Survival against the odds: Modeling the social implications of care provision to seriously disabled individuals

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ABSTRACT

Survival of an adult male (M9) with juvenile-onset quadriplegia in Neolithic Vietnam indicates provision of continuous care from his community, and adds to the growing literature documenting survival of disabled individuals in prehistory. Although the role of care-giving in achieving survival is occasionally acknowledged it is rarely elaborated, and a bioarchaeological model of care is missing. Contextualized analysis of specific instances of care can offer unique insights into contemporary culture, as the case of M9 illustrates. The 'bioarchaeology of care' identifies likely functional impacts of the pathology; possible and probable health challenges encountered; and nature of the support required to sustain life. Consideration of these factors in relation to lifeways practices and behaviours extends and enriches archaeological observations of M9's community. Additionally, M9's survival of extreme disability suggests certain personality traits touching on aspects of identity. Still under development, this new methodology promises to be a valuable heuristic tool.

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1. Introduction

Between 3700–4000 years ago in northern Vietnam a young man survived for approximately 10 years with disabilities so severe he would have been dependent on assistance from others for every aspect of daily life. Paralysed from the waist down and with at best very limited upper body mobility (Oxenham et al., 2009), the skeletal remains of Man Bac Burial 9 (M9) provide evidence of a pathological condition difficult to manage successfully in a modern medical environment. In a subsistence Neolithic economy the challenges to health maintenance and quality of life would have been enormous, yet M9 lived with minimally paraplegia and maximally quadriplegia from childhood into his third decade. M9’s survival reflects high quality, continuous and time-consuming care within a technologically unsophisticated prehistoric community. M9’s pathology and its diagnosis are detailed in Oxenham et al. (2009). The current paper builds on this previous work to explore the wider implications of M9’s survival.

A community’s response to the health care requirements of its members is shaped by a combination of cultural beliefs and values; collective knowledge, skills and experience; social and economic organisation; and access to resources (e.g. Bates and Linder-Pelz, 1990; Hardey, 1998; Hofrichter, 2003; Mishler, 1981; Pol and Thomas, 2001). In turn, and within physiological parameters, the way a person responds to the experience of a serious disease or injury reflects not only the treatment received, but individual characteristics, beliefs and behaviours formed within a specific socio-cultural environment (Bowling, 2002; Fábrrega, 1997; Garro, 2006; Lieban, 1977). It follows from these observations that analysis of the functional impact of a significant pathology and the manner in which both the person affected and their community respond to the demands of this condition potentially offers insights into aspects of the contemporary society, and even a sense of the personality of the individual receiving care.

The provision and receipt of health care may therefore reflect some of the most fundamental aspects of a culture. There exists a rich palaeoanthropological and bioarchaeological literature documenting individual cases of palaeopathology, including those in which the likelihood of care is explicitly acknowledged if not elaborated (see for example Dickel and Doran, 1989; Hawkey, 1998; Luna et al., 2008; Trinkaus and Zimmerman, 1982), and exploring interactions between lifeways, environment and evolution of disease and impact of these on population health status (e.g. Larsen, 2000; Ortner, 2003; Roberts and Manchester, 2005; Steckel and Rose, 2002). However, archaeology has overlooked prehistoric health care provision as a specific focus for analysis, and a valuable source of information on past behaviours is being ignored. A 'bioarchaeology of care' analytical framework, outlined below and illustrated through application to the case of M9, is being developed to address this deficit.

In the prehistoric setting, provision of health care is inferred from physical evidence in human remains which suggests that, at
some stage, an individual experienced a pathology that required and received assistance to enable or facilitate continued survival. Indicators of receipt of care comprise skeletal or preserved soft tissue evidence that (i) suggests survival over time with a continuing disability rendering functional independence impossible, or (ii) represents healed or healing lesions associated with an illness or injury necessitating care for recovery. 'Health care' is operationally defined as the provision of assistance to an individual incapacitated as a result of a pathological condition who, without this assistance, may have been unlikely to survive to age at death. Care provided may have lasted weeks, months or years, and could have consisted of anything from basic supply of provisions, through dedicated nursing or direct medical intervention, to longer term modification of group activity to enable community participation. In this paper 'disability', a contentious term in bioarchaeology (Dettwyler, 1991; Cross, 1999; Molleson, 1999; Roberts, 1999, 2000), is employed in accordance with the World Health Organisation (2008) usage to refer to a state arising from impairment in body function or structure, associated with activity limitations and/or participation restrictions, and given specific meaning in relation to the lifeways context in which the pathology is experienced.

The bioarchaeology of care approach is designed for application at a case-study level. Initial analysis focuses on the probable impact of a serious pathology upon an individual's ability to operate within their immediate physical and social environments. Where diagnosis is relatively straightforward (pace Waldron, 1994), modern clinical literature can provide information on the range of associated diseases symptoms and likely outcomes. Even in cases where the exact diagnosis is uncertain, the physical evidence of pathology may allow conclusions about minimum level and duration of functional impairment. It is taken as given that every individual's experience of a pathology is unique (Bowling, 2002; Martin Ginis et al., 2005 in relation to spinal cord injury specifically) and that complete confidence in relation to the nature and extent of the impact of a pathology is not possible. However, a model of what care-giving likely comprised may be derived from considering (i) the minimum range of disability/ies associated with the evidence of pathology in relation to (ii) the possible opportunities for, and constraints on, the provision of support in the corresponding lifeways context.

The above principles are employed to explore what M9's extended period of survival, against all odds, may contribute to understanding the social and economic practices of the prehistoric community of Man Bac, and what it may suggest about this young man as an individual. This study provides a demonstration of the amount and quality of information obtainable through a bioarchaeology of care analysis. In doing so it contributes to the growing discussion in the bioarchaeological literature on social dimensions of the past and, more broadly, helps to illustrate how case studies of individual remains can contribute to achieving a fuller picture of prehistoric society.

1.1. The context for care

Identifying the range of care likely required for M9's survival, and how, and at what cost, this care might have been provided, requires an understanding of the Man Bac physical environment, socio-cultural context and general level of health.

In summary, the Man Bac cemetery is located in Ninh Binh province of northern Vietnam, 100 km south of Hanoi. Excavations carried out between 1999 and 2007 produced the remains of 95 individuals, extending through three separate layers, all primary burials, and comprising the first signs of human presence at the site. During occupation Man Bac was located at the mouth of an estuary of one of many rivers making up the Red River Delta, with a landscape of flat loess interspersed with sharply rising, rugged, limestone karsts (Fig. 1). The climate would have been similar to that of the present, with cool, humid winters (minimum average temperature during January is 12°C, frequently descending to 6°C) and hot, wet summers (Sterling et al., 2006).

Archaeological evidence suggests a predominantly hunter-gatherer economy. Faunal remains indicate a focus on terrestrial and aquatic vertebrate resources (Sawada and Vu, 2005), with preliminary stable isotopic data indicating over 50% of protein intake derived from fish (Yoneda, 2008). While long grain rice has been recovered from contemporaneous Red River Delta sites (Nguyen et al., 2004), confirmatory evidence for rice cultivation/consumption has proved elusive at Man Bac. A preliminary analysis of the Man Bac pottery suggests extensive regional links among the Red River Delta communities (Nguyen, 2008), while lithic evidence indicates trade routes extended as far as Shang Dynasty China during this period (Higham, 1996).

A detailed description of M9's pathologies, a brief review of some common health implications of immobility, and more information on the bio-cultural context for the discussion of care are presented in the supplementary information section. Readers are strongly encouraged to view this before continuing.

2. Caring for M9

M9, a male of between 20 and 30 years, was buried flexed, on his right side, and oriented north–south. This contrasts with standard Man Bac mortuary practice (extended, supine, east–west orientation). Skeletal abnormalities suggestive of serious pathology were immediately apparent on excavation, and are clearly visible in Fig. 2.

M9's remains manifest extreme disuse atrophy of lower and upper limbs, full ankylosis of all cervical and the first three thoracic vertebrae, a permanent torticollis, and bilateral temporomandibular joint degeneration. A diagnosis of Klippel Feil Syndrome (KFS) Type III has been proposed (Oxenham et al., 2009). The severity of pathology leaves no doubt that M9 was dependent on others for survival from onset of paralysis in adolescence onwards. The precise nature of the support he required cannot be known, but the constraints inherent in osteological analysis make it likely that the nature, duration and complications of his pathology will be underestimated. Nevertheless, analysing the likely impact of M9's disabilities within the contemporary physical and cultural environment of Man Bac is one way of identifying what – at a minimum – his care comprised.
There are obvious caveats to this approach. Individual variability in response to disease has already been acknowledged. Similarly, palaeopathology relies on clinical experience to understand the effects of disease on physical and psychological function, and this modern, usually Western, frame of reference refers to a very different medico-cultural environment to that of the Vietnamese Neolithic. More particularly, the manner in which M9's condition emerged may have helped to shape the support he received. Although making no difference to the practical aspects of long-term support required, the timing and nature of disability onset may have had implications for the decision to provide care and for mode of care-delivery. This information is not retrievable from the archaeological record, and the following analysis of M9's care is based on evidence of disease present at time of death.

By referring to modern clinical literature (e.g. Bergman et al., 1997; Martin Ginis et al., 2005) a minimum level of practical support required for M9’s survival can be identified under the headings of:

- **Basic care**: assistance with the daily necessities of life, such as provision of food, water, shelter, transport, and help with dressing and other everyday activities; and
- **Advanced care**: maintenance of personal hygiene, managing environmental and physical safety concerns, general health maintenance, monitoring to ensure continued well-being, and dedicated nursing and other medical interventions as needed.

This division does not imply that various tasks were necessarily carried out by different people or at different times. Caring for a person with severe handicaps is an integrated activity; the distinction between basic and advanced care is arbitrary, because all aspects of care are critical to preserving life, and all interact to make up the standard of care provided. Arguably, however, the forms of care listed as ‘advanced’ are more intimate, more labour intensive and demand a higher level of skill and/or commitment than those described as ‘basic’, and this is what these categories reflect.

### 2.1. Basic Care

#### 2.1.1. Food and Water Provision

M9 was incapable of obtaining food and water independently, so these essentials must have been supplied by others. Upper limb handicap, combined with cervical ankylosis and a permanent torticollis, would have affected coordination, possibly posing problems for M9 in feeding himself. Restrictions on head and neck movement, combined with those associated with temporomandibular joint osteoarthritis, may have been an obstacle to efficient mastication, although level of tooth wear observed in M9 appears normal for age. It would have been more difficult for M9 to hold a drinking vessel at the correct angle for imbibing. It is probable that M9 received assistance with both eating and drinking, but he would almost certainly have required help in relation to the latter.

M9 may have been provided with a special diet, possibly involving additional processing to encourage appetite and facilitate digestion and absorption. Immobility is associated with adverse gastrointestinal outcomes ranging from anorexia to constipation (McKinley et al., 2002; Olsen and Schroeder, 1967; Schnelle and Leung, 2004). Constipation and/or mechanical bowel obstruction are an almost inevitable corollary to prolonged immobility in the absence of an appropriate diet, and the consequences can be severe (McKinley et al., 2002; Olsen and McCarthy, 1967; Teasell and Dittmer, 1993). M9 may have received food(s) with known laxative properties to facilitate bowel movement. Immobility-associated changes in metabolic function also affect dietary requirements; high levels of dietary protein are needed to compensate for poor nutritional absorption resulting from reduction in cell metabolism rates, and foods with an acid residue, such as fish, meat, poultry and cereals, may be beneficial in countering increases in system alkalinity which affect urinary and other functions (Agarwal, 2002; Olsen and McCarthy, 1967; Olsen and Schroeder, 1967). M9’s carers may not consciously have been aware of developing an optimal dietary regime, but they probably arrived at one through trial and error – aided by the fact that their normal diet was based on high protein, low fat, marine foods.

It is critical for immobilised individuals to be kept well hydrated. Dehydration can be both an outcome of, and a contributor to, body organ dysfunction (Bergman et al., 1997; Massagli and Reyes, 2008; Olsen and McCarthy, 1967). Attention must have been given to ensuring not only that M9 had water within easy reach (particularly important in the hot months when sweating increases loss of body fluid), but that he was assisted in drinking if this was required.

Maintaining M9’s health must have involved establishing a balance between his digestive capabilities and his nutritional requirements; his continued survival suggests this was achieved.

#### 2.1.2. Transport

Following onset of paralysis it would have been impossible for M9 to undertake significant independent movement. There is no evidence of contemporary draught animal domestication in this region, so if travel was undertaken M9 must have been transported by others, possibly on a litter or even by water. Consideration of transportation issues may offer an insight into the Man Bac economy. It would not be impossible for a community undertaking seasonal movement to support a seriously handicapped individual (e.g. Dickey and Doran, 1989), but it would be very unusual. The extreme fragility of M9’s limbs would have rendered them vulnerable to fracture from even minor trauma. Given the lack of evidence of antemortem injury it seems unlikely that M9 was involved in travel over long distances, supporting the independently derived hypothesis that Man Bac was predominantly a sedentary community. Despite this, M9 may have been moved over short distances, if only for the purposes of maintaining the standard of hygiene necessary to avoid infection. He would have been dependent on the physical strength of others for his conveyance, and on their caution in carrying him for his safety.

#### 2.1.3. Shelter

There is no direct evidence of dwellings from this period, but it would have been impossible for M9 to have survived constant exposure to the elements for any period of time. A water, wind and sun-resistant shelter must be assumed. M9’s continued survival would also have been dependent on both (i) a structure elevating him off cold or wet ground, and possibly providing him with support for resting in a sitting position, and (ii) provision of a soft...
surface upon which to lie. Failure in either of these areas would have resulted, at a minimum, in continuous challenges to M9’s health from acquired pressure sores and respiratory tract infections (AHCPR, 1992; McKinley et al., 2002; Olsen and McCarthy, 1967).

2.1.4. Dressing

Limitations on upper body function would have been a serious impediment to self-dressing. In a modern clinical context the ability of an individual with spinal cord injury to clothe and clean themselves is given prominence because independence in these areas is associated with psychological well being (Krause et al., 1997). Although nothing has been recovered from the cemetery excavations that sheds light on the specific dress customs of the Man Bac community, there is clear evidence for textile manufacture in the contemporary Phung Nguyen period (Cameron, 2002), and winter temperatures (Sterling et al., 2006) would have necessitated some form of covering during this season at least.

2.2. Advanced care

2.2.1. Personal hygiene

M9 would have been completely reliant on others for the maintenance of personal hygiene, and this must have involved a regular regime of bathing and toileting. Although possibly bathed in situ, M9 may have been moved elsewhere for, and/or assisted in, the voiding of bowel and bladder.

This care was fundamental to his survival. Had M9 been left for any extended period lying in his own waste this would have increased vulnerability to breaches of skin integrity and to bacterial and parasitic infection (AHCPR, 1992; Stillman, 2008). Similarly, changes in metabolic function associated with immobility may lead to increased sweating (Campagnolo, 2006; McKinley et al., 2002), and this physiological response would have intensified during the humid summer season. Sweat-moistened skin would also have increased M9’s susceptibility to pressure sore development and have required particular attention. All the above complications can have potentially fatal consequences for an immobile individual (Stillman, 2008; Thompson Rowling, 1967; Yeo et al., 1998). Assistance would have included removal and disposal of body wastes; continual observation and action to ensure M9 was clean and dry (wiping, bathing, towelling); and frequent replacement of soiled bedding.

2.2.2. General supervision

Individuals who suffer loss of sensation as a result of spinal cord damage are vulnerable to acquired injury in affected areas of their body because they are unable to tell when damage is occurring; even immobile individuals who do not suffer sensory deficit will lose an amount of sensation over time (Bergman et al., 1997). For M9, hazards probably included open fires; surfaces capable of penetrating or tearing the skin; disease-carrying or poisonous insects or reptiles; lengthy exposure to damp or cold; and the range of domestic accidents that happen when people live in close proximity. Support in this context would not only have entailed being aware of the location of M9 in relation to potential threats and acting to reduce risk, either by environmental management or by removing M9 from danger, but also undertaking regular physical examinations to ensure absence of injury.

2.2.3. Health maintenance, health monitoring, and dedicated nursing

Modern clinical experience suggests that care interventions must have occurred at various stages throughout the latter half of M9’s life. Characteristics of symptom onset would have shaped treatment approach. If M9 experienced a gradual decline in mobility and sensation, then the initial need for direct medical intervention may have been minimal and support efforts concentrated on compensation for functional restrictions. If paralysis was of sudden onset, then intensive care would have been necessary over the initial period of stabilisation (Lee and Green, 2002), followed by development and implementation of an ongoing support regime. At a minimum, M9 probably experienced severe restrictions on head and neck movement from birth, and he may also have manifested other signature characteristics of KFS (Hensinger et al., 1974; Thomsen et al., 1997). Indeed, M9 may have been marked out as ‘different’ and possibly in need of assistance before paralysis occurred.

Individuals with long term mobility constraints face an extensive range of possible secondary complications. Some, such as osteoporosis, are unavoidable, and many are potentially life-threatening (e.g. Anderson and Spencer, 2003; Dittmer and Teasell, 1993; Marik and Fink, 2002; Teasell and Dittmer, 1993). M9 displays extreme atrophy and bone demineralisation of both upper and lower limbs (Oxenham et al., 2009), but most other complications have no effect on bone. It is therefore impossible to say what other health challenges M9 experienced, but it is hardly credible that he experienced none at all (Corcoran, 1991; Lee and Ostrander, 2002; McKinley et al., 2002). Close monitoring of an immobile individual is required to ensure that symptoms associated with complications are addressed quickly. Consideration of what this monitoring may have comprised in relation to M9, and what sort of care may have been provided in direct response to an acute challenge, provides insight into carers’ awareness of what constituted a health threat and their ability to respond effectively.

‘Looking out for’ M9 must have included recognition of early symptoms of distress, even if these could not be attributed to a specific cause. Cardiovascular dysfunction may manifest in dizziness, rapid heart rate, excessive sweating and headaches (Claydon et al., 2006; Olsen and Thompson, 1967; Winslow, 1985) and respiratory system dysfunction in difficulties in breathing and coughing, or raised temperature (McKinley et al., 2002; Olsen and Johnson, 1967). Urinary and renal dysfunction may manifest in raised temperature, pain, blood in the urine or nausea (Bergman et al., 1997; Olsen and Schroeder, 1967). Constipation or bowel obstruction may manifest in loss of appetite, general discomfort, abdominal swelling, tangible mass in the colon, or abdominal pain (McKinley et al., 2002; Olsen and McCarthy, 1967).

The community’s ability to treat these conditions aggressively was probably limited, but effective therapies may have existed nonetheless. Modern clinical experience shows that physical therapy interventions can be very successful if applied in the early stages of complications. Mobilisation, turning, repositioning, elevation, massage, percussion and postural drainage can improve respiratory and circulatory function, and repositioning, elevation, manual pressure, massage and manipulation can assist urinary flow and faecal elimination (McKinley et al., 2002; Olsen and Johnson, 1967; Olsen and McCarthy, 1967; Olsen and Schroeder, 1967). Preventing dehydration and providing appropriate nutrition, previously discussed, is critical to maintaining the fitness levels necessary for overcoming health challenges. Historic and ethnographic research suggests that use of herbal remedies for treatment of fevers, pain and gastrointestinal complaints may have been common (e.g. Ferrence and Bendersky, 2004; Halberstein, 2005; Lieban, 1977). Direct evidence for the use of betel nut (Areca catechu) in Metal Age northern Vietnam is clear (Oxenham et al., 2002) and its use as medicament for children at Man Bac has been inferred (Oxenham et al., 2008a), but a general lack of palaeobotanical evidence from Man Bac precludes further comment.

When M9 experienced acute health complications, intensive care over days or even weeks would have been necessary. The physical therapies outlined above must have been applied at frequent
Absence of evidence: pressure sores and bone fracture. Changes in skin elasticity, vascular function and muscle tone resulting from prolonged immobility render the skin vulnerable to both pressure and shearing forces, and facilitate pressure sore (ulcer) formation. When the skin's surface is ruptured the risk of wound infection is high; once established infection is difficult to control, and unless contained will cause extensive deep tissue damage, may become systemic, may spread to bone, and may prove fatal. Pressure sores need early attention to achieve uncomplicated healing (AHCPR, 1992; Margolis et al., 2003; Olsen and Edmonds, 1967; Stillman, 2008).

To avoid sores the resting surface of an immobile individual must be soft but supportive, and the person must be regularly repositioned to relieve areas of pressure (AHCPR, 1992; Olsen and Edmonds, 1967; Stillman, 2008). Monitoring skin condition is essential; damp conditions increase vulnerability to lesions, but cracked, dry skin creates entry points for infection, and requires lubrication (AHCPR, 1992; Olsen and Edmonds, 1967; Stillman, 2008). In modern, sophisticated, clinical contexts the lifetime risk of immobile individuals experiencing pressure sores is approximately 85% (Stillman, 2008, p. 1), and pressure sores are acknowledged as an ever-present problem for this population (AHCPR, 1992; Margolis et al., 2003; Olsen and Edmonds, 1967; Stillman, 2008).

Had M9 suffered untreated pressure sores these lesions would almost certainly have led to long-term systemic infection, which, had M9 survived, would likely have been expressed in bone. The absence of evidence for infection from pressure sores (or from any other cause) in the recovered skeletal elements, combined with length of M9's survival with paralysis, suggests a minimum level of care comprising regular inspection and cleansing of skin surfaces, provision of cushioning materials, and routine physical manipulation.

It is unlikely that M9 was able to avoid the initial stages of pressure sore development, given their ubiquity in situations of prolonged immobility (AHCPR, 1992; Stillman, 2008). Treatment would have required keeping the lesion clean, with possible debridement of necrotic tissue to promote healing. This management of early stage pressure sores would have been within the technological capability of the Man Bac community, and it is possible that the site’s marine proximity encouraged the use of seaweed dressings or saline washes, effective antiseptics used in some therapies today (Stillman, 2008). Treatment would have required sophisticated and dedicated effort, however, and again reflects the high level of commitment to M9's survival.

Absence of evidence of antemortem bone fracture in M9's remains, despite their gracility, also reflects the quality of care provided. Immobility over a lengthy period results in osteoporosis; lack of weight-bearing exercise leads to depletion of bone calcium and demineralisation and bones lose density, becoming brittle and subject to fracture under minor stress (Bergman et al., 1997; McKinley et al., 2002; Olsen and Edmonds, 1967), with such fractures occurring most commonly in the femur, spine, and wrist (Dittmer and Teasell, 1993). M9's preserved lower and upper limbs display no sign of antemortem damage, despite extreme atrophy rendering them potentially vulnerable.

3. Discussion

The case of M9 is perhaps the earliest and the most extreme prehistoric experience of long-term survival with total disability. Only one other instance of survival with such extensive paralysis is known; that of an individual from Hokkaido, dating to around, 3500 years BP (Suzuki et al., 1984). The predicted outcome of a condition with such a severe functional impact and such a wide range of potential health complications would have been rapid death, long before the pathology had a chance to register in the skeleton. There can be no question that M9's survival was due to the care he received, and this enables certain observations to be made about Man Bac as a community and about M9 as a person.

Because the size and composition of the Man Bac community is not known, it is impossible to tell whether carers came exclusively from M9's family; whether carers were drawn from non-kin community members; or whether there existed dedicated healers for particular aspects of treatment. It is possible to extrapolate, however, that the act of caring for M9 received general community endorsement. At some stage following paralysis onset the extent of functional impact, combined with failure to improve, would have made it clear that M9 was not going to recover independence; that his health would probably deteriorate further; that he would never be capable of making a substantive material contribution to the community (whatever other contribution he was capable of); and that he would require continuing and labour intensive support for the rest of his life. In practical terms, the costs to a small community of supporting M9 involved not only the provision of resources necessary for his survival, but also compensation for the labour foregone of those involved in meeting care requirements. The Man Bac environment was relatively resource rich—a situation facilitating the full time support of a dependent individual and compensating for community members taken out of mainstream activity to provide dedicated care. Nevertheless, in a small subsistence community it is usual for all members to participate in the economy as soon as they are old enough to do so (Oxenham et al., 2008a). In the case of M9, it is fair to assume that the adoption and maintenance of support behaviours, resulting in reduced productive capacity for the community over a period of years, would have required consent and cooperation from the group as a whole.

Consideration of the support likely received by M9 provides clues about behaviours in Man Bac for which there is no material evidence as yet. For example, essential tasks of bathing and drying M9, as well as the need for covering in colder months, suggest textile production. Lack of antemortem injury to M9 suggests a sedentary community lifestyle. Meeting M9's dietary requirements suggests a broad knowledge and range of food resources, food processing skills capable of overcoming constraints on appetite and digestion, and the ability to take the time needed for special food preparation. Furthermore, while prior experience of such an extreme condition as M9’s is unlikely, the effectiveness of the care enabling his long term survival suggests a community experienced in looking after people incapacitated by disease or injury. The elevated level of general health stressors in Man Bac (Oxenham et al., 2008b), as well as ethnographic research into disease frequencies and healthcare practices among hunter-gatherer and horticulturist societies in South America, Africa and Papua New Guinea (e.g. Frankel, 1986; Kaplan et al., 2000; Lewis, 1975; Sugiyama, 2004), indirectly support this observation.
In summary, the effective and long-term response to M9’s condition argues for a socially stable and cohesive community experienced in nursing the sick; capable of assessing the likely demands and costs of care-giving in relation to a serious and permanent pathology; able to develop a set of procedures for responding to this situation successfully; and willing and able to maintain these procedures over years. The Man Bac community made an informed commitment to the extended care of one of its members, probably one reviewed and re-committed to in response to changes in – and the inevitable decline of – M9’s health status.

3.1. Caring for M9: cultural values in practice

Motivations for any substantive human behaviour are multi-faceted, ambiguous, often contradictory and, at a distance of around 4000 years, impossible to unravel completely. We can never know exactly how the Man Bac society understood illness and how this may have affected the decision to care for M9, but while acknowledging the warnings of authors such as Dettwyler (1991) on the dangers of retrospective attribution of motive (particularly that of compassion) in the bioarchaeological context, it may still be possible to gain partial insight into the value placed by this community on caring for others in need. For example, the considerable effort put into keeping M9 alive suggests that the people of Man Bac were not fatalist in their views of disease and its origins.

Man Bac mortuary practice indicates that, in death at least, the community made little distinction between individuals on the basis of age, sex or other visible characteristics (Oxenham et al., 2008a). However, individuals who are perceived as ‘different’ by their community in life are frequently distinguished by different treatment in death (Fay, 2009; Shay, 1985). Although M9 was buried with his contemporaries in the Man Bac cemetery, there were dispositional anomalies in his burial. His atypical position and orientation may have been an outcome of limitations imposed by his physical condition: specifically, difficulty in breaking ankylosis and flexure. Conversely, it is possible that this mortuary positioning was a mark of M9’s difference, and had meaning in relation to either his position in the community or his passage into the afterlife. Whatever the reason for differences in mortuary treatment, there is no indication of careless handling and every sign of respect for someone who was unique in his physical disability.

M9’s survival may reflect a high value placed on individual life within the Man Bac community. While the culturally-mediated nature of psychological health is acknowledged (Lillard, 1998; Schepet-Hughes and Lock, 2006), it is worth speculating on M9’s experience in the context of modern clinical observations. Psychological depression, associated with loss of self esteem, social isolation and social rejection, is a significant morbidity of paralysis resulting from spinal cord injury (Bockian et al., 2002; Boekamp et al., 1996; Kennedy and Rogers, 2000; Krause et al., 1997; Olsen, 1967). Direct (suicide) and indirect (e.g. failure to cooperate with treatment) self-destructive behaviours are a leading cause of mortality among this population, with perceived quality of life positively correlated with length of survival following disability onset (Krause et al., 1997). Additionally, psychological depression, mediated via physiological stress systems, is associated with a variety of adverse impacts on physical health status, including reduction in general immune system function (O’Leary, 1990; Weiss, 1992; Zorrilla et al., 2001); increased risk of cardiovascular disease and congestive heart failure (Jagoda et al., 2003; Sherwood et al., 2007); and increased incidence of respiratory tract pathologies (O’Leary, 1990).

It is impossible to make a direct comparison between modern and prehistoric experience at a behavioural level, but it is reasonable to assume that physiological responses to stress were the same then as now. In a situation in which amenities were basic, had M9 suffered from clinical depression there is little doubt that he would have quickly succumbed to health challenges in his environment.

It seems reasonable to conclude, therefore, that to have survived with his disabilities for more than 10 years M9 must have received extensive psychosocial as well as physical support. Modern experience (Bockian et al., 2002; Krause et al., 1997) suggests that at a non-culturally specific level this must have included the creation of a secure, emotionally-supportive, inclusive environment in which care was provided ungrudgingly, enabling M9 to grow to adulthood, to develop a role for himself within the group, to retain a sense of self respect, and to interact with others in his community at whatever level was possible. In view of the prolonged and particularly demanding nature of the care provided, it seems justifiable to speculate that the carers’ motivations included compassion, respect and affection.

3.2. M9 – the individual

The past 15 years has seen growing interest in attempts to infer ‘the individual’ from archaeological evidence of material culture (Meskell, 2000; Thomas, 2002). In most cases this focus has resulted in the production of a stereotype or cipher identified as the ‘actor’. It has rarely revealed any hint of a once-living human being.

Osteological evidence can enrich approaches to understanding the individual within their archaeological context, although this potential is rarely exploited in practice (Sofaer, 2006). Considerable information can be extracted from skeletal remains, including sex (implications for gendered behaviour); age at death (implications for rites of passage); general physical demands of corresponding lifeways; and place of origin, travel undertaken, and diet (Oxenham and Tayles, 2006; Robb, 2002; Sofaer, 2006).

Palaeopathological analysis contributes an intensely personal perspective – there is little that has more immediacy than experiencing a pathology severe enough to leave markers on bone. Where aspects of individual response to pathology can be inferred, this may provide clues to personality.

For a minimum of the last 10 years of his life M9 would have been unable to take on the normal role of those in his cohort. He could only watch on as his peers participated in the activities of late childhood/early adolescence in Man Bac. He experienced the hormonal changes of adolescence as a severely disabled individual (although the impact of these may have been mitigated by immobility-related changes in metabolic function [Olsen and Wade, 1967]). M9’s peers moved through adolescence to adulthood, being admitted into the roles and responsibilities associated with achieving different age-related stages in life (Robb, 2002), while he remained without prospect of attaining ‘normal’ development. Although M9 may have contributed to his group in many ways – for example, the very success of M9’s continued survival may have been a source of strengthened community identity and cohesion – none of these is archaeologically accessible. All that can be concluded with certainty is that M9 was reliant on others for every aspect of his physical and social existence.

M9’s prolonged survival with disability suggests an extraordinarily strong will to live; a robust psychological adaptation; a self esteem capable of overcoming the complete loss of independence; and a personality capable of inspiring others to maintain high quality and costly care over time.

4. Conclusion

The bioarchaeology of care approach uses evidence of caregiving to explore details of past behaviour that may be impossible to retrieve through other means. It does this by providing a focus and a framework for synthesising information from archaeological,
anthropological, palaeopathological and modern clinical sources. The methodology is based on individual case studies. As the number of case studies increase these will undoubtedly contribute significantly to the broader theoretical debate on the origins of care, but at present generalisation from one situation of caring for a disabled individual to another such situation should be undertaken with extreme caution. Although there may be points of similarity, each case of care-giving is unique. The example of M9 illustrates the methodology’s potential for achieving a more detailed and more nuanced understanding of aspects of contemporary prehistoric cultural practice and social relations in a specific small community, and in this instance consideration of M9’s experience of pathology over time also allows speculation on aspects of personality, allowing a glimpse, if only partial, of a real person.

By definition, the bioarchaeology of care approach is restricted to instances in which care-giving can be inferred. Although in the example of M9 the level of disability involved was extreme, the methodology employed in this study can be used in less dramatic cases of pathology where the evidence suggests that the individual required assistance from others over a period of time. Even when it is only possible to use this approach in a limited way, the perspective it offers should enrich more general analyses. The analytical framework is still undergoing development, but as demonstrated in this paper it promises to be a valuable heuristic tool.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ijpp.2011.02.003.

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