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GOOD CARE PRACTICES CAN MITIGATE THE NEGATIVE EFFECTS OF POVERTY AND LOW MATERNAL SCHOOLING ON CHILDREN'S NUTRITIONAL STATUS: EVIDENCE FROM ACCRA

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ABSTRACT

This study uses data from a representative survey of households with preschoolers in Accra, Ghana to (1) examine the importance of care practices for children's height-for-age z-scores (HAZ); and (2) identify subgroups of children for whom good maternal care practices may be particularly important. Good caregiving practices related to child feeding and use of preventive health services were a strong determinant of children's HAZ, specially among children from the two lower income terciles and children whose mothers had less than secondary schooling. In this population, good care practices could compensate for the negative effects of poverty and low maternal schooling on children's HAZ. Thus, effective targeting of specific education messages to improve child feeding practices and use of preventive health care could have a major impact on reducing childhood malnutrition in Accra.

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1. INTRODUCTION

Care is increasingly recognized as an important determinant of good health and nutrition among preschoolers, along with food security, availability of health services and a healthy environment (UNICEF 1992). The specific characteristics of urban life are thought to present special challenges for the provision of adequate child care. The trade-offs mothers face between their productive and reproductive, maternal and caring roles are likely to be more acute in urban than rural areas because mothers' employment often requires being away from home for long hours, in environments that are not conducive to taking the child along. Alternative child care may also be less available than in rural areas where extended families are more common. In Accra, we found that the main constraint to good child care practices was maternal schooling and that, contrary to our expectations, maternal employment was not associated with child care practices although up to 58 percent of mothers worked full-time (Armar-Klemesu et al. forthcoming; Maxwell et al. forthcoming). This appeared to be due to the fact that mothers adapted their work patterns to the age and specific needs of their young child, in an effort to protect them. The present paper goes beyond the analysis of the constraints to child care and examines the importance of good care practices for child nutrition in Accra. Data are from a cross-sectional survey of a representative sample of households with children less than 3 years of age.

Care is the provision in the household and the community of time, attention and support to meet the physical, mental, and social needs of the growing child and other household members (ICN 1992). The focus of this paper is on care of children 4-36 months old, as provided by the main caregiver. The caregiving behaviors studied relate to child feeding practices and to the use of health services for preventive care (immunization and growth monitoring) as reported by mothers through interviews.

The main objectives of this paper were to (1) determine whether a meaningful care index could be derived from a simple recall questionnaire about child feeding practices and the use of preventive health services in a cross-sectional survey; (2) determine whether care practices (as proxied by the index derived) were associated with children's nutritional status when controlling for potential confounding factors at the child, maternal and household level; and (3) identify subgroups of children that may benefit more than others from good maternal caring practices.

We hypothesized that good care practices may be particularly important for children of less educated mothers; for children of mothers working outside the home for whom the trade-offs between income generation and time for child care are particularly acute; for younger and more dependent children; and for children from households with limited resources, low income, poor housing conditions or lack of access to hygiene and sanitation services. We hypothesized that among these families, good care practices may help compensate for lack of resources.

2. METHODS

SOURCE OF DATA

The data are from a representative survey of households with children 3 years or younger in Accra, Ghana. The overall objective of the study was to understand the nature of urban poverty and the relationships between urban poverty, food insecurity and malnutrition in a major urban center in Africa. The study combined qualitative and quantitative methods and included a multidisciplinary team to provide information to policymakers and to promote appropriate policies and programs for intervention in urban poverty and food insecurity. The study is part of a multicountry program coordinated at the International Food Policy Research Institute on "Urban Challenges to Food and Nutrition Security." Only the data from the quantitative survey are used here. Information on the design and major findings of the overall study are available elsewhere (Maxwell et al. forthcoming).

SURVEY SAMPLING STRATEGY AND DATA COLLECTION METHODOLOGY

The basic sampling units for the survey were households with children under 3 years old. A two-stage sampling strategy was adopted, with "enumeration areas" mapped out by the Ghana Statistical Service as the primary sampling units. Sample size calculations were made on the basis of +/- 3 percent precision in prevalence estimates of low anthropometric status, and to detect statistically significant differences of 0.5 Z-

scores between groups with 90 percent power. The required sample size was 36 households in 16 enumeration areas, for a total of 576 households. The achieved sample size was 556 households distributed among 16 enumeration areas.

The analysis presented in the present manuscript excludes all households who had children under the age of 4 months (n = 44) because the main factor of interest was caring practices and the index could not be constructed for infants less than 4 months (see description of care index, next section). This brought the sample size to 512 households. The creation of the care index also resulted in 37 missing values (7 percent), which brought the sample size to 475.

The survey included the following questionnaire modules: household roster, employment and self-employment, adaptive strategies, credit, transfers and other income, urban agriculture, livestock and fishing, food habits and coping strategies, meals roster, household consumption and expenditure, maternal characteristics, child care and morbidity, a hygiene spot check and child anthropometry. All modules were based on an interview (self-reporting), except anthropometry (measurements were taken) and the hygiene spot check, which was done by observation.

The survey was carried out between January and March 1997, after eight weeks of enumerator training and questionnaire pre-testing. Questionnaires were field checked by the immediate supervisor as well as the field manager, and supervisors made random spot checks on all enumerators every week. All data were double-entered to minimize data

entry errors. Systematic data cleaning was carried out and discrepancies were corrected by reference to the questionnaire.

Anthropometrists were trained and standardized in measuring children's weight and length/height, using standard methods (WHO 1979; Lohman, Roche, and Martorell 1988). Height was measured for children 24 months and older and recumbent length for younger children. Length/height and weight data were transformed into Z-scores using the WHO/CDC reference values (WHO 1979).

All households gave their verbal consent after the study objectives and methodology were read to them. Ethical clearance was obtained from the Health Research Unit of the Ministry of Health of Ghana.

VARIABLES USED AND INDEX CREATION

The variables used in the present analysis are listed below.

1) At the child level: child's age, gender, anthropometry (weight-for-age, height-for-age, weight-for-height Z-scores). Stunting, underweight, and wasting were defined as height-for-age, weight-for-age, and weight-for-height less than -2 Z-scores, respectively.
2) At the mother level: age, height, body mass index (BMI), schooling, ethnic group, maternal work status, if the mother is female head of household, care practices index (see description below).

3) At the household level: household size, per capita income (proxied by per capita total expenditure), calorie availability per adult equivalent unit (derived from the food expenditure module), and quality of housing and asset index (see description below).

In this study, household income was proxied by household total consumption expenditure (food + nonfood), which is believed to be a more reliable and less variable indicator of permanent income than income measures themselves (Deaton 1987). For food expenditures, particular attention was given in this survey to capture the consumption of street foods, or food consumed away from home, because of the importance of this phenomenon in an urban setting and particularly in Accra. Food consumption recall was for the previous week, and nonfood consumption was for a period of 1 month or 1 year, depending on the item. Total expenditure per capita (or income) is used in the multivariate analysis either as a continuous variable or as income terciles (as specified).

The estimated energy requirements used for this study were derived from the Estimated Average Requirements for the United Kingdom, Department of Health and Social Security 1981 (Gibson 1990). The recommended daily energy allowance per adult equivalent was 2,900 kilocalories. The Ghana food composition table was used to derive calories (Food Research Institute/Ghana and UNDP/FAO 1975).

Additional information on the study methodology is provided in Maxwell et al. (forthcoming).

Care Index

A care index was created using data on child feeding practices and on the use of preventive health care services. The list of variables used to create the index is presented in Table 1, as well as the scoring system used to grade each question. The index was created only for children 4 months or older because only 2 variables were available to construct the index for infants below this age. These two variables are the first ones presented in Table 1: whether the mother reported having used prelacteal feeds or not before initiating breast-feeding and whether the mother reported currently breast-feeding the child. Because the number of variables for this age group was so small, and because there was very little variability in breast-feeding (98 percent were breast-feeding) it was decided to exclude this age group from the analysis of caregiving practices.

The general scoring system was to allocate a score of -1 for a bad practice and a score of 0 for a good practice (Table 1). When a practice was particularly good, such as using fortified cereals for complementary feeding, a score of +1 was given. Practices were considered good or bad based on current child feeding recommendations (WHO 1995; WHO 1998) and on available scientific evidence about their benefits or risks. For example, breast-feeding between 4 and 9 months of age was given a score of +1 because it is a recommended practice and it is known to have a protective effect on children's

health, and not breast-feeding was graded -1 (potentially detrimental to the child). For older children in the 9-18 months group, however, not breast-feeding was given a score of 0 because it is not clear whether or not breast-feeding at this age really has a negative effect on children's health and growth. Scientific evidence on this issue is controversial (Brown, Creed-Kanashiro and Dewey 1995). Similarly, breast-feeding after 18 months of age was not included in the index because there is no evidence of additional benefit from continued breast-feeding after this age. For age-censored practices such as immunizations for DPT and measles, which are expected to occur when the child reaches a specific age, the variables were included in the index only for the age group that was older than the recommended age for receiving this immunization. For instance, full DPT immunization is expected to be completed by 3 months of age, and therefore is included in all age groups, whereas measles immunization is given at 9 months of age and therefore the variable is included only for children 9 months and older.

The index was created for each age group by adding up the scores obtained for the different practices. The maximum possible score was +2 and the minimum was -11 for each age group. The mean and standard deviation were -2.49 and 1.92 respectively. Terciles were created to form 3 categories of caring practices: (1) poor, (2) average, and (3) good.

Quality of Housing and Assets Index

This index was created using principal components analysis. An index was created because variables related to quality of housing, asset ownership and availability of services are usually highly correlated, which may result in multicollinearity problems in multivariate models. To create the index, a "possession" index was first created by summing up four assets owned: refrigerator, electric stove, tape deck, and television set. Then, factor analysis was used to derive one factor, that would summarize variables related to the quality of housing (construction material for roof, walls, and floor), the "possession" index, the source of drinking water, and the availability of sanitary facilities and garbage disposal. The principal components factor extraction method was used. Loadings smaller than 0.5 were excluded from the initial model. The final model had 5 variables (floor, walls, water source, possession index and sanitary facilities), all with factor loadings greater than 0.53, and explained 46 percent of the variance.

ANALYTICAL METHODOLOGY

The main objectives of the analysis were to study the importance of care practices on children's height-for-age controlling for potentially confounding factors, and to determine whether care practices were more important for some subgroups of children compared to others. Thus, the dependent variable of the multivariate models was height-for-age Z-scores and the independent variable of interest was care practices (the care index score). Main effect models were used to test the importance of care practices for

children's height-for-age, and interactive models—models that included two-way interaction terms between care practices and various factors of interest—were used to test whether some subgroups of children benefitted more than others from good care practices. Ordinary least squares (OLS) and two-stages least squares (2SLS) with instrumental variable methods (Judge et al. 1985) were used for the multivariate analyses.

The analysis is based on the UNICEF conceptual model whereby "Food - Health - Care" are considered the three main pillars of factors affecting children's nutritional status (UNICEF 1990). Appropriate variables for food availability and care practices were available in this data set, but we did not have a good measure of health that captured the availability of health services and a healthy environment. We had a measure of household hygiene, but this variable was highly correlated with most of the household socioeconomic variables such as housing quality and assets, income and maternal schooling, and was endogenous in our model. Failure to control for endogeneity leads to biased coefficient estimates (Judge et al. 1985). One common approach to controlling for endogeneity is the use of instrumental variable and two-stages least squares (2SLS) methods. In this case, however, our efforts to derive a strong prediction equation for household hygiene failed, probably because the variable had only 6 categories and was not normally distributed. The other health (morbidity) variables available were at the individual level—whether the child had diarrhea, fever, and other morbidity symptoms in the previous two weeks. The only morbidity symptom known to be associated with child growth is diarrhea, but diarrhea and child nutritional status are simultaneously determined

by the same independent factors. Thus, unless statistical modeling allows for estimating both outcomes (nutritional status and health) simultaneously, they should be modeled separately. We did not explore statistical approaches to handle the simultaneity issue and chose to leave the child health outside of the nutritional status model.

Instrumental variables were used for income and calorie availability, which are endogenous variables, and thus correlated with the error term. The variables included in the income prediction equation were education of head of household, age of head of household, asset index, if the house was owned and household size. The adjusted R-square was 0.37 and the F test was 48.28. The calorie availability prediction equation included: maternal education, age, migration status, household size, female-headed household, income, household assets, education and age of head of household, whether they own their house, and various community variables, mainly prices of specific food items and population density. The adjusted R-square for this equation was 0.44 and the F-test was 25.46. The specific equation and variable specification for both equations is published elsewhere (Maxwell et al. forthcoming)

The care variable is also endogenous, in the sense that it is thought to be determined by some unobserved variables that may also affect the outcome nutritional status. We attempted to predict care practices using a set of maternal and household characteristics, namely maternal age, physical health, schooling, ethnic group, migration and work status, household income, calorie availability and assets, and family composition (an indicator of availability of alternative child care). The resulting

prediction equations were weak and only maternal schooling was a significant determinant of child care practices. For this reason, the care index variable was included in the models without predicting it.

Full models (including all hypothesized determinants) as well as parsimonious (including only the statistically significant variables) are presented. Probability values < 0.05 for main effects and < 0.20 for two-way interactions were considered statistically significant. Least squares means (adjusted for other covariates by OLS) were reported for those interactions that were statistically significant.

3. RESULTS

CHARACTERISTICS OF THE SAMPLE

The main characteristics of the sample are presented in Table 2. The average age of children in the sample was 18 months. The mean height-for-age and weight-for-age Z-scores were close to -1 (-1.04 and -0.93, respectively), whereas the mean weight-for-height was -0.57. Stunting prevalence was 17 percent, wasting was 5 percent and the percentage of underweight was 14.5 percent. High prevalences of diarrhea and fever were reported: approximately one-third of children had diarrhea, and 37 percent had fever in the previous two weeks. This may be in part due to the age range included in the sample (4-36 months), which is the age of highest morbidity from infectious diseases during childhood.

Mothers were generally young (mean = 30 years) as a result of our sampling strategy, which was to include only mothers with children less than 3 years of age. Their average body mass index was 24.5 kg/m^2; 6 percent of mothers were underweight (BMI < 18.5), while 11 percent were overweight (BMI = 25-26.9) and 25 percent were obese ($\geq$ 27). Up to 12 percent of the sampled mother had no schooling, the majority had some primary or middle school-level schooling (62.5 percent; only 22 percent had actually completed middle school), and 26 percent had some secondary or higher level schooling. Irrespective of their schooling level, most mothers in Accra were engaged in income generating activities (10 percent worked part-time, 58 percent full-time, and 2 percent were unemployed but looking for work at the time of the survey). Alternative child care, however, was used by only 37 percent of mothers, which indicates that many mothers took their child with them to work.

Mothers and their children lived in precarious, unsanitary and crowded conditions. Up to 90 percent lived in a room, as opposed to a house or an apartment, only 8 percent had water piped inside their dwelling, household garbage collection was available only for 12 percent of the households, and only 30 percent had either private latrines (20 percent) or flush toilets (10 percent). There was, on average, 4 people per room, but the range extended up to 9 individuals per room.

The mean expenditure per capita per year was equivalent to $539 and families spent, on average, 54 percent of their budget on food, an indication of limited resources.

The average household calorie availability per adult equivalent unit (aeu) was 2,617 calories/aeu, roughly 90 percent of their daily recommendations (Gibson 1990).

CARE PRACTICES

The second column in Table 1 presents the main descriptive statistics for each of the variables included in the care practices index. It shows that approximately half of the children 4-36 months of age were still breast-fed at the time of the survey. Feeding practices during the first 4 months, however, were less than ideal. Very little exclusive breast-feeding was reported: up to 69 percent of the mothers reported offering water, 26 percent sugar-based liquids, 32 percent infant formula and 17 percent offered milk in addition to breast milk. Even solid foods were commonly given to children before 4 months of age (58 percent). The first solid or semi-solid foods offered were largely unfortified cereals (*koko*, a thin porridge). Only 30 percent gave some type of fortified cereals and 10 percent did not use any special weaning food as a transition into the family diet. Approximately three quarters of the caregivers reported helping their 9-36 months old child to eat (all mothers helped younger children to eat), but 21 percent said they did not do anything to stimulate the child when he or she refuses to eat.

Immunization rates were high, as is typical of many urban areas in the developing world (Ruel et al. 1998): 91 percent of children older than 3 months had received all their DPT immunization and 85 percent of children older than 9 months had been vaccinated

against measles. Growth monitoring, on the other hand, was less well attended: only 63 percent of children had been taken for growth monitoring in the last month.

CARE PRACTICES AND CHILD NUTRITIONAL STATUS

Results of bivariate analyses show a strong association between care practices and child nutritional status (Figure 1). The prevalence of stunting and underweight was significantly smaller among children whose mothers scored in the highest tercile of care practices. The magnitude of the difference between the lowest and the highest care practices tercile was more than 3-fold for stunting (24.1 percent compared to 7.3 percent) and 2.5-fold for underweight (22 percent versus 8.7 percent). This translated into differences of approximately 0.5 Z-score in mean height-for-age and weight-for-age between the two extreme care practices terciles (not shown). Differences of that magnitude are considered biologically important. Care practices were not associated with differences in the prevalence of wasting, which is not surprising because wasting is not a major problem in this population (the overall prevalence of wasting in the sample was only 5 percent).

MULTIVARIATE ANALYSIS

Results of the multivariate analysis of the determinants of height-for-age Z-scores are presented in Table 3. The first two models (A and B) present the main effect models (full and parsimonious) and the following three models include interactive terms.

The full main effect model (A) includes all the variables that were hypothesized to be potential determinants of children's height-for-age Z-scores. Both predicted income and predicted calorie availability are included in this model. We also tested the models with only one of the two variables alternatively, but neither variable was found to be statistically significant in any of these models. The results presented in model A show that care practices were statistically significant determinants of HAZ, after controlling for various child, maternal and household-level variables. Besides care practices, only age of the child, maternal height and education, and the household quality of housing and asset score were statistically significant determinants of height-for-age Z-scores. This parsimonious model is presented as model B.

The next model (C) tested the statistical significance of various interactions between care practices and other hypothesized factors, namely child age, maternal work status and schooling, and household calorie availability, income and the house quality and asset index. A full model was used where all main effects and the two-way interactions were tested. The only statistically significant interaction identified in this model was the interaction between maternal care practices and schooling. The parsimonious model, which includes the same main effects as in model B plus the interaction between maternal care and schooling is presented in model D. The interaction was statistically significant at an alpha level of 0.05. Finally, we also tested whether the hypothesized interaction between care and household income could be detected when income was included in the model as a categorical variable (terciles, where 1 is the lowest and 3 is the highest income

tercile). This interaction was found to be statistically significant at the alpha level of 0.10 and the model is presented as model E.

Figures 2 and 3 present the adjusted mean height-for-age Z-scores of these two interaction terms (the means are adjusted for all variables included in models D and E, respectively). These figures clearly show that the benefits of good care practices are much larger among some subgroups than others. Among the group of mothers with less than a secondary education, improved care practices have a large positive effect on children's mean height-for-age Z-scores (HAZ). The difference in HAZ between the lowest and highest care practices tercile is larger than one half a Z-score (0.55) for mothers with no education and slightly smaller for mothers with primary or middle school level. This brings the HAZ of children of mothers with less than secondary schooling but good care practices to literally the same level as those of mothers with secondary or higher schooling (approximately -0.75 Z-score [see Figure 2]). Thus, the improvement in children's HAZ resulting from good care practices among mothers with less than secondary schooling is of the same magnitude as the overall difference in HAZ attributable to maternal schooling (approximately one-half of a Z-score). Note, however, that the difference in HAZ due to maternal schooling is almost entirely due to differences among mothers with poor care practices. Among this group, the difference in HAZ between mothers with no schooling and those who have some secondary schooling or higher is almost 1 Z-score (0.97), an enormous difference. Among mothers with better care practices, education does not make a difference for children's HAZ.

Similar results were found for differences in HAZ by care practices and income level. Good care practices were important for children from the two lower income terciles, but made no difference for children from the highest (third) income tercile. The magnitude of the difference in HAZ between the poor and the good caregivers within the two lowest income terciles was slightly lower than one-half a Z-score (approximately 0.45). Good care practices among poorer households (from the two lowest income terciles) brought children's mean HAZ almost at the same level as the average for children from wealthier families (highest income tercile: HAZ = -0.69). Good maternal care among the poorest households (two lower income terciles) protected the nutritional status of young children who, on average, had a HAZ of -0.55, slightly better than the nutritional status of children from the wealthier group combined (average for all higher income tercile children =-0.69 Z-score).

4. DISCUSSION

MAIN FINDINGS

We have previously shown that maternal education was the most important predictor of good care practices in our sample from Accra (Armar-Klemesu et al. forthcoming). The present study now shows that care practices are strong determinants of children's nutritional status, and particularly so for children from poorer households and children of mothers with less than a secondary school education. In Accra almost three-quarters of mothers had less than a secondary education. Among this group, better

maternal care practices brought the HAZ of children to the same level as that of children from wealthier families or of more educated mothers, approximately one half of a Z-score higher. The magnitude of this difference is biologically important and is similar to or larger than the size of differences typically found in the literature between socioeconomic groups, maternal education groups or as a result of successful nutrition interventions (Menon, Ruel, and Morris, unpublished analysis of DHS data; Ruel et al. 1995; Rivera et al. 1998; Brown, Peerson, and Allen 1998). Surprisingly, good care practices provided no additional benefit to children from more educated mothers and from wealthier households, whose HAZ was already approximately 0.5 Z-score higher than the poorer and less educated groups.

A correlate of these findings is the fact that poor maternal schooling and low income were found to have a negative effect on children's HAZ only if mothers were poor caregivers. As seen in Figures 2 and 3, most of the difference in HAZ found between income terciles and maternal education groups could be explained by differences among mothers with poor care scores. Greater maternal schooling and higher income made hardly any difference in HAZ for children whose mothers had average or good care practices. Thus, in this population, good care practices could compensate for low maternal education and insufficient income.

There is ample literature showing the importance of maternal schooling for child health, nutrition and well being (Caldwell and McDonald 1982; Cleland and van Ginneken 1988; Alderman 1990; Cebu Study Team 1991). A few studies have also

documented an interactive effect between maternal schooling and household socioeconomic status. These studies show that maternal schooling is associated with improved child nutrition, but only among households that have access to a minimum level of resources without being among the wealthiest group (Reed, Habicht, and Niameogo 1996; Bairagi 1980; Doan 1988). These findings highlight the fact that maternal schooling is not sufficient when resources are too scarce, but also that maternal schooling may not be such a critical factor for children's well-being when resources are relatively abundant. The mechanisms by which maternal schooling impacts child outcomes, however, are poorly understood and our study is one of the few that sheds light on this issue. Various hypothetical pathways have been proposed, but only improved maternal knowledge (Christian et al. 1988; Ruel et al. 1992; Niameogo 1993), child care practices (Cebu Study Team 1991; Joshi 1994) and access to information (Thomas, Strauss, and Henriques 1987) have been demonstrated empirically. Our Accra study shows that the beneficial effect of maternal schooling on children's HAZ does act through care practices, but only for mothers with less than secondary schooling. Among more educated mothers, children's mean HAZ was already approximately 0.5 Z-score higher and good care practices did not confer any additional benefits. In Lesotho, the effect of maternal schooling was mediated through increased nutrition knowledge (and probably better care practices), but only among households that had access to a minimum level of resources. Among the poorest, nutrition knowledge appeared to be insufficient for mothers to be able to adopt optimal child care practices (Ruel et al. 1995). The opposite was found in

Accra where care practices had a greater impact on children's nutrition among poorer households and made no difference among the upper income tercile. Differences in absolute levels of poverty between Accra and rural Lesotho are probably responsible for these contrasting results. They highlight, however, the importance of conducting context-specific analyses of this type before designing program and policy recommendations.

OTHER FINDINGS

Household income and calorie availability were not statistically significant determinants of child nutritional status when the more proximal determinants of child nutritional status such as maternal schooling and caring practices were included in the models. This suggests that, at least in this sample, household income and calorie availability did not have additional effects on children's nutritional status beyond their effects through maternal schooling and caring practices. Various studies have shown that the effect of maternal education on child outcomes often exceeds the income effect (Caldwell 1979; Barrera 1988; Behrman and Wolfe 1984; Thomas, Strauss, and Henriques 1990; Wolfe and Behrman 1987). Evidence also suggests that maternal schooling may be the prime determinant of nutritional status among young children (< 24 months), whereas income may become more important as children grow older and have greater daily requirements of nutrients and other basic needs (Sahn and Alderman 1997; Garrett and Ruel, forthcoming).

In our sample, the variable ‘quality of housing and household assets’ was positively and significantly associated with children’s HAZ (in most models), even when controlling for income and calorie availability, and the more proximal determinants of children’s nutritional status. It is possible that because this variable represents the long-term wealth and socioeconomic status of the family, rather than current income, it is more strongly associated with HAZ, also a measure of cumulative long-term nutritional status.

Maternal work, either part-time or full-time, was not associated with children’s nutritional status, either as a main effect or in interaction with care. These relationships will be explored in greater depth in future analyses of these data, but it is likely that the effect of maternal work is mediated largely through care practices, which would explain the lack of association when both variables are in the model. In our analysis of the constraints to good care, however, maternal work was not associated with the care index (Maxwell et al. forthcoming).

STRENGTHS AND WEAKNESSES OF THE STUDY

This study is the first one to our knowledge that has measured and quantified care practices into an index, using cross-sectional survey data. We are also unaware of any other studies that have used appropriate statistical modeling to control for the potential confounding effects of factors at the child, maternal and household level to examine the strength of the association between care practices and child nutritional status. An additional strength of the study was the multidisciplinary nature of the team involved in

planning the survey and questionnaire modules and in the analysis of the data. Most nutritional surveys lack carefully collected consumption expenditure data and thus, usually only partially control for socioeconomic factors, when they do.

It is important to highlight the fact that the care index constructed for this study only reflects two of a large number of aspects of the overall concept of care (Engle, Menon, and Haddad 1997). The index only captures a few practices related to child feeding and the use of preventive health care, largely because of the limitations of interview and recall techniques. Care is better measured though observations in households and through longitudinal studies that allow the timing and nature of changes and transitions to be captured (Engle and Ricciuti 1995). This was not possible in the context of our survey that had a wide range of other objectives and for which care was only one of many components. We have shown, however, that it is possible to measure care as it relates to child feeding practices and use of preventive health care on a relatively large sample and with the use of a simple interview instrument in a cross-sectional survey.

Another important methodological issue addressed in this study in the construction of the care index was the need to make the index age-specific, both relative to the questions asked and to the scoring system used. In future studies, efforts should be made to overcome the difficulties we experienced in identifying relevant care practices for the very young infants (0-4 months old).

The issue of endogeneity of income, calorie availability and care was addressed as well as possible by our statistical modeling. To our knowledge, this was the first time, aside from the work of the Cebu Study Team (1991) that an attempt was made to predict care practices using a set of instruments. It is unfortunate that our attempts were unsuccessful, but this experience raises important issues for future research, particularly the need to explore stronger sets of instruments to predict care.

As noted above, the original sample from which these data were taken was a representative sample of households with children under the age of three in Accra. Exclusion of the 0-4 months old group (n = 44) affected the representativeness of the sample. This, however, does not affect the internal validity of our main findings, i.e., that care practices are important for children's nutritional status, and that their importance is contingent on mothers' education and household income. The generalizability of the findings, however, should be restricted to households with children 4-36 months in Accra. Our results are suggestive of an important role of care in child nutrition but these results need to be replicated in other regions, countries and contexts before generalizations can be made. There are also no reasons to believe that our findings are specific to an urban context, but it would be interesting to see whether similarly strong associations are found between care practices and child nutritional status in rural areas.

POLICY IMPLICATIONS

The main findings of this research have important policy implications. They suggest that specific training in child feeding and use of preventive health services for poor mothers with little formal education could have a large impact on the growth of children living in impoverished environments. Although continued effort to improve formal education of mothers is crucial, a complementary short-term approach could be to target specific relevant messages to mothers with currently low levels of education. Our results from Accra suggest that this approach could markedly reduce differences in HAZ attributable to poverty and poor education. In fact, according to our findings, informal education could mitigate the negative effects of poverty and low maternal schooling on children's HAZ. With better care practices, poor children from less educated mothers could improve their nutritional status by at least one half a Z-score.

The fact that maternal schooling came out so clearly in this analysis greatly facilitates targeting. One can hardly imagine an easier variable to measure than formal schooling and it is also a variable that is not subject to biases due to recall or intent to withhold information. It is interesting to see that the interaction was also found between care and income tercile, but because income is difficult to measure it is not such an attractive candidate for targeting, especially for interventions in the health sector. The recommendation would therefore be to try to target the specific education messages to mothers with little or no schooling and to do so as early as during pregnancy. Waiting until the mother takes the young infant to the health clinic for immunization is already too

late because good child feeding practices have to start at birth and successful exclusive breast-feeding is determined during the first few weeks of a child's life. In addition, these specific messages should be included in the formal education curriculum and a special effort should be made to reach teenage girls even before their first pregnancy.

Implementing effective and successful education strategies is always a challenge, but our findings clearly indicate that it could have a large payoff in terms of reducing malnutrition in Accra.

TABLES

Table 1. *Practices and scoring system used, by age group, to create the care index (child feeding and use of preventive health care services)*

PRACTICES INCLUDED IN THE INDEX		Scores allocated to different practices, by age group (mo)		
Breast-feeding and feeding practices	**Results**	**4-8.9**	**9-17.9**	**≥ 18**
Prelacteal feeds used	Yes: 33%	Yes:-1 No: 0	Yes:-1 No: 0	Yes:-1 No: 0
Still breast-feeding	Yes: 51%	No =-1 Yes = 1	No = 0 Yes = 1	
Water: gave to 0-4 months old child	Yes: 69%	Yes:-1 No: 0	Yes:-1 No: 0	Yes:-1 No: 0
Sugar-based liquids: gave to 0-4 months old child	Yes: 26%	Yes:-1 No: 0	Yes:-1 No: 0	Yes:-1 No: 0
Infant formula: gave to 0-4 months old child	Yes: 32%	Yes:-1 No: 0	Yes:-1 No: 0	Yes:-1 No: 0
Cow milk: gave to 0-4 months old child	Yes: 17%	Yes:-1 No: 0	Yes:-1 No: 0	Yes:-1 No: 0
Solid foods: gave to 0-4 months old child	Yes = 58%	Yes:-1 No: 0	Yes:-1 No: 0	Yes:-1 No: 0
First food offered to child	a) Unfortified cereals (koko): 60% b) Fortified cereals: 30% c) No special weaning food: 10%	a) 0 b) +1 c) -1	a) 0 b) +1 c) -1	a) 0 b) +1 c) -1
Does anyone help the child eat	No: 28%		No: -1 Yes: 0	No: -1 Yes: 0
What does caregiver do when child refuses to eat	a) Nothing (child left alone): 21% b) Other (coax, play with, force, change food, not a problem): 79%	a) -1 b) 0	a) -1 b) 0	a) -1 b) 0
Preventive health care services use				
Growth monitoring (past month)	Yes: 63%	No: -1 Yes: 0	No: -1 Yes: 0	No: -1 Yes: 0
DPT immunization (> 3 mo)	Yes: 91%[2]	No: -1 Yes: 0		
Measles immunization (> 9 mo)	Yes: 85%[3]		No: -1 Yes: 0	No: -1 Yes: 0

Table 2a. *Continuous variables (means and standard deviations) characteristics of the sample (n = 512)*

Characteristics	Mean	Standard Deviation
Child		
Age (months)	18.2	9.4
Weight-for-age Z-score	-1.04	1.04
Height-for-age Z-score	-0.93	1.15
Weight-for-height Z-score	-0.57	0.93
Mothers		
Age (years)	30	8
Height (cm)	160	6
Body mass index (kg/m^2)	24.5	5.0
Household		
Household size	5	2
Expenditure per capita per year (cedis)[a]	1,051,556	980,090
Food budget share (%)	54	16
Calorie availability per adult equivalent unit (calories per adult equivalent)	2,617	930

[a] Exchange rate during the survey was 1,950 cedis for US$1.

Table 2b. *Frequency distribution (percentages) characteristics of the sample (n=512)*

Characteristics	Percentage
Child	
Percent males	52%
% who had diarrhea in previous 2 weeks (self-reported)	33%
% who had fever in previous 2 weeks (self-reported)	38%
% stunted (HAZ < -2 Z-scores)	17%
% wasted (WHZ < -2 Z-scores)	5%
% underweight (WAZ < -2 Z-scores)	14.5%
Mother	
Civil status	
Single (cohabiting)	6.8%
Single (not cohabiting)	9.4%
Married (only wife)	66.6%
Married (senior or other wife)	10.4%
Widowed/divorced/separated	6.8%
% who receive help from father	77%
Ethnic group	
Gha/Adangbe	36%
Ashanti/Fanti/Akan	29%
Ewe	23%
Other	12%
Migrant status	
Indigenous	31.1%
Not indigenous (born in Accra)	27.3%
Migrant	41.6%
Schooling	
None	11.7%
Primary 1 to Middle 4	62.5%
Secondary 1 or higher	25.8%
Work status	
Not working	29.9%
Working part-time	9.8%
Working full-time	58.2%
Unemployed (looking for work)	2.1%
Use alternative child care	37.0%
Of those who use some, % who use:	
Single person	59%
Multiple persons	12%
Creche	29%

(continued)

Table 2b (continued)

Characteristics	Percentage
Household	
Type of dwelling	
Room(s)	90%
Apartment	4%
House	6%
Types of walls	
Mud	5%
Brick/stone/wood	15%
Concrete/landcrete	80%
Type of roof	
Old tin/aluminum/grass	43%
New tin/aluminum	9%
Tile/slate	48%
Source of drinking water	
Vendor/well	55%
Piped outside	37%
Piped inside	8%
Garbage disposal	
Gutter/empty lots	14%
Bury/burn on compound	7%
Public dumping pin	67%
Household collection	12%
Sanitary services	
Open space	16%
Public latrine	54%
Private latrine	20%
Flush toilet	10%

Notes: Abbreviations: HAZ = height-for-age Z-scores; WAZ = weight-for-age Z-scores; WHZ = weight-for-height Z-scores.

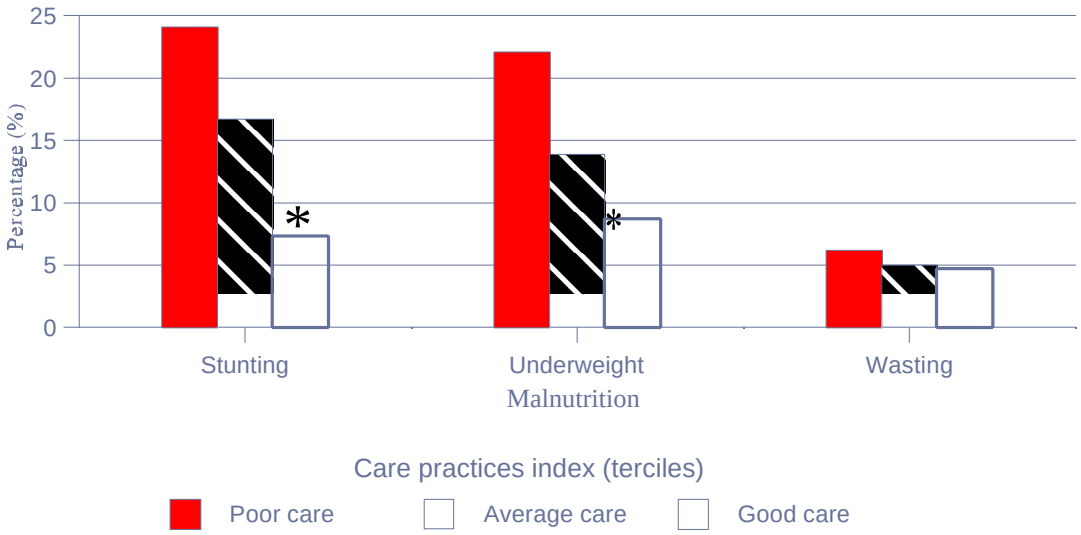
Table 3. *Multivariate analysis of the determinants of children's height-for-age Z-scores*

Variable	Main effect models				Interaction models					
	(A) Full		(B) Parsimonious		(C) Full		(D) Parsimonious (care*maternal education interaction)		(E) Parsimonious (care*income tercile interaction)	
	Coefficient	T-statistic	Coefficient	T-statistic	Coefficient	T-statistic	Coefficient	T-statistic	Coefficient	T-statistic
Constant	-8.82	-2.61*	-9.05	-6.82*	-8.85	-2.46*	-10.05	-7.52*	-10.26	-7.52*
Age of child	-0.08	-3.23*	-0.08	-3.34*	-0.08	-3.33*	-0.08	-3.52*	-0.08	-3.56*
Age squared	0.001	2.45*	0.001	2.48*	0.001	2.39*	0.001	2.62*	0.001	2.64*
Sex of child (1=M; 2=F)	0.12	1.25			0.14	1.44				
Mother's age	0.001	0.01			0.00	0.09				
Mother's height	0.05	6.49*	0.05	6.68*	0.05	6.30*	0.05	6.67*	0.05	6.76*
Mother's education 0=None; 1=Primary and middle; 2=≥ Secondary	0.26	2.57*	0.26	2.88*	0.06	0.40	0.66	2.85*	0.23	2.56*
Care index score	0.07	2.34*	0.06	2.24*	0.23	1.94*	0.39[a]	2.79*	0.40[1]	2.41*
House quality and assets score	0.15	1.96*	0.13	2.56*	0.08	0.82	0.11	1.90	0.09	1.72
If female head of household (0,1)	0.02	0.15			0.01	.11				
Ethnic group (if Gha/Adangbe) (0,1)	-0.09	0.50			-0.09	-0.49				
Ethnic group (if Akan/Fanti/Ashante) (0,1)	0.02	0.11			-0.01	-0.07				
Ethnic group (if Ewe) (0,1)	-0.02	-0.86			-0.02	-0.14				
If mother works part-time (0,1)	0.21	1.16			-0.08	-0.30				
If mother works full-time (0,1)	-0.03	-0.24			-0.17	-0.95				
	-0.01	-0.21			-0.00	-0.10				
Income (predicted)	-0.05	-0.24			-0.01	-0.05			0.38[b]	2.31*
Calorie availability (predicted)	0.04	0.35			-0.04	0.21				
Care * maternal schooling					-0.08	-1.51*	-0.21	-1.99*		
Care * child age					-0.00	-0.16				
Care * expenditure					-0.00	-0.48				
Care * calorie availability					-0.00	-0.01				
Care *maternal work (part-time)					-0.12	-1.24				
Household size					-0.06	-1.11				
Care * house quality and assets					-0.02	-0.55				
Care * income terciles									-0.13	1.70*
Adjusted R-square	0.18		0.19		0.18		0.20		0.20	
F	7.02		19.26		4.78		17.27		15.16	
N	459		462		459		462		462	

Notes: All variables are continuous, unless specified otherwise.
[a] Care terciles (values 1-3 from lowest to highest) were used in this model, both as a main effect and in the interaction term.
[b] Income terciles (values 1-3 from lowest to highest) were used in this model, both as a main effect and in the interaction term.
* indicates a statistically significant main effect ($p<0.05$) or interaction ($p<0.10$) regression coefficient.

FIGURES

Figure 1. *The association between maternal care practices (terciles) and malnutrition prevalence*



* statistically significant difference (p< 0.05)

Figure 2. *Interaction between maternal schooling and caring practices on children's height-for-age Z-scores*

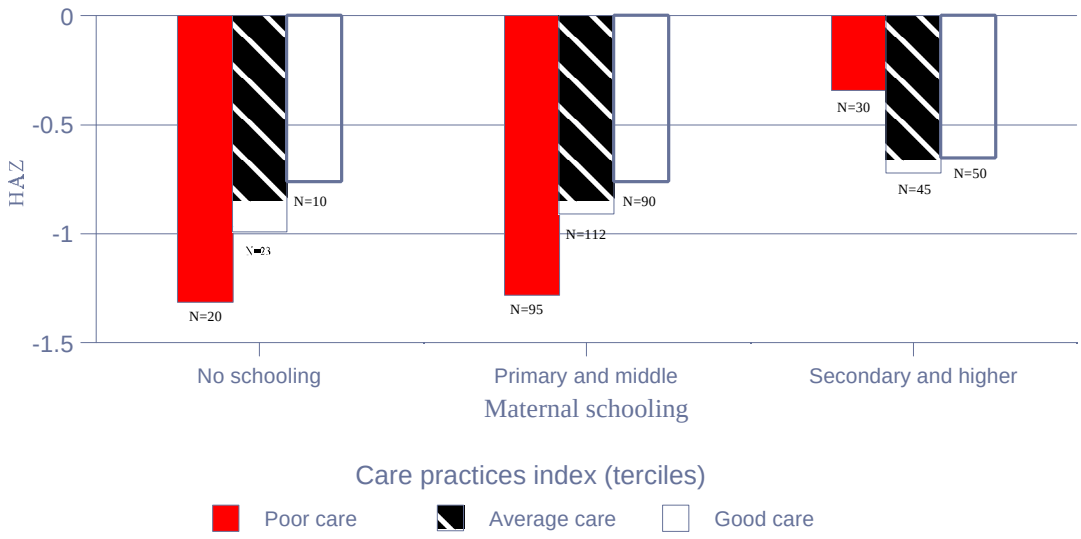
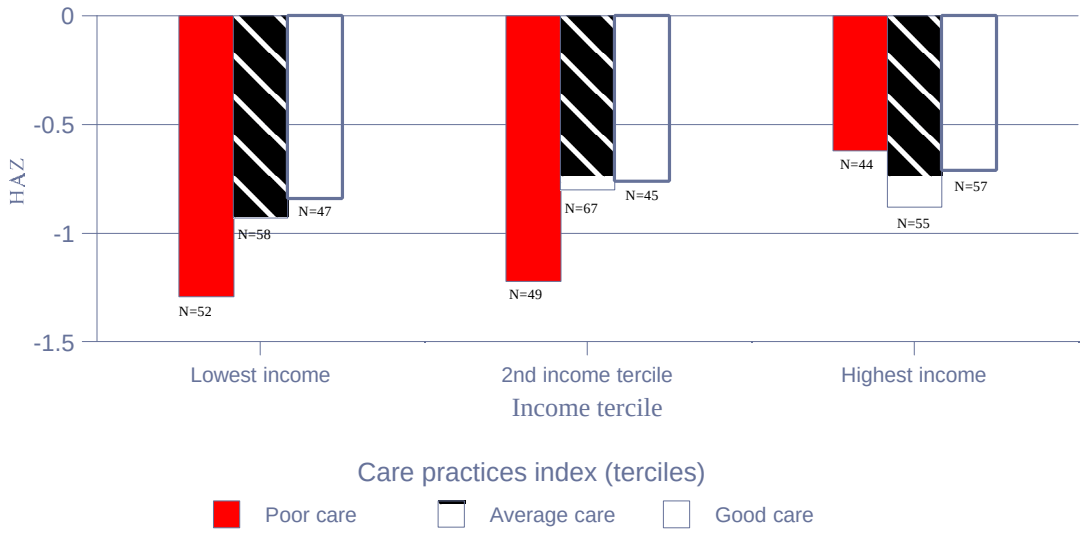


Figure 3. *Interaction between household income and maternal caring practices on children's height-for-age Z-scores (HAZ)*



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