Published in final edited form as:
Scand J Public Health Suppl. 2007 August ; 69: 107–117. doi:10.1080/14034950701355700.

The social context of children's nutritional status in rural South Africa[1]

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Abstract

Aim: To investigate the relationship between children's nutritional status and a series of measures capturing both the current status and the lifetime history of their connection with adult caregivers in the Agincourt sub-district of rural South Africa.

Methods: Using data on a sample of 202 children from a recent ethnographic study of children's social connections and well-being, the authors (1) compare height for age and weight for age to an accepted international standard and (2) conduct bivariate analyses of the relationships between selected measures of social connection and extreme deviations below expected weight and expected height.

Results: Fitted curves for weight for age and height for age fall between the 5th and 50th percentiles of CDC growth curves. Compromised nutrition, defined as being more than two standard deviations below expected height or weight, is associated with the death or non-co-residence of the mother, and with the absence of financial support from the father. The co-residence of maternal female kin as substitutes for the mother do not fully compensate for her absence.

Conclusions: The findings highlight the importance of parental living arrangements, parental financial support, birth order and the composition of sibling sets, and lifetime residential patterns in facilitating access to nutrition.

Keywords

Children; height; nutrition; social connection; social context; South Africa; weight

[1]This paper has been independently peer-reviewed according to the usual Scand J Public Health practice and accepted as an original article.

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Aim

The impact of social relationships on children's health and nutrition is generally recognized. Particularly in situations of economic hardship and institutional weakness, people have used their social relationships in myriad ways to cope with the many challenges, including rearing their children. In this paper, we investigate the relationship between social situation and nutritional status for a group of children in rural South Africa. Specifically, we are interested in (1) comparing weights and heights with international standards and (2) relating variation in nutritional status to measures of social relationships.

Background

The study of children's health has a long history in South Africa because of the huge disadvantages that black children experienced during apartheid. Numerous studies have documented poor nutritional outcomes for black children during apartheid [1-3]. More recent studies have also documented high rates of stunting among black children [4,5]. Of particular concern is the well-being of children not raised by their biological parents. Apartheid-era studies found that fostered children faced substantial health risks due to unequal treatment by the foster parents [6] and/or poverty [7]. Studies of child fosterage in West Africa have also found some nutritional disadvantage among fostered children [8] but have cautioned against attributing causality to the practice of fosterage itself. Spurred by the HIV/AIDS epidemic in southern Africa, a few recent studies have shown that AIDS orphans may face greater risk of nutritional neglect [9]. The direct determinants of good nutritional status center on the adults who are responsible for determining what, how much, and how often the child eats as well as the child's living conditions. Understanding the relationship between children's social connections and nutritional status is, therefore, crucial for determining appropriate interventions.

This analysis is timely for several reasons. First, while apartheid has now been relegated to history, social and economic inequality continues to be a prominent feature of post-apartheid South Africa. High rates of unemployment, continuing labour migration, and HIV/AIDS morbidity and mortality are only some of the many issues that may affect children's access to proper nutrition. Indeed a recent article on food security in the country concludes that

hunger exists at unacceptable levels in various communities [10]. Second, the increasing numbers of adults dying from HIV/AIDS has caused great concern over the well-being of children orphaned. Third, in South Africa, as in other countries, efforts are underway to combat childhood obesity and diabetes through the promotion of exercise and good nutrition. Obesity and under-nutrition may both plausibly be linked to the collapse of apartheid through such factors as increased access to fast-food restaurants, decreased time to cook, and the increased use of cars and other transport. All these may be seen as signs of post-apartheid progress but all also have unintended negative consequences. Insights gained from our analysis can make a valuable contribution to policy initiatives and intervention programs that are aimed at improving the health of all South African children.

Conceptual framework

In their influential work on child morbidity and mortality in developing countries, Mosley & Chen [11] brought together *proximate determinants* such as maternal factors, nutrient deficiency, injury, and environmental contamination, and *socioeconomic determinants* such as income, education, norms and attitudes about health, and power relationships within the household, to identify the pathways through which children's well-being may be either jeopardized or protected. However, their model does not focus on the social relationships between adults and children, which clearly determine how socioeconomic forces influence the proximate determinants of child health. For example, children's current relationships to their caregivers and the history of these relationships need to be included in any model that seeks to explain precisely how individual and household income impact on children's health. Our paper is an attempt to integrate this missing set of intervening social determinants into the Mosley–Chen framework.

Much of the literature on children's well-being stresses the importance of the presence or absence of parents in the child's household as a key factor in children's health [12,13]. Recent research on feeding practices in Limpopo province focused on mothers exclusively [14]. Even when the contributions of non-co-resident parents are considered, research is frequently confined to the value of financial contributions in the form of child support or remitted wages. However, anthropological research in various African contexts has established that domestic units disperse and coalesce over annual cycles or as part of the process of fission and fusion of domestic groups [15,16] underscoring the need for a life-course perspective to fully understand the nature of social connection and support for children. Domestic groups have also been characterized as fluid in their composition as adult children move out and return, as spouses move between natal and marital households, and as children are loaned, fostered, or adopted [17,18]. In Southern Africa, long-term economic security and employment instability have added labour migration as a factor in household composition and change, and the concept of domestic fluidity has become even more appropriate to characterize living arrangements [19,20]. South African social scientists have analyzed the residential arrangements of the population in terms of “stretched” households and “dispersed” kin groups [21]. Children are circulated between residences to meet their needs for care and education, to make use of their labour, and to allow adults to move in search of employment [6]. The role of women as heads of households and as income earners in male-headed households has produced a complex picture of their own and their children's vulnerability [22]. Several studies have emphasized children's varied living arrangements, many of which do not include co-residence with one or both parents [23].

In examining the nutritional status of children, it is important to understand how children's living arrangements and their connections to adults affect their access to food. Put another way, the socioeconomic determinants in the Moseley and Chen model make themselves apparent in children's living circumstances, which, in turn, impact on their health status. For

example, high unemployment rates in the Agincourt villages continue to be a “push” factor for men, and increasingly women, to look for jobs in bigger towns and cities. This often means that children are left in the care of aunts and/or grandmothers. For children whose mother has a stable job and brings money and food home with her at “month end”, and whose daily life is supervised by a competent maternal aunt with whom they share a dwelling to which their grandfather or maternal uncle also contributes, their mother's absence may have a positive impact on nutritional status. For other children, whose parents' income has to be distributed among the members of a domestic group, their mother's absence may cause a decline in the amount and regularity of the food they receive. In general, the local and national labour market, parents' personal characteristics and human capital, and the ability and availability of reliable caregivers mediate the effects of “parental absence” so that it may have a positive or negative effect on children's nutritional status. Because of this, we need to include children's connections to adults in any model that seeks to explain health outcomes of children.

Site description

The sub-district of Agincourt is located 500 km northeast of Johannesburg in Limpopo Province. To the east, the Agincourt area borders on the Kruger National Park, one of the largest game parks in Africa; to the west are the Drakensberg Mountains. High population density and low rainfall make the area inadequate for subsistence farming and more suitable for cattle or game rearing. The population has low levels of education and high rates of unemployment. Part of a former homeland, and destination for people forcibly resettled under apartheid, this rural area inhabited by 70,000 people dispersed over 21 villages has always had high rates of both labour migration and refugee influx from neighbouring Mozambique. The most common language is XiTsonga and the most common ethnic identity is Tsonga, though sizeable minorities identify as Pedi, Sotho, Swazi, and Zulu. Mozambican immigrants to the area speak a dialect of XiTsonga and tend to be classified as Tsonga.

The Agincourt sub-district is also home to the MRC/Wits Rural Public Health and Health Transitions Research Unit (Agincourt), which runs the Agincourt health and demographic surveillance system (AHDSS), initiated in 1992 in response to an urgent need for reliable demographic data on rural populations. The program has been conducting an annual census of the *entire population* since that time and has amassed longitudinal database that includes information on household structure, fertility, mortality, and migration as well as on selected topics such as labour-force participation and healthcare utilization. Anthropometric data have not been collected in Agincourt despite the finding that nearly half of all deaths in children under five between 1992 and 1995 were from diarrhoea and kwashiorkor [24]. However, anthropometric data collected at the provincial level suggest that Limpopo Province ranks poorly compared with the national average [4]. In addition, the Agincourt Unit has been the site of numerous quantitative and qualitative satellite projects undertaken by researchers based at institutions in South Africa and elsewhere that have built on existing AHDSS data and benefited from the longstanding relationship with the study community and extensive research infrastructure. The data for this analysis come from: the Children's Well-Being and Social Connections (CWSC) study, designed to study the full range of children's social connections and the effects of those connections on their well-being.

Material and methods

The fundamental purpose of the CWSC research was to understand why some children in this rural population in South Africa thrive and some do not. We used the results of a comparative study of the 21 villages in the sub-region [25], and information gathered

through discussion with local members of the research team, to select two contrasting but typical villages. One village was on a main graded dirt road, served by regular taxi service, and had a supermarket, post office, clinic, and other services. The other was on a minor road, less accessible to public transport, and had only a few small kiosks selling a limited array of groceries. Both villages had primary and secondary schools, electricity, and water provided at public taps.

In each village, we used the economic status module of the AHDSS to divide the households into three socioeconomic strata and randomly selected two households containing at least one child aged 10 or 11 from each stratum in each village. Of the 12 households selected, only one was unwilling to participate and was replaced by another randomly selected household. The selected households were not conceptualized as the centers of networks but rather as points of entry into connected groups of households that we have termed “contact groups”. On average, contact groups were made up of 6 households so we eventually collected an extensive array of information on 73 households and about 600 individuals, of whom 316 are under the age of 22. While the majority of households are located in the AHDSS area, some are located in villages and towns outside the AHDSS site. Working with a team of eight local research assistants, we mapped out all the links of kinship, visits, support, and residence between the members of the initiating households and the rest of their contact groups over a period of three months. The project used a suite of quantitative and qualitative methods including lifetime education and residence histories for all children under 22; detailed kinship diagrams covering 4–5 generations; participant observation of daily activities and special events; interviews on selected topics; anthropometric measurements; and detailed observation logs of children's activities. Each method was designed to capture a different perspective on social connectivity, which is both a multidimensional and a dynamic concept.

In the present analysis we use anthropometric data, measures of lifetime residence, and support received from others, as assessed for the 202 children in the CWSC study who were resident in the AHDSS villages. Teams of two researchers weighed and measured the children using digital scales and measuring sticks. Infants were weighed in neonatal paediatric digital scales and measured using measuring tape. All measurements were taken to the nearest centimeter or tenth of a kilogram and were repeated to verify accuracy, checked, and recorded by both researchers. Aberrant data points discovered in field editing were corrected through renewed measurement.

The first part of our analysis presents graphic comparisons of the observed height for age and weight for age of our sample with an accepted international standard published by the United States National Center for Health Statistics [26]. We used the CDC's “Anthro” program guidelines, implemented in STATA 8.0 using the “Anthro” add-on file, to fit growth curves to our data and to calculate expected values and Z scores for the deviation of observed from expected measurements. Although recent research in developing country settings has questioned the appropriateness of using standards based on Western populations [27,28], these standards are widely used and accepted in international public health research and there are no generally accepted alternative standards suitable for South African populations.

In the second part of our analysis, we conducted logistic regressions to identify factors associated with compromised nutrition. The World Health Organization (WHO) standards classify child health as compromised if a child's weight and height for age are more than two standard deviations from the median of a standard population [29]. We define a child as nutritionally compromised if he or she is more than two standard deviations below the expected value for any one of weight for age, height for age, or body mass index (defined as

weight/height^2). Our three indicators of compromised nutrition are highly correlated. We used height for age and weight for age separately because they have been associated with long-term and short-term nutritional stress respectively. The group of children who were more than two standard deviations below expected for either weight for age or height for age included all but one of the children more than two standard deviations below expected for BMI. Our measure of compromised nutrition, while unconventional, does capture all cases of nutritional stress in our sample. We use a variety of independent variables in the logistic regressions and divide them into two groups: (1) “parental connectivity” measures of children's current and lifetime residence patterns with parents and financial support from parents, and (2) “non-parental connectivity” measures of current and lifetime co-residence with and support from maternal and paternal grandparents and female maternal kin. We also used a set of variables designed to describe each child's position in a sibling set and a binary variable to distinguish children from the two villages. While the size of our sample limits us to a series of bivariate analyses, we did include the age of child as a control variable in all analyses.

Results

Our graphic representation plots the fitted growth curve of the CWSC sample alongside CDC growth curves at the 50th and 5th percentiles. Figure 1 presents weight for age by sex.

Overall we see the CWSC curve falling between the 5th and 50th percentile curves for both boys and girls, with a higher percentage of thin children in the youngest ages. Two features merit comment: (1) above age 10, the curve for boys' weight for age remains close to the 5th percentile of the standard and there is considerable variation in weights, and (2) above age 15, the curve for girls' weight for age rises above the 50th percentile of the standard, also accompanied by considerable variation in weight.

Figure 2 presents height for age by sex.

Again, we find all three lines rising in parallel, with the CWSC sample falling between the 5th and 50th percentiles of the CDC growth curves. As in the measurement of weight for age, there is increased variation in height for age between the ages of 10 and 15 suggesting variation in either the onset of puberty or social configurations or a combination of both.

Table I summarizes the data on our sample by showing the percentage of children, by age and by sex, who are nutritionally compromised and the percentage whose nutritional status is adequate (i.e. their weight for age, height for age, and BMI are all within two standard deviations of the CDC standard population). Because we do not have exact ages for all children, we computed each child's z-score from the difference of their observed value and the standard median value for the midpoint of each year of age. A child age 9, for instance, is compared with the standard at age 9.5.

The most striking feature of Table I is the prevalence of compromised nutrition in the youngest age group for both boys and girls. Of children below 5 years, 53% of boys and 60% of girls are nutritionally compromised, while for those between 15 and 21 years the level has dropped to 28% of males and only 10% of females. A second interesting feature is that the male advantage in the youngest age group reverses with age, transformed into a resounding female advantage in the oldest age group. Differential intensity and duration of breastfeeding for boys and girls and differences in the quality of weaning foods could contribute to the male advantage among young children. We do not have enough cases to offer quantitative data on this topic, but our impression from conversation and observation of the parents of young children is that fathers, particularly young unmarried fathers, are somewhat more likely to acknowledge paternity of boys and that they, or their parents, are

more likely to provide some financial support to sons. Adolescent boys, on the other hand, are more physically active, though not necessarily more productive, than girls. Herding and other tasks, as well as their own excursions away from the village, take them away from the home fires where food is available, and boys are more frequently fending for themselves than are girls.

Our quantitative data do allow us to shed some light on the potential social determinants of compromised nutrition. The size of our sample restricts the significance of multivariate results, so we present the results from regression analyses of the relationship between compromised nutrition and a series of social connection variables. Tables II and III present odds ratios with significance levels based on chi-squared tests for the dichotomous variables and F tests for continuous variables. We included age of the child as a control variable in all analyses: higher age is significantly associated with lower odds of being nutritionally compromised. In Table II, we focus on the parental connectivity variables.

Considering first the variables that describe a child's current situation, there is no significant association between being nutritionally compromised and living with father or with father being away at work or dead. Nor is there an association with living with both parents. By contrast, currently living with mother is significantly associated with a reduced chance of being nutritionally compromised, while the death of the mother is associated with a fourfold increase in those odds. Moving to a lifetime perspective, we found no significant effects for the percentage of a child's life that either mother or father have co-resided with the child or worked away from home. The mother's support, either currently or over the life-course, has no significant impact. Regarding financial support, the differences are only significant for father's support. Currently being supported by a father is associated with a halving of the odds of being undernourished. From a lifetime perspective, the longer the father has contributed during the course of the child's life, the lower are the child's odds are of being nutritionally compromised. Taken together, the results of the regressions presented in Table II indicate that the co-residence of the mother and the support of the father both have a positive impact on children's nutritional status. The death of a child's mother, that is the complete absence of both connection and support and the loss of her ability to persuade her kin to care for her children, is the circumstance with the greatest negative impact on a child's chances of being adequately fed.

In Table III we present the results of regressions aimed at predicting children's nutritional status from their connections to kin other than their parents, and from the size and composition of their sibling set. Looking first at the variables describing children's sibling sets, we find that children with more siblings, and children with more older siblings, are more likely to be nutritionally compromised than children with fewer siblings and fewer older siblings controlling for child's age. In addition, we find that the number of older sisters a child has is significantly associated with increased risk of low height, weight, or BMI for age controlling for age of child. In contrast, we find a significant effect for only one of the variables we have used to measure kin support and co-residence: for a child, “currently living with maternal female kin but not living with mother” almost doubles the odds of being nutritionally compromised. Support from, and co-residence with, either paternal or maternal grandparents have no significant effects on a child's odds of being nutritionally compromised. These results, together with the parental regressions, are the subject of the following discussion.

Discussion

A great deal of description and theorizing about family life in South Africa, and our own ethnographic sense in the specific context of the Agincourt area, confirms the extended-

family household as an important mechanism for pooling resources and distributing domestic labour. The absence of nutritional benefit to children from their grandparents' co-residence and support is, therefore, surprising. We suggest that the absence of significant effects in our regressions is an artifact of the different economic situations of “parent and children only” households, from those including three generations and a variety of kin. A “parent and children only” household, without a stable wage earner, is not viable as a long-term domestic unit because the income available from casual work and subsistence agriculture is inadequate for the household's needs. The few such households we came across, consisting of unemployed parents and children, were usually in dire straits and, on closer examination, had recently lost a wage earner to death or unemployment, or received insurance payments or some concealed subsidy from kin. The persistent “parent and children only” households we observed all had at least one adult who was employed in a stable and reasonably compensated job and who spent his or her earnings on household expenses. That is, the children not living with kin other than their parents were those children whose parents integration into the formal economy was an adequate substitute for the support of kin.

As with grandparental contributions, we would expect, in general, that it is maternal female kin, most obviously the mother's sisters and her own mother, who would provide the best substitute for the care and support of a child's mother and would protect the child from being under-fed. Again, however, our ethnographic data suggest that the connection between the composition of residential groups and their economic situation provides an explanation for our regression result. We saw in Table II that living with a mother halved, while the mother's death quadrupled, the odds of a child being nutritionally compromised, and in Table III that living with maternal kin but not a mother doubled those odds. Reconciling these results requires knowledge of the economic options and situations of poor women in South Africa. Apart from the minority of women who have post-secondary training, many rural women do not have access to jobs that allow them to adequately support a family. Jobs on commercial farms and game lodges in the region, and domestic work in urban areas, provide women with board and lodging but limited cash income. The narratives that we collected indicated that transport to and from work could absorb a great deal of that cash. The result is that those mothers who are not living with their children because they are away at work are able to contribute to their children's support, but are not able to support them fully. They might, for instance buy an 80 kg sack of maize flour at the beginning of the month and leave a little cash or pay off their credit at a local shop. They would then hope that the maize would last until the month end, knowing that the cash for bread, sugar, and other staples would be exhausted before then. For the majority of mothers, seeking work away from home was something they did only when they had no alternatives. Mothers with these low-paying jobs were well aware that they were fighting a losing battle, but not all women had the qualities needed even to get or keep such jobs; with the result that many of the missing mothers did not contribute to their children's support. Some had simply left their children with kin and were, as people said, “lost” to contact with their families even when their locations were known.

The consequence for those children most likely to be living with maternal kin, was that their mothers were either entirely absent or were unable to provide adequate support. We can now understand the regression result that the death of a child's mother puts that child at greatly increased risk. The child is deprived not only of the mother's direct care but also of the link that she provides to other kin. In particular, the child's father, unless he has claimed the child and taken it to live with his kin, rarely takes an active role in the life of a child once the mother has died or disappeared. And the break with the father entails also a break with paternal kin and halves the potential sources of support available. In contrast, living with his or her mother but no other maternal kin almost always implies the dependable support of the

child's father. Living with a mother and other kin usually means that the household has one or more working adults who are contributing to the child's support.

The effects of birth order, number of siblings and older sisters on children's nutritional status may also be explained through social processes (recognizing that children with many siblings face the pressure of numbers on limited resources). Low birth-order children, at least in their early years, face less competition for their parents' resources than do their later-born siblings. However their parents are also young and may be expected to have fewer resources to distribute. These potential negative effects are mitigated, in the Agincourt population, by the practice of young mothers living in established households headed by adults of the preceding generation. These senior adults were formerly, following the cultural norm of patrilocality, the father's parents, but it is now more common for young mothers to give birth in their own parents' homes and to remain there with their young children, either indefinitely or until they establish homes of their own. Low birth-order children are thus likely to spend their early years living with their mothers and other adult maternal kin, while their younger siblings are more likely to be dependent on the resources of their parents alone. It is through processes like this that the socioeconomic conditions of employment shortage and wage differentials between male- and female-dominated occupations affect the living situations of children and hence the proximate determinants of their health and well-being.

Conclusion and future research

These descriptive data and analyses of children's living situations contribute to understanding the health of South African children. We are aware that this paper raises questions and methodological problems which the data we have presented cannot resolve. We will discuss three of these, which we intend to address in future work. First, and most obvious, is that the size of our sample, and possible biases, prevent us from drawing definitive conclusions. Our ethnographic data suggest that the effects of certain of the social connection variables could prove significant with a larger sample. This would also permit multivariate analyses through which we could assess the relative influence of particular factors. We hope to identify, from our detailed data and intensive observation, a limited set of variables that capture the key characteristics of children's living situations and which can be measured through relatively rapid observation on a large sample.

A second methodological problem involves relating measures of height and weight to children's current situations and to measures of their life-course experience. Being underweight can plausibly be associated with wasting as a consequence of relatively short-term food shortages, resulting from the loss of a child's source of support through unemployment, desertion, or death. Low height for age, on the other hand, is usually associated with stunting, an effect of long-term under-nutrition resulting from a child having lived for several years in a household with chronically insufficient income, or lacking any competent adult to provide care and ensure the child has adequate access to food. While we have made an attempt to capture both short- and long-term effects in our measure of compromised nutrition, we are unable to determine the timing of a child's deprivation and thus connect shortage of food to the child's living situation at that time. The assumption that children's current living situation is indicative of their past experience is untenable in the Agincourt setting. In 2004 we re-measured the height and weight of all the children in our sample. These data, not included in the present analysis, will provide measures of growth over a two-year period for which we also have detailed data on children's living situation. Analysis should allow more robust conclusions concerning the impact of children's connections on their health and nutrition.

The third issue raised by our present analysis is that of the mechanisms through which those social determinants identified as associated with nutritional deficits, such as maternal co-residence, size and composition of a child's sibling set, and paternal support, influence the amount, quality, and frequency of the food children eat day by day. We have collected finely detailed observational data recording the activities, interactions, food preparation and consumption of 24 pre-school-age children and all the members of their households. Analyses of these data should identify precisely the kinds of care and support provided by different kin and any patterns of differential care and feeding between children in the same household.

In this paper, we have compared the growth of children in the Agincourt area with international standards of weight for age and height for age to document the extent of compromised nutrition. While it is quite clear that the Agincourt population is not severely undernourished in the way that many African populations are, our data demonstrate that many children do not attain the weight or height for age that would indicate good nutrition. In a community in which most families are struggling to maintain a livelihood, and in which the pursuit of employment requires mobility, we have observed a pattern of fluid living arrangements in which various adults assume different responsibilities towards children over time. We have found notable variation in children's growth, that reflects their differential access to resources. We have also tried to identify variables that describe the social context intervening between socioeconomic factors and the proximate determinants of children's nutrition. Our findings indicate complex interactions between parental and non-parental connections to children, the age of the child, and nutritional outcomes.

Acknowledgments

The authors are indebted to the MRC/Wits-Agincourt Unit for support in carrying out this research. In particular, they thank Kathleen Kahn for her guidance in designing the nutrition data collection instruments and Mark Collinson for drawing the initial sample. The research could not have been done without their team, which included Dudu Dlamini, Victoria Dlamini, Isaacs Khosa, Peggy Khosa, Council Mbetse, Busie Mnisi, Sibongile Nxumalo, and Norman Shabane. Finally, they are indebted to Lacey Andrews for assisting with measuring children in the field. This research was funded by the National Science Foundation (No. 0109916).

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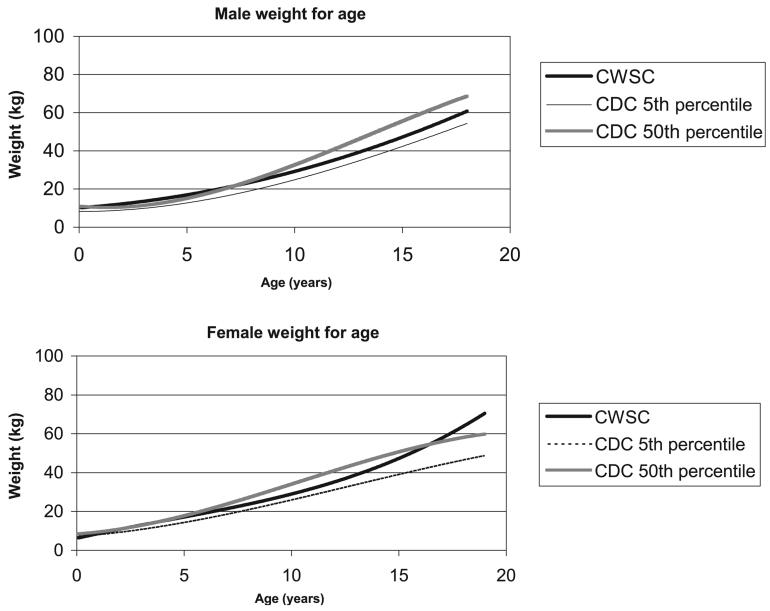

Figure 1.
Weight for age: Comparison of CWSC growth curves with Centers for Disease Control (CDC) growth curves, Agincourt 2002. CWSC: Children's well-being and social connections study.

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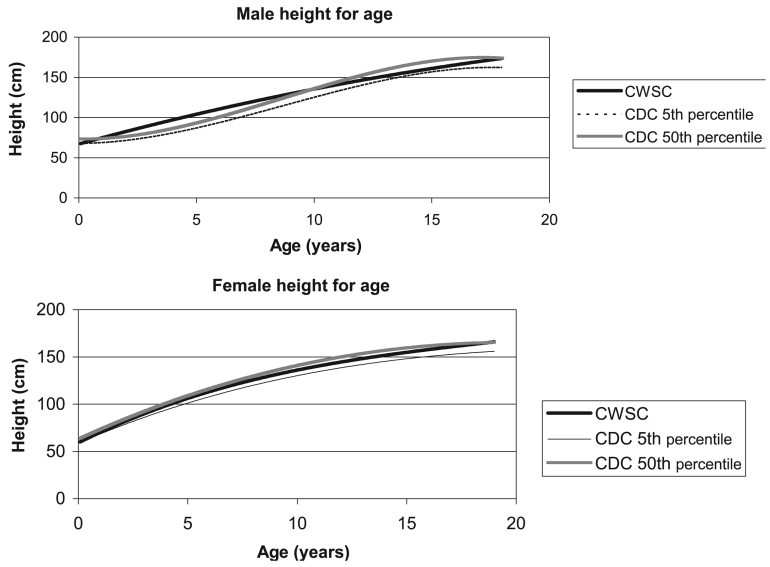

Figure 2.
Height for age: Comparison of CWSC growth curves with Centers for Disease Control (CDC) growth curves, Agincourt 2002. CWSC: Children's well-being and social connections study.

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Table I

Nutritional status of CWSC children by sex and age (n=202) in comparison with international standard (%), Agincourt 2002.

Age group (years)	0–4		5–9		10–14		15–21	
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)
Adequate nutrition[a]	47	40	67	83	70	67	72	90
Compromised nutrition[b]	53	60	33	17	30	33	28	10
n	17	30	27	23	40	27	18	20

[a]Children with adequate nutrition have measures of height for age, weight for age, BMI for age all within two standard deviations of the median standard.

[b]Children with compromised nutrition have at least one of their measures of height for age, weight for age, BMI for age more than two standard deviations below the median standard. Standard: US Growth Charts 2000, National Center for Health Statistics, Centers for Disease Control.

Table II

Logistic regression predicting the odds of having compromised nutrition[a] using parental connection variables[b], Agincourt 2002.

	Odds ratio
Currently living with mother	0.45**
Currently living with father	NS
Currently living with both	NS
Father currently working away	NS
Father dead	NS
Mother dead	4.14*
Percentage of life co-resident with mother	NS
Percentage of life co-resident with father	NS
Percentage of life during which father was working away	NS
Percentage of life during which mother was working away	NS
Currently supported by father	0.46**
Currently supported by mother	NS
Percentage of life during which father provided support	0.99**
Percentage of life during which mother provided support	NS
n	202

[a]Compromised nutrition is defined as more than two standard deviations below the expected value for any one of weight for age, height for age, or body mass index.

[b]Age of child is included as a control variable in all the regressions and is significantly associated with lower odds of being nutritionally compromised.

**Significant at the 0.01 level.

*Significant at the 0.05 level.

Table III

Logistic regression predicting the odds of having compromised nutrition[a] using non-parental connection variables and variables describing child's sibling set[b], Agincourt 2002.

	Odds ratio
Currently living with maternal grandparent	NS
Currently living with paternal grandparent	NS
Currently living with maternal female kin[c] but not living with mother	1.99**
% of life co-resident with maternal grandparents	NS
Percentage of life co-resident with paternal grandparents	NS
Percentage of life co-resident with maternal female kin[c]	NS
Percentage of life maternal grandparents provided support	NS
Percentage of life paternal grandparents provided support	NS
Birth order among full siblings	1.16*
Number of full siblings	1.21**
No. of older full brothers	NS
No. of older full sisters	1.35**
No. of younger full brothers	NS
No. of younger full sisters	NS
Originating in richer village	NS
n	202

[a] Compromised nutrition is defined as more than two standard deviations below the expected value for any one of weight for age, height for age, or body mass index.

[b] Age of child is included as a control variable in all regressions and is significantly associated with a lower odds of being compromised nutritionally.

[c] "Maternal female kin" does not include the child's mother, but does include all other adult women on the mother's side.

** Significant at the 0.01 level.

* Significant at the 0.05 level.