ASSESSMENT OF THE TEMPORAL STABILITY OF LAND USE REGRESSION MODELS FOR TRAFFIC-RELATED AIR POLLUTION

Rongrong Wang, *The University of British Columbia, Canada*
Sarah Henderson, *British Columbia Centre for Disease Control, Canada*
Ryan Allen, *Simon Fraser University, Burnaby, Canada*
Michael Brauer, *The University of British Columbia, Canada*

Background and Aims: Land-use regression (LUR) models have been used to estimate exposure to traffic-related air pollution in epidemiologic studies, based on the assumption that the spatial patterns of pollution are stable over time. Under this assumption, a LUR model developed from a particular time point can be applied to other time points. However, this assumption of temporal model stability has not been adequately examined, and has specific relevance to cohort studies where models are developed in specific years and then applied to cohorts over periods of ~10 years.
Methods: A LUR model for annual average NO_2 in Metro Vancouver was developed in 2003, based on measurements at 116 locations (Henderson et al 2007). In 2010, we repeated measurements at the same locations and developed a new model using updated data for the same predictor variables. The temporal stability of LUR models over a 7-year period was evaluated by comparing model predictions and measured spatial contrasts between the two time periods.
Results: Annual average NO_2 concentrations decreased from 2003 to 2010 at 78% of the 73 measurement sites that were identical for the two periods. The correlation between measurements at these sites was 0.78 with a mean (sd) decrease of 1.3 (1.7) $\mu g/m^3$. LUR models from 2003 and 2010 explained 52% and 66% of the observed spatial variation, respectively. The 2003 model explained 52% of variability in 2010 measurements (forecast), as much as it did in the 2003 (concurrent) measurements. The 2010 LUR model explained 51% of the variability in the 2003 measurements (back-cast), less than it did in the 2010 measurements; however, the back-cast explains nearly the same amount of variability in the 2003 measurements as did the original (2003) model.
Conclusions: These results support the validity of applying LUR models to cohort studies over periods as long as 7 years.
References:

Henderson SB, Beckerman B, Jerrett M and Brauer M. Application of land use regression to estimate long-term concentrations of traffic-related nitrogen oxides and fine particulate matter. Environ Sci Technol. 2007; 41:2422-8.