

## Chapter 3 Case Study (3.5.1): Treponemal Disease and Status

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Treponemal disease, or treponematosi, is one of a handful of infectious diseases that can be differentially diagnosed from skeletal remains. In other words, it can leave physical impressions (i.e., pathognomonic) on bones that can be used to determine the causative infectious agent. However, not all cases of treponemal disease leave these pathognomonic changes. Factors such as the affected person's overall health, immune response, and length of time that he/she was infected at the time of death all impact the skeletal appearance of this infection. To address this range of skeletal manifestations, bioarchaeologists Maria O. Smith, Tracy K. Betsinger, and Leslie L. Williams (2011) developed a three-level scale of confidence in diagnosing treponemal disease. They examined patterns of treponemal disease in relation to status differences. They tested the hypothesis that differential baseline health between elites and non-elites in late prehistoric (AD 1300–1600) eastern Tennessee populations would also result in differences in rates of treponemal disease. Their hypothesis is based on the observation that in societies today, elite individuals will have access to better diets and living conditions generally than non-elite individuals.

The late prehistoric period of East Tennessee is known as the late-Mississippian period and is associated with complex sociopolitical organization, including status differences that are reflected in burial treatment, as well as intensive maize agriculture, permanently established villages, and burial mounds situated around a central plaza within the settlement. Individuals buried in mounds are considered social elites of ascribed and/or achieved status, while those buried in village areas are thought to be non-elites. In this region of Tennessee, previous studies have demonstrated some health differences based on status. Poorer baseline health would presumably make individuals more vulnerable to infectious diseases such as treponematosi.

The sociopolitical organization of this period in East Tennessee is not as simple or as straightforward as it may appear. Status may be of ascribed and/or achieved types and it may be part of a hierarchical (i.e., ranked) and/or heterarchical (i.e., different realms of power) power structure. Additionally, in these societies, the majority of individuals interred in mounds are adult males. There are fewer adult females and very few subadults included in the mounds. To address these complicating factors, Smith and colleagues utilized a large, multisite sample, each site including both mound and village burials, all dating to the late Mississippian period, specifically the Dallas phase (AD 1300–1550). In such sites, mound burials were accompanied by more grave goods and usually by more goods of nonlocal origin, which provides more evidence that such burials represented at least part of the societal elite. Utilizing several contemporaneous and geographically consistent sites allows the samples to be collapsed into a single sample, enabling larger sample sizes of elite and non-elite components, as well as larger sizes of age and sex cohorts that can be analyzed and compared.

Five sites were included in the study: the northernmost site of Cox located along the Clinch River; Toqua and Citico located along the Little Tennessee River; and Hiwassee Island and the southernmost site of Sale Creek, both located on the Tennessee River. A sample of 650 individuals from the collective five sites was analyzed for the presence of treponemal disease, based on one of three levels of confidence: pathognomonic (P), indicative (I), and consistent with (CW). Pathognomonic changes were progressive cranial lesions, including caries sicca. Goundou-gangosa (changes to the nasopalatal region) was included in this category if found in conjunction with cranial lesions. Indicative changes included sabre shins and nodes with cavitating lesions, while changes in the consistent-with category included discrete nodal lesions with advanced periostitis. Only skeletons with good to excellent preservation, including 50 % or more of the cranium, three upper limb shafts, and three lower limb shafts were included. Age and sex were previously determined. The subadult sample was divided into a younger (2–13 years) cohort and an older (14 – <18 years) cohort, and the adults were divided into three categories: young adult (~18–34 years), middle adult (~35–49 years), and mature adult (~50+ years) (Smith et al., 2011).

The results for the entire sample yielded a treponemal disease rate between 5.7% and 6.8%, depending on which categories of confidence were included (Smith et al., 2011). The adult sample had a rate of 7.5–8.7%, and the subadults were lower, with a rate of 2.0–3.0%. Of the 650 individuals, 110 were mound burials and 535 were village burials; 5 burials were unprovenienced (i.e., lack of data regarding burial location). The collective mound burials had significantly less treponemal disease (1.8%) than the collective village sample (6.4–7.7%;  $p=0.0207$  [P+I+CW],  $p=0.0670$  [P+I]). Comparisons including only the adults also yielded significantly more treponematoses in the village (8.7–10.2%) than in the mound (2.2%;  $p=0.0111$  [P+I+CW],  $p=0.0402$  [P+I]). There were no statistically significant differences among the subadult sample. Additionally, there were no sex differences within the collective mound or collective village samples. Comparisons of the adult components by age cohort also yielded no statistically significant results, and the mature adult category could not be separately analyzed due to small sample size.

Based on these results, the hypothesis that there would be differences in treponemal disease visibility based on status was supported by the Smith and co-workers study. Their results are consistent with studies published elsewhere. For example, the lack of sex differences in treponematoses and the frequency of adult treponemal disease being approximately double that of subadults mirror other results. However, this is one of the first studies to demonstrate status-based differences in treponemal disease visibility. The lower rate of treponematoses in the mound-interred elites may reflect better overall health of these individuals, which has been borne out in other studies examining stress markers and other general health indicators. Better elite health may have resulted from access to better palliative care. Social segregation within these communities, such as food and/or utensil sharing and restricted body contact, may also have impacted the transmission of infectious disease within elite and non-elite cohorts. Alternatively, since status was likely achieved to some degree, better health may have been a reflection of an

individual's virtue. In other words, those of good health were seen as more virtuous and, as a result, were likely to have a higher achieved status.

This study demonstrates the utility of infectious disease visibility in investigating questions regarding sociopolitical organization. Do elites in late Mississippian East Tennessee enjoy better health, especially as it relates to treponemal disease? Based on this study, the answer to this question is yes. However, whether this greater level of health in elites is the result of being high status or is a factor in becoming elite is unclear. In other words, do they have better health because they are elite or are they elite because they have better health? More data related to treponemal disease and overall health as well as more archaeological information will enable bioarchaeologists to address this question.

#### Reference

Smith MO, Betsinger TK, Williams LL. 2011. Differential visibility of treponemal disease in pre-Columbian stratified societies: Does rank matter? *American Journal of Physical Anthropology* 144:185-195.