Indirect Estimation of Precolumbian Life Spans at Teotihuacan, Mexico

Lourdes Marquez Morfin, ENAH, Mexico, and Rebecca Storey, University of Houston, USA

Osteologically-based paleodemography has been declared “dead” several times. There have been real problems, including age mimicry of the age structure of a known-age reference population in the final age distribution of deaths in a skeletal population of unknown ages. Recent research and methodological innovations have started to answer some of the real problems. However, two main problems are present.

The first is how to improve estimation of age at death, especially of adults. The underaging of older adults has been indicated in various studies, such as the Spitalfields coffin plate sample (Molleson al. 1993). Much of the recent research has worked to ameliorate this bias, such as transition analysis (Boldsen et al. 2002).

It has now been 10 years since the publication of The Rostock Manifesto (Hoppa and Vaupel 2002) which set out goals to improve paleodemography and the indirect estimation of skeletal age at death. The goals were:

- Work with existing and new reference skeletal collections to get better age indicators.
- Use the osteological age indicators to estimate Pr(c/a), the probability of having a particular stage in an age indicator, given the age of a skeleton.
- What is of interest is Pr(a/c), the probability of age given a particular stage in the age indicator in a skeleton of unknown age at death, which must be calculated from Pr(c/a) using Bayes’ theorem.

\[ \Pr(a/c) = \frac{\Pr(c/a) \times f(a)}{\sum[\Pr(c/a) \times f(a)]} \]

- f(a) must be estimated before Pr(a/c) can be estimated – a model of how the chance of death varies with age or the probability distributions of life spans in a target skeletal sample of unknown ages.

One solution is to use a uniform prior for f(a), but this is uninformative and unrealistic, as mortality is not distributed that way over the life span. It also tends to produce a few obviously unrealistically old ones (Godde and Hens 2012). There are several possibilities, but the selection of an informative prior is still not easily determined.

Part of the problem of selection is due to the second big question facing paleodemography. What kind of mortality pattern by age was present before modern times? Since most demographic information on mortality and life spans are from recent populations, after the Industrial Revolution, they may not provide good models for earlier populations. In fact, preindustrial populations have a particular mortality pattern not covered by any previous set of model tables (Seguy et al. 2008). These are populations that are primarily agricultural and without modern medicine or sanitary technology. Their demographic characteristics include:

- High infant and juvenile mortality.
- Low life expectancy at birth and similar to the life expectancy at age 20.
Fertility barely above replacement level
Populations often threatened by mortality crises.
This requires (Seguy et al. 2008):
New model tables to capture these demographic traits
Take into account rate of growth.
Application of these new tables to archaeological skeletal populations show that it
requires archeological and paleopathological data to be able to interpret the
paleodemographic estimations.

While the underaging of older adults is an important methodological problem, newer
techniques may have gone too far and created age estimations that actually overage older adults
or overestimate how many octogenarians, for example, were present in past populations.
Historical information and new model tables (Seguy et al. 2008) will provide more realistic
guidelines in our opinion, than just the use of some newer methods. Skeletal samples from two
neighborhoods of the preindustrial/Precolumbian city of Teotihuacan, Mexico, will provide the
comparisons of different aging estimations to the historical information.

Paleodemography has generally depended on the uniformitarian assumption that current
biological aging processes of skeletons from modern populations are similar to those of past
peoples of different environments and way of life. This assumption is what has allowed
researchers to use known-age recent skeletal populations to determine age indicators to apply to
unknown skeletal samples from usually more ancient societies. It is this assumption that we feel
is the next to be questioned and to have methodological innovations. This process is already
beginning. Here a more upscale, central urban neighborhood and a more modest, more
peripheral one will provide the differing urban environments that seem to influence the age-
distribution-of-deaths of the skeletal samples.

References

In Paleodemography: Age distributions from skeletal samples, edited by Robert D. Hoppa and

Godde, Kanya, and Samantha Hens. 2012. Age-at-death estimation in an Italian historical
sample: a test of the Suchey-Brooks and transition analysis methods. American Journal of
Physical Anthropology 149: 259-264.

Hoppa, Robert D., and James W. Vaupel. 2002. The Rostock Manifesto for paleodemography:
the way from stage to age. In Paleodemography: Age distributions from skeletal samples, edited

Report No. 86, York.