BAYESIAN METHODS FOR THE ASSESSMENT OF MEASUREMENT ERRORS FOR DATA-SPARSE POPULATION-PERIODS WITH THE USE OF MULTIPLE DATA SOURCES

Emily Peterson

Post Doctoral Fellow
Department of Biostatistics and Bioinformatics
Emory University, Atlanta, GA
emily.nancy.peterson@emory.edu

September 22, 2020

Abstract

Population level demographic data are often subject to substantial measurement error due to several factors including, but not limited to, complex sampling schemes, reporting errors, and/or underreporting of certain populations. Accuracy of error-prone data sources can be assessed by comparing such data to gold standard data for the same population-period. A challenge arises when dealing with population-periods that suffer from data sparsity, and differing levels of uncertainty with the use of multiple data sources. We present Bayesian methods for assessing multiple sources of error across different population periods and generalizing those settings where gold-standard data are sparse or lacking. Firstly, we present a Bayesian bivariate random-walk model to assess misclassification errors of maternal cause of death reporting in civil registration vital statistics data. Population level maternal mortality data suffer from reporting errors due to misclassification of cause of death and/or misclassification of death status. We use a sequential modeling approach to estimate sensitivity and specificity for countries without gold standard data and to incorporate temporal structure of misclassification parameters. Secondly, the United States Census Bureau reports small area estimates of population size based on complex sampling methodology from multiple surveys. Higher geographic resolution estimates and sampling schemes results in increased levels of sampling error associated with each data source. We present a Bayesian hierarchical Gaussian process model to assess data-source specific errors in small area population estimation using United States census data for 159 counties in Georgia.

[0]Work in collaboration with Emory University, University of Massachusetts Amherst, World Health Organization, Harvard University, and Imperial College London