H137 Establishing Organ Weight Norms for Caucasian and Minority Populations Using Autopsy Data From Two Institutions and the Evaluation of Autopsy Reports Using a Novel Free-Text Analysis Tool

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The goal of this presentation is to review organ weight data from adult autopsies performed across multiple demographics at two different institutions. A reference range of the expected weight for each organ examined, taking into account Body Mass Index (BMI), age, race, and sex will be presented. In addition, this presentation will illustrate the utility of macros to automate the review of autopsy reports for natural disease diagnoses.

This presentation will impact the forensic science community by providing a reference range of normal expected organ weights for unique demographic populations. This presentation will also underline the utility of developing custom programs to analyze reports.

Methods: Demographic and organ weight data was collected from 13,283 autopsies performed between 2013 and 2016 in the state of New Mexico, Office of the Medical Investigator (OMI) and from 2011 to 2016 from Birmingham, AL, Jefferson County Coroner/Medical Examiner Office, University of Alabama at Birmingham (UAB). Organs examined included brain, heart, lungs, kidneys, spleen, and liver. To evaluate adult organ weight norms, cases were excluded if they fell into any of the following categories: age less than 18 years, natural, pending or undetermined manner of death, documented postmortem changes, or greater than 48 hours between death and autopsy. In total, 2,552 cases were included in this study. Specific organs were excluded if there was evidence of trauma or natural disease that could influence organ weight (i.e., myocyte hypertrophy and heart weight). Lung weights from overdose cases were removed because of the frequency of pulmonary edema. Additionally, to better accomplish the task of removing natural disease, 400 OMI autopsy reports from 2013 were reviewed manually to flag diagnoses that would impact organ weight. After a list of diagnoses was established, a script (macro) in Visual Basic for Applications (VBA) was developed in Excel® to evaluate the same group of autopsies for natural disease. This macro was evaluated for accuracy against the manually flagged cases. Once the list of cases with normal organs (no disease, no trauma) was identified, Statistical Analysis System (SAS) was used to perform statistical analyses on the demographics and organ weights, with p-values of 0.05 or less considered statistically significant.

Results: Preliminary data indicate that OMI and UAB serve different populations and that all races, except Asian/Pacific Islander, were represented: OMI had 44.4% White non-Hispanic, 38.5% White Hispanic, 14.6% American Indian, and 2% African American, while UAB had 58.7% White non-Hispanic, 39.3% African American, and 2% White Hispanic. The OMI decedents were older than those at UAB ($p<0.0001$) and were significantly more obese ($p<0.0001$). Manner of death was statistically significant with a higher percentage of homicides at UAB (24.1%) than OMI (11.6%). BMI significantly affected organ weights, especially the liver and heart, which tended to be markedly heavier. Male organ weights were significantly heavier than females, regardless of race. African Americans had the largest mean heart weight (364 grams) while White non-Hispanics had the heaviest livers (1,709 grams).

The VBA script evaluated OMI autopsy reports and was in strong agreement (94.9% across flagged organs) with the method of manually flagging cases for natural disease. A sampling of 20 UAB autopsy reports correlated similarly. Kidney conditions were missed most often (92% agreement). Missed diagnoses were typically the result of a missing phrase in the program's vocabulary describing a diagnosis; for example, fatty liver was initially missed since the program scanned for steatosis. The script also struggled with misspelled words in reports. Of note, manually flagging cases missed several diagnoses (21 on heart alone) that the macro identified.

Conclusion: This study is the first to analyze how healthy organ weights are affected by multiple demographics, including race, BMI, age, and sex. Organ weights were most significantly increased with higher BMI and male sex. Additionally, this study developed a macro that was effective at flagging natural disease within organs. With this information, equations can be developed to predict normal weights on the majority of organs within these demographics and can establish average weights on a plethora of natural disease flagged by the macro. Additionally, there are histologic correlations for each organ; for example, correlations between histologic evidence of hypertrophic myocytes and interstitial fibrosis can be made to heart weight. Finally, future studies are planned to incorporate this organ weight data with Computed Tomography (CT) imaging data.

Organ Weight, Reference Calculator, BMI

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