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The Role of Women's Empowerment and Domestic Violence in Child Growth and Undernutrition in a Tribal and Rural Community in South India

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Abstract

Moderate undernutrition continues to affect 46 per cent of children under 5 years of age and 47 per cent of rural women in India. Women's lack of empowerment is believed to be an important factor in the persistent prevalence of undernutrition. In India, women's empowerment often varies by community, with tribes sometimes being the most progressive. This paper explores the relationship between women's empowerment, domestic violence, maternal nutritional status, and the nutritional status and growth over ...

Keywords: child nutrition, child growth, domestic violence, nutritional status, women's empowerment, maternal nutritional status

JEL classification: Q18, D19

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six months in children aged 6 to 24 months in a rural and tribal community. This longitudinal observational study undertaken in rural Karnataka, India included tribal and rural subjects. Structured interviews with mothers were conducted and anthropometric measurements were obtained for 820 mother-child pairs, the follow-up rate after 6 months was 82 per cent. The data were analyzed by multivariate regression. Some degree of undernutrition was seen in 83.5 per cent of children and 72.4 per cent of mothers in the sample, moreover the prevalence of undernutrition increased among children at follow up. Domestic violence was experienced by 34 per cent of mothers in the sample. In multivariate analysis, biological variables explained most of the variance in nutritional status and child growth, followed by health-care seeking and women's empowerment variables; socio-economic variables explained the least variance. Women's empowerment variables were significantly associated with child nutrition on enrolment and child growth at follow-up. At follow-up, mother's prior lifetime experience of physical violence significantly undermined child growth in terms of weight-for-age, and older age at marriage and high mobility of mothers predicted less stunting in their children. In addition to the known investments needed to reduce undernutrition, improving women's nutrition, promoting gender equality, empowering women, and ending violence against women could further reduce the prevalence of undernutrition in this segment of the Indian population.

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Tables and figures appear at the end of the paper.

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1 Introduction

Childhood undernutrition remains highly prevalent in India; 46 per cent of all children under the age of 5 years are stunted (International Institute for Population Sciences 2001). Growth faltering often begins in infancy, as early as three to four months of age (Allen 1993; Neumann and Harrison 1994; Shrimpton et al. 2001). The rate of weight gain and linear growth begins to decline, with the rate of linear growth declining more sharply (Allen 1993; Neumann and Harrison 1994; Shrimpton et al. 2001). Linear growth retardation or stunting is usually complete by two years of age, and while after this time the growth rate is comparable to that in normal children, there is little catch-up growth in already stunted children. Figure 1 presents aggregate regional data on the age range when growth faltering occurs (Shrimpton et al. 2001).

The far-reaching consequences of childhood undernutrition are well established (Pelletier et al. 1995; Grantham-McGregor and Fernald 1997; Tomkins and Watson 1989). Undernutrition is often inter-generational in nature, affecting women and children throughout their life-cycle (Allen and Gillespie 2001). Progress in reducing the prevalence of undernutrition in India has been steady but slow (Measham and Chatterjee 1999; UN/ACC/SCN 1996). Overall, investment in nutrition has been inadequate (Measham and Chatterjee 1999). Programme efforts to tackle undernutrition have focused on the provision of services, but these have been plagued with operational setbacks and have often not integrated community participation (Measham and Chatterjee 1999). Moreover, country-level analysis of DHS data clearly reveal that within-country differences in undernutrition are determined at the household level (Fenn et al. 2004). The direct causes of childhood undernutrition are inadequate dietary intake, disease, and inadequate care practices (Allen and Gillespie 2001). In India, low birth weight (23 per cent prevalence) is also a major contributing factor. Low birth weight not only is a consequence of maternal undernutrition but also contributes significantly to subsequent child undernutrition (International Institute for Population Sciences 2001; Allen and Gillespie 2001; Ramalingaswami et al. 1997; Osmani 1997). Maternal undernutrition in India, measured by chronic energy deficiency, defined as a body-mass index (BMI) <18.5 kg/m^2, affects 47 per cent of rural women (International Institute for Population Sciences 2001). Recent studies have found that maternal nutritional status is significantly associated with the nutritional status of young children, not just of neonates (Hautvast et al. 2000). Additionally, the effects of maternal undernutrition and low birth weight on childhood undernutrition are compounded by the practice of early marriage, which leads to early and frequent pregnancies (UNICEF 2005; Mathur et al. 2003). The underlying factors that most likely contribute to undernutrition through sociocultural pathways are gender inequality and women's lack of empowerment (Osmani 1997; Osmani and Sen 2003).

1.1 Women's empowerment

The extent to which empowering women in this region can bring about improvements in nutrition outcome is yet to be explored. Measuring women's empowerment is challenging, because the term itself is often poorly defined (Gurumurthy 1998; Kishor and Neitzel 1996; Mason 1986). The key underlying concepts that define women's empowerment relate to choices, control, and power (Malhotra and Schuler 2005). Women's empowerment is conceptualized as a function of women's access to and control over resources, which extends to their decision-making capabilities regarding

household decisions, employment, income, household assets and expenditure, fertility, sexuality, and freedom of movement (physical mobility) and their control over material and intangible resources such as property, information and time; their position within the household vis-à-vis other male and female household members; their experience of domestic violence; and their education (Gurumurthy 1998; Dyson and Moore 1983). For most women in South Asia, gaining control over resources, in addition to gaining access to resources, is essential (Gurumurthy 1998).

In fact, Osmani and Sen argue that one of the most significant factors that contributes to both the high prevalence of undernutrition and low birth weight in this region is gender inequality and women's lack of empowerment (Osmani and Sen 2003). In India, marriage in adolescence remains a widespread practice affecting 44.5 per cent of adolescent girls, and is a consequence of the broader social norms that encourage parents to marry their daughters off early (Mathur et al. 2003; International Institute for Population Sciences 2007). And this significantly affects both women's empowerment and child nutrition. At this early stage in their life-cycle, married adolescent girls are the least empowered members in their marital homes and the most at-risk nutritionally. Under these circumstances, they quickly go on to having children, but are unable to provide the optimum care because of their low status in the marital family.

1.2 Women's empowerment, child survival, and nutrition

Many studies have looked for associations between indicators of women's empowerment and child nutrition and survival (Bicego and Boerma 1993; Handa 1999; Reed et al. 1996; Smith and Haddad 1999; Kishor and Parasuraman 1998; Abbi et al. 1991; Engle 1993; Smith et al. 2003; Merchant and Udipi 1997; Asling-Monemi et al. 2003; Jejeebhoy 1998; Campbell et al. 1999; Sharriff 1998; Mencher 1988; Visaria et al. 1999). The increase in women's education from 1970 to 1995 is one indicator of women's empowerment that has contributed to a reduction of more than 50 per cent in the prevalence of underweight (Smith and Haddad 1999). Studies have found that secondary education for women confers the greatest benefit and that education is most beneficial to mothers when they also have moderate access to resources and wealth (Reed et al. 1996; Malhotra et al. 2003). The association between maternal employment and child health outcomes is inconsistent. Two studies found that among poor women who worked as daily wage labourers, maternal employment significantly increased the risks of child mortality and undernutrition (Kishor and Parasuraman 1998; Abbi et al. 1991). Qualitative research from India found that because women's wages are so low compared to men's, families prefer that women stay home where their efforts would be more productive for the household (Desai and Jain 1994). However, studies also show that mothers who contribute more to total household income are less likely to have malnourished children and that the majority of mothers' incomes are used to provide for their children (Engle 1993; Mencher 1998). A meta-analysis of Demographic and Health Survey data from 36 developing countries found that some indicators of women's empowerment, such as the mother's age at marriage, had a significant positive association with children's nutritional status (Smith et al. 2003). In a longitudinal study of slum children in Mumbai, India, poor growth in children was found to be significantly associated with illiteracy, experience of marital disharmony, younger age at marriage, and less decision-making power among mothers (Merchant and Udipi 1997).

1.3 Domestic violence, birth outcomes, and child survival

Several recent studies have also found that maternal experience of physical and sexual violence is significantly associated with an increased risk of under-five mortality, infant and fetal death, and low birthweight (Asling-Monemi et al. 2003; Jejeebhoy 1998; Campbell et al. 1999). Recent surveys have found that the prevalence of domestic violence (defined as physical beating or battering of a woman by a male intimate partner) ranges from 22 per cent to 60 per cent in developing countries (Visaria 1999; Heise et al. 1994). The prevalence of psychological and emotional abuse (defined as a woman being threatened with physical abuse, ridiculed, or ignored) is believed to be even higher (Visaria et al. 1999; Heise et al. 1994). Analysis of DHS data from several countries clearly show that women and girls are more likely to experience violence when they are married at the youngest ages in adolescence (UNICEF 2005). The precursors of domestic violence are marital conflict, male control over household wealth and decision-making, poverty, and unemployment (Heise 1998). Given the high prevalence of domestic violence and its impact on infant and child mortality, and birth outcome, it is important to explore the role of domestic violence on child nutrition, and it is reasonable to expect an association.

1.4 Women's empowerment in tribal and rural communities in India

Some tribes in India have social norms that enable their women to be more empowered than their rural counterparts (Visaria et al. 1999; Heise et al. 1994). For example, in these tribes women are more involved in decision-making, have greater freedom of movement, and are free to choose their marital partners, and can divorce and remarry without stigma (Shiva Kumar 1995; Kendra 1990). Our study explored the relationship between women's empowerment, maternal nutritional status, and the nutritional status and growth of their children 6 to 24 months of age in a tribal and rural community in South India. The primary objective of including both tribal and rural subjects in the sample was to ensure that there was sufficient variance in the dimension of women's empowerment to determine its role in child growth and nutrition. Therefore, while we present socio-demographic and sample characteristics of both tribal and rural women, in the multivariate analysis the two groups are analyzed as one sample. We present the analysis of enrolment and follow-up data on children's weight-for-age and height-for-age. Analysis of longitudinal data of this type is important because it provides insight into the factors that undermine child growth over time (Frongillo and Rowe 1999). Determining which variables impact undernutrition over time sheds light on potential interventions that may be needed in addition to those that currently exist. The findings presented here are part of a larger study, and some of the qualitative findings and cross-sectional analysis are presented elsewhere (Sethuraman et al. 2006).

2 Subjects and methods

2.1 Study population

This study was undertaken in the Mysore region of Karnataka, India (a rural region), between November 1998 and August 2000. The first phase used qualitative methods,

and the second quantitative. The study population included the scheduled caste, backward caste, and one scheduled tribe.[1] To obtain a sample in which the level of empowerment differed among women, the Soliga tribe and a neighbouring rural community were selected. This tribe was selected because it was known to have social norms conducive to empowering women, whereas the opposite was true for women in the rural communities (Kendra 1990). The Soliga tribe lived in the forested areas of southern Karnataka, and the neighbouring rural community included scheduled and backward caste families. The distance to the nearest major town or city was more than 20 km for the tribal community and 5 to 8 km for the rural villages. Originally, access to this tribe and the neighbouring rural population was obtained through Vivekananda Girijana Kalyana Kendra (VGKK), a local nongovernmental organization that has served this population in an area known as the BR Hills (Biligiri Renganna Betta Hills) since the 1970s.

2.2 Survey design

Qualitative research was undertaken primarily to inform the design of the questionnaire, verify the relevance of the conceptual framework to these communities, and confirm differences between the tribal and the rural women in terms of empowerment (Sethuraman et al. 2006). A conceptual framework for women's empowerment specific to the South Asian context was adapted from the literature (Gurumurthy 1998; Mason 1986; Dyson and Moore 1983; Batliwala et al. 1998). The study participants were asked a range of questions related to women's empowerment, such as their impressions of women's involvement in household decision-making. The questionnaire was developed from these qualitative data and from review of the literature and relevant survey tools (International Institute for Population Sciences 2001; Gurumurthy 1998; Batliwala et al. 1998). The overall design of the questionnaire and the format of the close-ended questions followed Babbie's (Babbie 1990) guidelines. The questionnaire was translated into the local language, Kannada, back-translated to ensure accuracy of content and semantic and conceptual equivalence, and then pre-tested. The interviewers were trained, and reliability tests were performed to ensure consistency in the methods of asking questions and recording answers. The questionnaire was field-tested and piloted on a randomly selected sub-sample of respondents. A local calendar was developed to obtain children's birth dates, and a letter was drafted to obtain oral informed consent. To meet the ethical guidelines on researching domestic violence, a counsellor was hired at this time and was available to the interviewers and respondents at all times for the duration of the study (WHO 2001). Every effort was made to ensure the respondents' privacy and maintain confidentiality during interviews. With a few exceptions, such as when a community center was not available, all the interviews were conducted in the *anganwadi* centers (child-feeding centers of the national Integrated Child Development Scheme). If other family members accompanied the women, they were asked to remain outside the centers; the counsellor played the role of gatekeeper at this time.

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1 The terms 'scheduled caste' and 'scheduled tribe' are used by the Government of India to refer to the caste previously known as 'untouchables' and the tribes previously known as *adivasis*, respectively. Similarly the term 'backward caste' is used by the Government of India to refer to the castes that include low-skill artisans such as potters or shepards; they are not considered as poor as the scheduled caste and tribes.

2.3 Anthropometry

Children 6 to 24 months of age were enrolled in the study and were followed-up after 6 months. Children's weight was measured to the nearest 0.1 kg with a Salter scale (CMS Weighing Equipment, London, UK) and recumbent length to the nearest 0.5 cm with a Starter mat (Starters, Norwich, UK). Maternal weight was measured on enrolment to the nearest 0.1 kg with a digital adult scale (THD 305, CMS Weighing Equipment) and maternal height to the nearest 0.1 cm with a portable stadiometer (Leicester Portable Measure, Leicester, UK). Children who were older than two at follow-up had their standing height measured on the stadiometer. Because there is a difference in measurement between recumbent length and standing height, adjustments were made to the final measurements. Maternal and child hemoglobin was measured in a fingerprick sample with a HemoCue (HemoCue, Sheffield, UK) on enrolment. At follow-up, only child hemoglobin was measured. All measurements were taken by the first author. Measurements were only taken on the children at follow-up.

Ethical approval for this study was obtained from Vivekananda Girijana Kalyana Kendra (VGKK), the local nongovernmental organization in BR Hills and the Institute for Child Health/Great Ormond Street Hospital, London, UK.

2.4 Sampling methods

Sample size calculations were based on a difference of 11 per cent in height-for-age between the tribal and rural children at 80 per cent power and 5 per cent significance level according to the findings of the previous National Family Health Survey of Karnataka undertaken in 1992/93 (Institute for Social and Economic Change and International Institute for Population Sciences 1995). Including an attrition rate of 20 per cent, the final sample size was 406 for the tribal cell and 406 for the rural cell. Measurements and structured interviews were completed on 405 rural and 415 tribal mother–child pairs on enrolment and 330 rural and 351 tribal children at follow-up. The follow-up rate was 82 per cent of the original sample. A brief questionnaire was also administered at follow-up. The responses on enrolment and at follow-up were recorded by the interviewers on paper questionnaires. A random cluster sample was drawn for the rural villages, including the villages for the pilot study. Seven villages were randomly selected, and all the children and mothers from the scheduled and backward caste neighbourhoods within them were enrolled in the study; only five eligible participants declined to participate. For the tribal mothers and children, the total population of the Soliga tribe in the state of Karnataka was 25,000, and a census sample was used to obtain adequate numbers of children for this cell; only two eligible participants declined to participate. Only one eligible child per household was included in the sample. An oral invitation to participate in the study was extended to eligible subjects. Oral informed consent was obtained from all the mothers for themselves and their children.

2.5 Statistical methods

The questionnaires were double-entered into a template created in Epi Info version 6 (Centers for Disease Control and Prevention, Atlanta, GA, USA). The data were extracted, verified, and cleaned. The anthropometric data were converted into Z scores based on the NCHS (National Center for Health Statistics) reference standards. The

subsequent statistical analysis was performed with the statistical package SPSS, version 11 (SPSS, Chicago, IL, USA).

Basic descriptive analysis, factor analysis, and bivariate and multivariate linear stepwise regression analyses were performed on the data set. Two sets of multivariate regressions were undertaken with the data; a first set of regression analyses were completed on the child nutrition data obtained at enrolment; and a second set of regression analyses were completed on the data obtained at follow-up. The purpose of these two sets of analyses were to determine the association between the women's empowerment and domestic violence variables on child nutrition on enrolment and at follow-up. For the regressions of the follow-up data, two types of regression analyses were conducted. The first was a developmental curve or growth curve model, and the second was the dynamic model (Frongillo and Rowe 1999). The developmental curve model captures change in the dependent variable and then determines how this change co-varies with the independent variables. For the developmental model, an interaction term for the first measurement multiplied by the age of the child, and the age of the child were entered in the regressions. An adjustment term needed to be included as children regress to the mean and nutritional status for this age group is closely linked to age (Bijleveld et al. 1998). The dynamic model estimates the influence of the independent variables on change in the dependent variable from time 1 to time 2. For the dynamic model, the same interaction term was entered in addition to the first anthropometric measurement and the age of the child.

The biological variables, such as hemoglobin, maternal height, maternal weight, and maternal BMI, were entered as actual values. Dietary intake, missed immunizations, and morbidity were entered as scores. The remaining independent variables were continuous variables from the factor analysis. The independent variables were grouped into four categories for analysis. The first consisted of only the biological variables, including maternal height or weight, children's hemoglobin, children's dietary intake, children's morbidity, and children's immunizations. The second set consisted of the nutrition and health variables, including health-care seeking, food security, child feeding, and maternal reproductive health. The third set consisted of the women's empowerment variables, including the mother's decision-making capabilities, freedom of movement, employment, and experience of domestic violence. The fourth set consisted of all the socio-economic variables, including education.

3 Results

The prevalence of underweight and stunting in the children in this sample was extremely high, and increased over the course of the study between enrolment and follow-up. Some degree of underweight and stunting was present in 83.5 per cent and 57.7 per cent of children on enrolment and 93.4 per cent and 76.7 per cent at follow-up, respectively (Table 1). The rate of stunting increased at a slightly faster pace than the rate of underweight over time. Tribal children were consistently more malnourished than their rural counterparts, a finding that is consistent with both national and state survey data from India (NFHS), in part because tribal families typically live in more remote resource-poor settings. However, the mean values for anemia were not significantly different between the tribal and rural subjects (Table 1).

The maternal characteristics of the tribal and rural women in the sample, such as maternal age and age at marriage, were not significantly different across the sample (Table 2). Mean maternal age was low, and early marriage and childbearing were the norm. In terms of demographic characteristics (Table 3), the tribal subjects were more likely to come from nuclear families, whereas joint families were significantly more common among the rural subjects. Tribal families had more limited access to electricity, education, and health care than rural families. Tribal families also were more food insecure, were more likely to purchase food on a weekly basis, and reported more days without food (Table 3). Tribal women, however, were significantly more likely to be involved in subsistence farming. Most subjects in both groups had to borrow money to pay for health care; rural subjects were more likely to use private health care (Table 3). Child-feeding practices were similar across the sample, and more than 80 per cent of the children were still being breastfed at the time of the study (Table 4). Many mothers introduced complementary foods at an appropriate age (about 6 months), but diet diversity was poor (Table 4).

Despite the young age of mothers in the sample, the degree of variation in empowerment is important to note among both the tribal and rural mothers, because young mothers with young children are usually the focus of nutrition programmes. It suggests that although younger women are probably still less empowered than older women, there is room to empower them even within the existing socio-cultural context. In this sample, tribal women had greater decision-making capabilities and freedom of movement than rural women; and they were also more likely to be employed (Table 5). Although tribal women are more empowered than rural women, child-feeding practices are the same in the two groups. This suggests that despite tribal women being more empowered, tribal and rural mothers alike do not have enough knowledge about appropriate feeding practices. Similarly, given the higher rate of undernutrition in tribal children, it also suggests that where access to information and resources is extremely limited, empowerment alone is an insufficient precondition to prevent undernutrition.

The two groups did not differ significantly, however, in the prevalence of domestic violence experienced and psychological abuse is more prevalent than physical violence (Figure 2). In this sample, violence is most likely a consequence of poverty. Among mothers who experience psychological abuse, 50 per cent also admitted to having experienced physical violence.

Bivariate associations with children's weight-for-age and height-for-age on enrolment and follow-up were as expected (Table 6). The biological variables consistently have the strongest association with weight-for-age and height-for-age. Maternal weight, maternal height, child hemoglobin, and missed immunizations are the variables with the strongest associations with weight-for-age and height-for-age on enrolment. At follow-up, maternal weight and maternal height continue to have strong associations with weight-for-age and height-for-age, respectively. The women's empowerment variables have a strong association with weight-for-age, but virtually no association with height-for-age on enrolment. At follow-up though, several of the empowerment variables are significantly associated with height-for-age, and others remain significantly associated with weight-for-age. Private health care is one variable for which the association with both weight-for-age and height-for-age strengthens at follow-up. Among the socio-economic variables, the association with weight-for-age and height-for-age remain strong at both time points, particularly for family structure and income, and family type and size. Interestingly, while the association with maternal education for both outcome

variables is marginal at enrolment, the association is more highly significant at follow-up.

Table 7 presents the multivariate regression analysis for child weight-for-age on enrolment and at follow-up. The model used for the regression of the follow-up data is a developmental or growth curve model. After controlling for the known immediate and underlying causes of undernutrition, women's empowerment variables are significantly associated with child weight-for-age on enrolment and at follow-up. Where young mothers are empowered to make decisions and have greater freedom of movement, their children's nutritional status tends to be better. However, one important finding is that a mother's prior lifetime experience of physical violence on enrolment is negatively associated with child weight-for-age at follow-up, suggesting that it undermines child growth. On enrolment, the biological variables have the strongest association with weight-for-age. Maternal weight, maternal hemoglobin, child hemoglobin, and energy-dense foods are strongly associated with weight-for-age. The next set of variables that have a strong association with weight-for-age on enrolment are the women's empowerment variables, namely the mother's position in the household and decision-making is positively associated, and current maternal employment and income is negatively associated. The health-seeking and food insecurity variables are marginally significant at enrolment, but highly significant at follow-up. However, at follow-up the strength of the association with the biological variables is weaker, and different women's empowerment variables are significant. The mother's mobility in the village is significant, and the mother's experience of physical violence is negatively associated with weight-for-age at follow-up. The socio-economic variables were non-significant. The adjusted R^2 for both models are as expected given this type of survey data. The multivariate regression of the follow-up data controls for the previous measurement, and thus explains the high adjusted R^2 values.

Table 8 presents the multivariate regression analysis with child height-for-age as the dependent variable. Here again, the model used for the regression of the follow-up data is a developmental or growth curve model. The overall rate and pattern of stunting in this sample from enrolment to follow-up is as expected, and the trend seen reflects the period in child growth when stunting occurs (6-24 months of age). On enrolment, stunting as an outcome variable is weak; only the biological variables explained the variance in the sample, but much of the variance remained unexplained. This is consistent with the pattern seen in the bivariate analysis for height-for-age on enrolment. Moreover, the adjusted R^2 is low. It is likely that because the process of stunting begins after children become underweight, with young children of this age, underweight is a stronger outcome variable. However at follow-up stunting becomes a much stronger outcome variable and the adjusted R^2 is more robust. The biological variables are not as strongly associated to height-for-age at follow-up, and are almost equal in weight to the other variables that remain in the model. As seen in the weight-for-age regression, health-seeking and food security variables become highly significant at follow-up. The women's empowerment variables that remain in the model are the mother's mobility within the village, and the mother's age at marriage. Maternal age at marriage is positively associated with stunting at follow-up, suggesting that older mothers have children that are less stunted. Age of marriage here not only reflects the socio-cultural norm of early marriage and women's lack of empowerment, but also the biological link, in which younger mothers who are often themselves malnourished adolescents, go on to have children that are malnourished also.

The strong positive association seen between maternal nutritional status and children's weight-for-age and height-for-age shows that undernutrition is intergenerational in nature, however the influence of maternal weight and height does diminish over time. The socio-economic variables do not remain in the final models, suggesting that the sample is relatively homogeneous. Maternal education did not remain in the final regression models most likely because there are few mothers in the sample with any education. The health-seeking behaviour variables reflect how much families can and do invest in their children's health and also how effective they are in obtaining resources, such as credit, to go to the health center. The association between the health-seeking variables and weight-for-age on enrolment is significant, but this association becomes much stronger for both weight-for-age and height-for-age at follow-up. This suggests that both the investment in children's health and the families' effectiveness in obtaining health care are protective of child nutrition and growth over time. Similarly food insecurity is highly associated with both weight-for-age and height-for-age at follow-up, suggesting that prior experience of food insecurity predicts higher undernutrition in children at follow-up.

Longitudinal data, such as that presented here, can in some cases provide information on causality, of prior experience or events influencing future outcomes. Table 9 presents a multivariate regression that uses the dynamic model for the follow-up data. In this model, by including the first anthropometric measurement taken on enrolment, the model more accurately estimates the influence of the independent variables on change in child growth at follow-up. The pattern seen here is consistent with the pattern seen in Tables 7 and 8, but these results provide further evidence that health-seeking, food security, and women's empowerment variables contribute independently to child growth at follow-up (and do not simply co-vary with the outcome variable). Importantly, in both the weight-for-age and height-for-age regressions, health-seeking and the mother's mobility within the village on enrolment is protective of child growth at follow-up. However, prior experience of food insecurity undermines child growth at follow-up. In the weight-for-age regression, diet diversity on enrolment is protective, but the mother's prior experience of physical violence significantly undermines child weight-for-age at follow-up. And in the height-for-age regression, older age at marriage is associated with less stunting at follow-up.

4 Discussion

Taken together, these study findings show that women's empowerment and experience of domestic violence are associated not only with child nutrition as presented in an earlier paper (Sethuraman et al. 2006), but that these associations also extend to child nutritional status as children grow older. Women's empowerment appears to promote child growth. But conversely, a mother's prior lifetime experience of domestic violence on enrolment appears to undermine her child's growth at follow-up. The opposite direction in which these two variables are associated with child growth are as expected, given that women who experience violence are less likely to be empowered (Sethuraman et al. 2006). In their analysis of DHS data for several countries, Fenn et al. concluded that within country differences in child undernutrition are determined at the household level; this community level survey further substantiates their finding (Fenn et al. 2004). In this sample, not only is child undernutrition determined at the household level, but our understanding of the role social determinants play in child undernutrition is further explained.

Importantly, this study does find that health care and food security are critical for improved nutrition as children grow, as in other studies (Allen 1993). But, they are not the only factors that can produce an improvement in nutrition outcomes. In fact, these findings clearly highlight the complexity of undernutrition at the community-level and the role that gender issues play in child nutrition. Few studies to date have focused on the social determinants of child nutrition in a country such as India where the prevalence of undernutrition remains extremely high. Yet there has been growing recognition that in this part of the world, the role of gender equality and empowerment in nutrition are important to understand as they can provide guidance on how nutrition programmes need to be adapted to local realities. Most nutrition programmes are designed to improve child nutrition by monitoring child growth, implementing behaviour change strategies, providing nutrition education and food and micronutrient supplements. But they rarely take into account the household realities of young mothers, much less tackle these issues; these are often perceived as beyond the scope of a nutrition programme. In this study, as elsewhere in India, the young mothers are both married and have their children in adolescence, at a time when they themselves are growing and often undernourished themselves – this in itself compounds the prevalence of undernutrition. At this stage of their life-cycle, young mothers are particularly vulnerable. In this socio-cultural context, their young age and being one of the newest members of their marital family severely limit their decision-making capabilities and control over their lives, and as this study shows, this appears to further undermine nutrition outcomes. It is important however, to acknowledge that even under these circumstances there is variation in the sample in the extent to which young mothers are empowered. Though the majority are not empowered in terms of decision-making, mobility, and other related parameters, there are a significant proportion of young mothers (almost 30 per cent) who are more empowered than their peers. This suggests that although women become more empowered as they get older, there is still room to empower some young women even in this context.

Several studies have found associations between women's experience of domestic violence and infant and child mortality, and birth outcomes (Asling-Monemi et al. 2003; Jejeebhoy 1998; Campbell et al. 1999; Curry and Harvey 1998). Merchant et al. found that both marital disharmony and less decision-making power for the mother contributed to slower child growth (Merchant and Udipi 1997). This study establishes a firm association between a mother's prior lifetime experience of domestic violence and child nutrition outcomes in the future. This finding adds to the growing body of evidence that domestic violence has far-reaching consequences. And is particularly important because domestic violence is highly prevalent in India and in the developing world. One implication is that both the high prevalence of domestic violence and its impact on women and children are both factors that need to be addressed by health programmes, and possibly also by nutrition programmes. Another implication is that the persistence of domestic violence will erode gains in women's empowerment that will also have implications for improving child nutrition in the long-term.

In contrast, the finding that older age at marriage is associated with less stunting in children as they grow older suggests that investing in programmes that delay early marriage may in the long-term have a positive impact in reducing the prevalence of stunting, simply because older mothers are better equipped to have and care for their children. Moreover in this context, delaying marriage is a more feasible option than delaying first pregnancy because women have little knowledge and choice in contraception upon marriage, and little power to decide when to have the first child. In

addition, there is evidence to suggest that girls married at an older age are less likely to experience domestic violence (UNICEF 2005).

The study findings presented here are a result of a rigorous mixed methods research design. The survey questionnaire was developed based on qualitative findings from the study site. The resulting questionnaire was sufficiently context-specific to capture a range of experience among young mothers and children, particularly in terms of empowerment, gender inequality, and their experience of domestic violence. As a longitudinal study, these findings shed light on important relationships between gender and child nutrition.

5 Conclusions and recommendations

The larger social context and gender inequality in particular, play a role in the prevalence of undernutrition at the community level in this region of Karnataka, India. Moreover, these findings seem to suggest that the influence of gender inequality extends to future child nutrition outcomes. Further research on the nexus between women's empowerment, domestic violence, and nutrition outcomes is clearly needed. In particular, given the high prevalence of domestic violence in developing countries and its far-reaching consequences, there is a need to understand the extent to which women's experience of violence undermines nutrition outcomes, women's caring capacity, and women's ability to become empowered. At a broader level, it is necessary to implement strategies to end violence against women.

These findings clearly reinforce the idea that to reduce undernutrition over the longer term, it continues to be important for health and nutrition programmes to enable adequate child feeding practices, promote health-seeking behaviour, provide health services, and address household food insecurity. But these findings also strongly suggest that gender inequality, women's lack of empowerment, and violence are factors that are not only associated with child nutrition and growth, but that undermine nutrition outcomes as young children grow older. Given this, it will be important for nutrition programmes to broaden their scope and innovate to find ways to promote nutrition by addressing gender inequality. Moreover, existing and new nutrition programmes would benefit from parallel efforts to promote gender equality, delay marriage, and empower women and girls. Further operations research is needed in community-based nutrition programmes to determine whether empowering women can have a multiplier effect on improving nutrition outcomes, and how this can be achieved. At the community level, a next step for nutrition programmes is understanding and overcoming the constraints women face because of their lack of decision-making authority; restricted freedom of movement; experience of domestic violence; and lack of access to and control over resources such as time and money. Addressing these gender constraints could lead to better-designed nutrition programmes and improved programme effectiveness for a greater and more sustainable impact on reducing undernutrition.

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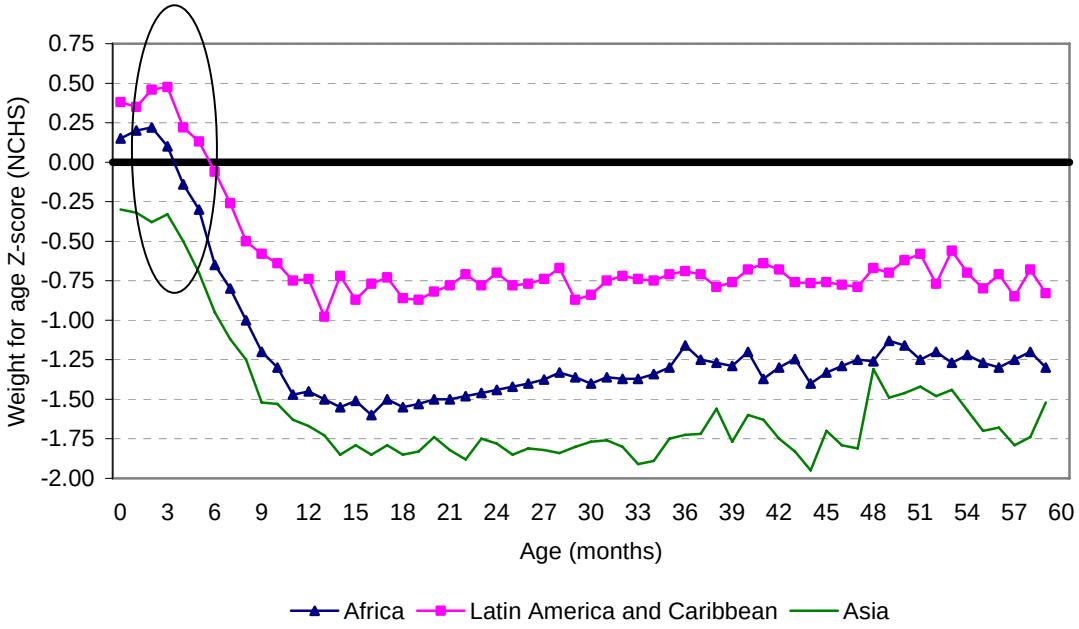
Figure 1: Regional data on the age range when growth faltering occurs



Source: Shrimpton et al. (2001).

Figure 2: Prevalence of domestic violence (n = 820)

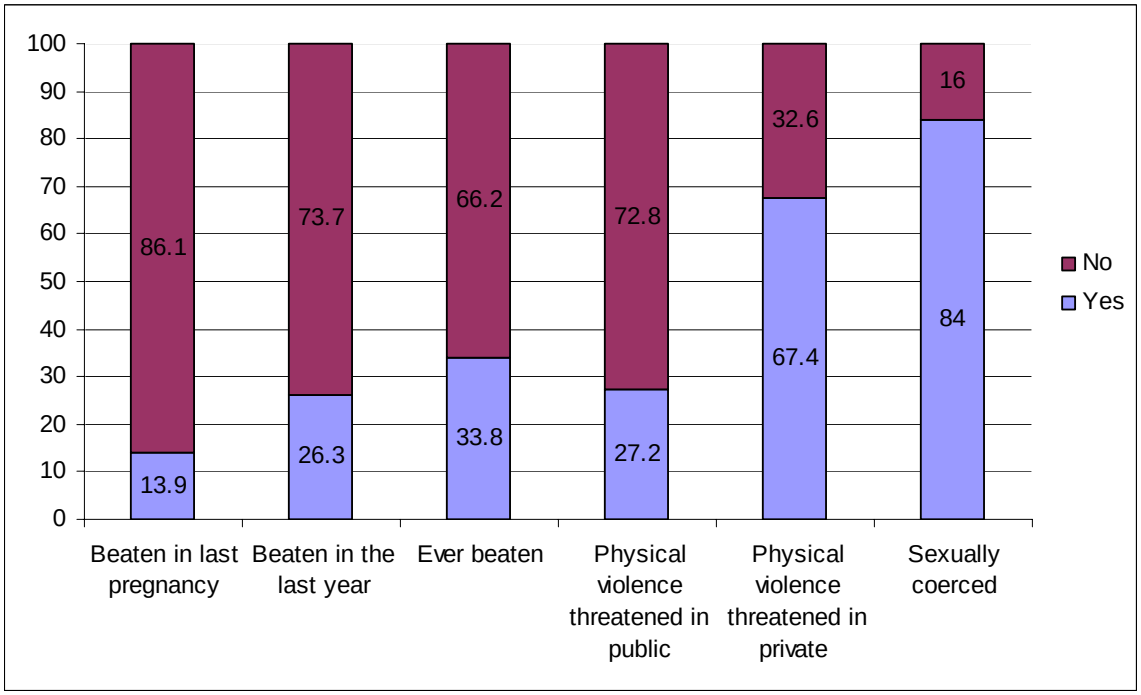


Table 1: Child characteristics and prevalence of malnutrition in tribal, rural groups and the whole sample at enrolment and at follow-up

	Enrolment			Follow-up		
	Tribal (*n* = 415)	Rural (*n* = 405)	Entire sample (*n* = 820)	Tribal (*n* = 343)	Rural (*n* = 327)	Entire sample (*n* = 670)
Child characteristics						
WAZ	-2.2 ± 1.0	-1.8 ± 1.0	-2.0 ± 1.0	-2.6 ± 0.87	-2.1 ± 0.91	-2.4 ± 0.93
HAZ	-1.4 ± 1.0	-1.2 ± 1.0	-1.3 ± 1.0	-2.0 ± 0.95	-1.6 ± 1.01	-1.8 ± 1.0
WHZ	-1.7 ± 1.1	-1.4 ± 1.0	-1.6 ± 1.1	-1.9 ± 0.82	-1.5 ± 0.78	-1.7 ± 0.82
Hemoglobin (g/dl)	9.3 ± 1.3	9.4 ± 1.6	9.4 ± 1.5	9.3 ± 1.4	9.2 ± 1.6	9.3 ± 1.5
Age (mo)	13.8 ± 6.0	15.2 ± 5.9	14.5 ± 6.0	19.9 ± 6.0	21.2 ± 5.8	20.5 ± 5.9
Child anthropometry: percentage of children below Z score cutoffs*						
WAZ						
< -1	87.7	79.3	83.5	97.1	89.6	93.4
< -2	61.7	45.4	53.7	76.9	58.1	67.8
< -3	21.7	11.6	16.7	36.7	15.3	26.3
HAZ						
< -1	63.6	51.6	57.7	83.1	70.0	76.7
< -2	27.2	22.2	24.7	47.8	33.1	40.6
< -3	5.3	5.2	5.2	14.3	8.6	11.5
WHZ						
< -1	75.9	67.9	72.0	87.2	75.8	81.6
< -2	43.2	30.7	36.9	43.7	25.3	34.8
< -3	9.9	3.5	6.7	7.0	2.4	4.8

Notes:

HAZ, height-for-age Z score; WAZ, weight-for-age Z score; WHZ, weight-for-height Z score.

*Z-score cutoffs: •1 = mild malnutrition; •2 = moderate malnutrition; •3 = severe malnutrition. Z-scores are based on NCHS reference standards.

Table 2: Maternal characteristics in the sample

Maternal characteristics			
	Tribal	Rural	Whole sample
	n = 415	*n* = 405	*n* = 820
Height (cm)	151.9 ± 5.5	151.8 ± 5.0	151.85 ± 5.2
Weight (kg)	40.2 ± 4.8	42.0 ± 5.7	41.1 ± 5.3
Hemoglobin (g/dl)	11.0 ± 2.0	11.8 ± 1.8	11.4 ± 1.9
BMI (kg/m^2)	17.4 ± 1.7	18.2 ± 2.2	17.8 ± 2.0
Age (yr)	21.8 ± 4.7	21.5 ± 3.9	21.7 ± 4.3
Age at marriage (yr)	15.0 ± 2.6	15.1 ± 2.9	15.1 ± 2.8
Years married	6.8 ± 4.4	6.4 ± 3.7	6.6 ± 4.1
No. of pregnancies	2.36 ± 1.3	2.14 ± 1.0	2.3 ± 1.2
Age at birth of 1st child (yr)	16.8 ± 2.6	16.9 ± 2.8	16.8 ± 2.7
No. of living children	2.2 ± 1.2	2.0 ± 1.0	2.13 ± 1.1
Education (yr)	1.3 ± 2.4	4.0 ± 4.3	2.62 ± 3.7
Maternal BMI: percentage of nonpregnant mothers below grade of chronic energy deficiency			
	n = 389	*n* = 358	*n* = 747
Normal (18.50)	20.1	35.8	27.6
Grade I (17.00–18.49)	33.9	28.8	72.4
Grade II (16.01–16.99)	25.4	20.4	40.9
Grade III (<16.00)	20.6	15.1	17.9

Notes:

BMI, body mass index; BMI reflects chronic energy deficiency (CED) in women, the grades are: grade I – mild CED; grade II – moderate CED; grade III – severe CED.

Table 3: Socio-economic, food security, and health characteristics of the sample (n = 820)

Characteristic	Tribal (%)	Rural (%)
Socio-economic		
Family structure		
Nuclear	76.4	54.4
Joint	18.8	39.3
Other***	4.8	6.2
Type of house		
Pucca	75.4	83.9
Kuccha**[1]	24.3	16.1
Houses with electricity***	20.0	63.9
Household food security		
Frequency of food purchases		
Daily	53.5	78.0
Weekly	39.0	14.4
Monthly	7.5	7.7
Days without food in past month		
0	34.5	49.4
1-3	45.3	41.7
•4-8 ***	20.3	8.9
Days without food in past week		
0	25.5	40.2
1	16.4	22.5
•2***	58.1	37.2
Food production (farming)		
No production or no land	45.8	56.9
Woman and others	35.7	2.0
Husband and others***	18.6	41.1
Health-seeking behaviour		
Time to health center		
<1 h	68.8	92.7
•2 h	28.3	5.7
Type of health center		
Government	56.6	26.4
Private***	42.9	72.1
Cost per health-center visit (rupees)		
0	23.5	12.1
<100	64.9	73.5
>100	11.3	13.1
Obtained credit for last health-center visit*	87.5	82.5
Obtained credit for health-center visit without husband's permission*	44.0	37.8

Notes: [1] Pucca houses are houses with cement, asbestos, or tile roofing; Kuccha houses are houses with thatched roofing. *p < .05; **p < .01; ***p < .0005.

Table 4: Child-feeding practices[a]

Practice	Tribal (%)	Rural (%)
Breastfeeding		
Time from birth to initiation		
<2 h	54.9	61.4
1 day	27.9	23.3
2–3 days	16.5	15.3
Colostrum given	51.2	51.5
Prelacteal feeds given	62.7	56.7
Currently breastfeeding	90.8	86.9
Complementary feeding		
Age when solids introduced (mo)		
<4	7.4	6.1
4-6	53.3	54.0
7-11	21.5	24.0
≥12	8.2	8.3
Not yet started	9.6	7.4
Who feeds child		
Mother	78.1	85.7
Child	9.2	2.5
Others	3.6	4.4
Foods offered		
Energy-dense foods	62.9	65.4
No food	37.1	34.6
Nutrient-dense foods	17.1	13.3
No. of food groups offered		
1	53.0	42.2
2	33.0	44.9
•3	4.3	5.2

Note: [a] All values are not significantly different from each other.

Table 5: Women's capabilities: decision-making and physical mobility

Capability	Tribal (%)	Rural (%)
Decision-making		
Woman involved in major family decisions*	41.7	12.4
Marriage		
Couple decided upon marriage independently of others*	27.0	5.4
Family paid dowry*	1.9	40.8
Woman involved in family-planning decisions*	38.4	24.5
Woman involved in health-care-seeking decisions*	33.9	21.0
Employment		
Woman decided to work for wages*	23.1	7.4
Woman currently working for wages*	27.2	11.4
Control over food		
Woman obtains credit for food*	15.4	5.5
Woman buys household food*	50.1	16.5
Mobility: woman goes alone		
Shopping in village or town*	55.3	21.3
To fields*	39.5	8.2
No land (families that do not own land)	45.8	57.2
To market*	11.4	3.0
To natal home*	50.5	23.8

Note: *$p < 0.0005$.

Table 6: Bivariate regression analysis of the independent variables on the dependent variable weight-for-age and height-for-age on enrolment (n = 820) and at follow-up (n = 665)

	On enrolment		Follow-up	
Independent variables	Child weight-for-age Z score	Child height-for-age Z score	Child weight-for-age Z score	Child height-for-age Z score
	F	*F*	*F*	*F*
Biological variables				
Maternal weight (kg)	69.3****	-	94.4****	-
Maternal height (cm)	-	43.2****	-	48.8****
Maternal BMI (kg/m^2)	43.1****	8.3***	50.5****	14.3****
Child hemoglobin (g/l)	28.4****	20.5****	7.5*	9.9***
Maternal hemoglobin (g/l)	14.1****	5.8*	9.6***	7.0*
Nutrition and health variables				
Missed immunizations	25.7****	13.5****	18.7****	10.5***
Antenatal care and cost	21.2****	8.5***	28.0****	19.5****
Private health care	10.4***	5.9*	25.7****	25.8****
Energy-dense foods	17.4****	6.4*	-	-
Breastfeeding practices	5.9*	4.8*	-	6.6*
Health decisions and woman's mobility	5.3*	-	-	-
Food insecurity	4.9*	6.0*	-	-
Family type and food purchasing	14.8****	-	14.9****	8.2***
Time, cost, and health decisions	8.7***	4.0*	-	4.8*
Women's empowerment variables				
Mobility within the village	24.7****	-	22.2****	10.5***
Mother's control over food supply	22.7****	-	9.0***	4.9*
Mother's current employment and income	22.7****	4.1*	8.4***	-
Mother's position in household and involvement in decision-making	17.0****	-	15.7****	9.0***
Mother's previous employment	12.1***	-	21.5****	9.3***
Family type and mobility around village	9.4***	-	8.6***	4.3*
Women's decisions	7.1**	-	6.7*	4.7*
Psychological abuse and sexual coercion	5.2*	-	-	-
Natal home and distance	4.3*	-	5.1*	-
Socio-economic variables				
Family structure and income	18.0****	-	18.7****	9.2***
Family type and size	17.6****	-	16.1****	6.9*
Husband's education	8.3***	4.4*	14.3****	10.0***
Maternal education (years in school)	7.4**	5.2*	13.6****	11.1***
Mother currently illiterate	7.5**	4.6*	19.8****	15.5****
Household water and sanitation	5.8*	4.8*	8.3***	7.4*
Household assets	-	-	-	6.1*

Notes: *p<0.05; **p<0.01; ***p<0.005, ****p<0.0005.

Table 7: Multivariate regression of cross-sectional (*n* = 820) and longitudinal (*n* = 665) weight-for-age data

	Weight-for-age			
	On enrolment		At follow-up	
		t		t
Maternal weight	0.23	7.14****	0.047	2.362*
Maternal HB	0.080	2.50**		
Child HB on enrolment	0.090	2.72**		
Child HB at follow-up			0.051	2.667**
Missed Immunizations on enrolment	-0.10	-3.05***		
Missed immunizations at follow-up			-0.043	-2.245*
Diet diversity on enrolment	-0.12	-3.70****	0.053	2.536*
Energy-dense foods	-0.20	-5.05****		
Private healthcare	0.08	2.34**	0.073	3.876****
Time, cost and health decisions	-0.080	-2.58**		
Food insecurity			0.068	3.543****
Maternal employment and income	-0.12	-3.70****		
Mother's experience of physical violence			-0.042	-2.239*
Mother's position in household and involvement in decision-making	0.090	2.65**		
Maternal mobility in village			0.049	2.559*
Age (days)			0.742	25.573****
WAZ*AGE interaction			1.155	40.916****
Constant		-9.60****		-18.305****
Number of observations		820	665	
Adjusted R^2	0.182		0.770	

Note: *p<0.05; **p<0.01; ***p<0.005, ****p<0.0005.

Table 8: Multivariate regression of cross-sectional (*n* = 817) and longitudinal (*n* = 665) height-for-age data

	Height-for-age			
	On enrolment		At follow-up	
		t		t
Maternal height	0.208	6.194****	0.152	3.925****
Child HB on enrolment	0.126	3.729****		
Child HB at follow-up			0.076	2.870***
Missed immunizations	-0.100	-2.965***		
Diet diversity	-0.070	-2.068*		
Bathing	-0.086	-2.554*		
Private healthcare			0.097	3.609****
Family type and food purchasing			0.067	2.662*
Mobility in village			0.089	3.402***
Maternal age at marriage			0.067	2.534**
Age (days)			0.323	10.564****
HAZ*AGE			0.762	24.738****
Constant		-7.375****		-7.509****
Number of observations		817		665
Adjusted R^2	0.086		0.548	

Note: *p<0.05; **p<0.01; ***p<0.005, ****p<0.0005.

Table 9: Multivariate dynamic model of independent variables association with weight-for-age and height-for-age over time (n = 665)

Dependent variable	Dynamic model			
	WAZ1-WAZ2		HAZ1-HAZ2	
		t		t
Maternal weight (kg)	0.072	2.449*		
Maternal Height (cm)			0.124	3.595****
Child HB at follow-up	0.067	2.409*	0.091	2.664**
Diet diversity on enrolment	0.095	3.113***		
Bathing	0.064	2.300*		
Private healthcare	0.105	3.750****	0.121	3.499****
Food insecurity	0.078	2.780**		
Family type and food purchasing			0.081	2.367*
Mobility in village	0.070	2.469*	0.120	3.557****
Mother's experience of physical violence	-0.065	-2.344*		
Maternal age at marriage			0.086	2.541*
Age (days)	0.834	13.537****	0.260	5.022****
WAZ	-1.041	-11.653****		
WAZ*AGE	0.968	8.290****		
HAZ			-0.608	-5.365****
HAZ*AGE			0.260	2.054****
Constant		-14.622****		-6.252****
Number of observations	665		665	
Adjusted R^2	0.507		0.253	

Note: *p<0.05; **p<0.01; ***p<0.005, ****p<0.0005.