

Title

*A multilevel simultaneous equations model for within-cluster dynamic effects,
with an application to reciprocal relationships between
maternal depression and child behaviour*

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Abstract

We propose a general multilevel simultaneous equations model for studying dynamic interdependencies between individuals in a cluster, for example members of a family or employees in an organisation. The model includes lagged and cross-lagged terms to allow for effects of one individual's outcome at time $t-1$ on the change in another individual's outcome between times $t-1$ and t , while allowing for the possibility that the outcomes of members of the same cluster may be influenced by a common set of unmeasured time-invariant cluster characteristics. We show how the model can be framed as a type of multilevel multivariate model and estimated using multilevel modelling software.

Our approach is illustrated in an analysis of maternal depression and child delinquency using longitudinal data from the Avon Brothers and Sisters Study. We differentiate between reciprocal influences between a mother and her children, as well as reciprocal influences of siblings on one another, allowing effects to depend on characteristics of parent, child and sibling pair. The multilevel model allows for residual variation in mother and child outcomes at the occasion, individual and family levels, and residual correlation between mother and child outcomes due to shared unmeasured environmental and genetic factors. The model can also accommodate mixed family sizes.

* Joint work with Jennifer Jenkins Department of Human Development and Applied Psychology, University of Toronto and Jon Rasbash Centre for Multilevel Modelling, University of Bristol