International Journal of Population Data Science

Journal Website: www.ijpds.org

Spatial epidemiology of premature mortality in Ontario, Canada

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Introduction

Geographic disparities in health indicators, such as premature mortality, may reveal area-level weaknesses in health system performance. Monitoring geographic trends can therefore have powerful implications for system evaluation and planning. However, attempts to understand patterns of population health can be complicated by underlying regional differences in demographics and behaviours.

Objectives and Approach

This study aimed to identify regional disparities in premature mortality (defined as death before age 75), and to investigate how fully these disparities can be explained by population-level characteristics. Ontario's 76 administrative Local Health Integration Network (LHIN) sub-regions, which vary in geographic and population size, were analyzed using linked population-level data from the Institute for Clinical Evaluative Sciences and Cancer Care Ontario.

Spatially structured, sex-stratified Bayesian hierarchical models were used to estimate standardized mortality ratios (SMRs) for each LHIN sub-region in the 2011-2015 period. Models were adjusted for key population-level demographic and behavioural risk factors.

Results

Large disparities in premature mortality presented at the sub-region level in males and females. Low premature mortality clustered around large, urban population centers in Ottawa and Toronto. Premature mortality was comparatively higher throughout the rest of the province, particularly in northern and southeast Ontario.

Higher prevalence of material deprivation, overweight and obesity, sedentary behaviour, and smoking were all significantly ($\alpha=0.05$) associated with elevated premature mortality risk, while increased alcohol consumption and immigrant population were associated with decreased risk.

Adjusting for model covariates reduced variance of sub-region SMR estimates by 87% in males and 89% in females.

Population-level characteristics thus explain a large proportion of geographic inequality in premature mortality. However, residual spatial variation suggests that systematic regional differences in premature mortality extend beyond population-level traits.

Conclusion/Implications

This study represents a novel application of small-area analytic techniques to Ontario mortality data, made possible by comprehensive linkage of vital statistics. The findings highlight the importance of population composition to geographic disparities in health. Future work should investigate the influence of system-level factors in areas with elevated premature mortality.