Spatio-Temporal Prediction Modeling of Influenza Cases in Edmonton, Alberta

Background
A timely, proactive response to influenza epidemics is essential to prevent the spread of disease. This can be facilitated through the use of syndromic surveillance systems, such as the Alberta Real Time Syndromic Surveillance Net (ARTSSN). ARTSSN monitors HEALTHLink Alberta (HL) calls, emergency departments (ED) visits, school absenteeism reports, and laboratory test results for the Edmonton area to forecast the likelihood of future health events. Using ARTSSN data, we developed statistical models to predict influenza patterns and trends in Edmonton, Alberta.

Methods
We analyzed HL calls (2003-2009) and ED visits (2004-2009) related to cough, as a marker for influenza, using spatio-temporal modeling and cross-validated predictions, focusing on predicting peak influenza rates. In addition, we examined geographic spread based on the Forward Sortation Area of residents’ postal codes.

Results
In total, 34,796 ED visits and 25,493 HL calls fit our definition of influenza. Modelling these data without spatial or temporal correlations showed the seasonal trends. However, incorporating spatial and temporal correlations dramatically improved the models’ predictive abilities. Our models were able to detect peak days with over 30 influenza-related HL calls/day, 7 days ahead, using 2 weeks of data (sensitivity=0.667, specificity=0.939) and peak days with over 32 influenza-related ED visits/day, 7 days ahead, using 2 weeks of data (sensitivity=0.577, specificity=0.932).

Conclusions
We are working to improve the predictive ability of these models so they will ultimately enable ARTSSN to forecast the probability of future influenza epidemics, providing valuable information to health care workers, public health professionals, and policy makers.