



## E16 Examining Potential Degradation Between Antemortem and Postmortem Fingerprints

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**Learning Overview:** After attending this presentation, attendees will understand the influence of health-related conditions on the deterioration of fingerprints between antemortem and postmortem collection.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by clarifying the effect of death and various antemortem health conditions on the quality of biometric data between living and postmortem scans.

Various medical conditions and the early decomposition process cause both internal and external deterioration of the human body. If fingerprint deterioration occurs between the time of antemortem and postmortem print captures, the viability of a positive identification could be compromised. This project is a first step in understanding the correlations between medical conditions, fingerprint degradation, and biometric data quality. Through this research, law enforcement and other agencies will begin to understand how a subject's prior medical conditions can inform collection protocol used for biometric identification and facilitate decision making on the best methods for obtaining a positive identification.

Biometrics are measurable physiological characteristics that are used to classify both living and deceased individuals. Research has indicated that fingerprints are comparatively the most successful biometric indicator for positive identification. Therefore, in this study, fingerprints were used as the primary indicator to examine biometric degradation and quality data acquisition from an antemortem to a postmortem scan. For the purposes of this study, "quality data" refers to a threshold met by a ratio of numerical scores provided by two types of biometric scanning technologies. Fingerprint quality was determined by the National Institute of Standards and Technology (NIST) Fingerprint Image Quality (NFIQ) v.2 algorithm where prints are scored on a 1–5 scale, with 1–3 denoting adequate to excellent prints and 4–5 denoting poor quality prints.

Biometric scanning technologies have been used to capture all ten digits, where applicable, of 395 living predonors (individuals who have pre-registered to donate their bodies to the Forensic Anthropology Center). Of these 395 individuals, 15 are now deceased and had their postmortem images captured upon their intake into the Bass Body Donation program. For the purposes of this study, quality scores were relied upon to compare the antemortem captures to the companion postmortem images. Comparing the antemortem directly with initial postmortem capture determines if print degradation occurred between the living and deceased scans.

This study examines the correlation between certain mortality-inducing health conditions (e.g., cancers, diabetes, heart disease, pulmonary disease) and the time (in months) between the living scan and death with the change in quality of biometric data. In addition to the antemortem fingerprint images, Cause Of Death (COD) and date of death for the 15 individuals in this study were collected from the Forensic Anthropology Center's donation database. The goals of this study were to examine: (1) if any changes in fingerprint quality occur between the antemortem and postmortem captures; and (2) if so, could such changes be a result of known health conditions.

The preliminary results of this study show that fingerprint quality is generally consistent through end stages of life. Of the 40% of individuals ( $n=6$ ) who died of cancer, only one individual showed degradation in quality, while another individual had a slight improvement in quality. The other four individuals exhibited no change. Thirty percent of individuals ( $n=5$ ) died of heart-related conditions and two showed slight print degradation. All other postmortem prints remained of the same quality as their antemortem counterparts. The time between the antemortem scan and death similarly does not affect the quality of fingerprints. There was no change in the 30% ( $n=5$ ) of individuals that passed a year after their antemortem captures. However, two of the 30% that passed less than six months after their living scans showed slight degradation. Of the five individuals that passed seven months to one year after antemortem scans, two showed slight degradation.

This study has yet to show any apparent trends in the relationship between time between antemortem and postmortem scans or health-related conditions on the degradation of print quality between living and deceased print scans; however, analyses are ongoing. This study builds upon previous work and continues to support the utility of physiological biometric identifiers to obtain positive identifications in postmortem contexts. Postmortem biometric research has the potential to make important contributions to forensic anthropology and the law enforcement, military, and medicolegal communities.

### Biometrics, Antemortem vs. Postmortem, Health Conditions