E97 Deconstructing Desiccation and Decomposition

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After attending this presentation, attendees will understand the importance of testing individual descriptive categories for estimating Postmortem Interval (PMI).

This presentation will impact the forensic science community by presenting the relationship between gross morphological changes in decomposition and their relationship to the environmental variables of temperature, humidity, solar radiation, and wind speed.

Documented attempts to determine the PMI based on gross morphological change date back at least to the 13th century.[1] Micozzi discussed sequential stages of decomposition, but points out that the dynamic nature of several interacting variables make it impossible to assign those stages to an absolute time since death.[2] Despite this caveat, and because of the probative value of the PMI, approximate times are frequently assigned, particularly to the early stages of decomposition (e.g., Clark et al.).[3] Based on the correlation between gross morphological change and temperature, Megyesi et al., as well as others, have proposed predictive models for estimating PMI throughout the trajectory of fresh to skeletonization.[4] Vass and Sorg and Wren added humidity to models (accumulated relative humidity days), and found that shade from a forest canopy played a role in decompositional differences.[5,6] They posit that both regional and microenvironmental differences significantly affect decomposition, supporting the need for regional decomposition sequences. Research conducted using human donors at the Forensic Investigation Research Station (FIRS), Colorado Mesa University, yielded the Total Body Desiccation Score (TBDS) within which Connor et. al. described a region-specific decomposition sequence and discussed its predicative ability in an arid environment, by adding descriptive categories useful for desiccated remains.[7]

This present study takes the general descriptive categories used in the TBDS (color, bloat, moisture, desiccation, and skeletonization) and compares the scores to Accumulated Degree Days (ADD), Accumulated Humidity Days (AHD), Accumulated Solar Radiation (ASR), and Accumulated Wind Speed (AWS). Each variable was calculated in a manner similar to ADD and AHD; a daily minimum/maximum average is successively added across all days within a defined PMI. The lower threshold for ADD is defined as 0°C (following Megyesi et al.); AHD, ASR, and AWS were not assigned a floor or ceiling threshold.[4] TBDS scores were considered both in sum, and by body segment, including: head and neck, torso, arms and legs.

Preliminary results suggest that some TBDS descriptors correlate with ADD more strongly than others (listed in order of efficacy): skeletonization (0.85), moisture (0.82), desiccation (0.70), color (0.69), and bloat (0.57). The head and neck region showed the strongest correlation with ADD (0.91). All environmental factors demonstrated strong correlations to TBDS: ADD r=0.81, AHD r=0.80, ASR r=0.83, and AWS r=0.83.

Further research will be used to strengthen the TBDS method by weighting the factors that were strongly correlated with PMI. Preliminary results at FIRS indicated that placing more weight on specific body regions (i.e., the head and neck region) and considering environmental variables such as solar radiation and wind speed in predictive models, along with temperature, has the potential to increase model robusticity.

Finally, comparative research in other geographical regions needs to be conducted. In the semi-arid west, solar radiation and wind speed were important correlates with decomposition. These additional environmental variables may be more powerful correlates for different decomposition stages and may be useful for developing predictive models. In other environments, these environmental variables may be less important and other environmental variables may be more useful. Exploring these factors will both deepen the understanding of macroscopic variation in decomposition and build stronger, microenvironment-based models for assessing the trajectory of decomposition and building analytical models for estimating PMI on human remains.

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