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Exploratory Analysis of Height-for-Age in Guatemala; An Examination of Potential Spatial and Environmental Components

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Short Abstract:

Recently demographers are exploring the role of community effects and the use of GIS for understanding contextual variables associated with malnutrition. In this poster presentation we begin with a geographic display of the spatial pattern of mean height-for-age z-scores (HAZ) for 373 PSUs (based on 6,308 children) from the 2002 National Maternal and Child Health Survey of Guatemala. Multivariate OLS regression on HAZ is carried out to obtain predicted HAZ and residuals based on individual characteristics. Mean residuals are geographically displayed and spatial statistics techniques applied to identify spatial patterns. Visual examination indicates the importance of altitude, geographic accessibility, and municipal level measures of poverty. These variables are extracted and assigned to the individual level data, and used in multilevel regression. Results indicate the important role of ethnicity, maternal and paternal education, work activities of father, and demographic characteristics of child at the individual level as well as the contextual role of access to local services, altitude, and poverty.

Long Description:

Near half (49.2 percent) of Guatemalan children ages 3 to 59 months suffer from retardation in growth as measured by "Height-for-Age," and are considered "stunted." Research in experimental settings indicates that retarded growth is the cumulative effect of prolonged inadequate food intake and/or from recurrent episodes of illness. Typical socio-demographic analytical approaches with household survey data focus on individual and household characteristics (SES, ethnicity, maternal education, and household infrastructure) associated with stunting, and occasionally take into account food in-take. More recently, demographers are exploring the role of community effects (Fotso & Kuate-Defo, 2005), and the use of GIS (Larrea & Kawachi, 2005; Mueller et. al., 2001) for understanding contextual and spatial patterns beyond individual and household predictors.

Data for individual level analyses is from the 2002 National Maternal and Child Health Survey of Guatemala. Six thousand, three hundred and eight (6,308) children, ages 3 to 59 months, were measured during the course of survey work in 373 primary sampling units (PSUs). Z-scores for height-for-age (HAZ) are calculated based on NCHS reference population. Analysis begins with standard OLS regression on HAZ by a series of household, maternal and child variables. Predicted and residual values associated with each case are aggregated at the PSU level to explore the spatial patterns in a geographic information system. Theissen polygons were recreated around each of the 373 segment points and different nearest neighbor techniques (e.g. "Getis-Ord" and "local Moran I") are used to identify areas with higher- and lower-than-expected (based on individual characteristics). The emerging patterns are inspected and compared with other environmental and socioeconomic data for Guatemala.

The geographic information systems (GIS) data are from the International Center for Tropical Agriculture (CIAT) and Central American Commission on Environment and Development (CCAD), and deal with environmental phenomena: precipitation, elevation, ecological zones, earthquake risk, climate risk, forest areas at risk, and an index of accessibility to community services. An "Index of Poverty," at the municipal level, from the Guatemalan Secretariat for Planning and Programming (SEGEPLAN, 2001) is also displayed for visual comparison. Analysis is carried out iteratively between OLS regression analysis and geographic display of predicted and residual estimates of HAZ, in the development of a final model. Results indicate the important role of ethnicity, maternal and paternal education, work activities of father, demographic characteristics of child at the individual level as well as the contextual role of access to local services, altitude, and municipal levels of poverty.

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Mueller, I, P. Vounatsou, B.J. Allen and T. Smith
2001 "Spatial Patterns of Child Growth in Papua New Guinea and Their Relation to Environment, Diet, Socio-economic Status and Subsistence Activities," Annuals of Human Biology, 28(3): 263-280.

Pebley, Anne R. and Norren Goldman
1995 "Social Inequality and Children's Growth in Guatemala," Health Transition Review 5: 1-20.

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2001 Mapas de Pobreza de Guatemala. Un Auxiliar para Entender el Flagelo de la Pobreza en el Pais., Guatemala. August, 2001. (http://www.segeplan.gob.gt/docs/ERP/pobreza/)