H14 Local Standards vs. Informative Priors in Applied Forensic Anthropology

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After attending this presentation, attendees will understand statistical methods for obtaining age estimates based on reference sample skeletal aging data and appropriate prior distributions for age-at-death.

The results of this research demonstrate the importance of prior information as well as the appropriate use of reference sample data when determining age-at-death from skeletal material. This research provides a statistical method for unbiased estimation of age-at-death in the applied forensic anthropology context.

Considerable debate over the need for "population-specific" skeletal estimators continues in forensic anthropology for sex, age-atdeath, and stature estimators. This debate acquires practical importance when forensic anthropologists are called upon to build descriptive profiles of decedents who come from populations that lack reference skeletal data. This paper addresses the perceived need for populationspecific information on age determination by explicitly considering the statistical basis for age-at-death estimation.

It is quite common in studies of age-at-death estimation to order age within each skeletal stage and then to calculate percentiles for ages falling within that particular stage. In some cases, percentiles such as the 2.5th and 97.5th are provided to give a 95% confidence interval for age-at-death conditional on stage. In other cases, the range of ages (from the minimum age, or 0th percentile, to the maximum age, or 100th percentile) is given for broader coverage. These percentile-based confidence intervals are deficient descriptors because of three statistical problems. First, the percentiles themselves are estimates that may be misleading when based on a stage for which few skeletons were observed. Second, the percentiles give a very incomplete description of the age-at-death (conditional on stage) data. Finally, the percentile values depend on not only the biological information contained in the age "indicator," but also the a priori age-at-death distribution of the reference sample.

In this paper it is suggested that a better method for presenting ageat-death data conditional on skeletal stage for a reference sample is to provide the Kaplan-Meier survivorship by skeletal stage. This solves the first and second statistical problems, in that confidence intervals are available for the survivorships (which are percentiles) and the survivorships provide all of the available percentiles. However, the KaplanMeier method does not solve the third problem, because the method still depends on both the biology of aging and the age structure of the reference sample. To show that this third problem remains, this paper compares the Kaplan-Meier survivorship by pubic symphyseal phase from a number of reference samples to the survivorship by phase for 232 known age-at-death individuals from the Korean War. The reference data survivorship by phase greatly exceeds that for the Korean War dead, because the a priori age distribution for the Korean War dead is much younger. There may also be population differences in biological aging between the reference samples and the Korean War dead sample.

To address the question of population specificity Kaplan-Meier survivorships by phase for the Korean War dead are approximated using parametric models that depend on an a priori age distribution and information on biological aging from a reference sample. In the case of the Korean War, there is a large amount of information available on the ageat-death for U.S. soldiers killed in action (see Frank A. Reister's "Battle Casualties and Medical Statistics: U.S. Army Experience in the Korea War" available on-line from http://history.amedd.army.mil/), which for the purposes of this paper is modeled using a log-normal distribution. This informative prior must then be combined with information on pubic symphyseal aging taken from a known age-at-death reference sample. For known age samples symphyseal data from the Korean War dead, males from anatomical and forensic collections, and males and females from the Balkans are used.

The results of the parametric models show that, from a practical standpoint, it makes little difference which reference sample is used to age the Korean War dead. The choice of an inappropriate prior, however, can have drastic effects on the models. It can consequently be suggested that forensic anthropology's concern with obtaining "population specific" estimators or "local standards" may be misdirected. Instead, greater emphasis should be placed on characterizing appropriate priors and on extracting information on biological aging from larger well-documented skeletal collections. In a similar vein, it may not be necessary to have, for example, stature estimation equations that are based on very specific reference collections. Instead, a combination of large generic reference samples with appropriate priors can be used to tailor make such "population specific" estimators (Ross and Konigsberg 2002). Ross AH, Konigsberg LW. New formulae for estimating stature in the Balkans. *J Forensic Sciences* 2002;47:165-167.

Age-at-Death Estimation, Statistical Methods, Survival Analysis

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