H96 Decomposition Patterns of Human Remains Within Enclosed Environments: A Comparative Analysis of the Midwest and Southeast

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The goals of this presentation are to explore the patterns and timing of the effects of decomposition for enclosed settings in both the Midwest and Southeast, and to identify taphonomic factors that will be useful for predicting the accumulated degree days (ADD). Attendees will be presented with predictive models for estimating ADD and a blueprint for retrospective decomposition studies.

This presentation will impact the forensic science community by presenting trends in human decay within two distinct geographical regions for an environment that has been largely unexplored. The identified patterns accentuate the need for generating comparative samples and engaging in collaborative research to create context-specific standards for estimating the postmortem interval (PMI).

Retrospective case studies from autopsy records were utilized to assess human decay trends in different geographical regions. The 2003- 2008 Nebraskan autopsy records revealed 69 cases within enclosed settings, and Florida's Hillsborough County Medical Examiner records for 2009 yielded 87 cases. Five outliers were removed (Nebraska: n=67; Florida: n=84). The reliability of Bass' (1997) model was tested for a correlation between time ranges (first day, 2–7 days, 8–31 days, and >31 days) and decay stages (fresh, bloated, advanced) to determine whether a context-specific standard can be applied to enclosed settings in varied U.S. regions. To test variation in decomposition, relationships between PMI (time in days) and Bass' stages were tested using *Spearman's Correlations* for each state, and differences in PMI among decay stages were tested with *Kruskal-Wallis* and *Mann-Whitney U* tests. The role of insect activity was described by location. *Spearman's Correlations* were further used to identify factors that may be powerful in predicting ADD in Nebraska and PMI in Florida. For Florida, preliminary trends were identified. For Nebraska, a *multiple regression model* was constructed for the prediction of ADD.

For Nebraska cases, the investigation of decompositional phases revealed that there were 49.3% (33/67) fresh, 37.3% (25/67) bloated, and 13.4% (9/67) advanced. PMI ranged from one to 66 days (*mean PMI=4.84 days, n=64*). For Florida cases, there were 6.0% (5/84) fresh, 77.4% (65/84) bloated, and 16.7% (14/84) advanced. PMI ranged from 2–26 days (*mean PMI=6.27 days, n=81*).

For both regions, Bass' decay stages were significantly correlated with time ranges (Nebraska: $r=0.829$, $n=64$, $p\leq0.000$; Florida: $r=0.366$, $n=81$, $p=0.001$). For both regions, relationships between PMI and decomposition were identified (Nebraska: $r=0.772$, $p\leq0.000$, $n=64$; Florida: $r=0.512$, $p\leq0.000$, $n=81$). For Nebraska, there were significant differences in PMI days among all decomposition stages ($X^2=37.818$, $df=2$, $p\leq0.000$). Florida possessed differences in PMI between bloated and advanced cases (*MW-U=165.500, p≤0.000*). Fresh cases could not be considered, due to small sample size.

For Nebraska, only 12.3% (7/57) cases with fly colonization were documented: 11.1% (2/18) within bloat and 71.4% (5/7) within advanced. The Florida sample included flies, ants, gnats and beetles; 73.56% (64/87) of cases had insect activity. Insect activity was more prevalent among Florida depositions.

For Nebraska, several factors were identified as significantly correlated with the transformed $\log_{10}$ADD. Ultimately, brain liquefaction, marbling, decompositional odor, mummified tissue and the use of A.C. or heat were selected for a predictive model (*Adjusted* $R^2=0.952$; $F=40.807$, $df=5, 5$ *and* $p\leq0.000$). For Florida, taphonomic variables identified as having a relationship with PMI include: necrophagy ($r=0.268$, $p=0.015$, $n=81$), livor mortis ($r=0.234$, $p=0.035$, $n=81$), bloating ($r=-0.251$, $p=0.024$, $n=81$), mummified tissue ($r=0.527$, $p\leq0.000$, $n=81$), brain liquefaction ($r=0.285$, $p=0.038$, $n=53$), and organ decomposition ($r=0.281$, $p=0.038$, $n=55$). Although preliminary, these decomposition variables may be powerful predictors of ADD for Florida.

Correlations between stages of decay and PMI, as well as the disparity in PMI days among stages indicate that retrospective data are well suited for identifying what taphonomic effects have a relationship with time and would serve as powerful predictors of the PMI. Although Bass' model for outdoor Tennessee decomposition accounted for a significant portion of the variation for both locations, the low *Spearman's rho* score for Florida indicated that Bass' model cannot adequately address decomposition rates for enclosed settings in Florida. The disparity in insect activity and the selection of different decomposition variables as predictors of PMI and ADD for both locations suggest that taphonomic factors vary in influence over decay rates by geographical region. Collectively, these results lend support for the need to create quantitative models for predicting ADD that are geographically and contextually specific. Predictive models can be constructed by

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identifying taphonomic influences and effects that best characterize decompositional change in a given environment.

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