A116 Decomposition Rates: Autopsied vs. Non-Autopsied Human Remains

Cortnee J. Agan, Colorado Mesa University, 1100 North Avenue, Grand Junction, CO 81501; Christiane Baigent, MSc*, Forensic Investigation Research Station, Colorado Mesa University, 1100 North Avenue, Grand Junction, CO 81501; Melissa A. Connor, PhD, Colorado Mesa University, 406 Lowell Heiny Hall, 1100 North Avenue, Grand Junction, CO 81501-3122; and Eriek S. Hansen, PhD, Colorado Mesa University, Dept Biological Science, 1100 North Avenue, Grand Junction, CO 81501*

After attending this presentation, attendees will better understand the impact of the bloat stage and the effect of penetrating trauma on the trajectory of human decomposition in an arid environment.

This presentation will impact the forensic science community by increasing sample size in future taphonomic studies while highlighting the importance of region-specific testing of the variables assumed to affect rate and timing of decomposition.

Forensic taphonomy research facilities accepting both autopsied and non-autopsied human remains must contend with subsequent sampling concerns. Autopsy incisions approximate penetrating trauma, while evisceration attendant to organ examination and sampling adds an additional layer of insult. Post-autopsy, organs are typically bagged and returned to the thoracic cavity, resulting in the removal of soft tissue structures and the associated necrobiome, both assumed critical impetus to decomposition. While the sum of these postmortem modifications may reflect the circumstances of case trauma, the appropriate use of autopsied remains in controlled research facilities is poorly understood, making assignment to research cohorts challenging and retrospective data difficult to apply.

The potential for differential decomposition between autopsied and non-autopsied human remains was tested at the Forensic Investigation Research Station (FIRS) in Grand Junction, CO.

A sample of 12 individuals, 6 autopsied and 6 non-autopsied, was used to assess the trajectory of decomposition within and between groups. Decomposition was measured using a Total Body Score (TBS), a qualitative measurement of decomposition derived from gross assessment of value-assigned categories of change within three anatomical regions.[1] The indices of time and temperature were combined as Accumulated Degree Days (ADD). ADD was calculated as the average of hourly temperatures within a 24-hour cycle using data collected from an onsite weather station. All data points collected from the time of body placement to the time of analysis were considered in this study. Maximum ADD presented a range of 6,073-11,916 ADD for autopsied donors and a range of 6,178-12,721 for non-autopsied donors.

To ensure there were no significant differences in autopsied and non-autopsied cohorts, *t*-tests were used to compare donor age, height, and weight (α=0.05). A Linear Mixed Model (LMM) using maximum likelihood estimates was used to determine if the rate of decomposition varied between the two groups. The dependent variable was TBS (TBS^2 transformation). The independent fixed variables were ADD (Log_{10}(ADD+1) transformation), an indicator variable for autopsied (*indicator*=1) or non-autopsied (*indicator*=0) remains, and an interaction term (Log_{10}(ADD+1) x Indicator). The random effects for both intercepts and slopes were ADD and donor. The interaction term was used to determine if the slopes were significantly different. The *p*-value for the interaction was determined by a likelihood test comparing the model with and without the interaction term. The analysis was conducted in Program R (version 3.4.0) using the lme4 package.[2,3]

There was no significant difference for age, height, or weight between the two groups. The decomposition rate did not differ between autopsied and non-autopsied donors based on a comparison of slopes $\chi^2_{(1)}$=0.576, p=0.448.

FIRS is located in a semi-arid, high-altitude region, which promotes prolonged periods of tissue retention following desiccation of dermal and visceral tissues. Bates and Wescott observed a similar pattern between autopsied and non-autopsied cohorts in west Texas and concluded that penetrating trauma affects the pattern of decomposition but not the rate.[4] Results at FIRS concur, but also suggest that the bloat stage may not influence the overall trajectory of decomposition as is generally assumed. Bloat is the byproduct of bacterial metabolism within confined organ structures. The removal of the constituent parts necessary for bloat did not have an appreciable effect on the rate of decomposition. This highlights the necessity for regional testing of the biological phenomenon (both direct and auxiliary) traditionally assumed to influence the rate of decomposition and suggests that while dramatic in gross presentation, bloat does not significantly affect decomposition rates in arid regions.

Understanding the variables that affect rate of decomposition is important in the evaluation of prior research studies, future research studies, and for forensic scientists estimating postmortem interval on remains presenting large penetrating wounds.

Reference(s):

1. Megyesi M.S., Nawrocki S.P., Haskell N.H. Using accumulated degree-days to estimate the postmortem interval from decomposed human remains, *J. Forensic Sci*. 2005;50:1-9.
2. R Core Team. 2017. *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.
3. Bates D., Maechler M., Bolker B., Walker S. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software.* 2015;67(1): 1-48. doi:10.18637/jss.v067.i01.
4. Bates L.N., Wescott D.J. Comparison of decomposition rates between autopsied and non-autopsied human remains. *Forensic Sci. Int.* 2016;261:93-100.

Taphonomy, Autopsied/Non-Autopsied, Decomposition