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Household social capital and socioeconomic inequalities in child undernutrition in rural India

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ABSTRACT

Social capital has gained attention for poverty reduction efforts in low- and middle-income countries, but questions remain about people's unequal access to and benefits from social capital—especially for addressing child health inequalities. Analyzing 2005 India Human Development Survey data on 9008 rural-dwelling children and their families, we test hypotheses regarding how SES shapes household access to and child health benefits from three different forms of social capital located inside and outside the community. Specifically, we examine households' memberships in bonding and bridging organizations, which respectively connect people who are socio-demographically similar and dissimilar, and linking ties to representatives of formal institutions (health care, education, and government) who have power and privilege in society. Results indicate that greater household wealth is associated with each social capital form and amplifies the extent that linking ties to medical and educational institutions, and within-village bridging organizations are associated with lower odds of child underweight. Our findings warrant considering the unequal distribution, differential utility, and geographic location of social capital in designing efforts to address health inequalities.

Social capital—the actual or potential resources inherent in social connections to individuals and organizations—has figured prominently in health inequalities research (e.g., Kawachi et al., 2008). Yet, few of these studies have focused on low- and middle-income countries (LMICs) and, among those that have, few have investigated the potential relevance of social capital for child health inequalities (e.g., Carter and Maluccio, 2003; De Silva and Harpham, 2007; Moestue et al., 2007; Story, 2014).

These two research gaps are significant for four reasons. First, child health and nutrition—especially high rates of child morbidity and mortality attributed to undernutrition—are substantial public health concerns in LMICs. Within these settings, undernutrition is linked to 3.1 million annual deaths among children under age five (and 45% of total child deaths in 2011) and is linked to poorer cognitive and educational outcomes in later childhood and adolescence as well as reduced economic productivity in adulthood (Black et al., 2013). Second, child nutrition status in LMICs is strongly patterned by household wealth (Boyle et al., 2006). In India, for example, socioeconomic inequalities in child stunting and underweight have increased over time, with household wealth identified as the primary contributor to inequalities in childhood malnutrition (Chalasani, 2012). Third, in LMICs, social capital—whether derived from membership in organizations or social ties to individuals—can be used by the poor as a primary means of protection against socioeconomic vulnerability, serving as a substitute for human, economic and other forms of capital that they are lacking (Story, 2013). Fourth, despite the potential for social capital to aid households and reduce child undernutrition, access to social capital and its potential benefits are unequally distributed by socioeconomic status (Moore et al., 2014) and geographic location (e.g., within or outside one's community), posing important implications for programs and interventions aimed to increase social capital in LMICs and reduce health inequalities (Kozel and Parker, 2000).

Given the inequalities in child nutrition status and distribution of social capital, we investigate how different forms of household social capital—i.e., actual or potential resources available to a household via its members' social ties to organizations and individuals—may contribute to socioeconomic disparities in child underweight. Specifically, we formulate hypotheses regarding how

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socioeconomic status (SES) shapes (1) household access to and (2) child health benefits from three different forms of social capital located inside and outside the community: household memberships in organizations that connect people who are socio-demographically similar and dissimilar (respectively, *bonding* and *bridging* social capital) and ties to representatives of formal institutions (such as health care providers, teachers and government officials) who have power and privilege in society (*linking* social capital). We test our hypotheses using multilevel data on children and their families residing in rural villages of India.

1. Background and hypotheses

In providing our study background, we define our use of social capital in this study, discuss potential mechanisms by which SES shapes access to and child health benefits from social capital in India, and formulate hypotheses through which these forms of social capital operate.

1.1. Defining social capital

Due to its multi-disciplinary history, social capital is defined in various ways, but most definitions emphasize a network and/or a communitarian focus (Son and Lin, 2008; Woolcock and Narayan, 2000). While a network focus considers how *individuals* access resources within their networks of family, friends, and acquaintances for pursuing *personal goals* (Bourdieu, 1986; Lin, 2001; Portes, 1998), a communitarian focus considers how group or associational membership aids in pursuing *collective goals*, such as social and economic development (e.g., Putnam et al., 1993; Woolcock and Narayan, 2000).

Our study focuses on how rural village household members' ties to individuals and organizations—including organizations with collective-oriented aims—may contribute to the health of one or more children in that household. Therefore, we define social capital in a manner consistent with both network and communitarian approaches: *household members' actual or potential resources inherent within personal and organization-based networks that can be used for pursuing individual or collective goals*. Using this integrated conceptualization, we examine three social capital forms that have received attention within development scholarship for initiatives and programs addressing economic development, poverty reduction, and other outcomes: bonding, bridging, and linking social capital.

1.1.1. Social capital from ties to bonding and bridging organizations

Organizational membership figures prominently in social capital theory. As argued by Putnam and colleagues (1993, p. 173), networks of civic engagement (e.g., community associations, religious groups, sport/hobby clubs) constitute an "essential form of social capital" that increase the possibility of cooperation and mutual benefit via fostering robust norms of reciprocity, facilitating communication that strengthens interpersonal trust and cooperation, and providing cultural templates of success for guiding future collaborations (see also Coleman, 1988; Putnam, 2000).

Building on this argument, social capital scholarship has distinguished between bonding and bridging forms of social capital (e.g., Putnam et al., 1993; Putnam, 2000; Szreter and Woolcock, 2004). *Bonding social capital* refers to ties or organizations that link together individuals with similar socio-demographic characteristics (e.g., a religious or ethnic group), building in-group loyalty and providing resources to group members (Putnam, 2000). *Bridging social capital* concerns ties or organizations that connect individuals who differ according to their socio-demographic characteristics (e.g., different age groups or religious and ethnic backgrounds) and, compared to bonding social capital, are more ideal for providing access to external assets and information diffusion (Putnam, 2000:22).

The conceptualization of social capital as membership in bonding and bridging organizations has received prominent attention for identifying ways to improve health and alleviate poverty in LMICs (Woolcock and Narayan, 2000). Ties to bonding organizations are useful for generating mutual aid, such as generating resources from close family and friends, for the use of health services (Story, 2014). Similarly, ties to bridging organizations can diversify one's access to resources and information about healthy behaviors, as well as provide opportunities to voice their needs and negotiate support to live healthier lives (Islam et al., 2006).

In the context of child nutrition, bonding social capital may provide immediate and necessary material (e.g., food) and informational resources (e.g., parenting advice) for coping with economic circumstances (Story, 2014; Moestue et al., 2007). Alternatively, bridging social capital may facilitate financial and educational opportunities, including opportunities for improving the human or cultural capital of household members and the economic situation of the household itself. These opportunities can improve household capacity to cultivate food and increase access to medical care and other household necessities for child well-being (Moxley et al., 2011).

1.1.2. Social capital from linking ties to representatives of public institutions

In addition to organizational membership, another significant focus of social capital research is how personal action can be facilitated via economic, cultural, symbolic, political, and other resources inherent in one's ties to other individuals (Bourdieu, 1986; Lin, 2001). These theories suggest that persons of higher class or SES are more likely to possess higher quantities of social capital, while less advantaged persons may also benefit from ties to more advantaged or powerful others—thereby providing a potential means to circumvent or overcome socioeconomic constraints (Carpiano, 2006).

This focus on ties to influential individuals is consistent with the concept of *linking social capital*—social connections to people of power and authority in a society—which is often discussed within development scholarship and, to a lesser extent, population health research (Woolcock and Narayan, 2000; Szreter and Woolcock, 2004). Linking social capital differs from bridging social capital in that linking ties cut across explicit power gradients in society (Szreter and Woolcock, 2004). Relationships between community members and individuals who are representatives of (or work within) formal institutions—such as health care providers, school teachers, and government officials—can help leverage resources, ideas, and information either directly or via connecting parents to programs, services, and agencies to potentially assist them and/or their children, especially in poor communities. Thus, linking social capital has been argued to be one of the most appropriate conceptualizations of social capital for LMICs due to its potential to reduce health disparities by establishing social ties between underserved communities and people with power and influence (Story, 2013).

In the context of child nutrition, linking social capital may provide access to information and services from medical providers, teachers/school administrators, and government officials (who can assist with locating/registering for government services). These people, and the institutions they represent, have potential to assist in preventing disease and maintaining a child's health (Story, 2014; Szreter and Woolcock, 2004).

1.1.3. The location of social capital

The *location* of social capital—notably, whether it is concentrated within or outside of a person's community—may influence its effect on socioeconomic inequalities in child nutrition due to its accessibility, particularly in LMICs. Health research on social capital generally focuses either on intra-community social capital (e.g., neighborhood-based social capital) or non-location-specific network social capital (for one exception, see Moore et al., 2011).

Social connections to organizations and/or influential individuals *within* one's community can be enabling for health and other outcomes by providing access to social support and available resources. These intra-community connections, however, may restrict access to new material and informational resources if they are embedded within a community that has limited assets and/or is geographically isolated—making such ties either less useful or even detrimental for pursuing specific goals (Portes, 1998; Woolcock and Narayan, 2000). Conversely, social connections to organizations and/or influential individuals *outside* of one's community can provide individuals with access to more diverse resources that may benefit household and child well-being, including information and economic opportunities (Kozel and Parker, 2000).

1.2. Inequalities in access to and benefits from social capital in India

The preceding discussion of bonding, bridging, and linking social capital and their respective locations motivates two central facets of our study: socioeconomic disparities in access to and benefits from social capital. We investigate these two aspects by focusing on the empirical case of socioeconomic disparities in child underweight in rural India, where approximately 68–71% of the country's total population resided between 2005 and 2014 (World Bank, 2015). In addition to this population concentration, we focus on rural India due to the high burden of child underweight (45.6% of all children under the age of five [IIPS, 2007]), increasing inequalities in child mortality and malnutrition (Chalasani, 2012), and disparities in access to resources to improve child nutrition (Paul et al., 2011). Inequalities in child nutrition in rural India can be addressed through the resources embedded within social connections, including improved feeding practices obtained from women's and/or self-help groups; in addition to child nutrition and growth monitoring services offered by government-run Anganwadi Centers (AWC)—a part of the Indian public health system that provides basic health services to rural villages with a specific focus on child nutrition education and supplementation—and improved health care access for infectious diseases.

Studies conducted in India have found that social capital is associated with the use of maternal and child health services (Story, 2014; Vikram et al., 2012) and child nutrition (De Silva and Harpham, 2007; Moestue et al., 2007). Yet, few of these studies have examined social capital in relation to socioeconomic disparities in child nutrition and underweight in LMICs (De Silva and Harpham, 2007).

1.2.1. How does household SES shape access to social capital?

Based on existing research conducted in India and other contexts, we formulate three conjectures regarding how household SES might shape access to social capital in India.

1.2.1.1. Opportunity hoarding of social capital. Given prior social capital research, we conjecture that there may exist an *opportunity hoarding* explanation (Wright, 2009), whereby greater socioeconomic advantage enables greater capacity to amass and/or control specific resources due to social closure in networks that restricts or excludes the less advantaged from accessing such resources. Research conducted in rural Indian communities identified socioeconomic patterns in social capital, whereby the poor had fewer helpful social ties (e.g., to obtain employment or economic capital) than their non-poor counterparts (Kozel and Parker, 2000). Likewise, linking social capital has been found to be associated with education, wealth, caste, and religion (Vanneman et al., 2006).

1.2.1.2. Bonding ties for coping with disadvantage. For bonding ties, we conjecture a potential *coping explanation*, whereby such ties may be invested in and relied upon more by *lower* (versus higher) SES households to minimize or potentially alleviate the adverse effects of their material and psychosocial circumstances. Disadvantaged households may derive health and other benefits from social capital rooted in ties to similarly disadvantaged others (e.g., Cattell, 2001). Notably, Kozel and Parker (2000) found that the limited helping ties possessed by the rural poor in India were extensively used for defending themselves against financial risk and vulnerability. Thus, social capital can be a critical resource in the absence of other forms of capital, especially during emergent situations when the household needs immediate access to resources (Warren et al., 2001; Story, 2014).

1.2.1.3. Geographic patterning of social capital inequalities. Regarding geographic location of social capital, we conjecture that *higher* (versus lower) SES households will be more likely to access social capital existing outside their village due to their greater ability to overcome costs and physical barriers to establishing and maintaining outside ties. Kozel and Parker (2000) found that social capital of rural, poor Indian households was more limited to the immediate community, while wealthier households had outside village ties that could be used to obtain more lucrative employment or investment capital. Thus, while SES may matter for establishing and possessing social capital inside one's community, it may be even more important for possessing social capital outside one's community.

1.2.2. How does household SES shape the benefits from social capital on child undernutrition?

If a household possesses social capital that, in turn, has potential benefits for a child's nutrition, then how might the household's SES impact the utility of that social capital for realizing this outcome? A limited number of studies (none of which focused on child nutrition) have explored this SES moderating relationship (Uphoff et al., 2013). Building on these studies, we offer several conjectures about the utility of social capital, in general and in terms of geographic location.

1.2.2.1. Resource substitution explanation. First, we conjecture that social capital may offer greater benefit for *lower* (versus higher) SES households due to its importance in compensating for their lack of economic, cultural, and other forms of capital that higher SES persons may already possess and thereby need to depend less on social capital for accessing and pursuing specific actions (e.g., Warren et al., 2001). Previous research demonstrates that lower (versus higher) SES persons may derive greater benefit from different forms of social capital based on ties to similar and higher SES others (Carpiano, 2006; Story, 2014). Hence, we offer a *resource substitution explanation*, which considers the possibility of relatively greater child health benefits from bonding, bridging, and linking social capital for lower (versus higher) SES households.

1.2.2.2. Fundamental cause explanation. An alternative conjecture to the resource substitution explanation is that social capital will provide greater benefit for *higher* (versus lower) SES households because the former are more able to take advantage of existing social capital and its opportunities for promoting better child

health and development—due to their higher stock of other forms of capital (e.g., human, economic, cultural capital) that can be used in tandem with social capital to maximize its benefits. Therefore, we propose the *fundamental cause explanation* premised on the fundamental cause theory of health disparities. This theory posits that higher (versus lower) SES individuals possess greater capacity to avert disease and maintain health due to having greater access to money, knowledge, status, and beneficial social connections. As such, health disparities emerge and are reproduced whenever the capacity to control or eliminate morbidity and mortality risks is distributed unequally by these resources (Carpiano et al., 2008). Therefore, from a fundamental cause theory perspective, to the extent that bonding, bridging, and linking social capital can provide benefits for child undernutrition, those benefits will be best realized by higher (versus lower) households.

1.2.2.3. Proximal resource substitution explanation. These resource substitution and fundamental cause explanations also motivate ideas regarding how SES might moderate the impact of location-specific social capital on child undernutrition.

Expanding upon our aforementioned resource substitution perspective, we conjecture that inside-village social capital provides greater benefits for child undernutrition among lower (versus higher) SES households. The premise of this *proximal resource substitution explanation* is that geographic proximity to social capital is particularly important for lower SES households due to limited access to transportation and communication technology that would help establish and maintain social connections over a greater distance (Pigato, 2001). Therefore, when needing to compensate for their lack of other resources useful for meeting everyday challenges, including child care, inside- (versus outside-) village organizations and interpersonal relationships will be more beneficial for lower SES households.

1.2.2.4. Fundamental divide explanation. Building on our fundamental cause explanation, we posit that higher (versus lower) SES households will consistently realize greater benefits from available social capital, and the SES inequalities of these benefits will be even greater for outside- (versus inside-) village social capital. From the standpoint of fundamental cause theory, higher SES persons may have a greater range of resources (e.g., transportation, phone, and/or internet; and more scheduling flexibility) to more frequently access social capital (Pigato, 2001). Furthermore, prior non-health research found higher (versus lower) SES households possess greater outside-village social capital that had significant value for pursuing various personal goals (Kozel and Parker, 2000). Hence, for what we term a *fundamental divide explanation*, household SES should have a greater influence on the impact of outside-village bonding, bridging, and linking social capital on child undernutrition than it has for the impact of these analogous inside-village social capital forms.

1.3. Study hypotheses

Based on these potential explanations for the inequalities in access to and benefits from social capital in India, we test two sets of hypotheses:

1.3.1. SES and access to social capital

H1a. Higher household SES is associated with higher odds of bonding, bridging, and linking social capital (*resource hoarding explanation*).

H1b. Lower household SES is associated with higher odds of membership in bonding organizations (*coping explanation*).

H1c. Higher household SES is associated with higher odds of all three forms of social capital existing outside (versus inside) the village.

1.3.2. SES as a moderator of social capital and child underweight

H2a. All three forms of social capital demonstrate a stronger reduction in the odds of child underweight in lower versus higher SES households (*resource substitution explanation*).

H2b. All three forms of social capital demonstrate a stronger reduction in the odds of child underweight in higher versus lower SES households (*fundamental cause explanation*).

H2c. All three forms of inside-village social capital are more strongly associated with lower odds of child undernutrition for lower (versus higher) SES households (*proximal resource substitution explanation*)

H2d. All three forms of outside-village social capital are more strongly associated with lower odds of child undernutrition for higher (versus lower) SES households (*fundamental divide explanation*).

2. Methods

2.1. Data and study sample

We test these hypotheses using data from the 2005 India Human Development Survey (IHDS), a nationally representative survey of 41,554 households in 2474 villages or urban neighborhoods across 33 states and union territories of India (Desai et al., 2005). The IHDS includes 27,010 rural households and 14,544 urban households selected via a stratified random sampling design. Villages and urban blocks (comprising of 150–200 households) formed the primary sampling unit from which the households were selected. The total sample response rate was 92%; information about data collection, funding, and quality assurance has been previously documented (see Desai and Wu, 2010).

Given our study focus, we restricted our sample to the 10,554 children under five years of age (the age range for the World Health Organization [WHO] child growth standards) living in 7738 rural households. The IHDS interviewed a knowledgeable informant (typically the household head) regarding household socioeconomic conditions (Desai et al., 2005) and, for all 1454 rural villages, collected contextual data that enabled us to control for village-level factors and determine the location of bonding, bridging, and linking social capital relative to the location of the household.

Omitting cases with missing data yielded a final analytic sample of 9008 children in 6753 households and 1347 rural villages [average number of children per household = 1.3 (range: 1–4) and the average number of households per village = 6.7 (range: 1–50)]. Additional analyses (not shown) indicate that the sociodemographic characteristics of the full rural and analytic samples are similar.

2.2. Measures

Child underweight was defined by the current WHO standard of <2 standard deviations under the median weight-for-age of the international reference population, where children who were not underweight were coded as 0 and children who were underweight were coded as 1.

Household SES was based on household wealth and assessed using an established additive household asset index of 30 dichotomous housing and consumer goods items reflecting asset ownership and housing quality (Desai and Wu, 2010).

Bonding and bridging social capital were measured by household membership in nine social organizations categorized into bonding and bridging organizations based on prior evidence which showed that bonding and bridging organizations are (1) theoretically distinct due to the similarity (bonding) and dissimilarity (bridging) of each organization based on socio-demographic characteristics as well as their differential impact on health care use (Vikram et al., 2012) and (2) empirically distinct in a factor analysis whereby the organizations loaded on two separate factors (Story, 2014). Although organizational membership does not directly assess household access to resources embedded within an organization, it is commonly used as a proxy for social capital (Narayan and Cassidy, 2001). Using a prior empirical technique (Vikram et al., 2012), bonding ties were categorized as membership in any religious, caste, or festival organization, whereas bridging ties were categorized as membership in development groups (e.g., women's groups, self-help groups, credit or savings groups, development groups or non-governmental organizations). For both bonding and bridging ties, households were coded as 1 if they were members of at least one organization and 0 if not.

Linking social capital was measured via a household's relationships with individuals working in health care, education, and government institutions: a doctor or nurse, a teacher or principal, and a government officer. We computed ties to each of these individuals as three separate variables, coded 1 if the household had any non-familial relationship with such a person and 0 if no tie existed. Consistent with the development literature's focus on social capital that may be generated via interventions that build and sustain linking ties, these variables only include ties to representatives who were not family. We were not interested in linking ties that were generated via existing family relationships. Representatives who were family had a relatively lower prevalence in the sample, but we nevertheless included them as a control variable in our analyses.

For the *geographic location* of social capital, we coded our bonding, bridging, and linking social capital variables based on whether the organization or individual was located inside or outside the household's village. All survey questions for bonding, bridging, and linking social capital (including the geographic location), are included in Annex 1.

Our analyses also include several child-, household- and village-level covariates that may confound the relationship between SES, social capital, and child underweight.

Child-specific covariates were sex and age (reported by the mother in months and analyzed as a continuous variable). Both are consistently associated with nutrition status (De Silva and Harpham, 2007). In India, the probability of underweight is higher for girls and increases with age for children under five (IIPS, 2007).

Household-specific covariates included maternal age, household education level (highest level of education achieved by any household member), number of school-age children (ages 0 to 14) living in the household at the time of the survey, number of child deaths that had occurred in the household, caste, and religion. Caste was coded using the four common categories of Brahmin, Other Backward Classes, Scheduled Castes (*dalits*), and Scheduled Tribes (*adivasis*), plus an "Other" category. Religion was coded as three categories: Hindu, Muslim, and "Other."

For our two *village-specific covariates,* average household wealth was calculated as each village's mean household asset score based on the entire rural village sample of 27,010 households. Physical infrastructure was a binary variable, which was assessed via interviews with village officials and other key informants and coded based on prior research (Story, 2014) as follows: good infrastructure (villages where households have access to paved roads and >75% of households have electricity) versus poor infrastructure (villages where households have no paved road access or <75% of households have access to electricity). Also, to better understand the effect of formal nutrition services on child nutrition at the village level, we tested, as a covariate, the presence of an AWC. Over 90% of the villages in our sample had an AWC and there were no substantive differences in the social capital estimates; therefore, we excluded this covariate from our final models.

2.3. Analyses

Due to the nested design of our data, our analyses utilize a multilevel binary logistic regression approach in Stata 13.0. First, we estimated two-level (households nested within villages) logistic regression models to test the first set of hypotheses focused on the relationship between household SES and household possession of each social capital form, while controlling for household- and village-level covariates.

Next, we estimated three-level (children nested within households nested within villages) logistic regression models to examine the second set of hypotheses concerning social capital (with and without regard to location), household assets, and child underweight, controlling for all child-, household-, and village-level covariates. The multilevel model was appropriate for the analysis because 35% of the variation in child underweight was accounted for by the village and household levels.

We also tested for moderation by specifying a series of product terms for household assets and each social capital form. According to Ai and Norton (2003), interactions in nonlinear models cannot be evaluated by looking at the sign, magnitude, or statistical significance of the product term for nonlinear models. A simple summary measure of the interaction effect is difficult to interpret in nonlinear models because it can have different signs for different observations. For example, a statistically insignificant interaction effect may actually be significantly positive for some observations and negative for other observations. Therefore, we calculated the adjusted predictions of child underweight at representative values of household SES for all interactions between each social capital variable and SES to avoid misinterpretation.

We report all slope estimates (standard errors) as odds ratios (95% confidence intervals). All p-values <0.05 are reported as statistically significant.

3. Results

Table 1 details our variables and their descriptive statistics. Forty-six percent of the children under the age of five in our sample were underweight, which is similar to the national rural average of 45.6% (IIPS, 2007). Regarding social capital, 20% of the households had a member in at least one bonding organization and 22% had a member in at least one bridging organization. Linking ties to health care providers and teachers were also common (26% and 28%, respectively); however, ties to government officials were less common (8%). Bonding and bridging social capital were more common inside rather than outside the village, but there was no distinguishable pattern for linking social capital.

3.1. SES and access to social capital

Table 2 displays results of analyses testing our hypotheses regarding household SES and social capital. For social capital

Table 1
Descriptive statistics for all study sample variables.

		Mean (SD)	Empirical Range
Child-level (n = 9008)			
Child Underweight		0.46 (0.50)	0–1
Female child		0.48 (0.50)	0–1
Child's age in months		31 (17)	0–60
Household-level (n = 6753)			
Social Capital	Bonding ties	0.20 (0.40)	0–1
	Inside village	0.15 (0.35)	0–1
	Outside village	0.07 (0.26)	0–1
	Bridging ties	0.22 (0.42)	0–1
	Inside village	0.16 (0.37)	0–1
	Outside village	0.09 (0.29)	0–1
	Medical ties	0.26 (0.44)	0–1
	Inside village	0.10 (0.29)	0–1
	Outside village	0.16 (0.37)	0–1
	School ties	0.28 (0.45)	0–1
	Inside village	0.14 (0.34)	0–1
	Outside village	0.14 (0.35)	0–1
	Government ties	0.08 (0.27)	0–1
	Inside village	0.02 (0.15)	0–1
	Outside village	0.05 (0.22)	0–1
Family linking ties		0.09 (0.29)	0–1
Household assets		9.1 (5.2)	0–27
Mother's age in years		27.1 (5.7)	15–49
Number of children in household		3.1 (1.6)	1–17
Number of child deaths		0.21 (0.61)	0–7
HH education	None	0.25 (0.43)	0–1
	1–9 standard	0.45 (0.50)	0–1
	10-College grad	0.30 (0.46)	0–1
Caste	Brahmin	0.04 (0.19)	0–1
	Other backward class	0.40 (0.49)	0–1
	Scheduled caste	0.24 (0.43)	0–1
	Scheduled tribe	0.12 (0.32)	0–1
	Other	0.20 (0.40)	0–1
Religion	Hindu	0.81 (0.39)	0–1
	Muslim	0.12 (0.32)	0–1
	Other	0.07 (0.25)	0–1
Village-level (n = 1347)			
Household assets		9.2 (3.7)	2–22
Good infrastructure		0.39 (0.50)	0–1

Note: SD = standard deviation.

(regardless of location), each one-unit increase in household assets is associated with 7% higher odds of the household belonging to respectively, a bonding organization and a bridging organization. For linking social capital, every one unit increase in household assets is associated with 10% higher odds of a connection to a doctor/nurse, 10% higher odds of a connection to a teacher/principal, and 16% higher odds of a connection to a government officer. These results provide evidence for the opportunity hoarding explanation (H1a) but not the coping explanation (H1b).

For geographic location, the relationship between assets and inside-versus outside-village social capital vary across social capital forms. There are no substantial inside- versus outside-village differences in the odds of belonging to a bonding organization, belonging to a bridging organization, or being connected to a doctor/nurse. However, the 10% and 18% higher odds of being respectively connected to a teacher/principal and government official *outside* the village are higher than the 3% and 6% higher odds of being respectively connected to a teacher/principal and government official *inside* the village—as evidenced by the non-overlapping confidence intervals. These results partially support our hypothesis that higher household SES is associated with higher odds of social capital existing outside (versus inside) the village (H1c)—i.e., only for linking ties to a teacher/principal and a government official.

3.2. SES as a moderator of social capital and child underweight

Table 3 reports the main effects of each social capital form on child underweight. Model 1 presents the estimates for all social capital forms regardless of their location: bridging social capital is associated with 21% lower odds of underweight and is the only social capital form significantly associated with the outcome. Model 2 shows the estimates for inside- and outside-village social capital. Similar to Model 1, any bridging ties inside the household's village is associated with 27% lower odds of child underweight. No significant association exists for any bridging tie outside the village (nor for any other social capital forms).

Fig. 1a–c depict the interactions between household assets and social capital regardless of location and located inside and outside the village. These graphs are a more accurate representation of how the moderating effects differ across social capital forms than the odds ratios presented in Supplementary Table 4. In graphing all interaction terms, household SES does not appear to moderate the effect of linking ties with government officers and ties to bonding organizations on child underweight (figures not shown).

In Fig. 1a, lower SES households with a bridging tie have significantly lower probabilities of having an underweight child relative to lower SES households without a bridging tie: a 10% difference among the lowest SES households (i.e., household assets score = 0) and a 6% difference for households with an asset score of

Table 2
Adjusted odds ratios (95% confidence intervals) of possessing each form of household social capital as predicted by household assets after controlling for other household and village characteristics.

	Organizational Ties		Linking Ties		
	Bonding	Bridging	Medical	School	Government
Social Capital Anywhere					
Household assets	1.07*** (1.04–1.10)	1.07*** (1.05–1.09)	1.10***(1.07–1.12)	1.10***(1.07–1.12)	1.16***(1.12–1.20)
Social Capital Inside Village					
Household assets	1.07***(1.03–1.10)	1.07***(1.04–1.10)	1.05**(1.02–1.09)	1.03*(1.00–1.06)	1.06*(1.00–1.11)
Social Capital Outside Village					
Household assets	1.08***(1.03–1.12)	1.08***(1.05–1.12)	1.08***(1.05–1.10)	1.10***(1.07–1.12)	1.18***(1.13–1.22)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Note: n = 7568 households within 1379 villages; Each cell represents a separate model. Each model controls for household-level (family linking ties, mother's age, number of children in household, number of child deaths, household education, caste, and religion) and village-level (household assets and village infrastructure) covariates. These findings do not substantively change when the analysis is restricted to the analytic sample as described in Table 1. The full models with control variables can be found in Supplemental Tables 2a, 2b, and 2c.

Table 3
Adjusted odds ratios (95% confidence intervals) of child underweight regressed on household assets and social capital (located anywhere and inside- and outside-village).

	Model 1	Model 2
	OR (95% CI)	OR (95% CI)
Social Capital (Anywhere)		
Organizational ties		
Bonding	1.06 (0.90–1.24)	–
Bridging	0.79** (0.68–0.92)	–
Linking ties		
Medical	0.93 (0.79–1.08)	–
School	0.92 (0.79–1.08)	–
Government	0.87 (0.68–1.10)	–
Social Capital (Inside Village)		
Organizational ties		
Bonding	–	1.04 (0.87–1.25)
Bridging	–	0.73*** (0.61–0.86)
Linking ties		
Medical	–	1.00 (0.80–1.25)
School	–	1.00 (0.82–1.22)
Government	–	0.74 (0.49–1.11)
Social Capital (Outside Village)		
Organizational ties		
Bonding	–	1.14 (0.89–1.45)
Bridging	–	0.95 (0.77–1.17)
Linking ties		
Medical	–	0.88 (0.74–1.06)
School	–	0.85 (0.71–1.03)
Government	–	0.93 (0.70–1.23)
Household assets	0.94*** (0.92–0.95)	0.94*** (0.92–0.95)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; *Note*: n = 9008 children in 6753 households in 1347 rural villages; All models control for child-level (sex and age), household-level (family linking ties, mother's age, number of children in household, number of child deaths, household education, caste, and religion) and village-level (household assets and village infrastructure) covariates. The full model with control variables can be found in Supplemental Table 3a.

9. Among higher SES households, however, no significant differences in the outcome exist between having (versus not having) a bridging tie. When stratified by the location of the bridging social capital, the same abovementioned pattern for lower SES households is observed for inside-village bridging ties (respectively 14% and 8% differences for households with asset scores of 0 and 9); but no significant differences exist among outside-village ties.

Fig. 1b reveals that only higher SES households with (versus without) a medical tie have significantly lower probabilities of having an underweight child (respectively 8% and 10% differences for household asset scores of 18 and 27). When examined by geographic location, these same patterns exist for inside- and outside-village medical ties. Additionally, for inside-village ties, the lowest SES households with a medical tie have an 11% higher probability of child underweight compared to the lowest SES households without such ties.

Fig. 1c shows that the lowest SES households with (versus without) a school tie have a 10% lower probability of having an underweight child. By contrast, higher SES households with and without a school tie do not significantly differ in the probability of child underweight. The difference observed among the lowest SES households seems to be driven by school ties located outside—not inside—the village, where there was an 11% lower probability of child underweight among the lowest SES households.

These results support the resource substitution explanation (H2a) for bridging ties and linking ties to a teacher/principal. However, the results for linking ties to a doctor/nurse support the fundamental cause explanation (H2b). When considering the geographic location of social capital, the proximal resource substitution explanation (H2c) was partially supported by bridging ties inside the village; however, the fundamental divide explanation (H2d) was not supported by any social capital form.

4. Discussion

We examined how SES shapes access to three forms of social capital (bonding, bridging, and linking) and how SES moderates the relationship between each form of social capital and child underweight—including their respective geographic locations—using multilevel data on children and their families living in rural villages throughout India. Our analyses provide substantial evidence that SES is not only associated with greater access to social capital, but impacts the utility of that social capital for addressing child underweight. Below, we discuss our results in terms of our study hypotheses.

4.1. SES and access to social capital

Our findings corroborate the opportunity hoarding explanation (H1a), which proposes that higher household SES (relative to lower household SES) entails a better capacity to accumulate resources to prevent future adversities (Wright, 2009). This finding is consistent with Uphoff et al. (2013) systematic review on social capital and socioeconomic inequalities in health and prior research in India in which wealth and education were found to be the primary determinants of the breadth and depth of one's social networks (Kozel and Parker, 2000; Vanneman et al., 2006).

With respect to location of social capital, we found that higher household SES is associated with higher odds of linking ties to teachers/principals and government officials existing outside (versus inside) the village (H1c). For all other social capital forms, the correlation with SES did not vary inside versus outside the

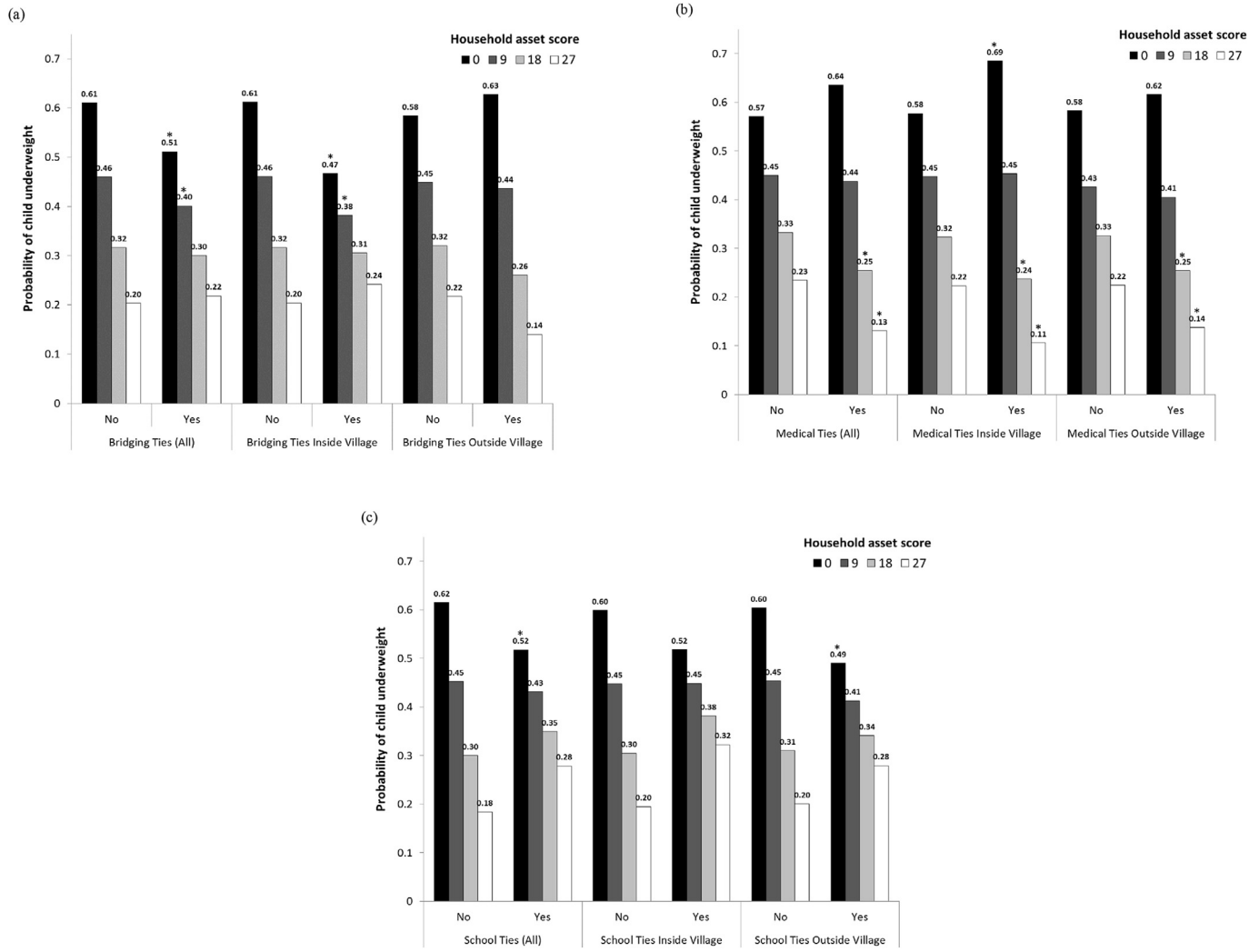

Fig. 1. Adjusted predictions of child underweight at representative values of household assets stratified by location of (a) bridging ties (b) medical ties, and (c) school ties. *Note*: * Statistically significant ($p < 0.05$) difference in underweight compared to households without the specific social capital tie but with the same household asset score.

village. Therefore, the proximity of these social capital forms will not likely reduce the observed SES disparities.

4.2. SES as a moderator of social capital and child underweight

In examining how the potential benefits of social capital differ by SES, we found that household SES significantly moderated the effects of ties to bridging organizations, and linking ties to a doctor/nurse and to a teacher/principal for child underweight.

Consistent with our *resource substitution hypothesis* (H2a), lower SES households with ties to bridging organizations and school personnel had a lower probability of having an underweight child compared to lower SES households without such ties. Most of the bridging organizations examined in our study (e.g., women's groups, self-help groups, credit or savings groups, and development groups) were established to empower the poor and help alleviate poverty, even though some higher SES individuals and households may still join and benefit from them (Deshmukh-Ranadive, 2004). These groups come together to find a solution to a common problem (e.g., child health and nutrition). Therefore, bridging social capital strengthens the capacity of the poor to overcome deficiencies in other forms of capital by building ties between communities and social groups (Woolcock and Narayan, 2000).

Social connections to principals and teachers might benefit households by increasing knowledge about child health through interaction with more educated individuals (e.g., better feeding practices or disease prevention), which is particularly important for low-income households. Moestue et al. (2007) found that the association between child nutrition and level of literacy within one's social network was stronger among the poorest households in Andhra Pradesh, India, which led them to conclude that these households may have more to gain from being connected to educated others compared to less poor households. Similarly, Parashar (2005) suggested that higher education levels of rural Indian women may aid in disseminating information about child health through social interactions at the community level.

Conversely, in support of the *fundamental cause hypothesis* (H2b), higher SES households with a medical tie had a lower probability of having an underweight child compared to households without a medical tie. This corroborates findings in Vietnam

regarding individual support (from formal and informal networks) being more beneficial for child weight-for-age among non-poor households (De Silva and Harpham, 2007)—likely due to their receiving support from similar non-poor people that is more effective at improving (and/or maintaining) child nutrition. Therefore, in the context of our study, if a child from a lower SES household becomes sick and is malnourished, s/he will have a difficult time overcoming her/his illness due to insufficient resources to rehabilitate the child. On the other hand, higher SES households have greater access to economic resources and knowledge to help a child recover from her/his illness after receiving treatment from a medical professional.

Evidence supporting the *proximal resource substitution hypothesis* (H2c) is limited to inside-village bridging social capital being associated with a lower likelihood of child underweight only among lower SES households. This finding corroborates those of Carter and Maluccio (2003), who found that South African households that suffered an economic shock were better able to absorb this stressor (i.e., child nutrition status was not affected) when they were embedded within communities with more informal associations and groups. Thus, it is important for more vulnerable households to have access to bridging organizations in close proximity to their home to access the resources and relationships available within these types of organizations.

Our findings fail to support the *fundamental divide hypothesis* (H2d), but, as noted above, are consistent with fundamental cause theory in general. Inside- and outside-village medical ties were each significantly associated with lower probability of child undernutrition for higher (versus lower) SES households; but these associations were not substantively stronger for outside-versus inside-village ties.

4.3. Additional findings inconsistent with hypotheses

We also observed findings inconsistent with the two aforementioned location-specific hypotheses (H2c and H2d). First, among low SES households, an inside-village medical tie was associated with a *higher* probability of child underweight. Thus, lower SES households may be seeking poor quality medical care close to home when their child becomes sick. This child may not be able to recover from the illness due to the quality of care and lack of resources at home, yet the respondent still reports a connection to a nearby medical professional.

Second, outside-village school ties were more strongly associated with *lower* probability of child underweight for lower (versus higher) SES households. This suggests that the benefits of the education system do not need to be nearby in order to have an impact on child nutrition. Lower SES households may not have access to a school in their village, and thus child nutrition may benefit from a connection to a school outside their village, especially if the school includes a meal program, which is common in India (Afridi, 2010).

4.4. Limitations and strengths

Though our study provides evidence for informing important knowledge gaps on child health inequalities in LMICs, we consider several potential limitations.

First, we analyzed cross-sectional data, which limit our ability to make causal inferences. Some of our findings could be due to self-selection—either alone or in tandem with causation mechanisms. For example, an unhealthy or undernourished child may motivate parents and households to build ties with specific organizations and individuals. Nevertheless, our data allowed us to refine our hypotheses so that we can further test them with other longitudinal data as they become available.

Second, with respect to our measures, the IHDS dataset only contained information on whether someone in the child's household had membership in bonding and bridging groups or linking ties. No information existed on specific resources exchanged, which would have been informative for delineating the potential importance of various ties. However, the IHDS measures of social capital enabled us to thoroughly assess membership in a wide range of common organizations as well as ties to representatives of institutions. This breadth is an asset over many other existing data options and enabled important insights into several issues that, to date, have received limited empirical attention—notably, linking social capital and geographic location of social capital.

4.5. Conclusions

Our study provides evidence on how different social capital forms may mitigate as well as sustain or reproduce socioeconomic disparities in child underweight. In testing several theory-driven hypotheses, our findings (1) support conceptualizing and operationalizing social capital into three forms—bonding, bridging, and linking—to better understand the consequences of social capital on SES inequalities in child nutrition in LMICs and (2) offer three summative conclusions for guiding future research on social capital and disparities in child underweight (and child health more broadly) in LMICs.

First, with respect to SES disparities in accessing social capital, our findings suggest that SES not only affects access to health care resources for reducing malnutrition (Chalasani, 2012), but also affects access to societal resources that may otherwise help reduce disparities in child underweight. This points to the need for future studies to evaluate equity in access to social capital strengthening interventions—such as the self-help group model in India (Knowles et al., 2013)—and not merely equity in access to health care resources.

Second, in terms of the differential health benefits or utility of social capital by SES, our findings indicate that (1) for lower SES households, social capital may offer a beneficial compensatory resource in the absence of other resources (money and education), and (2) for higher SES households, social capital may be utilized as part of a package of flexible resources for maintaining and improving child health—and ultimately reproducing child health inequalities in LMICs (Carpiano et al., 2008). Therefore, future research needs to consider these nuanced and complex mechanisms in designing studies that can best isolate the interaction between social capital and SES to determine their health impacts.

Third, with respect to geographical location, our findings suggest that the association between social capital and child health is indeed contingent on where social capital is located and how locations might be more or less accessible and useful by different levels of household SES. Hence, future studies should consider and assess the location of specific types of social capital—as proximity may matter for ease of access and most optimal utility for benefitting child health.

In closing, our study highlights how these three elements offer ways to advance health research on social capital in LMICs by facilitating more focused analyses of specific mechanisms through which social capital may operate for health and, in turn, informing the design of effective interventions.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2017.03.043.

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