Exploring Social Disorganization:
A Multilevel Analysis of Child Mortality in Metropolitan São Paulo, Brazil

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Introduction

Widespread interest in the association between child health, family, and community signals to the importance researchers place on environmental surroundings that affect health. Prior research suggests that individual characteristics and environmental factors vary over space and that this variation has been overlooked when community social contexts are excluded. These studies have attempted to rectify this oversight by examining social environmental factors, which are associated with community variations in health outcomes and well-being, within a social capital framework (Chandola 2001; Franzini et al. 2005; Kawachi et al. 1999; McCulloch 2003; Sundquist et al. 2005; Wen et al. 2005). A handful of recent health studies, on the other hand, examine the effects of social disorganization, a prominent theory of delinquency and a counterpart of 'social capital,' to gauge the both individual and community health. However, these ecological theories have rarely been tested outside the context of the United States and Western Europe.

In this study, we investigate the effects of local environmental characteristics as indicators of collective well-being or collective disadvantage in predicting child mortality (child death counts of individual mothers), within a social disorganization theoretical framework. Child mortality is an indicator of individual's ultimate health status in the highly unequal, but rapidly changing Brazilian urban society, Metropolitan São Paulo. We employ a multilevel negative binomial regression model to predict individual mother's number of children lost, which are nested in the geographic distribution of higher-level (aggregate) structural factors. Using a multilevel data derived from various sources, we examine how structural variables that are indicative of ineffectual community organization, which earlier studies on health and communities found to be important, contribute in predicting child life expectancy across geographic domains. Our objective is to further understand how the effects of individual-level deprivations on child mortality could be mitigated or enhanced by community-level characteristics while also considering the mechanisms that produce healthier communities.

Child Mortality and Ecological Context

Health status is an outcome measure that can be used to measure inequality in standard of living, available resources and environment, and health-related behaviors. Child health is a particularly sensitive indicator of disparity in level of mothers' quality of life and health, reflecting the accumulated impact of deprivation throughout mothers' life on their children. Thus, child mortality has been used as an outcome measure in assessing inequality in the standard-of-living, available environmental resources, and health-related behaviors.

While the demographic literature is replete with studies that point to the importance of household characteristics and individual socioeconomic background on child mortality (Desai 1992, Montgomery et al. 2000; Astone et al. 1999; Hummer et al 1993; Lovell and Wood 1998; Sastry 1998; Burgard 2002), there has been a growing interest in geographic variations of child mortality. Mothers' place of residence, typically measured as a rural-urban dichotomy, has been employed as a covariate of the major social factors of child mortality, such as income and education, and as a proxy measure for living conditions in

illustrating both public and medical health provisions. The significance of community attributes such as infrastructure levels and ecological setting (e.g. educational services, healthcare facilities, and the prevalence of city services) on child mortality have been addressed in many earlier studies. Furthermore, complementary relationships between child mortality and covariates may be altered by changes in community characteristics (Sastry 1994, 1995, 2002). At the same time that interest has increased among researchers in the geographic and community characteristics of health, social capital been used as a possible explanation of the findings with respect to inequalities in health and for understanding the relationship between income inequality and health (Kawachi et al. 1999; Almeida-Filho et al. 2003; Pearce and Davey-Smith 2003), particularly since contextual effects remained after controlling for a variety of individual factors (Leclere et al. 1998; Congdon and Curtis 1997).

Theoretical Perspectives: Social Disorganization and Social Capital

Although social capital theory has been studied quite extensively in the health literature, the inspiration for this study draws from the social disorganization, including Sampson's (1999) conceptualization of "collective efficacy." The basic idea underpinning social disorganization is the (in)ability of a community to manifest common values or ideals in order to adequately maintain informal social controls or to work out community problems (Kawachi et al., 1999, Sampson and Grove, 1989, Bursik, 1988; Kornhauser, 1978). Neighborhoods characterized by severe economic deprivation, population heterogeneity and migration, and high numbers of young males are thought to experience higher rates of disorder, health problems, and delinquency since they are unable to effectively control individual community members, particularly juvenile males. Clifford Shaw and Henry McKay, the original authors of social disorganization, came to this conclusion in their investigation of economically disadvantaged communities in twenty-one U.S. cities (1942). They found that it was the "persistent contextual effects" of the community that differentiated community crime rates because, while these communities remained poor, high population turnovers and changes in ethnic composition did not vary community-specific delinquency rates (Kawachi, 1999: 721).

Social disorganization theory is premised on a number of key interrelated assumptions. First, etiological explanations of delinquency can only be understood by examining the structural ecological contexts in which behavior occurs as well as individual causes. Second, poverty or economic deprivation correlates to high population turnover since people will move to better neighborhoods at the first opportunity. Third, informal social controls are difficult to establish in places where individuals do not have a stake in or are uninterested in remaining (Bursik, 1988; Kornhauser, 1978). Fourth, ties that bind people in a community cannot develop or last when such communities are destabilized by rapid population turnover (Sampson et al., 1997) or they are in "constant state of flux" (Bursik, 1988: 21). Last, population heterogeneity disrupts the collective development of people coming together to defeat community problems.

Beyond the particulars of social disorganization theory, studies examining the geographic distribution of macro-structural factors on individual outcomes have been of principle concern to urban sociologists and demographers. There is an abundance of evidence in the criminology literature that social disorganization is associated with relative deprivation (income inequality) and, is an indicator of low social capital, which can be expected to explain community variations in health and well-being (e.g., Bursik, 1988, Sampson, Raudenbush, and Earls, 1997; Kawachi, et al. 1999). In fact, variation in community differences to collectively organize for an order and well-being maintaining function has been

linked to diverse array of negative health outcomes at the community and individual level. Research in this area includes studies on low birth weight, elderly mortality, psychological stress, drug abuse, and serious illness such as coronary heart disease (Boardman et al. 2001; Chandola, 2001; Gee et al., 2004; Sunquist et al., 2006; Kawachi and Berkman, 2003; Leclere, 1998; Mohan et al., 2005; Ross and Moirowsky, 2001; Wen, et al., 2005).

Methods and Data

This study uses multilevel data composed of individual/household-level variables and community-level characteristics such as population (racial) dissimilarity, unemployment rate, migrant rate, female household heads rate, health institution, educational institution, crime, and transportation (see Table 1) derived from multiple sources (Instituto Brasileiro de Geografia e Estatística 1999, 2000, 2004; Secretaria da Segurança Pública 1999; Fundação Sistema Estadual de Análise de Dados 1999). Our analysis includes all women aged between 20-34 who have at least one child in the Municipal of São Paulo. The municipal of São Paulo is composed of 96 census districts and 79,721 women.

Table: Explanatory Variables Used in Statistical Analysis of Child Death Counts

LEVEL 1: INDIVIDUAL CHARACTERISTICS	LEVEL 2: COMMUNITY ATTRIBUTES
OFFSET: Total Child Ever Born	**SOCIAL ORGANIZATION INDICES**
	% Urban Areas
DEMOGRAPHICS	Average of Years of Education
Mother's Age (Years)	Average of Years of Living
Place of Residence (Urban/Rural)	Female Household Head
Race: White (ref.), Afro-Brazilian, Asian	% Unemployment
	% Migrant
SOCIOECONOMIC STATUS	Population (Racial) Dissimilarity Index
Mother's Education (Years)	% Juvenile
Mother's Income (R$)[1]	Murder Rate
Job Situation (Working/Not Working)	Burgrary Rate
Marital Status (Married/Unmarried)	Drug Trafficking
PROXIMITY/CONNECTIVITY	**COMMUNITY CAPITAL/HEALTH SERVICES**
TO NEIGHBORHOOD	% Water
Nativity (If born in the same municipal)	% Sewage
Years of Residence	% Electricity
Water Supply (If piped into residence)	% Trash Collection
Sewage System (If connected to residence)	% Roads/Street Paved
Electricity	% Street Lights
	# Prep Schools (per 1000 students)
	# Primary Schools (per 1000 students)
	# Public Health Institutions (per 100,000)
	# Private Hospitals (per 100,000)
	# Beds per Hospital (per hospital)
	# Specialized Clinics (per 100,000)[2]

Notes: [1] Currency units are adjusted to Brazilian Real (current currency) following the methods of Paulo de Martino Jannuzzi

[2] Number of adult males [15] and adult females [16] within household except for family members

[3] Number of obstetricians and gynecologists

We employ the multilevel negative binomial regression to examine variations in child mortality between individual mothers and between communities. Multilevel models have been used elsewhere to

understand how causal effects of community characteristics on child outcomes, account for the correlation among observations measured at the same level (Cameron and Trivedi, 1986; Goldstein 1995, 2003). Multilevel negative binomial model functions by allowing for between individuals random variation of the expected number of events, namely child death counts in this study. The assumption behind the model is that the set of parameters represent the situation in every part of the study area, namely, global statistics which are spatially stationary. An explanatory variable might be highly relevant in one area but seemingly irrelevant in another or parameters describing the some relationship might be negative in one area but positive in another (Goldstein 2003; Fotheringham et al. 2002). We may assume that the relationships between child mortality and causal factors vary across space. In order to more precisely measure contextual effects reflecting local conditions, the issue of spatial stationality has to be solved by employing multilevel regression models with negative binomial approximation. Multilevel results will be obtained using iterative generalized least squares estimation with first order marginal quasi-likelihood approximation in a statistical software package, MLwiN (Goldstein et al. 2005).

Expected findings

Our challenge in this study is to figure out if social environmental factors, including crime related indices, are relevant in explaining child survival chances and community variations. Although the individual level characteristics have significant effects on child mortality in contemporary Brazilian society, we expect to find that areas with relatively higher levels of social disorganization represented by area crime rates, population dissimilarities (race) and stability of community (average years of residence as stability of community, percentage migrant) are associated with child mortality.

We will present maps overlapping the predicted child mortality aggregated at the community-level (district) with several community-level predictors, which are significant in multilevel analyses for identifying vulnerable population groups and areas, as well as their community characteristics that allow us to understand how individuals, areas, and causalities are related visually.