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A bayesian way to correct for measurement error in drug risk estimates from EHR data.

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Introduction

Data from electronic medical records is now readily available and records information needed in pharmacoepidemiological studies not usually found in administrative data such as risk factors and biometrics. Yet, EMR data leads to measurement error due to primary non-adherence. Bayesian bias correction could provide corrected estimates from administrative data.

Objectives and Approach

We present a method for correcting risk estimates from EMR data using linked data. In our example, we estimate the risk of cardiovascular events from oral-hypoglycemics in patients with type-2 diabetes in Boston, Quebec, and the UK between 2009 and 2012. Using linked EMR and administrative data in Quebec, we compute a positive and negative predicting value of prescription on dispensation for each class of oral-hypoglycemics. The cardiovascular risk is then analysed using a bayesian Weibull survival model adjusted for potential confounders. A similar model is then computed that accounts for exposure measurement error using the PPV and NPV.

Results

The Quebec and Boston cohorts have similar sizes with 1197 and 2346 patients, but the UK was bigger at 41370 patients. In Quebec's data, there were important differences in PPV and NPV by class of oral-hypoglycemics with PPVs for Biguanides at 0.81, Sulphonylureas at 0.65, and others at 0.50. The pattern for NPV differed with the same classes having respectively values of 0.56, 0.97, and 0.99. Estimates from the naïve model are typical of similar analysis but compared to their correction, they were generally overprecise and biased towards the null. The adjusted estimated were adequately representing the increased uncertainty with hazard ratios for Sulphonylureas going from 1.72 (1.22, 2.41) to 3.19 (1.36, 5.93), and from 1.09 (0.86, 1.39) to 1.05 (0.45, 2.16) for no drugs

Conclusion/Implications

Bayesian adjustment for measurement error allowed us to use linked data to regenerate uncertainty and to correct the bias in our risk estimates. Our approach was impacted by the observed low predictive value of prescribing, by reduced transportability of our PPV and NPV estimates, and other sources of bias.

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