to deal with a continuous demand on resources. Their long-term survival despite having limited mobility and self-sufficiency demonstrates the community's tolerance of handicap and active caregiving. The building of potential and plausible descriptions of their experiences has been assisted by the implementation of the Index of Care.

5.2 Care in the Middenbeemster community

To sum up, one should note that there is not a specific list of bone lesions that indicate the presence of care. This research illustrates that bone lesions are highly variable in their expressions of diseases. There is, however, no meaning without context. Therefore, care can only be inferred from these bone lesions in relation to their contextual information. The Bioarchaeology of Care approach reveals valuable information about identities, caregiver-recipient dynamics, and the community within their context. Thus, it is concluded that during the post-medieval period, disabled adults in the Middenbeemster community were cared for in the privacy of the home by close relatives. In order to accommodate the disabled, they were given a social identity with (atypical) duties and, when required and practical, reduced or modified obligations. With reduced self-sufficiency and mobility, their survival indicates the community's tolerance and understanding of disability to a certain extent and active care provision within small family groups. Carrying such demands in a small group required considerable commitment, organization, and flexibility. However, in the case of unfavorable attitudes towards their difference, their incapacity to contribute to and support the domestic income was most likely the cause of these. The importance of

family unity is demonstrated by the fact that care for the handicapped was provided in the household for years and sometimes decades, perhaps as a result of religious ideals of almsgiving. Not every physically challenged individual in Middenbeemster required special care; some surely managed to lead quite normal lives and perhaps even contribute to the family's finances, as in the example of Sara/0945's marriage. In this approach, the research contributes to a deeper knowledge of past attitudes, beliefs, and practices within the Middenbeemster community about health and disease.

Finally, this study reaches the conclusion that The Bioarchaeology of Care is fundamental as it connects the clinical to the social, the lesion to the symptom, and the bone to the human. By giving a full picture of the conditions, this study contributes to the development of more in-depth interpretations of care and quality of life. In doing so, it breathes life into the skeletal remains of not only the individual of Middenbeemster but also of the period as a whole.

7. Abstract

Prior to the nineteenth century, disability studies generated a diverse body of work, usually evoking potentially naive or blanketing generalizations about the positions of disabled people throughout history. To counter the prevailing narrative of disability as an individual medical illness or weakness, this thesis uses an approach that recognizes the diverse and complex character of disability as ingrained in culture and power relations. The skeletal collection of Middenbeemster (The Netherlands) was examined by using Tilley's (2021) 'The Bioarchaeology of Care Methodology'. Different skeletal indicators of disablement were examined to infer evidence of care. As a result, using this approach for three individuals, this thesis has qualitatively determined what this care likely involved in detail. The Index of Care has contributed to the development of plausible and possible narratives of their experiences. It revealed valuable information about identities, caregiver-recipient dynamics, and the Middenbeemster community within their context. The three individuals coped with a visible disability, and the community would know they coped with a disability just by looking at them. Nevertheless, each of them was buried like any other individual of the Middenbeemster community, without evidence of selection or segregation. During this post-medieval period, these disabled adults were cared for in the privacy of the home by close relatives. They were assigned a social identity with (untraditional) positions and modified or decreased tasks as required to accommodate them. With reduced self-sufficiency and mobility, their survival indicates the community's tolerance and understanding of disability to a certain extent and active care provision within small family groups. Carrying such demands required considerable commitment, organization, and flexibility. The fact that the disabled survived for years is evidence of the value of strong family ties, which were perhaps motivated by their faith, with prevailing ideals of almsgiving. Not every physically challenged person in Middenbeemster required special care; some, like Sara/0945, were clearly able to have quite normal lives and potentially contribute to the family's finances. In this respect, the research contributes to a deeper knowledge of past viewpoints, attitudes, and practices within the Dutch and Middenbeemster communities about health and disease.

Keywords*: Bioarchaeology of Care, Middenbeemster, caregiver-recipient dynamics, osteology, disability*

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7. List of Figures

7.1 Figures

7.2 Tables

8. Appendix

8.1 Microsoft Access

Legend
Blue = selected out because of undetermined sex
Green = selected for complete approach
Light green= qualified for further analysis, but not selected based on severity and diversity
Orange = selected out because not enough evidence for care
Grey = preservation issue
Red = Not complete enough

ID	Sex	Age	Pathology	Complete	Immobile	Pressure sores	Comments	Findnumber
63	f	late young adult	severe deformation of pelvic girdle. OA of lumbar vertebrae. Scoliosis. Mastoiditis. Crooked pelvis.	1	No	No		
61	f	middle adult	kyphosis cervical vertebrae, cause upper thoracic are collapsing. Green discoloration on leg.	3	Yes	No	brace?	
79	f	late young adult	Spondylolysis with secondary OA. Schmorl's nodes.Intervertebral DISC disease.Caries.Granuloma.	3	No	No		V0094
73	f	late young adult	extreme Scoliosis.Ebumnation in vertebral facets, lipping.infection occipital? very well preserved.	3	Yes	No		V0131
80	f	old adult	OA all over. Eburnation. Scoliosis. Thoracic fused.	3	Yes	No		V0156
7	f	old adult	Residual rickets: tibiae bowed. Lipping at ridge of oscoxa and ischium,	3	Yes	No		V0171
68	f	late young adult	bilateral bowing of humeri, ulnas, clavicles, fibulae: residual rickets.Left nasal conchae bullosa.	3	No	No		V0311
62	f	old adult	OA	2	No	No		V0334
47	f	middle adult	hypoplasia. Lordosis. Cloacae in maxillary sinus. Non-fusion of c1. thickening of occipital extreme.	3	Yes	No		V0520
54	f	middle adult	Lipping at the tubercles of right rib 6 + 10 and left rib 6. Lipping and osteophytes on the L and R os coxae.DISC. Sacrum enlarged foramina.	3	No	No		V0571

51	f	middle adult	Fracture of clavicle. Fracture of s3 (sacral v). Non-union neural arch C1.	3	Yes	No		V0584
28	f	early young adult	severe scoliosis. Generelised microontia. Residual rickets/deformity. Developmental issue of left arm: fusing of the head is different and shorter than other.	3	Yes	No		V0591
46	f	middle adult	TB.OA of spine & acromioclavicular joint. Blunt force trauma on head between parietals and occipital. Sacrum short and different.	3	No	No		V0616
38	f	old adult	OA in spine C4+5; L 1-6. OA in L+R acromioclavicular joint. OA in R hand / wrist (trapezium + MC1). OA in L + R acetabulum and femoral head. OA in L foot (MT1). Possible infection/abcess in right palate.	3	Yes	No		V0669
44	f	middle adult	Scoliosis, not severe enough not to walk; IVD; OA: vertebrae, TMJ, acromialclavicular joint and prox femora	3	No	No		V0733
45	f	middle adult	Congenital hip displasia-disluxation. Caries + eaten away teeth. Slight scoliosis; fused L6+S1, crooked. femora heads deformed.	3	No	No		V0757
33	f	old adult	serious OA spine& pelvic girdle	3	No	No		V0762
31	f	late young adult	Calculus (4.4)Caries (4.4 and 4.3)Hypoplastic line (4.4) OA (knees, right foot, spine). Intevertebral DISC (cervical and thoracic).OA (mandibular condyles, TMJ).	2	No	No		V0818
21	f	late young adult	Schmorl's nodes. Bowed tibiae & fibulae (rickets). Caries and granuloma. Possible scurvy. Indications for brace. Position of legs causing foot to point outwards.	4	Yes	No	Brace	V0876
30	f	middle adult	periodontal disease. Extra sacral element. Spurs on clacaneus. Periosteal bone formation on right rib medially.	3	No	No		V0880
35	f	late young adult	residual rickets. Big caries.	3	No	No		V0886
12	f	middle adult	Bone formation on ribs. Fibulae are very thin.	3	No	No	Very small person.	V0896
20	f	early young adult	Dental disease: bone loss on both mandible and maxilla. Caries. Granuloma. Abcess. Pitting on both temporomandibular joints. Slight bonegrowth because of alteration of joint contours. OA of left temporomandibular joint due to probably flexibility. Schmorl's nodes on T7-T11. Partially sacralized lumbar, causing pelvis to be assymetrical. Occipital thickening. Misshapen cervical vertebrae. Green discoloration on both arms in similar locations.	4	No	No		V0925
26	f	old adult	dwarfism. Ante-mortem tooth loss. Achondroplasia or hypochondroplasia. OA.	3	No	No		V0945
13	f	middle adult	Dental caries. OA of spine. Enthesopathy of ulnar head.	2	No	No	Green discoloration on right arm.	V0958
27	f	late young adult	bump from the inside of the skull.	3	No	No		V0965

25	f	old adult	Extensive new appositional bone deposits on upper and lower limbs. Slightly thickened skull. Periostitis? Scurvy? Paset's? Rotator cuff diease with impigment syndrome. Eburnation of humerus head. Infected humerus distal end.	3	Yes	No		V0968
14	f	early young adult	Enamel hypoplasia on 1.1,1.2,1.3,2.1,2.2,2.3. Schmorl's nodes. Not all bones completely fused yet.	3	No	No		V0985
8	f	early young adult	Premature suture closure	3	No	No	very small bones	V1097
9	f	late young adult	Slight bathrocephaly. L5 possible compression fracture	3	Yes	No		V1153
22	i	middle adult	osteoma and assymetrical occipital bone	3	No	No		V0872
58	m	middle adult	slight s in thoracic. Mastoiditis. OA of os coxae.	3	No	No		
60	m	middle adult	dental abcess. OD on distal tibia (right and left talus. Intra-thoracic pathology. Hip OA.; slight S curve; subchondral cyst tibia distal end.	3	No	No		
3	m	old adult	Probably meningeal tuberculosis; OA; traces of adipocere	2	Yes	No	Preservation issue	V0024
83	m	old adult	OA;Intervetrebral DISC disease;Osteoma;Calculus;Periodontal disease with abscess	3	No	No		V0059
77	m	old adult	Healed cribra orbitalia;Sacralisation;Cloaca ;DISC degenerative disease; Bone formation;OA	3	No	No		V0074
10	m	old adult	OA of joints and spine. DDD and possible DISH. Wormian bone on skull. Depression on occipital bone that could be a pressure sore.	3	No	Yes		V0118
16	m	late young adult	Caries. Lipping of some vertebrae. Schmorl's nodes. Divided vomer. Ante-mortem toothloss with abcess. Sacral vertebrae form bony bridge.	3	No	No	Broken nose.	V0122
78	m	late young adult	5th Lumbar : bilateral spondylolysis; Vertebral OA; Schmorl's nodes	2	No	No		V0124
76	m	middle adult	Extra lumbar vertebra (L6) Porosity vertebral ends of several L rib's; Possible TB; Schmorl's nodes thoracic vertebrae	3	No	No		V0133
4	m	middle adult	Residual rickets	4	No	No		V0148
72	m	old adult	OA; Vertebral OA ;Hip OA; Acromioclavicular OA; TMJ; AMTL;periostitis left tibia	2	No	No		V0196
71	m	middle adult	Spinal OA. Spondylosis; IVD; Spina bifida occulate; RA ; bstructed hypogloassal/jugular/condylar canal; Left hemiatrophy; Dental ; TMJ; Fibrous/soft tissue mid facial mass	3	No	No		V0222
59	m	late young adult	Schmorl's nodes; Lesion on sternal end of r clavicle; Early stage IVD (IUD?) (Porosity on vertebral bodies); asymmetrical forum magnum	3	No	No		V0282
56	m	early young adult	Schmorl's nodes. Very slight caries. S1 not fused.	3	No	No		V0335

57	m	old adult	IVD + OA of spine;Early DISH;OA of sternal - clavicular joint (L) + acromial - clavicular joint MTI (right);Slight bathrocephaly;lot of curve in upper thoracic	3	No	Yes		V0338
55	m	early young adult	Solitary osteolythic lesion location at right endocranial surface at the frontal bone;It seems that this lesion follows a patttern extending on the cerebral surface of the right greater wing of the spehnoid in general we see a porous destruction with the porotic lesions having smooth and rounded margins	3	No	No		V0369
65	m	middle adult	periodontal disease	3	No	No		V0411
66	m	old adult	OA vertebral columm;OA acromioclavicular joint ;Porosity on epiphyseal ends of tibiae;fibuae, femora and clavicula;Slight microporosity of vault on posterior frontal parietals;Shortened right tibia and fibular resulting in different limbs;Slight bowing in M- L place of right tibia	3	No	No		V0427
67	m	early young adult	schmorl's nodes. Periosteal new bone formation on right and left femora shafts and tibias. Uneven parietal shape.	3	No	No		V0432
52	m	old adult	Spondylolysis;infection of cranial base ;Possible mastoiditis ;OA;Several enthesopathies ;Dental caries;Abcesses dental ;Alveolar bone loss ;very light bones. Very tall guy. ; periostitis fibula right and left ;kyphosis	3	No	Yes		V0452
48	m	old adult	OA of elbow;Edentulous ;Severe OA on sacrum ;Green stains (metal);Sacralization on L5 ;Foot injury	3	No	No		V0466
53	m	early young adult	large bone protusion on left fibula.	3	No	No		V0472
40	m	middle adult	Residual rickets;Scoliosis;Vertebral osteophytosis;Ryphosis;OA of spine + acromion- clavicular joint;R femur + tibia have green + talus; Horizontal discolourations indicative of metal brace	3	No	No		V0671
41	m	late young adult	posterior plagiocephaly. Head is a peculiar shape.	3	No	No		V0676
0	m	old adult	Degenerative joint disease; Degenerative DISC; Schmorl's nodes;Pathological condition on left humerus; Dislation of mandible (possible); Spine infection?	3	No	No		V0741
29	m	old adult	healed cribra orbitalia. Osteomas. Bilateral fracture of fibula proximal shafts. Large callus. Healing. Tibiae unaffected by trauma.	3	No	No		V0766
36	m	old adult	probably DISH. Muscle attachment very pronounced. Extreme lipping at ridges of os coxa. Sacrum bony bridge. Thickening occipital.	3	No	No		V0815
32	m	middle adult	periodontal disease. Possible DDD and OD. Thickening occipital.	3	No	No		V0821
37	m	early young adult	sacralisation L6. fusing lines are still visible, so very young.	3	No	No		V0851
23	m	middle adult	OA C5 and fractured 5th right rib. Brace left leg?	3	No	No		V0907

39	m	middle adult	possible trauma of T10. mastoiditis.new bone formation on tubercle of right tibia. Periodontal disease.	3	No	No		V0926
15	m	middle adult	Residual rickets. Bowen femora. Lipping on vertebrae	4	No	No	Green discoloration occipital bone.	V0929
1	m	late young adult	Slight bending deformity of lower legs: Residual rickets	4	No	No		V0938
18	m	late young adult	Non-symmetrical head. Large and heavy person.	4	No	No		V1003
50	m	late young adult	laterally curved tibiae and ulnae. Rickets.	3	No	No		V1006
19	m	old adult	OA of spine and other joints. Possible DISH. Osteoporosis of tibia. Irritation of the ischium on both sides. Occipital thickening. Spurring on both heels.	3	No	Yes		V1030
6	m	old adult	OA of hip, spine, elbow, thumbs. Osteophytes on right tibia. Assymetry of jugular fossa. Wedge shaped L3: wedge fracture. Has likely walked with difficulty at end of life	3	No	No		V1057
2	m	early young adult	Pathology on left distal humerus, infected. Could be pressure sore. No other evidence of pressure sores.	4	No	Yes		V1062
11	m	middle adult	Residual rickets. Evidence of brace.	2	Yes	No	Brace	V1165
24	m	middle adult	osteoma. Thickening occipital. Intevertebral disc disease. OD. Pathology of jaw (cancer or phossy jaw). Residual rickets?	3	No	No		V1507
82	pf	middle adult	Laminar spurring on T3-12 and L1-5;Non-osseous tarsal;Non-union (calcaneus + navicular, right);Holes in carpals	3	No	No	green discoloration on right arm.	V0055
42	pf	middle adult	ODD:R+L capitulum humerus and L condyle l femur;OA:T3 t/m t6 ; L2 t/m L5; secondary Left knee, Manubrium; Residual rickets: L + R tibia + fibula. Periosteal new bone:L + R tibia + fibula. Deformation of right hip. Early onset dislocation. TB of the hip.	3	Yes	Yes		V0758
34	pf	middle adult	OA spine;Periodontal disease; Laminar spurring; Possible trauma of the spine; Right bending of both tibia and fibula	3	No	No		V0760
75	pf	early young adult	light S-curve in vertebrae; Schmorl's nodes; Cribra	3	No	No		V080
5	pf	middle adult	Possible TB, residual rickets, OA in both acromioclavicular joints, left wrist and hips. Bathrocephaly	3	No	No		V1037
17	pf	middle adult	Depression on inferior surface of L5 and corresponding promentory. Occipital bone is thickened.	4	No	No		V1054

81	pm	late young adult	AMTL;Mastoiditis of right mastoid process	3	No	No	preservation issue	V0050
74	pm	middle adult	schmorl's nodes.	3	No	No	preservation issue	V0192
64	pm	old adult	RCD;OCD;Scoliosis;button osteomas;bladder stone;Missing mandibular congenital central incisors Vastus notch;Subchondral cyst	3	No	No		V0440
69	pm	middle adult	Osteochondritis disease;Bathrocephaly;Secondary OA in right ankle;curve in right and left tibia	3	No	No		V0613
43	pm	early young adult	Historical records note he is 19. So likely delayed development???; Third molar eruption shows that he is 19, but body is not. Infection of clavicular joint.	3	No	No		V0724
49	pm	middle adult	Spinal osteophytosis/ schmorl's nodes;OA of lower and upper limbs; Rib fractures;Dentition = AMZ/caries/calculus	3	No	No		V0920
70	pm	middle adult	green discoloration on right leg. Severe DISC in lumbar vertebrae. Bathrocephaly. Osteochondritis disease.Secondary OA in right ankle.	3	No	No	brace?	V316

8.2 Bioarchaeology of Care approach

The step-by-step plan below (for each individual) is directly based on The Index of Care, designed by Tilley (2018). After completing the steps on the Index of Care, it generates a report based on the filled in forms, which have been copied exactly.

Results of V0945 / Sara

Index of Care - Step 1

The Individual

(i) Identifier(s) and provenance (e.g., location of recovery, date/period, culture, other)

V0945 'Sara'
period: 1863
culture: Middenbeemster, The Netherlands

(ii) General identifiers (e.g., age, sex, height, build, other)

female
66 years old
130.0 ± 5 cm

(iii) Skeletal elements recovered (list and describe skeletal elements in terms of e.g., completeness, preservation, measurement, morphology, anomalies, etc. - note that detailed description of pathology indicators is covered in SECTION 2).

Element	Description	Comment
Complete	Preservation is very good	No comments

Skeletal elements: additional comments/observations

Only the coccyx is unobservable.

(iv) Teeth recovered - Maxilla

(iv) Teeth recovered - Mandible

Tooth	Description/Comment
0	Edentulous

Pathology

(i) Location and description of each pathology indicator, status at the time of death (active, resolved, resolved with residual deformity, etc.), and comments/observations

Element/location on element	Indicator	Status at death	Comments/observations
long bones	extreme reduction long bones; displaying hypertrophied proximal and distal ends	resolved with residual deformity	Postcranial elements show most reduction and deformity, especially in ulna and radius
radius	substantial bilateral medio-lateral diaphyseal bowing	resolved with residual deformity	
ulna	antero-exterior diaphyseal bowing; displaying hypertrophied proximal and distal ends; olecranon process and olecranon fossa restrict humero-ulnar	resolved with residual deformity	

	articulation and cap forearm extension at 130 degrees		
femora	Femora disproportionately shortened compared to tibiae; osteophytes around edges of distal joint	resolved with residual deformity & active	
cranium	Basicranial compression causes a "domed" vault and occipital bulging, and the foramen magnum is oddly formed and much smaller than the rest of the collection. Occipital condyles sink into base of the skull. Clearly visible frontal and parietal bossing results in a 'flattened' forehead and midface from glabellar, orbital, and nasal abnormalities. Infantile like facial architecture moderately depressed nasal bridge	resolved with residual deformity	
hands & feet	normal-sized tarsals metatarsals of both feet relatively normal carpals, metacarpals, and normal phalanges	resolved with residual deformity	
vertebrae	osteophyte development on anterior and lateral edges of the vertebrae vertebrae C3, T9, T10, and perhaps T1 and T3's anterior height in relation to anterior wedging small lumbar neural canals with short pedicles	active	

(ii) Possible patterns/relationships involving some/all pathology indicators (If not relevant/no apparent relationship, indicate this; otherwise, e.g., causal, interacting, etc.;

Indicators	Relationship
osteophyte development	due to age or related to other deformities

(iii) Generalized indicators of health stress
Not visible.

(iv) Individual Pathologies
Pathology #1: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
Achondroplasia

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)
Hypochondroplasia, milder clinical symptoms.

(c) Possible cause(s) of pathology (including possible contributing factors)
Hereditary development disorder. The gene variants on chromosome 4 are responsible for 99 instances of achondroplasia (Jaffe, 1972). Despite the fact that periosteal ossification is unaffected, this deficiency leads to deficient enchondral ossification.
(d) Estimated pathology duration
life-long

(e) Course of pathology over time (e.g. congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
Congenital, acquired from birth onwards. Lived with pathology until death. Life expectancy is normal.

(f) General comments/observations
Without needing a specific illness categorization in this instance, the osteological data alone is adequate to determine the need for care. It is possible to argue in favor of the less severe variant, hypochondroplasia. Research on her offspring argues in favor of this diagnosis (Waters-Rist & Hoogland, 2013)

(g) Specific pathology references

Pathology #2: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
Osteoarthritis

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)
rheumatoid arthritis

(c) Possible cause(s) of pathology (including possible contributing factors)
Although the exact origin of OA is unknown, it is recognized that a number of variables play a significant role as predictors. Age, genes, sex, ethnicity, weight, trauma, and mobility are some of these variables (White & Folkens (2005). Her achondroplasia and her lifestyle are probably to blame for a common issue of deformed joints.

(d) Estimated pathology duration
middle age - death

(e) Course of pathology over time (e.g., congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
worsens throughout life-course until death, as the illness worsens, the articular cartilage degrades.

(f) General comments/observations
severe in the spine (cervical, lower thoracic, lumbar) and majority of limb joints. painful and often disabling.

(g) Specific pathology references

(v) Section 2: Pathology/Pathologies - additional comments/observations

(vi) References/sources
White & Folkens (2005)
Ortner (2003)
Jaffe (1972)

Mortuary Context
(i) Location of remains
(a) Remains not recovered from cemetery context (describe location).
The coccyx is likely still at the cemetery; this was not recovered.

(b) Remains recovered from cemetery context (describe location within cemetery, in relation to other burials - e.g. single/group burial, within main cemetery, on periphery, etc.)
The church graveyard is located on the south side of the church. The cemetery was separated into rectangles, each about the size of an adult coffin. Coffins were piled on top of one another; they were typically three or four deep, but burials with any number between one and six were not exempt. There was little to no disruption of burials; vertical disturbance was primarily due to coffin collapse or fresh depositions in the same plot. The

plots were highlighted because there was no horizontal disruption. Everyone was buried in a wooden coffin, some of which contained grave goods—only individual graves.

(ii) Deposition of remains (positioning, orientation, grave cut, etc.)
Northwest-southeast orientation, parallel to the church. In a stretched stance, individual graves. The legs were aligned in a straight line. Hands were positioned on the pelvic region.

(iii) Preserved grave goods (and placement of these)
No grave goods.

(iv) If found in cemetery context, compare subject's mortuary treatment with that of other burials (if possible, within same demographic cohort)
Like other burials, interred in a normal-sized coffin even though the individual was not normal-sized.

Lifeways (Biocultural Context)
(i) Physical environment
(a) Climate (e.g., temperature range, seasonal variation, rainfall - implications for shade and/or shelter, disease vectors, etc.)
The temperature is around 5-10 degrees on an annual average—the seasonal variation, with more rainfall in September-February (de Moel et al., 2011). As a result, the Netherlands was particularly vulnerable to flooding and experienced significant droughts.

(b) Topography and elevation (e.g., coastal, swamp, hilly, mountainous, easy/difficult to traverse - implications for managing mobile lifestyle, transportation, etc.)
A former lake that was recovered between 1609 and 1613 was known as a "polder," or "beemster." The polder was laid out in an equal-sized rectangular grid. Very swampy, but easy to navigate. Unhardened roads are used for transportation.

(c) Vegetation (e.g., desert, grassland, sparse/medium/dense forest - implications for access to fuel, building materials, food sources, etc.)
At low tide, sluices are opened to drain the polder of any remaining water. The internal water level should not be adjusted too low. Peat-based polder land, formerly marshland, will sink. Peat provides a heat source. Soil is very fertile. Vegetation is primarily grassland.

(d) Food and water sources (e.g., animals, plants, wild/domesticate, reliability of supply, ease of access, fertile/barren environment - implications for managing reductions in group productivity, cost of care, etc.)
water piping was first introduced in the 1800s. Before, accessibility to drinking water was quite flexible and changeable. People used surface water, precipitation, and groundwater to get their water. The Western Netherlands, which is low-lying, relied on rainwater since the surface and groundwater were brackish and contaminated by human and industrial waste.

(e) Environmental hazards (e.g., unsafe terrain, predatory animals, poisonous reptiles and insects - implications for safety/need for protection etc.)
Terrain is relatively safe. There are no venomous reptiles, deadly insects, or predatory mammals. Therefore, the need for protection from environmental hazards is low.

(f) Access to manufacturing materials (e.g., timber [see (c)], stone, clay, hide/textile, metals - implications for group 'wealth', meeting 'costs' of care etc.)
Access to timber is limited.

(g) Other variables and/or comments/observations
During this time, the Dutch population increased as mortality drop outpaced fertility decline.

(h) References/sources

de Kraker (2006)
de Moel et al. (2011)
Beersma and Buishand (2004)

(ii) Economy

(a) Food production / procurement strategies (e.g. [mixed/specialist] hunter-gatherer/forager, fishing, pastoralism, horticulture, agriculture - implications for potential role of disabled individual etc.)
The first half of the 19th century was a time of economic advancement and prosperity for Dutch farmers. Dairy farming gained popularity, and dairy products started to be exported in large quantities. Land reclamation and agricultural innovations raised agricultural production to levels comparable to some of England. Agriculture continued to be the most significant economic sector even though this placec country was highly urbanised at the time. A rural neighborhood called Middenbeemster is home to primarily dairy farmers and workers. Known occupations from Middenbeemster include farmers (mainly dairy), baker, doctor, turf-skipper, carpenter, cooper, shopkeeper, day laborer, teacher, painter, postman, and priest.

(b) Ease/difficulty in food procurement/production (e.g. abundance/scarcity of food, seasonality/reliability of access, nutritional value of diet - implications for 'costs' of caregiving, suitability of diet, etc.)
Risks to Dutch agriculture included flooding and soil subsidence. The threat of mildew to food, clothes, and furniture was unending. Wood resources were limited. Protein products are abundant such as meat, cheese, milk, and carbohydrates, such as grain—scarcity of fresh fruits in winter (Van Zanden, 1994).

(c) Technologies available, product manufacture, and materials employed (e.g., tools - stone, bone, wood, metal, other; pottery; textiles; other artifacts [domestic, personal]; etc.)
Modernization of agricultural techniques, including the use of new fertilizers and mechanization. Dutch farming tools, made of wood and metal, such as a shovel and reek. Also, wooden shoulder yokes, trays for skimming, and mechanics for churning and molding the process for butter and cheese.

(d) Trade/exchange activities (e.g., trade products, distances involved - implications for occupational options, interaction with other communities, exchange of knowledge, etc.)
Dairy farming was mainly for export. England was the most significant food importer and was supplied by Dutch dairy products from the Middenbeemster.

(e) Other variables and/or comments/observations

(f) References/sources
Falger et al. (2021)
Van Zanden (1994)

(iii) Socio-cultural context

(a) Basic lifestyle (e.g. mobile, semi-sedentary, seasonal occupation of established camps, established territory, permanent settlement - implications for ease/difficulty of care, keeping up with the group, etc.)
A long-term rural neighborhood made up primarily of dairy farmers. Data from bone morphology and musculoskeletal indicators indicate that the people of Middenbeemster were quite active (Palmer et al., 2013, Saers, 2012). More affluent people in upper classes did less manual labor. A total of 2971 individuals lived in the Beemster community in 1840, the majority of them had farms in the rural and commuted daily between farmlands, enclaves, and Middenbeemster. The location of the major market, the school, and other key amenities (Falger et al., 2012).

(b) Estimated group size (e.g., stable/variable; kin relationships between members; ability to provide dedicated care, etc.)
(Un)specialized household producers, yet by the end of the 1800s, farm sizes had started to rise. Based on kin relationships, the entire family worked together with specific parts of the productions process designated by sex/age.

(c) Habitation (e.g. cave or rockshelter; temporary/permanent construction [materials - timber, stone, clay, other]; size of dwelling, occupants [whole group, single/extended family, other])

Permanent construction of brick. One family would occupy one dwelling, with extended family nearby or present. Although gas systems reached Middenbeemster in 1900, There being few supplies of wood, warmth was likely provided by charcoal burners, and smoke from the kitchen or the main room was cleared by a single chimney. The traditional "stolpboerderij", which enabled for the storing of wheat and, in the wintertime, frequently required sharing living quarters with cattle, was used to build homes and farms throughout the entire Beemster area.

(d) Social organisation (e.g. organisation of 'family' groupings, heterarchical versus hierarchical, ascribed/assigned status - implications for understanding group and individual identity, social relations - where did the subject 'fit'?)
Social organization is in hierarchical family groupings, often with the eldest man as the head of the family. Often family enterprises were commonly run by the male head of the household. The entire family worked together with specific parts of the productions process designated by sex/age. Began from 5 years old.

(e) Role differentiation within the group (e.g. basis for differentiation if any [sex, age, other]; division of labour [skeletal indicators of occupation, other]; body modification(s); mortuary treatment [see below] - implications for understanding role and treatment of subject - where did the subject 'fit'?)
Differences in activity patterns for both sexes over the course of their lives and the distribution of labor depending on gender. Men's daily agricultural tasks vary as they mature, moving away from an apprentice-like status. From the herd's milking to more demanding and diverse activities. Men participated in an activity that involved extreme leg flexion/extension and rotation while pushing/pulling something heavy (milking posture).

Women's level of activity gradually reduced over the life cycle. Housekeeping and making dairy products. Daily scrubbing, polishing, scouring enormous pails, pans, and utensils. Scrubbing walls, woodwork, windows, rugs, boiling bleaching laundry, carrying large buckets of milk, shoulder yoke, or by hand. Churning or curd cutting, forming, and pressing cheese. Younger women are involved in the caretaking of the home and essential partakers in the dairy production process. Boys as early as four were expected to help with the herd and the twice-daily milking of each cow. Dutch dairy during this time included driving cattle, milking, feeding, washing, cleaning stalls, digging turf, fertilizing fields, and ditch dredging. For women of lower classes, it was not an option to solely manage the house, so many worked in the family enterprise. Women would also work the fields during times of need, such as the month-long harvest.

(f) Mortuary customs (e.g., 'standard' funerary treatment; differentiation on basis of age, sex, occupation, 'status', origin, disability, other 'deviance' - implications for understanding role and treatment of individual, etc. [this information may have been covered in whole or part in Section 3])
All residents of the Beemster were interred at the Middenbeemster cemetery, which is located in the town of Middenbeemster, which translates to "middle" in English. It is the only church in the area. It is likely that there was a social divide based on money or status and that those buried outside the church came from lesser social classes than those buried inside. After the ban on burial in churches in 1829, all high or low-rank people were buried in the cemetery. Both Catholics and Reformed were buried in the cemetery, including priests. From gravediggers to landowners, people from all walks of life were buried there.

(g) Other cultural practices (e.g., evidence for ritual, religion, diet, dress, artifact/ornament production and significance, body modifications [also covered above], etc. - relevance for the subject?)
The Church is a Protestant church; however, it was the only church in the area at the time and likely hosted other beliefs therefore as well. In addition, it was not big enough to accommodate the whole community simultaneously.

(h) Sociocultural contacts with other communities (e.g., intermarriage, migration, regular gatherings, shared ceremonies etc.)
Intermarriage occurs among neighboring populations. Up until the late 1870s, inter-provincial movement was uncommon (Wintle 2000). Migration of labor included a seasonal element. Regular gatherings happened on Sunday at church. The church was also a location of shared ceremonies during events such as marriage, Christmas, Easter, funerals, and baptisms.

(i) Violence (e.g., within and/or between-group; occasional, frequent, systemic; profile of 'typical' victims [sex, age]; location and severity of injuries sustained; 'nature' of violence ['personal,' domestic, ritual, acquisitive, other]; weapons used, etc. - how might 'care' fit with 'violence'?)
Violence between or within groups is not observable. Within the groups, there might have been occasional violence. However, these were primarily domestic. Children and women were, in those cases, typical victims. This type of violence can result in trauma to the head and ribs due to hits.

(j) Other variables and/or comments/observations

(k) References/sources
(Falger et al., 2012)
(Wintle 2000)
(Aten et al., 2012)
(de Wit, 2003)

(iv) Population health and disease
(a) Group demographic profile (e.g. age range, life expectancy [at infancy and post-adolescence], sex etc.)
The mortality profile meets what is expected for this period; a high infant mortality rate and a peak in mortality among young women. Most individuals (no matter the sex) have died between 36 and 50 years. Only in the early young adult category does there seems to be a clear difference: 16.2% of the women died between the ages of 18 and 25, while only 8.8% of the men in those years died. It is associated with pregnancy and childbirth.

(b) Indicators of health stress (excluding dental health) (e.g., rates of linear enamel hypoplasia, porotic hyperostosis/cribra orbitalia, Harris lines etc. - how does the subject compare?)
Enamel hypoplasia is comparatively low in adults (13%) but very high in the immature (43.5%). Cribra orbitalia is present, however, in a very low frequency. Nevertheless, the fact that it is in the Middenbeemster collection is highly prevalent indicates several stressful periods during the lifetime of these individuals.

(c) Patterns of dental/oral health (where possible by age group) (e.g., wear, cavities, abscess, tooth loss etc. - how does subject compare?)
High caries frequency and low mortem losses, where people influenced with caries
teeth already lost before death. There were many abscesses (30,4%) among the Middenbeemster population, but not abnormal for the province—percentage of periodontitis in Middenbeemster is relatively low (8.7%). Generally, the health condition of their teeth is bad; there is a lot of caries, calculus and abscesses. Pipe notches are present on individuals, mostly male.

(d) Degenerative joint disease (e.g., location, extent and severity; incidence by age and sex; etc. - how does subject compare?)
Osteoarthritis in the spine is most common in the Middenbeemster collection. OA of hands & feet is relatively high. Increase in OA for both sexes with increasing age.

(e) Trauma and likely cause (e.g., frequency; patterns in type and location of injury; result of general accident, occupational injury or interpersonal violence; etc.)
The likely cause for trauma in Middenbeemster is related to the daily activities and occupation, often from working outside. However, this frequency is relatively low and will often involve long bones.

(f) Other diseases (e.g., congenital; acquired; frequency; patterns in presentation; possible cause(s); etc.)
Infants (0 to 3 years) in Middenbeemster are prone to rickets (33.3 percent).
(g) Evidence suggesting healthcare 'custom' [n.b. although bioarchaeology of care analysis focuses on an individual set of remains, there may be evidence suggesting care practice in other cases/more generally] (e.g., indicators of other treatment intervention(s) - additional cases of survival with disability; evidence of surgery; presence of medical technologies; presence of possible pharmaceuticals; other).
More people with disabilities are surviving. But there is no indication of surgical treatment in this community. The pathological conditions are found to correspond to other populations; however, they differ in how they occur. There are no notable differences observed among the arthropathies, although differences in species exist

joints of the affected skeletons. The extent to which deficiency and infectious diseases are found does not differ substantially from those found in other populations. However, the percentage of rickets in children is on the high side. Doctors are present in the community.

(h) Other variables and/or comments/observations

(i) References/sources

Veselka et al. (2013)

Index of Care - Step 2

Section 1: Clinical Impact

Pathology #1 - achondroplasia

Body Function/System	Potential impact	Likelihood	Probable/possible symptoms and reasoning	Severity	Duration	Comments
1. (Neuro)musculoskeletal and movement-related functions/systems	Yes	Probable	not able to reach the parietal region, the middle of the back, or the buttocks chronic lower limb pain due to genu varum gait abnormalities	Severe impact	Throughout life	Arms are too short to reach back there. Twisting far enough is not an option after a certain age due to backpain.
2. Sensory functions/nervous system (i): pain (e.g. Acute, chronic, intermittent)	Yes	Probable	back pain, spinal stenosis. myelopathy. In case of stenosis: pain Numbness, muscular weakness, motor impairment, intermittent claudication, and problems with the bladder and reproductive organs. Due to OA joint pain is evident.	Severe impact	Long and constant	Has affected mobility in all daily activities.
3. Sensory functions/nervous system (ii): other (e.g. Sight, hearing, balance)	Yes	Probable	Otitis (90% of children with AHC get this). At least 50% of adult ACH patients will develop hearing loss, and recurrent otitis is a potential risk for deafness (Ortner, 2003).	Moderate impact	Short (<3 months)	Only in certain instances will it have affected daily life activities.
4. Mental functions (e.g. Intellectual, consciousness, attention, orientation, sleep, emotion, language	Yes	Possible	Sleep apnea. Speech delays brought on by hearing loss might also have an impact on communication abilities.	Moderate impact	long	
5. Cardiovascular system / function	Yes	Unknown	Obesity is complication of ACH. Cardiovascular deaths are commonly reported.	Not indicated		
6. Haematological system / function	No	Not indicated		Not indicated		
7. Respiratory system / function	Yes	Possible	Respiratory disorders	Moderate impact	long	difficulty breathing now and then, shortness of breath during increased activity

8. Immune system / function	No	Not indicated		Not indicated		
9. Digestive, metabolic and endocrine systems / functions	Yes	Possible	Gastroesophageal reflux,	Mild impact	long	
10. Genitourinary and reproductive systems / functions	Yes	Possible	infertility, menorrhagia, dysmenorrhea, leiomyomata and early menopause are more common. prematurity and foetal wastage happen more often too.	Moderate impact	long	
11. Integumentary system / function	No	Not indicated		Not indicated		

Potential for interaction between symptoms identified above

Obesity is a frequent consequence of ACH that affects genu varum, vertebral body stenosis, and obstructive sleep apnea, and even gait. Gait and OA influence each other both ways (Ortner, 2003)

Symptom change over disease course

Sleep apnea, hearing impairments and join pains will likely have worsened over time due to age.

Symptom interaction (implications)

Mobility already was less due to achondroplasia, which affects speed, strength, and gait. OA likely worsened this, and or might even be a consequence of achondroplasia.

Pathology #2 - osteo-arthritis

Body Function/System	Potential impact	Likelihood	Probable/possible symptoms and reasoning	Severity	Duration	Comments
1. (Neuro)musculo-skeletal and movement-related functions/systems	Yes	Possible	Movement of joints is more difficult, if not impossible or very painful.	Severe impact	long term	symptoms increasing with age
2. Sensory functions/nervous system (i): pain (e.g. Acute, chronic, intermittent)	Yes	Probable	Although discomfort is frequently present in osteoarthritis of the lower spine, it is unknown if this is also the case when the condition affects the cervical area. OA of joints tend to be painful and often disabling.	Severe impact	long term	symptoms increasing with age

3. Sensory functions/nervous system (ii): other (e.g. Sight, hearing, balance)	No	Not indicated		Not indicated		
4. Mental functions (e.g. Intellectual, consciousness, attention, orientation, sleep, emotion, language	Yes	Unknown	The pain and movement of joints can disrupt her sleep and emotions.	Not indicated		
5. Cardiovascular system / function	No	Not indicated		Not indicated		
6. Haematological system / function	No	Not indicated		Not indicated		
7. Respiratory system / function	No	Not indicated		Not indicated		
8. Immune system / function	No	Not indicated		Not indicated		
9. Digestive, metabolic and endocrine systems / functions	No	Not indicated		Not indicated		
10. Genitourinary and reproductive systems / functions	No	Not indicated		Not indicated		
11. Integumentary system / function	No	Not indicated		Not indicated		

Section 1 - Part 1: Potential Domains of Pathology Impact - Additional comments/observations

Due to the pain of OA, sleep, emotion and attention can be affected.

Symptom change over disease course

The symptoms of osteoarthritis increase as the disease progresses. Symptom expression and need for care will have become more intense as time progressed (White & Folkens, 2005)

Symptom interaction (implications)

The osteoarthritis may have interaction with the symptoms of achondroplasia. Her movement of joints already is affected by achondroplasia, and osteoarthritis likely aggravates this.

Section 2 : Functional Impact
Pathology #1 - achondroplasia
Part 1: Identify potential domains of pathology impact

Activities of daily living	Rating	Observations
1. Self-provisioning: ability to manage access to food and drink unaided (e.g. independently access nearby sources of food and water).	Capable	
2. Self-feeding: ability to physically eat and/or drink without assistance (i.e. to convey food and drink to mouth).	Capable	
3. Managing basic personal hygiene/caring for self: (e.g. washing, toileting, preserving skin integrity; treating infection and managing infection risk)	Not Capable	
4. Basic object manipulation: ability to manage items in the immediate environment - includes self-dressing (body temperature maintenance), item retrieval etc.	Capable	However, could have needed assistance reaching certain items.
5. Mobility over limited distance: ability to move unaided over short distances (e.g. inside and around dwelling, out of range of potential hazards etc.)	Capable	
6. Control over body position: ability (re)position body parts as desired without assistance (e.g. to sit up and transfer body weight from a reclining position unaided).	Capable	

Part 2: Instrumental activities of daily living

Domain	Likely domain activity/ies	Possible +ve / -ve factors	Rating	Elaboration/Comments
1. Basic lifestyle	Active, permanently settled, agricultural lifestyle. Women would work the fields during times of need, such as the month-long harvest at the end of summer.	Terrain is flat, and thus easy to transport over. \ Some spaces need the use of steps and ladders, adding an additional obstacle.	Needs moderate to substantial assistance	Could not have adhered to her community's normative role demands. Her spinal disease, effect on stride, and physical restrictions on her upper limbs make it improbable that she could have transported amounts of weight or volume.
2. Economic	Entire family worked together with specific parts of the productions process. Milk cows, work the field, dairy-related production. Resources procurement strategies are to buy groceries	Living is around economic activity. Technologies and tools in the sector are designed for average-sized adults.	Needs moderate to substantial assistance	Due to a combination of spinal disease, effects on locomotion, and physical restrictions on the upper limbs, it is improbable that this person could have transported heavy or bulky objects. However in an adapted way.

	and get water at a well in case pipes are not at the house.			
3. Domestic	Prepare food, maintain housekeeping. Sowing clothes. Making fire by burning peat. Hauling peat. Daily scrubbing, polishing, scouring enormous pails, pans and utensils. Scrubbing walls, woodwork, windows, rugs, boiling bleaching laundry. Carrying large buckets of milk, shoulder yoke or by hand. Churning or curd cutting, forming and pressing cheese.	House is designed for average-sized adults. Some spaces need the use of steps and ladders, adding an additional obstacle. Certain things may be out of reach.	Needs moderate to substantial assistance	Some spaces need the use of steps and ladders, adding an additional obstacle. House is designed for average-sized adults, so certain things out of reach. Unlikely to be able to move heavy or large loads.
4. Mobility	travel to church and shops for any utilities and other necessities. Traveled daily from the farm in the fields to other farms, and Middenbeemster, where market, school and other services were located.	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and cart for transport.	Needs moderate to substantial assistance	Not able to travel over long distances. likely needed assistance covering these distances.
5. Community life (other)	attend church every Sunday and during other ceremonies. visit relationships now and then. Traveled daily from the farm in the fields to other farms, and Middenbeemster, where market, school and other services were located..	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and cart for transport.	Able to participate	
6. Interpersonal relations	communicate on daily basis with family. head of the household. expected to have children.	Rural area, so not a lot of noise except communication of the family. No other relationships except family in the area.	Able to participate	Possesses normal intelligence and communication skills. Hearing might pose a challenge now and then.

7. Learning/applying knowledge	apprenticeship-based tasks. required to watch and accordingly perform tasks.	If they going to school, only until the age of 12 at most. Transportation to the center of Middenbeemster is necessary.	Able to participate	Possesses normal intelligence and communication skills. Might not be able to perform all expected tasks, however.

Change(s) in functioning over disease course

It is crucial that we understand that persons with physical disabilities typically find efficient methods to get past obstacles whenever possible. So, her functioning with achondroplasia will likely have improved over the disease course.

Final comments/observations

Did the subject likely require health-related care?	**Yes - likely that subject required care**

Pathology #2 - osteo-arthritis

Part 1: Identify potential domains of pathology impact

Activities of daily living	Rating	Observations
1. Self-provisioning: ability to manage access to food and drink unaided (e.g. independently access nearby sources of food and water).	Capable	But likely with difficulty and pain.
2. Self-feeding: ability to physically eat and/or drink without assistance (i.e. to convey food and drink to mouth).	Capable	
3. Managing basic personal hygiene/caring for self: (e.g. washing, toileting, preserving skin integrity; treating infection and managing infection risk)	Not Capable	Needed help cleaning after toileting, as she is not able to reach her backside.
4. Basic object manipulation: ability to manage items in the immediate environment - includes self-dressing (body temperature maintenance), item retrieval etc.	Capable	
5. Mobility over limited distance: ability to move unaided over short distances (e.g. inside and around dwelling, out of range of potential hazards etc.)	Capable	Although this may have become less with the worsening of OA and age.
6. Control over body position: ability (re)position body parts as desired without assistance (e.g. to sit up and transfer body weight from a reclining position unaided).	Capable	

Part 2: Instrumental activities of daily living

Domain	Likely domain activity/ies	Possible +ve / -ve factors	Rating	Elaboration/Comments
1. Basic lifestyle	Active, permanently settled, agricultural lifestyle. Women would work the fields during times of need, such as the month-long harvest at the end of summer	Terrain is flat, and thus easy to transport over. Some spaces need the use of steps and ladders, adding an additional obstacle.	Needs moderate to substantial assistance	Could not have adhered to her community's normative role demands after onset of OA. Her spinal disease, effect on stride, and physical restrictions on her upper limbs make it improbable that she could have transported amounts of weight or volume.
2. Economic	Entire family worked together with specific parts of the productions process. Milk cows, work the field, dairy-related production. Resources procurement strategies are to buy groceries and get water at a well in case pipes are not at the house.	Living is around economic activity. Technologies and tools in the sector are designed for average-sized adults.	Needs moderate to substantial assistance	Her spinal disease, effect on stride, and physical restrictions on her upper limbs make it improbable that she could have transported amounts of weight or volume.
3. Domestic	Prepare food, maintain housekeeping. Sowing clothes. Making fire by burning peat. Hauling peat. Daily scrubbing, polishing , scouring enormous pails, pans and utensils. Scrubbing walls, woodwork, windows, rugs, boiling bleaching laundry. Carrying large buckets of milk, shoulder yoke or by hand. Churning or curd cutting, forming and pressing cheese.	House is designed for average-sized adults Some spaces need the use of steps and ladders, adding an additional obstacle.	Needs moderate to substantial assistance	Some spaces need the use of steps and ladders, adding an additional obstacle.
4. Mobility	travel to church and shops for any utilities and other necessities. Daily	Terrain is flat, and thus easy to transport over. In the town there are hardened	Needs moderate to substantial assistance	Not able to travel over long distances. likely needed assistance covering these distances. Such as a horse and

	travel between the homesteads, enclaves, and Middenbeemster, at which school, main market, and other key institutions were situated, from farm in the countryside.	roads, even easier for transport. Possibility of horse and cart for transport.		cart.
5. Community life (other)	attend church every Sunday and during other ceremonies. visit Daily travel between the homesteads, enclaves, and Middenbeemster, where the center of the community is.	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and cart for transport.	Able to participate	
6. Interpersonal relations	communicate on daily basis with family. head of the household. expected to have children.	Rural area, so not a lot of noise except communication of the family. No other relationships except family in the area.	Able to participate	Possesses normal intelligence and communication skills. Hearing might pose a challenge now and then.
7. Learning/applying knowledge	apprenticeship-based tasks. required to watch and accordingly perform tasks.	learning/applying knowledge is close to the home and personal.	Able to participate	Possesses normal intelligence and communication skills. Might not be able to perform all expected tasks, however. Personal apprenticeship can be specifically adapted to her needs.

Change(s) in functioning over disease course

OA is a degenerative disease. Her functioning over the disease course will have become more painful and impaired (White & Folkens, 2005).

Final comments/observations

Did the subject likely require health-related care?	**Yes - likely that subject required care**

Symptom change over disease course

OA symptoms increase in intensity as disease progresses. symptom expression and need for care will thus have become more intense as time progressed.

Symptom interaction (implications)

The OA may have interaction with the symptoms of ACH. Her movement of joints is already affected by ACH and OA likely aggravates this and vice versa.

Index of Care - Step 3

Pathology #1 - achondroplasia

Section 1 - Care as direct support

Components of care practice	Part of care	Elaboration	Duration	Duration comments	Effort and resources involved	Efficacy of care
1. Provision of food and water	Not relevant					
2. Maintaining normal body temperature	Not relevant					
3. Facilitation of comfort, rest and sleep	Possible		Long term	throughout life	At least one person dedicating time to massage joints and lower back area, whenever pain became unbearable.	short-term relief of pain
4. Ensuring physical safety	Not relevant					
5. Maintaining/assisting mobility	Not relevant					
6. Monitoring health status	Not relevant					
7. Maintenance of personal hygiene/protection of integument	Probable		Long term	Since birth	At least one time a day, one person has to aid cleaning up after toileting.	Effectiveness is high
8. Physical manipulation, postural adjustment	Possible		Long term	throughout life, increasing intensity at the latest stage of life.	At least one person dedicating time to massage joints and lower back area, whenever pain became unbearable.	short-term relief of pain, comforting
9. Maintenance of physiological functioning	Not relevant					

10. Specific intervention(s) and technologies	Not relevant					

Section 2 - Care as accommodation

Domain	Part of care	Elaboration	Duration	Duration comments	Effort and resources involved	Efficacy of care
1. Basic lifestyle	Probable	Could not have adhered to daily life demands. Likely an adapted role.	Long term		adaptation to the demands of the position as a whole. alterations in the expectations and behaviors of the group.	
2. Economic	Probable	Could not have adhered to her community's normative role demands. likely an adapted role.	Long term		adaptation to the demands of the position as a whole. alterations in the expectations and behaviors of the group.	
3. Domestic	Probable	Not able to haul heavy or bulky things. Not able to endure as long as others. Countertops/tables etc might have to be adapted to her height.	Long term		adaptation to the demands of the position as a whole. alterations in the expectations and behaviors of the group. perhaps adapt design of the home as necessary.	
4. Mobility (over distance)	Probable	Needed assistance covering distances.	Long term		perhaps a cart and horse.	would solve mobility over long distances, but a drain on funds
5. Community life (other)	Not relevant					
6. Interpersonal relations	Not relevant					
7. Learning/applying knowledge	Possible	Apprentice-based teaching will possibly be adapted to her abilities.	Long term		adaptation to the demands of the position as a whole. changes in group expectations and behaviours. intellectual flexibility.	

STEP 3: Elements of the model of care

Care Element	Discussion
In order to deal with developmental delays throughout infancy and childhood, care likely consisted of an expansion of usual caring practices, which required more caregiver effort but presented minimal obstacles.	There is typically a delay in the onset of motor skills; for example, head stability and unassisted sitting can take several months, whereas walking can take between 12 and 24 months. Functional competence issues would be visible as early as infancy.
recognizing and adjusting for her physical and aesthetic differences	She is almost probably capable of making several contributions to her community. She couldn't have followed the expectations of her community's normative roles. was not anticipated to be able to move heavy or bulky cargo.
Changes in group expectations and behaviours	need for this care lasted from birth until death

Pathology #2 - osteo-arthritis
Section 1 - Care as direct support

Components of care practice	Part of care	Elaboration	Duration	Duration comments	Effort and resources involved	Efficacy of care
1. Provision of food and water	Not relevant					
2. Maintaining normal body temperature	Not relevant					
3. Facilitation of comfort, rest and sleep	Possible		Long term	'remainder of lifetime' care	At least one person	
4. Ensuring physical safety	Not relevant					
5. Maintaining/assisting mobility	Possible		Long term	'remainder of lifetime' care	At least one person, daily basis. Helping her get out of bed and assisting in her daily tasks.	
6. Monitoring health status	Not relevant					
7. Maintenance of personal hygiene/protection of integument	Possible		Long term	'remainder of lifetime' care	At least one person, weekly basis	
8. Physical manipulation, postural adjustment	Possible		Long term	'remainder of lifetime' care	At least one person	

9. Maintenance of physiological functioning	Not relevant					
10. Specific intervention(s) and technologies	Not relevant					

Section 2 - Care as accommodation

Domain	Part of care	Elaboration	Duration	Duration comments	Effort and resources involved	Efficacy of care
1. Basic lifestyle	Probable		Long term	remainder of lifetime	adjustment to the standard role expectations, filling in where necessary for her.	
2. Economic	Probable		Long term	remainder of lifetime	adjustment to the standard role expectations, filling in where necessary for her.	
3. Domestic	Probable		Long term	remainder of lifetime	assisting where she cannot complete tasks anymore. willingness, intellectual flexibility, and organizational skills.	
4. Mobility (over distance)	Probable		Long term	remainder of lifetime	a horse and cart	solves the impediment of mobility of long distances
5. Community life (other)	Not relevant					
6. Interpersonal relations	Not relevant					
7. Learning/applying knowledge	Not relevant	At the onset of OA, she is likely not learning any new tasks				

STEP 3: Elements of the model of care

Care Element	Discussion
flexibility	demands increasing as her osteo-arthritis and immobility progressed with age.
Assistance/support	assisting in daily tasks and mobility where needed

Index of Care - Step 4

Section 1 - Group agency and the decision to provide care

Decision steps	Discussion
1. Determine need for health-related care exists	Visible differences in physical capability and appearance. Knowledge of the disease was unlikely.
2. Assess considerations for/against care	Care might was the 'norm' since birth for her. Care demands are long term. As age progressed, care becomes more expected. Care is more maintenance than having a prospect of a successful outcome like not needing care anymore. Relationships within a family that is cohesive, not leaving her behind. Children likely able to make up for the demand on resources.
3. Decision to provide care	A cohesive community/family working together with the willingness, intellectual flexibility, and organizational skills required to deal with a constant demand on resources on a daily basis, intensifying as time progressed.
4. Determine and initiate strategies for care delivery (direct support/accommodation)	Likely meant allocation of responsibility for care tasks.
5. Implementing and reviewing care practice	As OA symptoms became evident, care had to be intensified. This process of gradual intensifying, constant reviewing and implementing changes. Demonstrates a desire to accept responsibility for some parts of care as well as the financial means to do so.
6. Cease care	The decision to cease care subject dies. They were likely still receiving care around death.
7. Decide treatment after death	Mortuary treatment is like any other person, marriage suggests she was socially well-integrated, like any other person in the community.

General comments/observations

Question	Observation
In an agricultural environment, what could a decision made to provide long term care to a disabled subject suggest about social relations?	Reflects cohesive community with strong collective identity - all members 'belong'. Willingness, intellectual flexibility, and organizational skills required to deal with a constant demand on resources.

Section 2 - Individual identity - The subject as 'Agent'

Part 1: The subject - evidence and inference

Domain	Evidence and inference (observations and comments)
1. Basic physical characteristics.	Differences in appearance. Smaller than most, only 1.30m. Female.
2. Social indicators	Female, married to a male. Social role of mother and a wife. Mortuary treatment suggests she was socially well-integrated.
3. Pathology(ies) and likely impact(s)	Congenital disability, with middle age onset of OA. She could not wipe her buttocks, nor reach her parietal region. Was not able to carry loads of weight or bulk. Likely not able to reach certain things. As OA progresses pain and mobility worsen.
4. Care received	Duration of care is from birth to death. Care pattern intensifies in final phase of life. Subject-carer interactions were likely due to family ties. Focus of care is not to heal, rather to accommodate.
5. Lifeways opportunities and constraints	Cart and horse will have opened up independent mobility to get to the town center of Middenbeemster and participate in community life. As a woman, she likely would have received help carrying bulk and transport loads. As most her tasks were around the house and

	self-employed, this enabled her to take rest when tasks would become too strenuous and plan her tasks according to her abilities.

Part 2: Experience of disability and care - the subject's perspective

Question	Adaptation, 'answer(s)' and comments
What does the subject's survival with disability suggest about their personality and motivation?	Survival with long-term differences in physical capability and appearance, suggests self-confidence and strong-mindedness. She likely experienced reactions and impediments due to her physical appearance, she did not give up.
What was the likely (quality of) relationship between subject and carer(s)?	The relationship between subject and carer(s) was likely close family ties. Caregiving often comprises more than a purely functional relationship, particularly when long term and/or costly. This was likely out of love and duty for their relationship(s).
Does the subject's ability to obtain care suggest any particular personality characteristics? Is there evidence for other cases of care in the group? If so, how do 'cases of care' compare?	Caregiving may be the norm, but specifics (such as the amount and quality) of care are often related to the emotional ties between the caregiver and recipient. As Sara turned 66 with care, we can suggest that she was a valued and appreciated member of her group.
What was required from the subject in terms of cooperation in their own care? What does cooperation suggest in terms of e.g., level of function, personality traits, etc.?	Success of care was likely due to cooperation in their own care. Sara likely voiced whenever care was necessary or unnecessary, allowing for a good 'fit' for the recipient as well as the carer. This positively affected her survival to old age.
Were different care options available in this case? If so, which was likely adopted, and did the subject possibly influence this choice? If so, how?	A different care option would have been to send her to an almshouse. This likely was not adopted, as she was married and had children, which suggests that she was cared for in the privacy of the home, contributing to life there.
To what extent did disability affect the subject's ability to perform the same activities as those of their cohort? How may this have affected the subject's self-perception and perception by others?	People with physical disabilities typically find effective methods to get past obstacles wherever possible, and Sara was probably definitely capable of making numerous contributions to her community. On the other hand, she could not have adhered to her community's normative role demands. However, considering she has a husband and children, perception of her disability by others and her self-perception were likely more on the background.
What might be the answer to the above question where opportunities to participate in alternative activities of equivalent value were available?	As she produced a family and was able to participate in social events, she was able to contribute 'worth' to the community socially. Economically her ability to contribute economically was diminished, which became less important with age.
Where care included assistance with 'self-maintenance' (e.g., toileting, postural positioning) involving intimate interventions (e.g. washing, massage) how might this affect self-esteem?	Care included assistance with cleaning up after toileting. This is an intimate intervention. Dependence on others for such an essential activity of daily living is often related to psychological depression. However, as she likely did not know any different since birth, she likely developed an effective way of dealing with the psychological repercussions.
Following from this question, what might long term survival in this dependent state suggest about a severely disabled subject? About their relationship with carer(s)?	Sara was cared for with a high quality of care, which has been critical to her long-term survival. This suggests that she was likely cherished, I might even speculate about love, by her direct environment.

Part 3: Producing a partial biography of the subject of care

Who was the subject of care?

See results and discussion

8.3 Bioarchaeology of Care approach results of V0584

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The Individual

(i) Identifier(s) and provenance (e.g. location of recovery, date/period, culture, other)

V0584

(ii) General identifiers (e.g. age, sex, height, build, other)

female

middle adult (36-49)

(iii) Skeletal elements recovered (list and describe skeletal elements in terms of e.g. completeness, preservation, measurement, morphology, anomalies etc. - note that detailed description of pathology indicators is covered in SECTION 2).

Element	Description	Comment
feet	no anomalies	
hands	no anomalies	
lower appendicular	no anomalies	
pelvic girdle	coccyx missing. fracture of S3. both acetabula signs of pitting.	
skull	no anomalies	
thorax	no anomalies	
upper appendicular	no anomalies	
vertebrae	non-union of neural arch of C1	

Skeletal elements: additional comments/observations

preservation is very good

Pathology

(i) Location and description of each pathology indicator, status at time of death (active, resolved, resolved with residual deformity, etc.), and comments/observations

Element/location on element	Indicator	Status at death	Comments
sacrum	transverse fracture around S2-S3. completely healed, but with a residual 90-degree angle of S3-S5 relative to S1 and S2.	resolved with residual deformity	
clavicle	fracture	resolved with residual deformity	
os coxa (right)	pitting of on interior part of the acetabulum	active	
os coxa (left)	pitting of on interior part of the acetabulum	active	

(ii) Possible patterns/relationships involving some/all pathology indicators (If not relevant/no apparent relationship indicate this; otherwise e.g. causal, interacting, etc.;

Indicators	Relationship

fractures	the fractures of the sacrum and clavicle could be due to the same traumatic event.

General comments / observations

(iii) Generalized indicators of health stress

(iv) Individual Pathologies
Pathology #1: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
transverse fracture of S2-S3

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)
not relevant

(c) Possible cause(s) of pathology (including possible contributing factors)
Often involves a fall from a serious height. Acute, high-energy trauma to the sacrum.

(d) Estimated pathology duration
9 to 12 weeks to heal. At least 7 years for the complete fracture to be invisible/remodeled (Waldron, 2009).

(e) Course of pathology over time (e.g. congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
Acute, after 12 weeks partial recovery (Gutierrez-Gomez et al. 2021). Complete recovery after 7 years (Waldron, 2009)., however with permanent deformity.

(g) Specific pathology references
(Waldron, 2009)
(Gutierrez-Gomez et al. 2021)

Pathology #2: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
Osteoarthritis at initial stage

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)

(c) Possible cause(s) of pathology (including possible contributing factors)
Gait changes due to sacral deformity. Age, sex, and activity pattern.

(d) Estimated pathology duration
Degenerative pathology: worsens over time.

(e) Course of pathology over time (e.g., congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
Lived with the disease until death

(f) General comments/observations
No other evidence of OA is present on the body, so likely early stage.

Mortuary Context

(i) Location of remains

(a) Remains not recovered from cemetery context (describe location).

The coccyx is likely still at the cemetery, this was not recovered.

(b) Remains recovered from cemetery context (describe location within cemetery, in relation to other burials - e.g., single/group burial, within main cemetery, on periphery, etc.)

The church's south side contains the church cemetery. The cemetery had been separated into rectangles, each about the size of an adult coffin. Usually three or four deep, coffins were stacked on top of one another, but burials with any number between one and six were not exempt. In the horizontal planes, there was little to no disruption of burials; vertical disturbance was mostly due to coffin collapse or fresh depositions in the same plot. The plots were highlighted because there was no horizontal disruption. Everyone was buried in a wooden coffin, some of which contained grave goods. Only individual graves.

(ii) Deposition of remains (positioning, orientation, grave cut, etc.)

Northwest-southeast orientation, parallel to the church. In a stretched stance, individual graves. The legs were aligned in a straight line. Hands were positioned on the pelvic region.

(iii) Preserved grave goods (and placement of these)

No grave goods.

(iv) If found in cemetery context, compare subject's mortuary treatment with that of other burials (if possible, within same demographic cohort)

Similar to other burials, interred in a normal-sized coffin even though the individual was not normal-sized.

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Section 1: Clinical Impact

Pathology - trauma sacrum

Body Function/System	Potential impact	Likelihood	Probable/possible symptoms and reasoning	Severity	Duration	Comments
1. (Neuro)musculo-skeletal and movement-related functions/systems	Yes	Probable	Immobilised for 9 to 12 weeks. On the long-term: gait changes and sitting disturbance.	Severe impact	Long term	
2. Sensory functions/nervous system (i): pain (e.g. Acute, chronic, intermittent)	Yes	Probable	As damage developed from acute to subacute to chronic deformity, the level of pain increased. After healing, chronic pain.	Severe impact	Long term	
3. Sensory functions/nervous system (ii): other (e.g. Sight, hearing, balance)	Yes	Possible	Due to deformation pelvis, instability.	Moderate impact	Long term	
4. Mental functions (e.g. Intellectual, consciousness, attention, orientation, sleep, emotion, language	No	Not indicated		Not indicated		
5. Cardiovascular system / function	No	Not indicated		Not indicated		
6. Haematological system / function	No	Not indicated		Not indicated		
7. Respiratory system / function	No	Not indicated		Not indicated		
8. Immune system / function	No	Not indicated		Not indicated		
9. Digestive, metabolic and endocrine systems / functions	No	Not indicated		Not indicated		
10. Genitourinary and reproductive systems / functions	Yes	Possible	obstetric issues. slim chance of giving birth. sexual dysfunction.	Moderate impact	Long term	

11. Integumentary system / function	No	Not indicated		Not indicated		

References/sources
(Gutierrez-Gomez et al., 2021)
(Hessmann et al., 2010)

Potential for interaction between symptoms identified above
malunion of sacrum + chronic instability = cause of persistent pain, but also vice versa

Symptom change over disease course
As the damage developed from an acute to a subacute to a chronic deformity, the level of pain increased. Immobility will be temporary (9-12 weeks).

Section 2: Functional Impact
Pathology - trauma sacrum

Part 1: Identify potential domains of pathology impact

Activities of daily living	Rating	Observations
1. Self-provisioning: ability to manage access to food and drink unaided (e.g., independently access nearby sources of food and water).	Capable	Not in the acute stage however.
2. Self-feeding: ability to physically eat and/or drink without assistance (i.e., to convey food and drink to mouth).	Capable	
3. Managing basic personal hygiene/caring for self: (e.g., washing, toileting, preserving skin integrity; treating infection and managing infection risk)	Capable	Not in the acute stage however.
4. Basic object manipulation: ability to manage items in the immediate environment - includes self-dressing (body temperature maintenance), item retrieval etc.	Capable	Not in the acute stage however.
5. Mobility over limited distance: ability to move unaided over short distances (e.g., inside and around dwelling, out of range of potential hazards etc.)	Capable	Not in the acute stage however.
6. Control over body position: ability (re)position body parts as desired without assistance (e.g., to sit up and transfer body weight from a reclining position unaided).	Capable	Not in the acute stage however.

References/sources
(Gutierrez-Gomez et al., 2021)

Part 2: Instrumental activities of daily living

Domain	Likely domain activity/ies	Possible +ve / -ve factors	Rating	Elaboration/Comments
1. Basic lifestyle	Active, permanently settled, agricultural lifestyle. Women would work the fields during times of need, such as the month-long harvest at the end of summer.	Terrain is flat, and thus easy to transport over. Some spaces need the use of steps and ladders, adding an additional obstacle.	Needs moderate to substantial assistance	Could not have adhered to her community's normative role demands. Combination of her chronic pain, impact on gait, and instability, unlikely to have been able to be as productive and will need adaptations.
2. Economic	Entire family worked together with specific parts of the productions process. Milk cows, work the field, dairy-related production. Resources procurement strategies are to buy groceries and get water at a well in case pipes are not at the house.	Living is around the economic activity.	Needs moderate to substantial assistance	Could not have adhered to her community's normative role demands. Combination of her chronic pain, impact on gait, and instability, unlikely to have been able to be as productive and will need adaptations.
3. Domestic	Prepare food, maintain housekeeping. Sowing clothes. Making fire by burning peat. Hauling peat. Daily scrubbing, polishing, scouring enormous pails, pans and utensils. Scrubbing walls, woodwork, windows, rugs, boiling bleaching laundry. Carrying large buckets of milk, shoulder yoke or by hand. Churning or curd cutting, forming and pressing cheese.	Some spaces need the use of steps and ladders, adding an additional obstacle.	Needs moderate to substantial assistance	Steps and ladders pose a challenge. Physical work is more demanding and strenuous. Needed adaptations for this.
4. Mobility	Travel to church and shops for any utilities and other necessities. everyday travel between the farm houses, enclaves, and Middenbeemster, at which school, primary market,	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and	Needs moderate to substantial assistance	Not able to travel over long distances. likely needed assistance covering these distances. Such as a horse and cart.

	and other key institutions were situated.	cart for transport.		
5. Community life (other)	Attend church every Sunday and during other ceremonies. visit relationships now and then everyday travel between the farm houses, enclaves, and Middenbeemster, where the center of the community is.	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and cart for transport.	Able to participate	
6. Interpersonal relations	communicate on daily basis with family. head of the household. expected to have children.	communication is personal	Needs moderate to substantial assistance	Possesses normal intelligence and communication skills. However, unlikely to successfully give birth to children or have sexual intercourse. Needs adapted role.
7. Learning/applying knowledge	apprenticeship-based tasks. required to watch and accordingly perform tasks.	learning/applying knowledge is close to the home and personal	Able to participate	Possesses normal intelligence and communication skills. Might not be able to perform all expected tasks, however due to pain. Personal apprenticeship can be specifically adapted to her needs.

Change(s) in functioning over disease course

She was not able to perform majority of these tasks during acute stage of her traumatic injury.

Final comments/observations

Did the subject likely require health-related care?	**Yes - likely that subject required care**

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Pathology - trauma sacrum

Section 1 - Care as direct support

Components of care practice	Part of care	Elaboration/comments	Duration	Duration comments	Effort and resources involved	Efficacy of care
1. Provision of food and water	Probable	only during acute stage	Short term	only during acute stage	Everyday, at least one person	Efficient, seeing she has healed
2. Maintaining normal body temperature	Probable	only during acute stage and subacute stage	Short term	only during acute stage	Everyday, at least one person	Efficient, seeing she has healed
3. Facilitation of comfort, rest and sleep	Probable	only during acute stage	Short term	only during acute stage	Everyday, at least one person	Efficient, seeing she has healed
4. Ensuring physical safety	Not relevant					
5. Maintaining/assisting mobility	Probable	only during acute stage and subacute stage	Short term	only during acute stage and subacute stage	Everyday, at least one person, aiding in getting up, moving around, re-positioning. Later perhaps with crutches.	
6. Monitoring health status	Probable	only during acute stage	Short term	only during acute stage	One person, three times a day	
7. Maintenance of personal hygiene/protection of integument	Probable	only during acute stage and subacute stage	Short term	only during acute stage and subacute stage	Everyday, at least one person	
8. Physical manipulation, postural adjustment	Probable	only during acute stage	Short term	only during acute stage	Everyday, at least one person	Efficient, as there is no evidence of pressure sores
9. Maintenance of physiological functioning	Possible	only during acute stage	Short term	only during acute stage	Everyday, at least one person	
10. Specific intervention(s) and technologies						

Section 2 - Care as accommodation

Domain	Part of care	Elaboration	Duration	Duration comments	Effort and resources involved	Efficacy of care

1. Basic lifestyle	Possible		Long term	adaptation to the demands of role in community	changes in group expectations and behaviours. community and family.	
2. Economic	Probable		Long term	adaptation to the demands of role in community	changes in group expectations and behaviours. community and family.	
3. Domestic	Probable		Long term		changes in group expectations and behaviours. perhaps adapt design of the home as necessary.	
4. Mobility (over distance)	Probable		Long term		weekly, perhaps resources like horse and cart	would solve mobility over long distances, but a drain on funds
5. Community life (other)	Probable		Long term			
6. Interpersonal relations	Probable		Long term			
7. Learning/applying knowledge	Probable		Long term		changes in group expectations and behaviors perhaps by family.	

References/sources
Tilley & Cameron, 2014

STEP 3: Elements of the model of care

Care Element	Discussion
essential care/emergency management	notify doctor. Continuous food and drink provision, pain treatment, infection control, and health status monitoring are done throughout this period. 9 to 12 weeks. A modified diet and extensive hygiene support are used to prevent infection. Given rest and more food for recuperation.
accommodating difference on the long term	assistance in entering and exiting these places or modifying their layout. Aiding during instability. ongoing efforts at assisting the patient in regaining stability, strength, and mobility and managing her pain.
emotional support	sexual dysfunction and slim chance of giving birth. Possibly struggling with the personal challenge of altering her expectations for playing the role of a woman

Index of Care - Step 4

Section 1 - Group agency and the decision to provide care

Decision steps	Discussion
1. Determine need for health-related care exists	Visible differences in physical capability and appearance. The knowledge that it was related to her acute trauma would likely not improve.
2. Assess considerations for/against care	Care was the 'norm' since the accident for her. Care demands are long term. As age progressed, care becomes more expected. Care is more maintenance than having a prospect of a successful outcome like not needing care anymore. Relationships within a family that is cohesive, not leaving her behind. She is a demand on resources, as she is not bearing children successfully to compensate.
3. Decision to provide care	She was part of the family group, so because of these close ties, they likely decided to provide care and nurse her back to health. By then they were likely unaware of the permanent outcome of her trauma.
4. Determine and initiate strategies for care delivery (direct support/accommodation)	Both "accommodation of difference" and a form of "direct assistance" were provided to her throughout the early stages of her injuries as she learned to deal with the long-term ramifications of her trauma. This kind of damage calls for various care, if not many caretakers. Assignment of responsibilities for care duties and a plan to cover care expenses (e.g., compensating for lost labor); acquisition of additional resources where necessary.
5. Implementing and reviewing care practice	Caretakers' ongoing efforts would be aimed at assisting the patient in regaining stability, strength, and mobility and managing her pain.
6. Cease care	Subjects recovers. Switching to accommodating difference.
7. Decide treatment after death	Mortuary treatment as others, no segregation on selection visible.

General comments/observations

Question	Observation
In an agricultural environment, what could a decision made to provide long term care to a disabled subject suggest about social relations?	Reflects cohesive community with strong collective identity - all members 'belong'. Willingness, intellectual flexibility, and organizational skills required to deal with a constant demand on resources.
What does survival with reduced self-sufficiency and mobility indicate about the community?	Disability acceptance and understanding in the community, as well as the provision of active care

Section 2 - Individual identity - The subject as 'Agent'

Part 1: The subject - evidence and inference

Domain	Evidence and inference (observations and comments)
1. Basic physical characteristics.	Differences in appearance. Cope with chronic pain, gait changes, instability, and the possibility of female obstetric issues.
2. Social indicators	Not relevant
3. Pathology(ies) and likely impact(s)	Severe case of acute, high-energy trauma to the sacrum. The presence of her healed clavicle facture may have happened around the same time; however, this cannot be deduced from the human remains. Sacrum permanent malunion. Likely she was in pain for the rest of her life.

4. Care received	Continuous health status monitoring, pain treatment, infection control, and food and water provisioning are required during an acute period. Intensive care would have to be provided in all aspects of her life to ensure her survival, such as an adapted diet and significant hygiene assistance to prevent infection. To recover from this major trauma, she would have required rest and extra calories to heal. After healing, caretakers' ongoing efforts would be aimed at assisting the patient in regaining stability, strength, and mobility and managing her pain.
5. Lifeway's opportunities and constraints	Cultural activities such as dancing were likely not possible to participate in. Assistance entering and exiting spaces. A lower capacity to participate to the labor requirements (such as milking, and churning) . able to contribute like other women by housekeeping. Daily scrubbing, polishing, scouring enormous pails, pans and utensils, and doing laundry. Nonetheless these activities likely were more strenuous for her, as well a painful compared to other women of her cohort. slim chance of giving birth successfully, at the very least. Sexual dysfunction is common

Part 2: Experience of disability and care - the subject's perspective

Question	Adaptation, 'answer(s)' and comments
What does the subject's survival with disability suggest about their personality and motivation?	Survival with long-term differences in physical capability and appearance, suggests self-confidence and strong-mindedness. She likely experienced reactions and impediments due to her physical appearance, she did not give up.
What was the likely (quality of) relationship between subject and carer(s)?	Relationship between subject and carer(s) was likely close family ties. Caregiving often comprises more than a purely functional relationship, particularly when long term and/or costly. This was likely out of love and duty for their relationship(s).
Does the subject's ability to obtain care suggest any particular personality characteristics? Is there evidence for other cases of care in the group? If so, how do 'cases of care' compare?	Caregiving may be the norm, but specifics (such as the amount and quality) of care are often related to the emotional ties between the caregiver and recipient. As this woman's sacrum completely healed, she was nursed back to health and survived after her acute trauma. We can suggest that she was a valued member of her group.
What was required from the subject in terms of cooperation in their own care? What does cooperation suggest in terms of e.g., level of function, personality traits, etc.?	Success of care likely due to cooperation in their own care. After the acute stage, she likely voiced whenever care was necessary or unnecessary; painful or relieving; allowing for a good 'fit' for the recipient as well as the caregiver. This positively affected her survival.
Were different care options available in this case? If so, which was likely adopted, and did the subject possibly influence this choice? If so, how?	Different care option would have been to send her to an almshouse. This was likely not adopted, as her acute situation did not seem to develop as a long-term disability yet. For her acute stage a hospital would have been an option, however unlikely due to costs and transport.
To what extent did disability affect the subject's ability to perform the same activities as those of their cohort? How may this have affected the subject's self-perception and perception by others?	People with physical disabilities typically find effective methods to get past obstacles wherever possible, and she was probably definitely capable of making numerous contributions to her community. On the other hand, she could not have adhered to her community's normative role demands. However, considering she was unable to bear children, the perception of her disability by others and her self-perception were likely quite present. She could have been struggling with the personal challenge of altering her expectations of playing the part of a female. In addition to her apparent difference. and

	changes in self-perception. ability to express her feminine identity may have been changed, or she may have changed into a nontraditional role.
What might be the answer to the above question where opportunities to participate in alternative activities of equivalent value were available?	She was able to participate in social events, and likely felt she was able to contribute 'worth' to the community socially. However, economically her ability to contribute economically was diminished, and her ability to provide a family and fulfill her social role was diminished as well. Major effect on a life, causing changes in self-perception, social isolation, and personal hygiene problems. However, her caregivers have coaxed her through this possible identity crisis. Indicating tolerance and understanding.
Where care included assistance with 'self-maintenance' (e.g., toileting, postural positioning) involving intimate interventions (e.g., washing, massage) how might this affect self-esteem?	Dependence on others for such an essential activity of daily living is often related to psychological depression. This type of care only happened during the acute stage of her trauma however, and thus was temporary.
Following from this question, what might long term survival in this dependent state suggest about a severely disabled subject? About their relationship with carer(s)?	She was cared for with a high quality of care, which has been critical to her long-term survival. This suggests that she was likely cherished, I might even speculate about loved, by her direct environment. . In any case, 0584's feelings about herself, how she regarded herself in relation to the group and how the community saw her role in the community. would go through a time of uncertainty and change.

Part 3: Producing a partial biography of the subject of care
Who was the subject of care?
See results and discussion

8.4 Bioarchaeology of Care approach results of V0591 / Jantje

Index of Care - Step 1

The Individual

(i) Identifier(s) and provenance (e.g., location of recovery, date/period, culture, other)

V0951
Jantje W.
born in 1836
19th century

(ii) General identifiers (e.g., age, sex, height, build, other)

very gracile build
female
early young adult, 21 years old
living with her parents, unmarried, no children
no listed occupation
She had four brothers and a twin sister, named Jannetje. Unfortunately, the burial place of the twin sister was disturbed, therefore she is not available for analysis

(iii) Skeletal elements recovered (list and describe skeletal elements in terms of e.g. completeness, preservation, measurement, morphology, anomalies etc. - note that detailed description of pathology indicators is covered in SECTION 2).

Element	Description	Comment
feet	no anomalies	
hands	no anomalies	
lower appendicular	bowing of both femora, outwards. very gracile; Midshaft diameter right side 21.77; Midshaft diameter left side 23. 81. deformity (outwards) of the tibiae, of which right more than left.	
pelvic region	Asymmetry of the os coxae: 648.2 mm right os coxa height; 633.4 mm left os coxa height. Sacrum deformed, very gracile and straight.	
spine	severely deformed and misshapen thoracic vertebrae.	
thorax	Left Ribs extremely thin; right ribs also thin but thicker than left. Manubrium asymmetrical, pointing higher to the right. Sternum bending outwards.	
upper appendicular	upper arms (humeri) of different lengths and development phases. left humerus underdeveloped and shorter. Maximum humerus lengths for the left and right are 276 and 315 millimeters, respectively.	

Skeletal elements: additional comments/observations

(iv) Teeth recovered - Maxilla

(iv) Teeth recovered - Mandible

Tooth	Description/Comment
2nd lower molar left	large carious lesion
2nd lower molar right	large carious lesion

Dental aspects: additional comments/observations
huge caries, but almost no tooth wear. multiple enamel hypoplasias.

(v) References/sources

Pathology
(i) Location and description of each pathology indicator, status at time of death (active, resolved, resolved with residual deformity, etc.), and comments/observations

Element/location on element	Indicator	Status at death	Comments/observations
vertebrae	Cobb angle measured 155. Spine displays a tripartite curve, from C7 to T6, T8 to L1 and L3 to L5.	active	Cobb angle of the primary curve
upper appendicular	shoulder lesion. asymmetry of the glenoid fossae is -6° (right -31°; left -25°)	active	
thorax	Fusion and underdevelopment of the ribs on right side	active	
lower apendicular	bowing of the legs	active	

(ii) Possible patterns/relationships involving some/all pathology indicators (If not relevant/no apparent relationship indicate this; otherwise e.g., causal, interacting, etc.

Indicators	Relationship
deformation	thorax deformation is likely caused by deformation of the vertebrae as well

General comments / observations

(iii) Generalised indicators of health stress
Multiple dental enamel hypoplasias

(iv) Individual Pathologies
Pathology #1: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
Severe (congenital) scoliosis

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)
Polio: Paralytic poliomyelitis is a possible disease causing limb asymmetry, which is consistent with neuromuscular problems. V0591's gracile, femora, tibiae, and fibulae are the most persuasive evidence of this disorder in her bones. Scoliosis is one of the skeletal symptoms of paralytic poliomyelitis. Other symptoms include foot abnormalities, femoral neck anteversion, and hip dysplasia, none of which are apparent (Novak et al., 2014). The skeletal characteristics do not exhibit the whole spectrum of polio symptoms, but the illness is very varied in each individual's manifestation, thus it is still a viable diagnosis.

Cerebral palsy: Muscular instability across the joints can lead to limb shortening, joint contracture, bone abnormalities, and joint displacement or dislocation. Other signs and symptoms of this disorder include lordosis, scoliosis, and kyphosis (Novak et al., 2014). Hemiplegia, which most frequently affects the left side, is a condition in which just one side is affected.

(c) Possible cause(s) of pathology (including possible contributing factors)
genetics, birth defects

(d) Estimated pathology duration
from onset lived with the disease until death, likely aggravated by vitamin D insufficiency

(e) Course of pathology over time (e.g., congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
caused osteoarthritis of the spine and degenerative disc disease over time.
likely causal/contributory relationship to cause of death.

(g) Specific pathology references
(Colonna & vom Saal, 1941; Ebnezar, 2011)
(Novak et al., 2014)
(Krigger, 2006)
(Koman et al 2004)

Pathology #2: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
brachial plexus birth injury (BPBI)

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)
cerebral palsy: Muscle imbalance across the joints can lead to limb shortening, joint contracture, bone abnormalities, and joint displacement or dislocation (Krigger, 2006). Other signs and symptoms of this disorder include lordosis, scoliosis, and kyphosis.

(c) Possible cause(s) of pathology (including possible contributing factors)
cause of the BPBI is unclear, and no data was found on the possible relationship between congenital scoliosis and BPBI

(d) Estimated pathology duration
life

(e) Course of pathology over time (e.g., congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
congenital

(g) Specific pathology references
Krigger (2006)

Pathology #3: Diagnosis
(a) Most likely diagnosis (where two or more diagnoses are equally likely, or where no diagnosis is possible, then this should be recorded)
rickets

(b) Diseases included in differential diagnosis (state if not relevant - e.g., in case of limb fracture)
congenital deformation

(c) Possible cause(s) of pathology (including possible contributing factors)
vitamin D deficiency

(d) Estimated pathology duration
life

(e) Course of pathology over time (e.g. congenital; acquired [age?]; acute/chronic; recovery [partial/complete] before death; lived with disease until death; relationship to cause of death [unknown/unrelated/contributory/causal], etc.).
lived with the disease until death

Mortuary Context
(i) Location of remains
(a) Remains not recovered from cemetery context (describe location).
The coccyx is likely still at the cemetery, this was not recovered.

(b) Remains recovered from cemetery context (describe location within cemetery, in relation to other burials - e.g. single/group burial, within main cemetery, on periphery, etc.)
The church's south side contains the church cemetery. The graveyard had been separated into rectangles, each about the size of an adult coffin. Usually three or four deep, skeletons were stacked on top of one another. In the horizontal planes, there was little to no disruption of burials; vertical disturbance was mostly due to coffin collapse or fresh depositions in the same plot. The plots were highlighted because there was no horizontal disruption. Everyone was buried
in a wooden coffin, some of which contained grave goods. Only individual graves.

(ii) Deposition of remains (positioning, orientation, grave cut, etc.)
Northwest-southeast orientation, parallel to the church. In a stretched stance, individual graves. The legs were aligned in a straight line. Hands were positioned on the
pelvic region.

(iii) Preserved grave goods (and placement of these)
No grave goods

(iv) If found in cemetery context, compare subject's mortuary treatment with that of other burials (if possible, within same demographic cohort)
Similar to other burials, interred in a normal-sized coffin even though the individual was not normal-sized. The grave was a rental grave, and for her funeral 15 guilders was paid.

Index of Care - Step 2

Pathology - all pathologies

Part 1: Identify potential domains of pathology impact

Activities of daily living	Rating	Observations
1. Self-provisioning: ability to manage access to food and drink unaided (e.g. independently access nearby sources of food and water).	Not Capable	likely unable to walk
2. Self-feeding: ability to physically eat and/or drink without assistance (i.e. to convey food and drink to mouth).	Not Capable	Based on her tooth wear and caries, she was likely provided with an adapted diet, high in carbohydrates and sustenance that required minimal chewing, such as oatmeal for example.
3. Managing basic personal hygiene/caring for self: (e.g. washing, toileting, preserving skin integrity; treating infection and managing infection risk)	Not Capable	
4. Basic object manipulation: ability to manage items in the immediate environment - includes self-dressing (body temperature maintenance), item retrieval etc.	Not Capable	
5. Mobility over limited distance: ability to move unaided over short distances (e.g. inside and around dwelling, out of range of potential hazards etc.)	Not Capable	
6. Control over body position: ability (re)position body parts as desired without assistance (e.g. to sit up and transfer body weight from a reclining position unaided).	Not Capable	

Part 2: Instrumental activities of daily living

Domain	Likely domain activity/ies	Possible +ve / -ve factors	Rating	Elaboration
1. Basic lifestyle	Active, permanently settled, agricultural lifestyle. Women would work the fields during times of need, such as the month-long harvest at the end of summer.	Terrain is flat, and thus easy to transport over. Some spaces need the use of steps and ladders, adding an additional obstacle.	Not able to participate	
2. Economic	Entire family worked together with specific parts of the productions process. Milk cows, work the field, dairy-related production. Resources procurement strategies are to buy groceries and get water at a well in case pipes are not at the house.	Living is around the economic activity.	Not able to participate	

3. Domestic	Prepare food, maintain housekeeping. Sowing clothes. Making fire by burning peat. Hauling peat. Daily scrubbing, polishing, scouring enormous pails, pans and utensils. Scrubbing walls, woodwork, windows, rugs, boiling bleaching laundry. Carrying large buckets of milk, shoulder yoke or by hand. Churning or curd cutting, forming and pressing cheese.	Some spaces need the use of steps and ladders, adding an additional obstacle.	Not able to participate	
4. Mobility	Travel to church and shops for any utilities and other necessities. Daily trips were made from the farmhouse in the countryside to Middenbeemster, where the location of the school, the primary market, and other important amenities was.	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and cart for transport.	Needs moderate to substantial assistance	Either a wheelchair, horse and cart. If not, then unable to participate.
5. Community life (other)	Attend church every Sunday and during other ceremonies. visit relationships now and then Daily trips were made from the farmhouse in the countryside to Middenbeemster, where the center of the community is.	Terrain is flat, and thus easy to transport over. In the town there are hardened roads, even easier for transport. Possibility of horse and cart for transport.	Needs moderate to substantial assistance	
6. Interpersonal relations	communicate on daily basis with family. head of the household. expected to have children.	communication is personal	Able to participate	
7. Learning/applying knowledge	apprenticeship-based tasks. required to watch and accordingly perform tasks.	learning/applying knowledge is close to the home and personal	Needs moderate to substantial assistance	learning might not be inhibited, however applying might deem more difficult.

Final comments/observations

Did the subject likely require health-related care?	**Yes - likely that subject required care**

Index of Care - Step 3

Pathology #1 - all pathologies

Section 1 - Care as direct support

Components of care practice	Part of care	Elaboration/comments	Duration	Duration comments	Effort and resources involved	Efficacy of care
1. Provision of food and water	Possible	Neck muscular stiffness and paralysis both during and following poliomyelitis can make swallowing difficult.	Long term		receive care and support on a daily basis	Multiple dental enamel hypoplasias suggest the individual underwent several physiologically

						stressful periods, so might not have provided her with the necessary nutrition.
2. Maintaining normal body temperature	Not relevant / unknown					
3. Facilitation of comfort, rest and sleep	Probable		Long term		receive care and support on a daily basis	
4. Ensuring physical safety	Not relevant / unknown					
5. Maintaining/assisting mobility	Possible		Long term	might not even have been mobile at all.	receive care and support on a daily basis	
6. Monitoring health status	Probable	She will have likely had periods of disease, indicated by the vitamin D deficiency and enamel hypoplasia.	Short term	in case of acute infections/diseases	receive care and support on a daily basis	fairly efficient considering she lived to her age
7. Maintenance of personal hygiene/protection of integument	Probable		Long term	likely immobile and unable to reach behind	receive care and support on a daily basis	fairly efficient considering she lived to her age
8. Physical manipulation, postural adjustment	Probable	cardiac and pulmonary problems	Long term	likely immobile	receive care and support on a daily basis	efficient considering absence of pressure sores
9. Maintenance of physiological functioning	Possible	cardiac and pulmonary problems	Long term	deformed torso would have caused pulmonary issues, and restricted other vital organs. often suffer from congenital heart conditions.	receive care and support on a daily basis	fairly efficient considering she lived to her age

10. Specific intervention(s) and technologies	Possible	Orthopedic treatment was possible and accessible. Several braces are available. However, were largely ineffective, and it is not known if they were used for Jantje nor available to this family.	Long term		for orthopedic treatment a doctor (specialized perhaps) and serious medical costs were involved.	were largely ineffective, and it is not known if they were used for Jantje nor available to this family.

Section 2 - Care as accommodation

Domain	Part of care	Elaboration	Duration	Comments	Effort and resources involved	Efficacy of care
1. Basic lifestyle	Probable		Long term			
2. Economic	Probable		Long term			
3. Domestic	Probable		Long term			
4. Mobility (over distance)	Probable		Long term			
5. Community life (other)	Probable		Long term			
6. Interpersonal relations	Possible		Long term			
7. Learning/applying knowledge	Probable		Long term			

STEP 3: Elements of the model of care

Care Element	Discussion
support system	Archive research suggests she had a family who would have provided such care
care and support (daily)	

Section 1 - Group agency and the decision to provide care

Decision steps	Discussion
1. Determine need for health-related care exists	From birth onwards, her family learns by experience what she needs and how to accommodate her. If able to afford an orthopedic, that person will aid in their knowledge on how to care for her.
2. Assess considerations for/against care	She is young, female, with a family support system. The disease is present since birth, and over time the prospect of a successful outcome became nihil for the caregivers. She was a long term, intensive demand on care.
3. Decision to provide care	Family members most likely gave the care in the seclusion of the home. The young female's prolonged survival suggests that an extensive and well-planned effort was made to keep her alive.
4. Determine and initiate strategies for care delivery (direct support/accommodation)	To meet bare minimum requirements, a rigorous and complex daily schedule was required; responsibilities demanded a high degree of dedication.
5. Implementing and reviewing care practice	As her situation deteriorated, survival may have needed care and direct supply. This necessitated assessing shifting care requirements, fine-tuning the care plan, and putting adjustments into action. Along with the subject's health state, this review could also involve the carers reevaluating the patient's ability to pay for treatment and/or desire to accept responsibility for some parts of care etc.
6. Cease care	Care is ceased because the subject dies. They likely received care still around the time of death.
7. Decide treatment after death	This might suggest that, at least in death, she was not treated separately from the way of community as she was interred in the same manner as other people in the cemetery and there was no sign of selection or segregation.

General comments/observations

Question	Observation
In an agricultural environment, what could a decision made to provide long term care to a disabled subject suggest about social relations?	Reflects cohesive community with strong collective identity - all members ‘belong'. Willingness, intellectual flexibility, and organizational skills are required to deal with a constant demand on resources.
What does survival with reduced self-sufficiency and mobility indicate about the community?	Disability acceptance and understanding in the community, as well as the provision of active care

Section 2 - Individual identity - The subject as 'Agent'
Part 1: The subject - evidence and inference

Domain	Evidence and inference (observations and comments)
1. Basic physical characteristics.	female, 21 years. Generally weak and sickly.
2. Social indicators	Lived with her parents, was unmarried, with no children, no listed occupation. She had four brothers and a twin sister, named Jannetje.
3. Pathology(ies) and likely impact(s)	She was dealing with a neuromuscular condition. Diagnosis still up in the air. Aggravated by a vitamin D deficiency and multiple nutritious stress periods. She experienced a number of incapacitating symptoms as a result of the onset of her diseases. mobility challenges, if even possible. hardly been able to carry out the majority of everyday necessities.
4. Care received	Family members most likely gave care in the seclusion of the home. a lengthy, well-planned project. To meet the bare minimum requirements, a rigorous and complicated daily routine is required. requires the family to make a significant amount of commitment. If her illness had become worse, she could have needed nursing care and direct provisioning to survive for years. was likely provided with an adapted diet, high in carbohydrates and sustenance that required minimal chewing, such as oatmeal.
5. Lifeways opportunities and constraints	to provide her with a distinct social identity with atypical duties and decreased obligations in order to fit her growing physical limits. Some essential everyday tasks, like participation in communal life, building and using interpersonal relationships, and learning new things, remained unaffected.

Part 2: Experience of disability and care - the subject's perspective

Question	Adaptation, 'answer(s)' and comments
What does the subject's survival with disability suggest about their personality and motivation?	As onset of maladies likely affected her since birth, it was probable that this was part of her (social) identity.
What was the likely (quality of) relationship between subject and carer(s)?	Family members / close relatives likely were emotionally invested in Jantje. care comprises more than a purely functional relationship, particularly because of the long term and costs involved.
Does the subject's ability to obtain care suggest any particular personality characteristics? Is there evidence for other cases of care in the group? If so, how do 'cases of care' compare?	As Jantje was likely dependent since birth or at least childhood, members were likely emotionally invested in Jantje. Personality-wise she thus might have been lovable, and sympathetic, rather than bitter and difficult.
What was required from the subject in terms of cooperation in their own care? What does cooperation suggest in terms of e.g., level of function, personality traits, etc.?	Jantje depended on nearly everything in every aspect of her life on others at some point. This calls for a lot of flexibility and cooperation on her side. She was likely able to voice her needs when her health was decent, ensuring a good 'fit' for her and the caregiver(s). Affecting any and all aspects of health outcomes, including survival.
Were different care options available in this case? If so, which was likely adopted, and did the subject possibly influence this choice? If so, how?	two possibilities. Only those who were barely able to care for oneself were admitted to the earlier institutions, in either almshouse or in the home; in exchange for food, shelter and care, each resident must contribute in a way. There is no proof that almshouses were in charge of the lengthy care of patients (with paralysis) (Frick, 2013). she had a large family to take care of her, so this seems most reasonable.

To what extent did disability affect the subject's ability to perform the same activities as those of their cohort? How may this have affected the subject's self-perception and perception by others?	reduced or removed her ability to make a contribution to the community's social and economic well-being.
What might be the answer to the above question where opportunities to participate in alternative activities of equivalent value were available?	She was probably mainly bedridden, therefore it was doubtful that she could contribute or take part in other activities of equal importance.
Where care included assistance with 'self-maintenance' (e.g., toileting, postural positioning) involving intimate interventions (e.g., washing, massage) how might this affect self-esteem?	Dependence on others for 'activities of daily living' is often related to psychological depression, and in turn with increased mortality. Due to the chronic pain and other disabilities, she experienced, not even mentioning the social stigma of not being married, I suggest this has affected her self-esteem in a negative way.
Following from this question, what might long term survival in this dependent state suggest about a severely disabled subject? About their relationship with carer(s)?	Still reaching her twenties for Jantje suggests that she was not a quitter. Despite her pain and inability to contribute, and be dependent on nearly everything, especially considering she had multiple stressful periods, likely due to other diseases. It would have been easy to give up, however, she did not. Her family likely pulled her through by supporting and caring for her.

Part 3: Producing a partial biography of the subject of care
Who was the subject of care?
See results & discussion