A82 Metric Identification Support Tool (MIST): A Statistically Based Instrument for Use in Medical Examiner/Coroner Offices to Support Personal Identification Results

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Learning Overview: The goal of this presentation is to provide attendees with a major update on the continuing development of MIST, a statistically based instrument designed for no-cost online access for Medical Examiner/Coroner (ME/C) offices to use in personal identification of unknown decedents. Attendees will be able to assess the potential of this method of analysis that quantifies circumstantial evidence to support identification outcomes for individual decedents and mass fatality cases when results from DNA and other methods are inconclusive or absent.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the current version of MIST and detailing the process by which pertinent circumstantial evidence pulled from medicolegal case information can be used in practice to mathematically assess the weight of this information in a personal identification case.

ME/C in the United States, who are responsible for the identification of unknown decedents under their jurisdictions, are hampered by the currently inadequate arsenal of identification methods. Most unidentified bodies receive a timely identification through fingerprints, dental records, or medical records, or the ME/C experience a longer turnaround time but receive successful results in cases requiring DNA analysis. However, many decedents remain unidentified for decades when the above-listed methods cannot be used or are inconclusive. In answer to this deficit, in 2016, the Disaster Victim Identification Subcommittee of the National Institute of Standards and Technology-sponsored Organization of Scientific Area Committees released a Research Need Request for "development of population-level likelihood values for circumstantial evidence to be used in support of human identification."[1]

MIST, introduced to an AAFS audience in 2020, is a method that quantifies the strength of the evidence collected by investigators (e.g., clothing, geospatial relationships of body location and residence, personal effects), as well as skeletal findings (e.g., demographic profile, anomalies, bony reactions to antemortem trauma or pathological conditions). In 2019, a database of qualitative information gathered from 5,000 de-identified medical examiner cases was submitted to the project for the development, testing, and validation of MIST. The results from the early MIST development process and an automated preview of the instrument were presented at the 2020 AAFS Meeting. Once fully developed and operationalized, MIST will be a valuable tool in personal identification that applies statistical weight to the available qualitative evidence.

Progress on MIST has continued over the past year. Methods have been modified to use fuzzy numbers and logic. Fuzzy mathematics was developed to help quantify everyday imprecision and measurement uncertainty; the seminal paper was by Zadeh.[2] For example, "decedent stature is 70" from a postmortem exam might be replaced by an estimation of height using a bell curve to describe uncertainty in the decedent's height. An eyewitness description of a missing person as "heavy-set" could be restated as "between 200 and 275 pounds." Imprecise descriptors like "red-headed" or "looked Hispanic" might also be quantified. Fuzzy logic is a mature discipline, reducing the time needed for further MIST development. In addition to the incorporation of fuzzy logic into MIST when comparing the features of a missing person and the features of a decedent, a measure of likelihood has been added, based on distance between the location of the body and the residence of the missing person. Research efforts now focus on: (1) how best to quantify imprecise verbal descriptions, and (2) using simulation to determine the best ways to combine multiple descriptive features into an overall quantification of matching that allows useful ranking of candidate missing persons to a decedent (or vice versa). Examples include geometric mean, minimax (rank by weakest matching feature), and maximin (rank by strongest matching feature).

Reference(s):

1. www.nist.gov/sites/default/files/documents/2016/08/29/osac_disaster_victim_identification_research_needs_assessment_form_-_contextual_id.pdf.
2. Zadeh, Lotfi A. Fuzzy sets. *Information and Control* (8) 1965:338-353.

Identification, Forensic Anthropology, Forensic Pathology

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