# Death certificates vs. autopsy reports: misclassification of causes of death among USTUR Registrants

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## Abstract

The U.S. Transuranium and Uranium Registries performs autopsies on each of its Registrants as a part of its mission to follow up occupationally-exposed individuals. This provides a unique opportunity to explore death certificate misclassification errors, and the factors that influence them, among this small population of former nuclear workers. Underlying causes of death (UCOD) from death certificates and autopsy reports were coded using the 10th revision of the International Classification of Diseases (ICD-10). These codes were then used to quantify misclassification rates among 275 individuals for whom both death certificates and autopsy reports were available. The ICD-10 categorizes diseases using 22 chapters. Death certificates incorrectly identified the UCOD ICD-10 disease chapter in 25.5% of cases. The misclassification rates for the most common disease chapters were: 9.9% neoplasms, 16.4% circulatory, 37.5% nervous system, 59.3% respiratory, and 18.7% external causes. A logistic regression revealed that both clinical history and the use of autopsy findings have a statistically significant influence on the match rate. Calculating the odds ratio for clinical history indicates that the odds of a match were 2.7 times higher when clinical history was mentioned on the autopsy report than when it was not. Similarly, when cases in the unknown autopsy influence group were excluded, the odds of a match were 4.0 times higher when death certificates were completed using autopsy findings than when autopsy findings were not used.

## U.S. Transuranium and Uranium Registries

- Research program that studies biokinetics of actinides in the human body.
- Former nuclear workers (Registrants) donate organs and tissues, or entire bodies, for postmortem radiochemical analysis.
- Autopsy is performed on each Registrant.

## Background

- Effort is often invested into improving the reliability of epidemiological findings by improving dose estimates. However, the quality of mortality data is also important.
- Gold and Kathren (1998) studied causes of death among the first 260 autopsied Registrants.

## Questions

- What is the level of agreement between death certificates and autopsy reports?
- How does the use of autopsy findings to complete death certificates influence match rates?
- How does availability of clinical history when completing autopsy reports influence match rate?
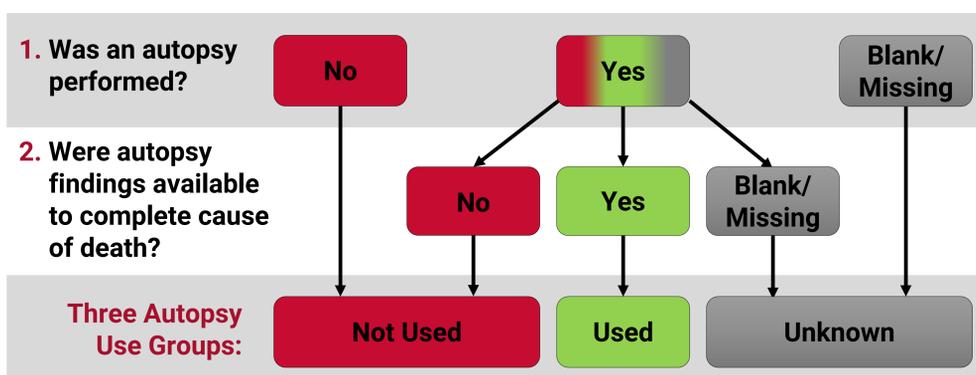
## Case Selection
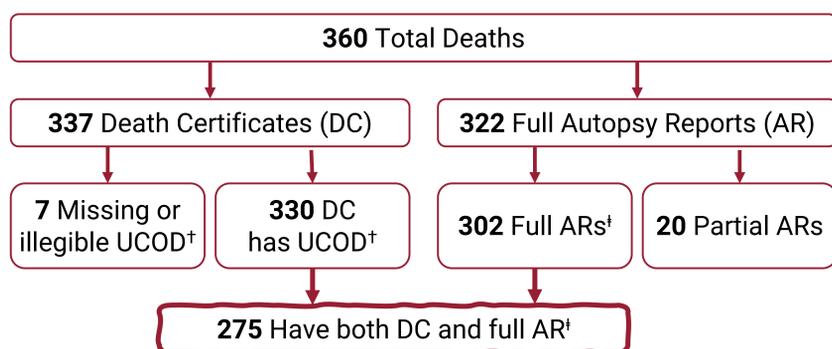


†UCOD = Underlying cause of death
‡Full AR = Multipage report containing gross descriptions of internal findings for various organs or organ groups

## Autopsy Use Groups

Cases were categorized according to whether autopsy findings were used to complete the death certificates.
- Two death certificate fields shed light on this…



## Misclassification Metrics

If the underlying cause of death on the death certificate belonged to the same International Classification of Diseases Revision 10 (ICD-10) disease chapter as the underlying cause on the autopsy report, the case was coded as a match.

$$\text{Mismatch Rate} = 1 - \frac{Number\ of\ Matches}{Total\ Number\ of\ DCs}$$

$$\text{Over classification} = \text{False Positive Rate} = \frac{Number\ of\ False\ Positives}{Total\ Number\ of\ Non\ Disease\ on\ ARs}$$

$$\text{Under classification} = \text{False Negetive Rate} = \frac{Number\ of\ False\ Negatives}{Total\ Number\ of\ Disease\ on\ ARs}$$

## Results – Mismatch Rates and Logistic Regression

Significance codes were calculated using a logistic regression where Mismatch was the dependent variable and the independent variables were AR Used, Clinical History, Circulatory, Respiratory, External Nervous, and Other Diseases. AR Use Unknown cases were excluded from the regression.

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

### Top 5 disease categories



**25.5%** Mismatch rate All cases
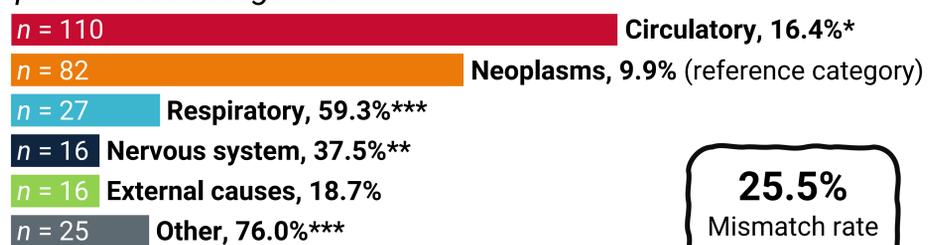
### Autopsy Report Use Categories



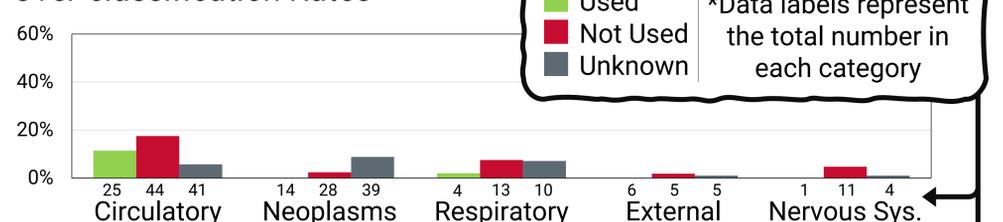Odds ratio = 4.0 (AR used vs. AR not used)
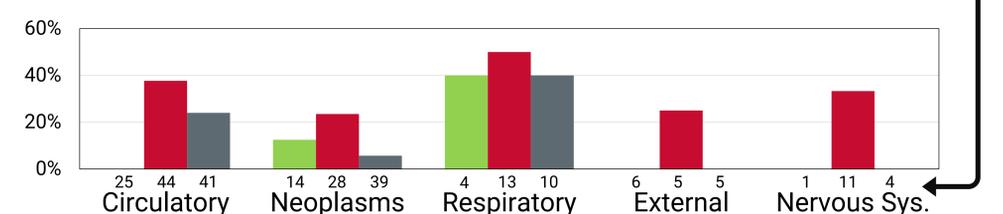
### Clinical History



Odds ratio = 2.7 (Clinical history vs. No clinical history)

## Misclassification Rates

### Over-classification Rates



### Under-classification Rates



## Conclusions

- This all-autopsied population of former nuclear workers provides insight into the rates of misclassification in a major target population for epidemiological studies.
- There was significant misclassification of underlying causes of death, when death certificates were compared to autopsy reports.
- Use of autopsy findings to complete death certificates and availability of clinical history to pathologists resulted in higher match rates, emphasizing the vital role of good communication between physicians and pathologists.

## Reference

Gold B, Kathren RL. Causes of death in a cohort of 260 plutonium workers. Health Phys. 1998;75(3):236-40. doi: 10.1097/00004032-199809000-00001