

Testing Differential Frailty in a Sudanese Sample

Tommy Budd | Amanda Wissler Center for Bioarchaeological Research, School of Human Evolution and Social Change, Arizona State University

Background

Periosteal lesions are often used as non-specific indicators of overall levels of stress and health in the past but their interpretations are far from straightforward (Wood et al., 1992). Using medieval London samples, Sharon DeWitte (2014) demonstrated that distinguishing between active and healed periosteal lesions can significantly improve our understanding of stress and differential frailty. She found that with healed lesions correlated with higher levels of survivorship when compared to active or no lesions.



Hypothesis

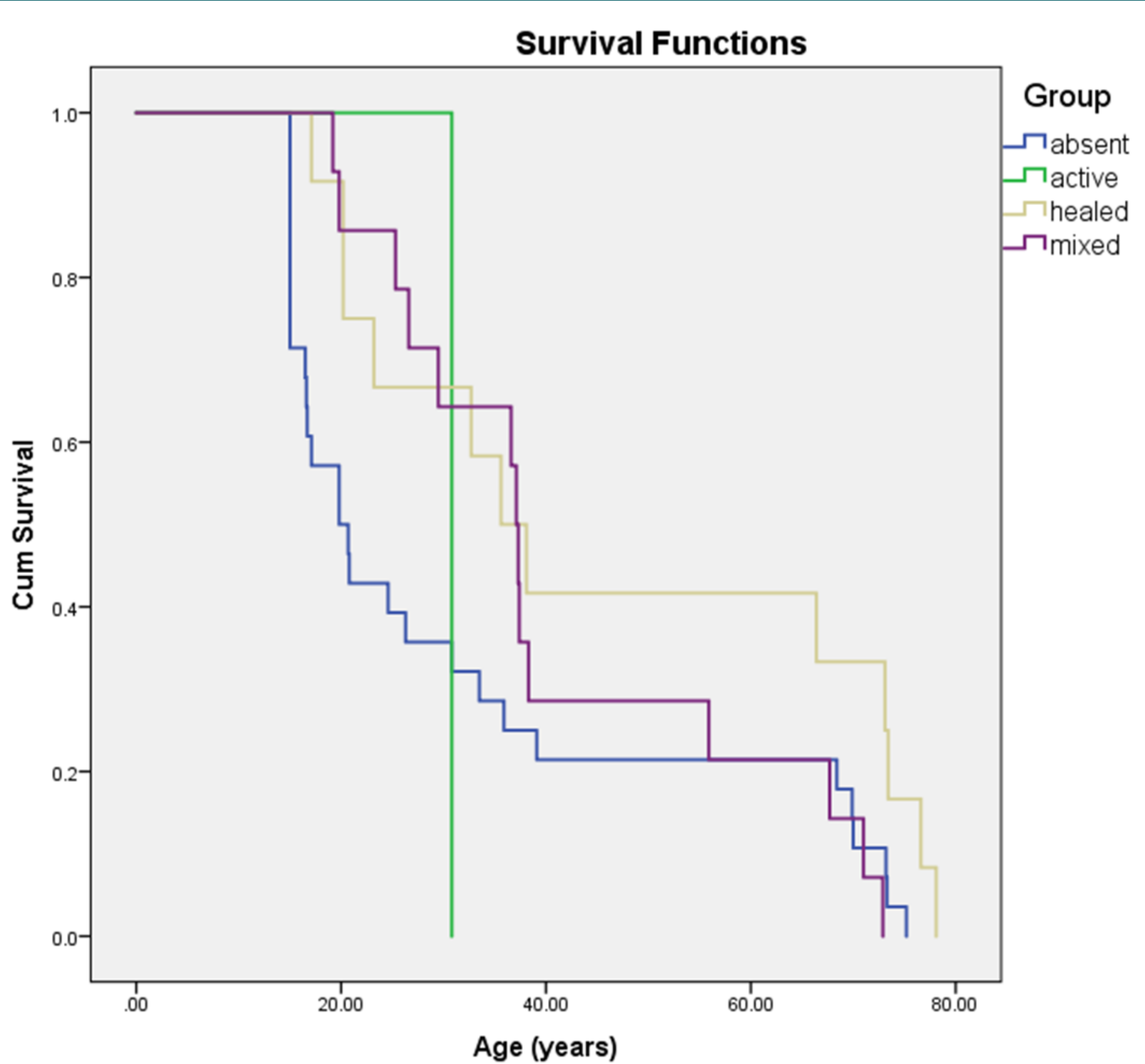
Consistent with DeWitte’s (2014) findings, we hypothesize that presence of healed periostitis is associated with increased rates of survival compared to presence of active lesions and absence of lesions. Additionally, we hypothesize that severity of lesions is positively correlated with increased survival.



Materials

The materials used here consist of a sample of human remains excavated 1966-1968 (Žabkar and Žabkar, 1982) from the Nubian site of Semna South and dating to the Meroitic (350 BCE to 350 CE), X-Group (350 to 550 CE), and Christian (550 to 1400 CE) periods. Over 800 individuals were excavated from the cemetery north of the Semna South Fort, and come from a variety of grave structures with grave goods including vessels of wood, ceramic, glass, and metal, metal jewelry, leather sandals, shrouds, and hunting equipment. Skulls, vertebrae, sacra, long bones and pathological specimens were sent to Charles Merbs at University of Chicago and later moved to Arizona State University.

Individuals were selected for inclusion in this study based on criteria following DeWitte (2014). Individuals must minimally have included either skull or one os coxa from which age and sex could be estimated. Additionally, individuals must have included both tibiae for which presence or absence of periostitis was observable. As a result of these procedures, and the incomplete nature of most of the skeletons, 55 individuals aged 15+ were included in the study.



Methods

Sex was estimated based on cranial morphology, and pelvic morphology when possible, using standards in Buikstra and Ubelaker (1994).

Age was estimated using the transition analysis technique developed by Boldsen and Milner (2002) and the accompanying software program ADBOU version 2.1.044. Due to the paucity of os coxae in the sample, we relied primarily on cranial suture closure. Dental eruption and epiphyseal union were also used to estimate age for the youngest individuals when possible (Buikstra and Ubelaker, 1994).

Periosteal lesions were scored on the anterior surfaces of the tibiae. To avoid pathology as a result of trauma, both right and left tibiae had to be present and observable. Lesions were scored as active, healed or mixed. Active lesions presented “woven bone, with its characteristic grey color, porous and disorganized appearance, and sharp, unremodeled edges, often appears to be resting on top of the cortical bone surface” (Weston, 2008; pg 52). Healed lesions presented “lamellar bone, usually the same color as the surrounding bone, with a more disorganized appearance and rounded remodeled edges” (Weston, 2008; pg 52). Periosteal lesions were also scored on Lallo’s (1973) severity stages.

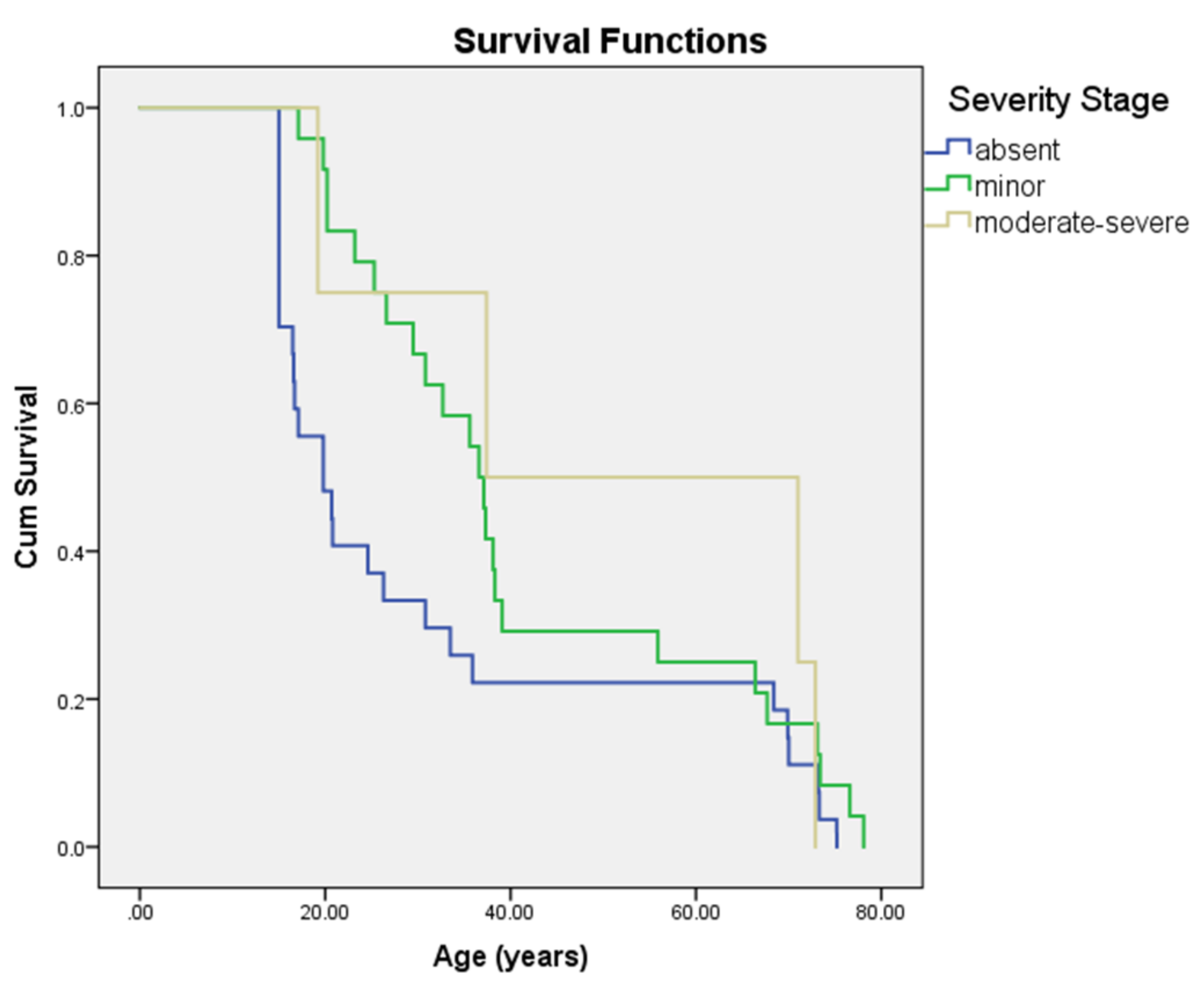
The relationship between periosteal lesions and survival was assessed using a Kaplan-Meier survival analysis with log ranked and pooled data in the statistical software program SPSS version 23.

Results and Discussion

The Kaplan-Meier survival plot suggests that individuals with healed lesions show higher rates of survival than individuals with mixed, active, or no lesions, consistent with DeWitte (2014). Due to the small sample size, however, as well as likely errors in age estimates due to the use of cranial suture closure, results are not statistically significant.

Similarly though less clearly, the survival plot of severity suggests that lesion severity may be positively correlated with survivorship, though these results are again not statistically significant.

Based on the Kaplan-Meier analysis, we suggest that DeWitte’s (2014) results are replicable and that her methods are applicable to other populations, but that large sample sizes are needed to achieve statistical significance. Additionally, we suggest that these results may be achievable even with incomplete and biased skeletal collections like that used here.



Acknowledgements

Thank you to Jane Buikstra, our adviser, and to Arleyn Simon and Ellis Locke for their help in accessing the Semna South collection at ASU.

References

Boldsen JL, Milner GR, Konigsberg LW, and Wood JW. 2002. Transition analysis: a new method for estimating age from skeletons. In: Hoppa R, and Vaupel J, editors. Paleodemography: age distributions from skeletal samples. Cambridge: Cambridge University Press. p 73-106.

Buikstra JE, and Ubelaker DH. 1994. Standards for data collection from human skeletal remains: Proceedings of a seminar at the Field Museum of Natural History (Arkansas Archaeology Research Series 44). Fayetteville Arkansas Archaeological Survey.

DeWitte SN. 2014. Differential survival among individuals with active and healed periosteal new bone formation. International Journal of Paleopathology 7:38-44.

Lallo J. 1973. The skeletal biology of three prehistoric American Indian populations from Dickson Mound. Unpublished Ph D dissertation, Department of Anthropology, University of Massachusetts, Amherst.

Weston DA. 2008. Investigating the specificity of periosteal reactions in pathology museum specimens. American journal of physical anthropology 137(1):48-59.

Wood JW, Milner GR, Harpending HC, Weiss KM, Cohen MN, Eisenberg LE, Hutchinson DL, Jankauskas R, Cesnys G, Česnys G et al. . 1992. The Osteological Paradox: Problems of Inferring Prehistoric Health from Skeletal Samples [and Comments and Reply]. Current Anthropology 33(4):343-370.

Žabkar LV, and Žabkar JJ. 1982. Semna South. A preliminary report on the 1966-68 excavations of the University of Chicago Oriental Institute expedition to Sudanese Nubia. Journal of the American Research Center in Egypt 19:7-50.