International Journal of Population Data Science

Journal Website: www.ijpds.org

A methodological framework to account for missing laboratory data when incorporating test results into population-based mortality and morbidity risk estimation

Robert Talarico[1], Daniel McIsaac[1], Carl van Walraven[1], and Meltem Gulsum Tuna[2]

[1]Ottawa Hospital Research Institute, Ottawa, Canada; ICES, Toronto, Canada
[2]ICES, Toronto, Canada; Ottawa Hospital Research Institute, Ottawa, Canada

Background

Population-level laboratory data have a strong and consistent association with health outcomes such as mortality However, a fundamental problem with integrating laboratory tests into population-based mortality risk prediction is missing data. Lab tests are usually ordered by physicians to diagnose health issues. This bias impacts methods for dealing with missing data, all of which assume that data missingness is independent of outcomes.

Objectives

To develop a methodological approach to estimate population-level associations of laboratory test order status and test results with mortality risk and return more accurate mortality risk estimates for an entire population. Methods: We used linked health administrative data consisting of all adult Ontarians in 2019 and included 24 laboratory tests. The primary outcome was one-year mortality. Statistics Canada life tables were used to assign baseline one-year mortality probabilities. We fit iterative two-staged logistic models across all tests and updated Statistics Canada life tables.

Results

We included over 10.5 million Ontarians, in whom 1.1% died within one-year. 54.7% had $\geq$1 lab test ordered. Those in whom a test was ordered had a 500-fold greater mortality risk compared to those without testing. The final model had excellent performance (c-statistic = 0.911). Furthermore, 66% of updated life table risk groups had a mortality risk lower than that based on Statistics Canada, where the median (IQR) increase in estimated life expectancy was 1.6 (−0.8,7.5) years.

Conclusion

Methods to incorporate population-level laboratory data into mortality prediction models results in substantially improved prediction capabilities. Both test order status and test value influence death risk.

https://doi.org/10.23889/ijpds.v11i5.3551