Exploring the Meaning of Context for Health:

Community Influences on Child Nutritional Status in South India

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Abstract

Much research attention has been devoted to community effects on health. The work on neighborhood effects defines communities as spatial units, while the work on social groups, such as race or caste, segregates individuals according to shared histories or identities. Using data from a unique "natural experiment" in South India, we use multi-level modeling to examine both neighborhood and caste contexts in an effort to disentangle which of these influences is more important for child health. In the sample, 26% of children ages 1-6 were born with low birth weight and 40% were underweight at age 1. Preliminary regressions show significant variance across neighborhoods in malnutrition and low birth weight. There are no significant effects of caste on either health outcome, which is a surprising finding for India. Future work will investigate how gender of the child interacts with both community types to produce continued sex discrimination in child health.

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Introduction

A great deal of research attention has been devoted to the connection between community contexts and health. A large body of work concerns neighborhood effects on individual health outcomes, including self-reported health, health behaviors, and mortality (e.g., Browning et al. 2006, Horne et al. 2004, Browning and Cagney 2003, Malmstrom et al. 1999, Pebley et al. 1996). This work views community as a geographically defined space, such as a neighborhood, village, or region, in which individuals reside and emphasizes how shared beliefs and practices or the spatial distribution of resources and services are mechanisms by which neighborhoods might impact health (Cohen et al. 2006, Sastry et al. 2006, Stephenson and Tsui 2002, Pebley et al. 1996, Sastry 1996).

Community can also be defined in relational terms, which segregates individuals into social groupings according to shared histories, identities, and interests (Abbott and Luke 2008, Cornish and Ghosh 2007). By this classification, membership in groups, such as race, ethnicity, or caste, influence health outcomes regardless of space and residential patterns. There is a large literature on racial and ethnic health disparities, and the mechanisms by which membership in these groups affect health are believed to include shared cultural beliefs and practices or differential access to health information and services (Boardman et al. 2005, Pebley et al. 1996). Similar mechanisms are proposed to be operating to produce caste differences in health outcomes in India (Bonu and Baker 2003, Kabir et al. 2003).

Emerging research in developing countries finds that child health, including low birth weight and nutritional status, can be determined by a variety of factors that operate not only at the individual- and family-level but at the spatial and relational levels as well (Griffiths et al. 2002, Madise et al. 1999). Here, too, the mechanisms by which communities affect child health include common cultural beliefs and practices regarding food for mothers and children, differential access to infrastructure or health services, or other environmental conditions (Madise et al. 1999, Madise and Mpoma 1997). A persistent cultural issue in South Asia is sex discrimination against girls, which affects child health and nutrition (Das Gupta 1997, 1990, 1987, Miller 1997, Behrman 1988, Chen et al. 1981). Little research has considered how son preference may reflect spatial or relational community preferences, however.

Remarkably absent from the research on community effects is an examination of both spatial and relational contexts simultaneously in an effort to disentangle which of these influences is more important for particular health outcomes.[1] One reason may be that several methodological issues complicate this endeavor. First, community effects may be endogenous. Health outcomes may be determined by underlying individual characteristics—such as socioeconomic status—that are correlated at the level of the community and are not a consequence of the neighborhood or social group *per se* (Sastry et al. 2006, Luke and Munshi 2007a, Pebley et al. 1996). This issue plagues all community effects research, but it is particularly pertinent to work that aims to examine multiple types of communities concurrently. Another issue is that individuals may overlap in

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[1] Browning et al. (2003) and Do et al. (2008) investigate both race/ethnicity and neighborhood effects on self-reported health. Their interest is in investigating if neighborhood effects can explain the race differentials they originally estimate. In contrast, we explore which dimensions of community (caste or neighborhood) matter for health outcomes.

their relational and spatial groupings, for example, when race or ethnic groups tend to reside in the same neighborhoods, making it difficult to separate the two types of community effects (Oakes 2004, Subramanian 2004, Rosenzweig and Wolpin 1986). This issue is particularly relevant in rural India, where castes are traditionally segregated into different hamlets (like small neighborhoods) within each village, producing a nearly perfect correlation between neighborhood and caste.

We overcome these methodological problems and attempt to isolate the effects of caste and neighborhood on low birth weight and child nutritional status by using data from a unique setting in South India. We conducted our study in a group of tea plantations, or estates, all of which belong to the same tea company. An ideal research scenario would be to randomly assign individuals to castes and to neighborhoods. Because one is born into a caste in India, caste affiliation is exogenous. In the tea estates, residential assignment is essentially exogenous as well. Families of all castes are widely dispersed on each estate into multiple divisions, which we treat as a neighborhood. Each division has approximately 100 families, who live adjacent to one another in rows of housing referred to as "labor lines." Divisions are separated from one another by several miles over very hilly terrain, and thus their boundaries are quite clear.[2] Thus, in contrast to rural India, where caste groups are segregated within the village, all castes live amongst each other in labor lines.

The structure of the tea estates provides additional benefits that allow us to isolate community effects. Many features are standardized within the estates, including health facilities and services, housing, water and sanitation, and educational facilities. With respect to child nutrition, an intensive monitoring and intervention program operates across all estates. Furthermore, although there is sex segregation by task (women generally pluck tea leaves and men are involved in supporting tasks), the jobs are the same across all individuals and castes, which also translates into same income across castes (Luke and Munshi 2007a). Thus, the tea estates provide a "natural experiment," which allows us to control for important structural factors and determine if community effects remain, such as social and cultural differences across castes or neighborhoods. We use multi-level analysis to explore the individual, household, and both spatial and relational community-level factors that are associated with the risks of low birth weight and child malnutrition.

Data and Methods

Nutrition Dataset

To create a dataset of individual-, family-, and community-level variables, we merge three different sources of data from the tea estates. First, our research team conducted a survey of a random sample of 3700 female tea plantation workers ages 18-58 in January to March 2003. The

[2] This solves another common problem, which is defining a neighborhood and its appropriate boundaries. This problem is particularly severe for researchers who use artificial administrative boundaries, such as census tracks (Stephenson and Tsui 2002, Sastry et al. 2006).

survey collected information on women's demographic characteristics, household decision-making, social support, and women's and children's health. Women also report the characteristics and behaviors of their husbands, including alcohol consumption. Second, in preliminary fieldwork in March 2002, we obtained accurate information on yearly income for women and their husbands from the tea company's computerized records, and we subsequently merged this information with the survey data.

Third, information on child health was collected from estate health records in March 2002. Each division maintains a crèche staffed with trained attendants for all children ages 5 and under, which is free of charge. Each estate hospital records weight at birth, and the child's weight-for-age, which is a measure of both acute and chronic malnutrition (Griffiths et al. 2002), is recorded monthly in the crèche. Medical personnel in the estate hospital subsequently convert this information into Z-scores to compare the child's status to an international standard. Children more than 1 standard deviation (1 Z score) below the reference mean are categorized as slightly malnourished, while those 2 standard deviations below are moderately malnourished, and 3 standard deviations below suffer from severe malnutrition. Children less than 1 standard deviation below the mean are considered to have normal weight-for-age. Each month, if a child is recorded as malnourished at any level, the family is counseled on feeding practices and the child is given a nutritional supplement during the daily lunch meal in the crèche.

In March 2002, we collected information on the Z-score category (0, 1, 2, or 3 Z-scores below average) at exact ages 1, 2, 3, 4, and 5 as well as birth weight, birth order, and gender for every child currently age 5 and under. These data were merged with the survey and income data. Due to the differing dates of the survey and collection of nutrition data, our sample of children range in age from 1 to 6 in early 2003 at the time of the survey. The final sample of children with low birth weight information is 792 and children age 1 with nutritional status information is 749.[3]

Dependent Variables

Birth weight is recorded in kilograms and a dichotomous measure is constructed, with low birth weight (<2.5 kilos) coded 1; 0 otherwise. Malnutrition is a dichotomous variable coded 1 for yes and 0 for no. Because few children experienced moderate or severe malnutrition in the tea estates (4.54 percent and 0.40 percent at age 1, respectively), we collapsed the 3 categories of underweight into one category of malnutrition.[4]

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[3] It should be noted that the reference periods for all variables are not consistent. Birth weight was measured *n* years ago for children presently age *n* at the time of the survey in 2003, and child nutritional status at age 1 was measured *n*-1 years ago for children presently age *n*. Most independent variables are measured in the current year (2003), and income is measured as 3-year average as of one year before the survey, 2002.

[4] Other studies examine community effects on other child health outcomes, including immunizations and mortality. We did not record child immunization status, as almost all children are routinely vaccinated in the tea estates due to close follow up by medical staff, and therefore there is little variation in coverage. Future papers will explore infant and child mortality and community effects, however.

Independent Variables

Individual child-level variables include gender, birth order, and current age of child in 2003. We control for current age of the child to control for period effects, such as environmental conditions that may fluctuate from year to year. Family-level variables include age, highest year of schooling for women and their husbands, women's and total household income, and husbands' alcohol consumption (regularly vs. rarely or never). The women's autonomy variable is measured by responses to 2 questions: the woman can buy a sari without her husband's permission (yes/no) and she can give money to her natal family without her husband's permission (yes/no). If either or both of these responses is yes, the variable is coded 1; 0 otherwise.

We also wished to include information on women's support networks and whether they included caste members or neighbors. The survey included 2 questions asking women whom they turn to for help if they (1) are ill or (2) need money. Response codes for both questions included "neighbors in the labor lines" and "caste members in the estates." For the variable for neighborhood support, if either question included the response "neighbors in the labor lines" we coded the variable 1; 0 otherwise. The variable for caste support is coded 1 if either question's response included "caste members in the estates"; 0 otherwise.

We also include variables that capture neighborhood and caste community effects. First, we create dummy variables for each caste group and each division. On the survey, women reported their sub-caste and we coded these into 5 major caste groups, including Thevar (warrior castes), Sakliyar (laborer castes), Pallar and Paraiyar (former slave castes), and a residual category including all smaller groups who do not fit into these categories. Second, there are 79 divisions for the respondents in our final sample. We created dummy variables for each of these divisions.

To explore the mechanisms though which communities affect child health, we create 5 parallel variables for both castes and divisions by aggregating individual-level measures. These group variables include caste group or division poverty, measured by the percentage of families who are poor (lowest quartile of household income in all the sampled estates). Neighborhood poverty and disadvantage have been linked to health outcomes in numerous past studies (e.g., Browning et al. 2006, Horne et al. 2004; O'Malley et al. 2003, Kapra et al. 2002, Malmstrom et al. 1999). We also create variables for the average years of schooling of women, the average years of schooling of husbands, and the percentage of women empowered within each caste group and division. Finally, we construct a measure for each division of the percentage of women who turn to neighbors for help and a measure for each caste group of the percentage of women who turn to caste members for help.

Preliminary Results

Table 1 reports the percentages of children with low birth weight and malnutrition based on weight-for-age at age of 1 to 5 years old. Over one-quarter (26 percent) of children experienced low birth weight and 39 percent were slightly, moderately, or severely malnourished at age 1. The percentages malnourished increase at age 2 but decrease at ages 3, 4, and 5.

Table 2 presents the results from random-effects logit regressions for low birth weight and malnutrition at age 1 that include division-level variables. The risk of low birth weight is significantly lower for male children than for females. Higher birth order is significantly related to a reduced risk of low birth weight as well as father's years of schooling. Children with mothers who receive help from their caste members when ill or in need of money have significantly lower risk of low birth weight than those in families where mothers do not receive such help. None of the division-level variables are significant; however, the significant division-level variance suggests that there are other unobserved division-level factors that affect the risk of low birth weight.

The child's current age is positively and significantly related to malnutrition at age 1, suggesting that children's nutrition in the tea estates is improving over time. Unsurprisingly, low birth weight is also a significant predictor. Significant gender difference, in favor of male children, also exists. Mother's income shows a significant protective effect against malnutrition, though its magnitude is very small. Children living in divisions with higher average years of mother's schooling are at significantly lower risk of malnutrition. The significant division-level variance suggests that there are other unobserved division-level factors that affect the risk of malnutrition.

Table 3 shows the results from random-effects logit regressions for low birth weight and malnutrition at age 1 that include caste-level variables. Overall, the child's current age, birth order, and gender are significantly associated with low birth weight, as well as father's schooling. With respect to malnutrition, low birth weight, mother's schooling, and father's age are significant. None of the caste-level variables are significantly associated with low birth weight or malnutrition, and the caste-level variance is also insignificant for both regressions. These results suggest that caste at the individual- and community-levels is not related to these two measures of child health, which is surprising given the persistent disparities in child health by caste throughout much of India today. It could be the case that the provision of and equal access to health services and infrastructure on the tea estates has erased these inequalities across caste.

In future analyses, we will explore additional family-, division-, and caste-level factors that may be associated with low birth weight and child malnutrition to uncover the mechanisms by which communities impact health outcomes. We will also investigate how to integrate our two separate community levels (caste and division) into the random-effects model, which, to the best of our knowledge, has not been completed before. In addition, we will examine how gender of the child interacts with both community types to produce continued sex discrimination in child health.

Table 1. Frequency of Low Birth Weight and Malnutrition (Weight-for-age) at Age 1-5

	Freq	Percent
Low birth weight(<2.5 kg)	207	26.14
Weight-for-age at age 1		
Normal	455	60.75
Slight	257	34.31
Moderate	34	4.54
Severe	3	0.40
Weight-for-age at age 2		
Normal	378	57.62
Slight	256	39.02
Moderate	22	3.35
Weight-for-age at age 3		
Normal	367	66.61
Slight	174	31.58
Moderate	10	1.81
Weight-for-age at age 4		
Normal	270	69.59
Slight	108	27.84
Moderate	10	2.58
Weight-for-age at age 5		
Normal	178	74.79
Slight	54	22.69
Moderate	4	1.68
Severe	2	0.84

Table 2. Random-Effects Model Estimates of Low Birth Weight and Malnutrition (Weight-for-age) at Age 1 with Division-Level Aggregated Variables

	Low Birth Weight			Malnutrition at Age 1		
	Coef.	S.E.		Coef.	S.E.	
Individual level factors						
Age	0.06930	0.06396		0.16332	0.07821	**
Gender (female)						
Male	-0.45203	0.21584	**	-0.48318	0.23080	**
Birth order	-0.29847	0.14097	**	0.02625	0.13124	
Low birth weight (no)						
Yes				2.57038	0.43819	***
Family level factors						
Mother's caste (Pallar)						
Thevar	0.38244	0.37843		-0.00375	0.43120	
Paraiyar	-0.13041	0.28840		0.19753	0.32321	
Sakliyar	0.10311	0.48675		0.90566	0.57573	
Other	-0.27110	0.38056		0.26908	0.40646	
Total family income	0.00002	0.00002		0.00001	0.00002	
Mother's income	-0.00004	0.00003		-0.00008	0.00003	**
Mother's empowerment (no)						
Yes	-0.02178	0.26535		0.09544	0.28699	
Mother's years of schooling	-0.00806	0.03639		-0.05357	0.03911	
Father's years of schooling	-0.07761	0.04053	*	-0.00212	0.04481	
Mother's age	-0.01977	0.04205		0.03647	0.04595	
Father's age	0.01951	0.03615		-0.05820	0.04000	
Alcoholic father (no)						
Yes	-0.45814	0.45143		0.24739	0.45716	
Neighbors' help when ill or needing money (no)						
Yes	0.30096	0.28670		0.11334	0.30038	
Caste members' help when ill or needing money (no)						
Yes	-0.62530	0.35897	*	0.27508	0.36651	
Division level factors						
% families with neighbors' help	0.00633	0.02138		0.03797	0.03264	
Mothers' average years of schooling	0.00015	0.24789		-0.71825	0.38311	*
Fathers' average years of schooling	0.04428	0.26785		0.23812	0.40393	
% families in poverty	-1.07281	1.52876		-1.76505	2.26573	
% empowered mothers	-0.00512	0.01381		-0.01485	0.02015	
Constant	-0.99680	2.60181		-0.57418	3.68556	
Family level variance	1.34635	0.90211		1.20506	0.99593	
Division level variance	0.53234	0.27837	*	2.51507	0.93296	**
N	792			749		
Log-likelihood	-430.31			-404.36		

Notes: Reference categories are in parentheses; Coef.=coefficient; S.E.=standard error;
*p<0.1;**p<0.05;***p<0.01

Table 3. Random-Effects Model Estimates of Low Birth Weight and Malnutrition (Weight-for-age) at Age 1 with Caste-Level Aggregated Variables

	Low birth weight			Malnutrition at age 1		
	Coef.	S.E.		Coef.	S.E.	
Individual level factors						
Age	0.10407	0.05881	*	0.03306	0.07192	
Gender (female)						
Male	-0.49647	0.21166	**	-0.38146	0.23303	
Birth order	-0.34514	0.13773	**	0.04669	0.13234	
Low birth weight (no)						
Yes				2.21115	0.41296	***
Family level factors						
Mother's caste (Pallar)						
Thevar	0.01850	0.47154		0.06806	0.50703	
Paraiyar	-0.01371	0.28580		0.20712	0.32579	
Sakliyar	-0.87991	0.64273		0.02613	0.66784	
Other	-0.49153	0.40469		0.44139	0.41581	
Total family income	0.00002	0.00002		0.00000	0.00002	
Mother's income	-0.00004	0.00003		-0.00004	0.00003	
Mother's empowerment (no)						
Yes	0.01717	0.24833		-0.04000	0.28677	
Mother's years of schooling	0.02021	0.03527		-0.07857	0.04138	*
Father's years of schooling	-0.06466	0.03862	*	0.01585	0.04506	
Mother's age	0.00269	0.04027		0.04747	0.04725	
Father's age	0.01856	0.03477		-0.08388	0.04203	**
Alcoholic father (no)						
Yes	-0.40336	0.42650		0.34219	0.46996	
Neighbors' help when ill or needing money (no)						
Yes	0.32256	0.27383		0.42131	0.31487	
Caste members' help when ill or needing money (no)						
Yes	-0.43759	0.33480		0.52483	0.37063	
Caste level factors						
% families with caste members' help	-0.02676	0.03203		0.01844	0.03054	
Mothers' average years of schooling	-0.38553	0.29561		0.19130	0.31481	
Fathers’ average years of schooling	-0.57865	0.57683		-0.47422	0.61193	
% families in poverty	-1.91312	2.38499		-2.05336	2.35262	
% empowered mothers	0.01140	0.02050		-0.00896	0.02425	
Constant	4.05432	3.70053		3.30159	3.74860	
Family level variance	1.40334	0.92641		2.84219	1.50546	
Caste level variance	0.00000	0.00002		0.00000	0.00000	
N	790			745		
Log-likelihood	-430.58			-445.444		

Notes: Reference categories are in parentheses; Coef.=coefficient; S.E.=standard error; *p<0.1;**p<0.05;***p<0.01

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