THE EFFECTS OF TEMPERATURE ON THE DECOMPOSITION RATE OF HUMAN REMAINS

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Forensic anthropologists are frequently called upon to assist in the recovery and analysis of recently-deceased individuals. Estimating postmortem interval, or PMI, is an important part of a forensic anthropologist's job. The PMI serves two functions. First, estimating PMI can narrow down the potential pool of missing persons and ultimately help to identify the remains. Second, in homicide cases, law enforcement personnel use the PMI to exclude possible assailants.

Forensic scientists use many methods to estimate the PMI, but anthropologists tend to emphasize the decay and decomposition of soft tissues. Qualitative "stages" of decomposition that broadly correspond to the PMI have served as rough guides for most estimates made by anthropologists. However, nearly all previous studies have considered decomposition as a thing to be described, not as a process to be scored and used statistically to estimate the PMI. Forensic anthropology might benefit from applying quantitative methods to the study of decomposition.

Fly larvae (maggots) associated with decomposing remains grow and develop at a rate that is almost entirely dependent on ambient air temperature. Accumulated degree-days (ADD) and accumulated degree-hours (ADH) are heat unit values calculated from ambient air temperatures. Forensic entomologists use ADD and ADH to measure the energy requirements of developing maggots. Could forensic anthropologists use ADD to measure the energy needed to propel soft tissue decomposition and thus more accurately estimate PMI?

Human remains cases used in this study were taken from the files of Dr. Stephen Nawrocki, a forensic anthropologist at the University of Indianapolis, and Dr. Neal Haskell, a forensic entomologist at St. Joseph's College in Rensselaer, Indiana. A total of sixty-nine cases were eventually selected. All individuals were complete with no missing body parts and had been dead for less than one year. No burned, buried, or submerged remains were used. Nineteen states and one Province in Canada are represented in the dataset. All cases had a known PMI that was either calculated from insect evidence or determined from police reports.

Decomposition was scored from photographs using a point-based scoring method in which decomposition was assessed independently for three areas of the body: the head and neck, the trunk (thorax, abdomen, and pelvis), and the limbs (including the hands and feet). The decompositional scores of the three anatomical regions were combined to produce a total body score (TBS). Accumulated degree-days were calculated from average daily temperatures recorded by the National Weather Service Station nearest to where the remains were recovered. The TBS was then used to predict PMI with various linear and loglinear regression models.

Results indicate that estimating PMI by first predicting ADD from the TBS and then using ADD in conjunction with temperature records to estimate a date of death has less mean error than directly predicting PMI from the TBS. Loglinear regression analysis shows that 79% of the variation in decomposition was accounted for by variation in accumulated degree-days. This research demonstrates that a quantitative approach to estimating PMI from decomposition can produce more precise estimates than using the traditional qualitative approach.

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