

**Wealth, Health and Knowledge:
Determinants of malnutrition in
North Wollo, Ethiopia**

**SC(UK) Ethiopia
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1. Executive Summary

Wealth, Health and Knowledge tries to explain why nearly half the children in the northern highlands of Ethiopia are malnourished. It confirms that the problem is largely due to the way young children are cared for. More importantly, it shows that tackling the problem – improving child caring practices and thus reducing malnutrition in young children – is perhaps more complex than previously acknowledged.

Although educating mothers (and other caregivers) better will undoubtedly lead to an improvement in the way some young children are cared for, many mothers will never be able to act on their new knowledge because they are simply too poor. *Wealth, Health and Knowledge* identifies how poverty limits the options mothers have for properly caring for their children. The report calls for a better appreciation of these constraints in all initiatives designed to reduce child malnutrition.

Main findings of the study:

Household wealth was found to be an important determinant of child malnutrition. Some of the links between wealth and nutritional status revealed in the study have been found many times before: better-off households have better access to food and higher cash incomes than poorer households, allowing them a better quality diet, better access to medical care and more money to spend on essential non-food items such as schooling, clothing and hygiene products.

More interestingly, the study shows that while the main causes of malnutrition appear to change as a child grows, the links between child malnutrition and household wealth remains strong:

- For children under six months, breastfeeding pattern was the most important determinant of malnutrition. Children who were not exclusively breastfed were five times more likely to be malnourished than those who were. Unfortunately, poorer women have to leave the home earlier after giving birth and for longer periods in order to obtain food and income to look after their families. This means that poorer women are less likely to be able to exclusively breastfeed for the first six months of their child's life. Additionally, within this age group children's nutritional status is significantly related to maternal nutritional status: better-nourished women give birth to heavier children. Women from better-off households are better nourished than women from poorer households are.
- Between six and ten months is the time when most of the malnutrition among children in the study area develops. At this age, children should start to receive complementary foods in addition to breastmilk. The study found that most mothers give their children inappropriate weaning foods. While interviews revealed that many women did not know the ideal properties of weaning foods, many others stated that they could not afford either the time or the resources to produce ideal complementary foods such as porridge with oil.
- From 11 to 24 months, household wealth is only one of a number of factors associated with child malnutrition, including the child's illness status, household hygiene practices, feeding practices and maternal formal education and nutritional status. However, many of these other factors are also associated with household wealth. For example, better-off households are more likely to have soap and mothers from better-off households are more likely to have completed primary school. In multiple regression analyses, wealth group, the child's illness and maternal education and nutritional status remained significantly associated with malnutrition. This means that these variables are independently associated

with the risk of malnutrition: a poor child with an educated mother has a higher risk of being malnourished than a better-off child with an educated mother has.

The study also found that *children who were sick in the previous 24 hours were more likely to be malnourished than children who had not been sick*. The presence of disease leads to malnutrition through malabsorption of nutrients, altered metabolism, loss of appetite and by affecting feeding practices. But malnutrition also makes children more susceptible to diseases.

Interestingly, the study found that children from better-off households were significantly less likely to have been sick. This can be explained through several different mechanisms:

- Better-off households have a higher cash income, so if the child does get sick they are more likely to be able to afford medical care. Proper medical care will reduce the length and intensity of the illness.
- Women in better-off households have more time to care for a sick child than women from poorer households do.
- Better-off households are more likely to be able to afford measures that prevent illnesses developing, like buying soap, mosquito nets and fuel to boil water.

The study confirmed that, *children whose mothers attended school are less likely to be malnourished than the children of uneducated mothers*. This finding is common throughout the developing world. The study also found significant associations between maternal education and both the uptake of vaccinations and good hygiene practices. The explanations appear to be as follows:

- Educated mothers are more likely to understand the benefits of vaccinating their children, and are more likely to make the effort to get their children vaccinated.
- Educated mothers are more likely to know the causes of diarrhoea, better informed about the advantages of good hygiene and are more likely to prioritise soap use than uneducated mothers.

The use of soap, however, is also dependent on being able to afford it. Analysis of soap use showed that it is associated independently with both household wealth and maternal educational status. Thus soap use is associated with both maternal education and income. The same is true for complementary foods – better-off households are more likely to be able to afford the time and the ingredients to prepare suitable complementary foods, but knowledge is also a prerequisite.

Main recommendations:

Timing of any intervention

The most critical period in the development of childhood malnutrition in the northern highlands of Ethiopia is between five and ten months. Efforts to reduce malnutrition should be focussed at, or before, this time.

Wealth

Since wealth, or rather poverty, is an extremely important factor in the development of malnutrition, efforts should be made to improve the food and cash income of the poor. In particular, efforts should be focussed on enabling women to spend more time at home during the first six months of their child's life – to enable more women to breastfeed exclusively.

Health

Since illness, particularly diarrhoea, is a major contributing factor to malnutrition, both preventative and curative measures need to be improved. Priorities should include:

- Increase both the quantity and quality of water used by households with young children. Both physical inputs (increased number of protected water sources) and hygiene promotion are required.
- Improve access to health services for the poor. Poor households are currently denied access to public healthcare due mainly to the high cost drugs and user fees. One solution might be to provide free (or subsidised) essential drugs to all children under two years. Another option might be to develop new targeting mechanisms for user fees in the health sector, perhaps based on livelihood groups.

Education

The female education enrolment rate should be increased to improve the way future generations of children are cared for. Appropriate information on child caring practices should be made part of the syllabus. Given that it will be difficult to improve the proportion of mothers who have completed primary school in the short term, it is important to increase immediately the knowledge of mothers (and other care givers) on child caring practices. Special attention should be given to breastfeeding, weaning practices, and the prevention and treatment of diarrhoea.

Growth monitoring, if properly implemented, is one way to advise mothers of young children on how best to care for their children. However, growth monitoring by itself is likely to be ineffective if mothers are too poor to be able to act on the advice they are given. Given that the vast majority of households in the study area are defined as poor or medium (80%), programmes aiming to reduce child malnutrition must be thought through carefully, and may need to be linked to other interventions that improve poor mothers' ability to act on new knowledge they may gain about child caring practices.

Note on methodology:

The specific research objectives were: to assess current child caring practices in the northern highlands; understand the reasons behind the caring practices observed; and, identify possible interventions that could improve these practices and reduce child malnutrition. A mixed method approach using quantitative (in October 2001) and a qualitative (in February 2002) techniques was used. Data was collected at community level through a household survey, focus group discussions and interviews with key informants. The research was located in six *kebeles* of North Wollo, purposefully selected on the basis of sharing similar agro-ecological characteristics.

The quantitative component of the study involved administering a pre-coded questionnaire to the primary caregiver in all households with a child aged 0-24 months. Every household within the six *kebeles* of the study area was visited. All children aged 0-24 months (1471 children in all) were weighed and measured. Malnutrition in this study refers to low weight for age.

Wealth ranking of all households included in the study was done with village leaders who, after agreeing the characteristics of each wealth category, accompanied the data collectors to each household in order to identify discreetly its wealth status according to the predefined criteria. One village leader was responsible for identifying the wealth group of about 50 households.

2. Introduction

The importance of infant caring practices as a cause of malnutrition is now widely recognised. Caring practices include behaviours that have an impact on children's nutritional status such as infant and young child feeding, hygiene practices, health seeking behaviour and care for women. The caregiver's capacity to look after children determines the quantity and quality of care practices that are possible. The household's access to economic and human resources determines its caring capacity (1).

Much of the investment in large scale, long-term nutrition programmes is now focussed on addressing the care components of the causes of malnutrition. For example, the Ethiopian Government is planning to start a community growth promotion programme in selected, chronically food insecure, areas of the country shortly. This programme aims to educate mothers about caring practices through community based growth monitoring and hence improve the growth of young children. The premise of this programme is that providing education at the household and community level to change caring behaviours is a sustainable and effective way of decreasing malnutrition in the immediate term before poverty reduction can be achieved.

SC(UK) recognises that there is evidence to suggest that certain communities in Ethiopia employ caring practices that do not optimise child nutrition. For example, the recent DHS survey (2000) showed that only 32% of infants born in Amhara were breastfed within one hour of birth and only 54% of women reported knowledge of ORS packets (2).

However, there is little evidence to show that intervening at household and community level to change caring behaviour through growth promotion improves nutritional status in chronically food insecure areas of Ethiopia (3).

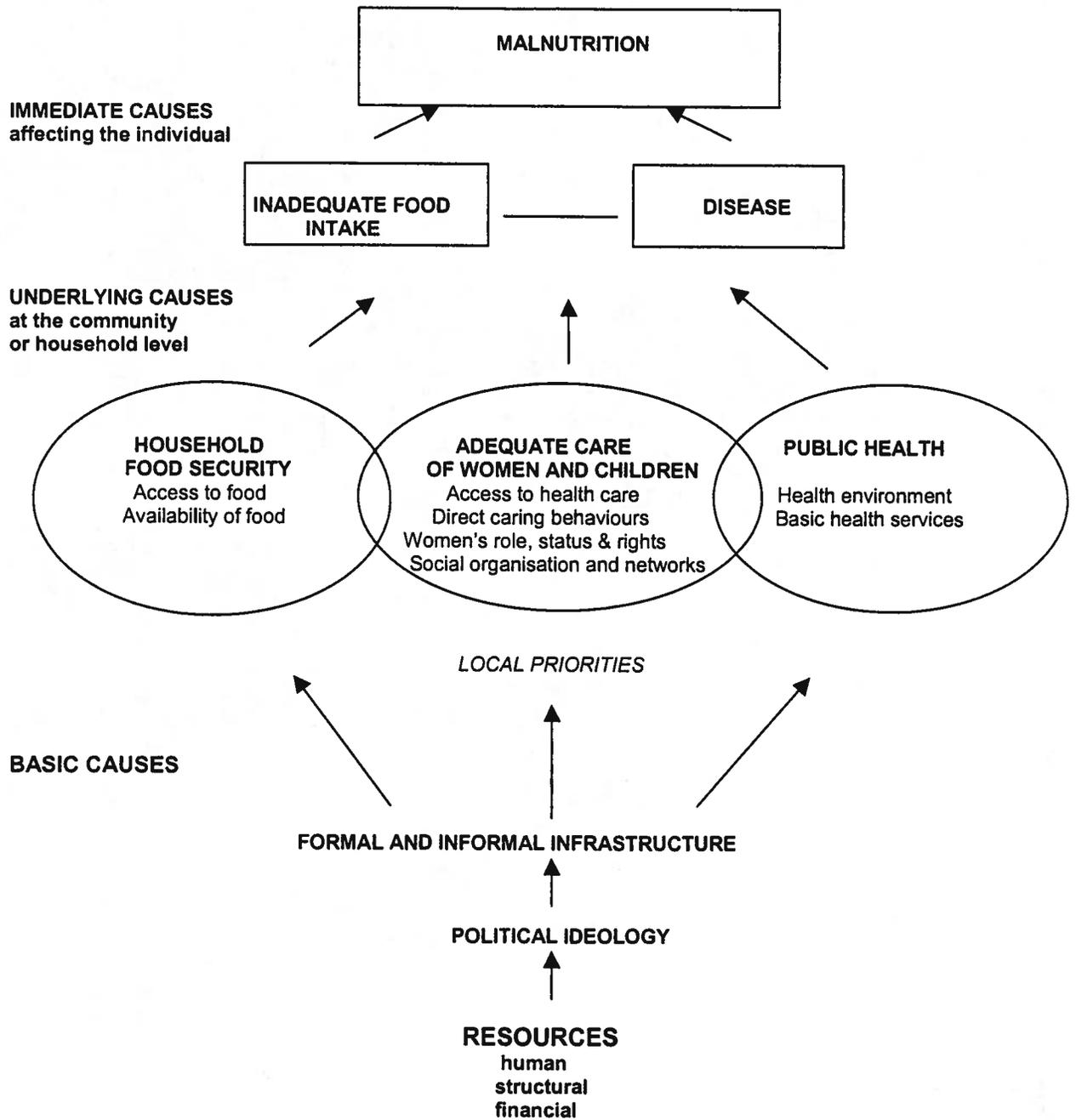
SC-UK is concerned that the relationship between caring practices and the economic and human resources to which households have access has been overlooked. By investigating this relationship we hope to better inform decisions on how to spend resources earmarked to improve caring practices.

This paper describes a study undertaken in Gubalafto woreda, North Wollo. The study aimed to assess the causes of malnutrition among children aged 0-24 months, with special attention to caring practices. In particular, the study aimed to assess current caring practices in the highlands, understand the reasons behind the caring practices observed and identify possible interventions that could improve practices.

3. Study hypotheses

The basis of this work is the UNICEF nutritional framework of the causes of malnutrition. In this framework (see figure 1), the immediate causes of malnutrition are insufficient food intake and disease. A wide range of underlying causes that operate at the household and community level influence the immediate causes. The underlying causes are grouped into three clusters: household food security, basic health services and the health environment, and adequate care of women and children. A third level of 'basic causes' are potential resources, the environment, economic structures, and the political and ideological superstructure.

Figure 1: The UNICEF Conceptual Model of the causes of malnutrition in emergencies



4. Method

The study was split into two sections: a quantitative part undertaken in October 2001 and a qualitative part undertaken in February 2002.

4.1 Site selection

The study was undertaken in the woina-dega¹ areas of Gubalafto woreda², North Wollo Zone in Amhara Region. The woina-dega communities in the North Wollo East plain are dependent on rain-fed agriculture. Land holdings in this area are very limited. Most households own between 0.5-1.0 ha of land (average household size is 5) (4).

The woina-dega areas of Gubalafto were selected for several reasons. Firstly, the population living in this area is relatively typical of Wollo zone; they are not living in either the extreme high or low land. Thus it was hoped that the results from this study would be generalisable to other parts of Wollo. Secondly, SC-UK has worked in Gubalafto for many years and currently has an office in Woldiya (the woreda centre). Finally, SC-UK has undertaken two food economy assessments in the woreda and our Nutritional Surveillance Programme systematically collected anthropometric and early warning data in this area for many years (4,5). Hence we had excellent background information on the area before starting the study.

4.2 Sampling

This study was not intended to be statistically representative of the areas studied. The purpose was to assess differences by wealth group in selected Peasants Associations (PAs)³ which were representative of the agro-ecological zone. Thus a list of Gubalafto's PAs (with information on population size and agro-ecological zone) and a map was obtained from the Woreda administration office. Six adjacent woina-dega PAs were then selected for the study. See Annex 1 for the list of selected PAs.

Households in the selected PAs were exhaustively sampled. Households with children under two were found by going from house to house in every gott⁴.

A total of 1,471 children were selected for weighing and measuring. Detailed sample size calculations are provided in Annex 1.

4.3 Questionnaire variables

Wealth ranking

Using participatory rural appraisal (PRA) techniques village leaders (key informants) identified different wealth groups in their community and defined the criteria for inclusion in each group. The wealth definitions included criteria related to asset ownership, access to food, household composition, expenditure and income.

The results of the community's wealth ranking exercise were almost identical to those obtained by SC-UK in household food economy surveys in the area (4). The most important factor identified for the better-off group was the ownership of at least one

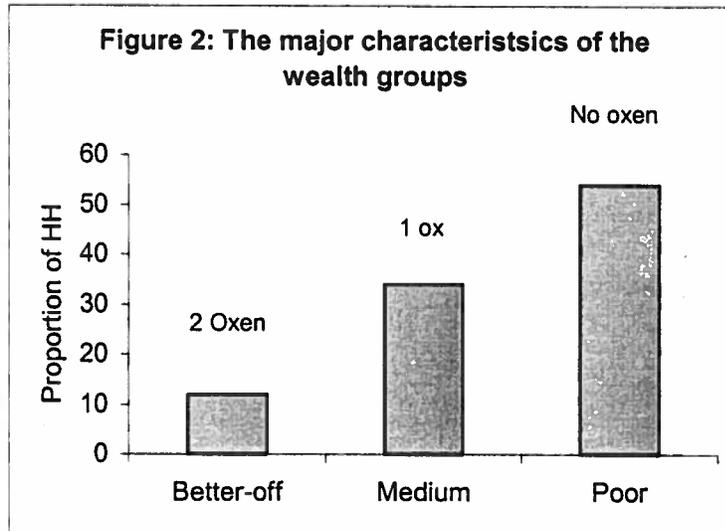
¹ Woina-dega areas lie between 1,500 and 2,500m above sea level.

² The total population of Gubalafto woreda was estimated at 160,000.

³ A peasants association (PA) is the smallest administrative unit recognised by the Government of Ethiopia. The population of the PAs in this study range from 5-6,000.

⁴ A gott is roughly equivalent to a village, and usually has between 100 and 150 households.

pair of oxen. Medium households were identified by having one ox and some other large livestock. The poor, apart from not owning any large livestock themselves, also included households without land, or households where the head was disabled, incapacitated or old and without support. A detailed description of the wealth groups can be found in Annex 2.



Having agreed the major characteristics of each wealth group, the key informants (village leaders) then accompanied SC-UK's data collectors to each household in order to discreetly identify its wealth status according to the predefined criteria. One key informant was responsible for identifying the wealth group of about 50 households.

Anthropometric variables

- Age to the nearest month was recorded for all children using a detailed local calendar. Mothers' age to the nearest 5 years was recorded.
- The weight of all children was recorded to the nearest 10g using Soehnle electric beam balance scales.
- Length was measured for all children aged 6 or more months. A standard wooden length board with 0.1cm demarcations was used.
- The presence of oedema was assessed for all children.
- Mid-upper arm circumference (MUAC) was measured on all mothers to the nearest 0.1cm using a standard measuring tape.

Questionnaire variables

Further information was collected through a structured, pre-coded questionnaire that was applied to the primary caretakers of the children at the household. If either the primary caretaker or the child was not available at the first visit the team returned to the household later. A copy of the household questionnaire can be found in Annex 3.

The questionnaire was based on SC-UK's previous experience with health education in the area (6). Wherever possible questions and indicators were consistent with international recommendations (2, 7).

The household questionnaire included questions on household characteristics such as sex of the head of household, number of members and hygiene practices. Information on the child was also collected including: vaccination status, feeding

practices and illness status in the 24 hours prior to interview. Questions to the mother included educational level, pregnancy status, knowledge of caring practices and health seeking behaviour.

A short village questionnaire was also applied in each gott. Questions concerned length of time taken to get to the nearest market/ health post/ water source. This questionnaire can be found in Annex 4.

The questionnaires were field tested in advance of the study and modified where appropriate.

Maternal knowledge score

A maternal knowledge score was created from the six questions concerning mother's knowledge of hygiene, health and feeding practices. The results of the answers to these questions can be seen in table 5. The score ranged from 0-6, with one point being scored for each correct answer. The mean score was 3.2. This score was later divided into two – women with good knowledge scoring correctly on at least three of the questions and those with poor knowledge correctly answering less than three questions.

4.4 Data analysis

Quantitative data were entered, cleaned and analysed in EpiInfo 6.04b-c upgrade. EpiInfo was used to calculate anthropometric indices (see section 3.5 below). Flagged records (n=29) were excluded from further analysis. Further analysis was conducted in the STATA programme.

Proportions were entered into contingency tables and associations analysed using Chi-squared. Where relevant the Mantel-Haenszel chi-squared test, and chi-squared test for trend were applied. Further analysis assessed the relationship between wealth groups and outcomes using multiple regression.

4.5 Definitions of malnutrition

Three types of malnutrition are commonly distinguished in Ethiopia:

- Low weight for height – when a child is thin for its height, but not necessarily short for its age. Low weight for height is also known as acute malnutrition and carries an immediate increased risk of morbidity and mortality.
- Low height for age – when a child is short for its age, but not necessarily thin. Low height for age is known as chronic malnutrition and carries long-term, developmental risks.
- Low weight for age – when a child can be either thin or short for its age. Low weight for age reflects a combination of chronic and acute malnutrition.

In this document we mean low weight for age when we use the term malnutrition. Weight for age is used for the sake of continuity because height was not measured in children less than 6 months (see above) and hence weight for height and height for age could not be calculated for this age group. In fact, the three measurements are highly correlated and related to each other: a child who is low weight for height is usually also low weight for age.

The cut-off point used to define low weight for age in this document is <-2 z-scores.

4.6 Focus group discussions

After analysing the quantitative data we returned to the study site to conduct a series of focus group discussions with the community. The basis of these discussions was the results of the quantitative study; we discussed our findings with the community and asked them for explanations. Further discussions focused on the community's priorities for improving the nutritional situation of their children.

The focus group discussions, which lasted several weeks, were organised in 3 different PAs. Within each PA we discussed with separate groups:

- Community leaders (all men)
- Poor or medium mothers (educated and uneducated in separate groups)
- Better-off mothers (educated and uneducated in separate groups)
- Grandmothers
- Adolescent girls who look after young children
- Government officials from MOH, MOA and MOE

A list of the topics discussed with each group is provided in Annex 5.

5. Study Findings

The results of both the qualitative and the quantitative studies are discussed in this section. Tables of the statistical results tables are shown in Annex 6. Earlier sections focus on the prevalence and causes of malnutrition at different ages. Later sections examine the importance of wealth and education in the development of malnutrition in Gubalafto.

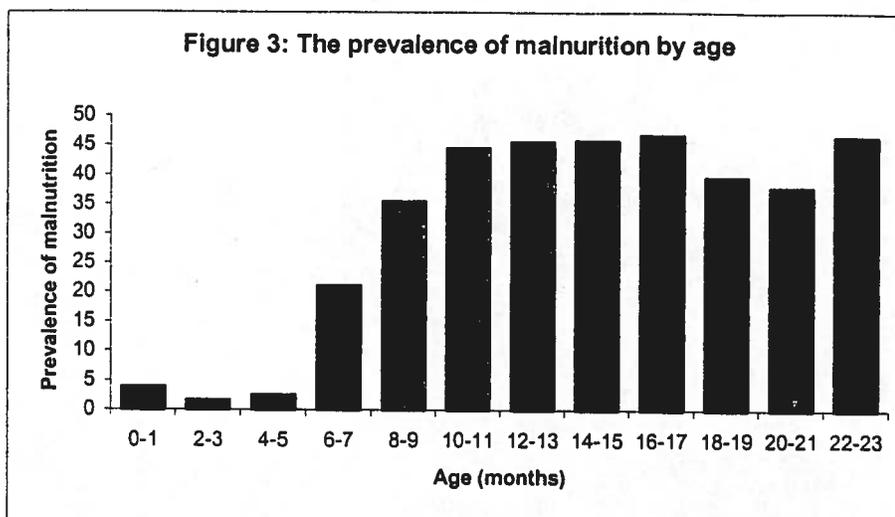
5.1 How much malnutrition is there in Gubalafto?

In October 2001, the prevalence of malnutrition (defined as low weight for age) among children aged 0-24 months living in Gubalafto was 35%. This figure is slightly lower than the Ethiopian average of 40% (estimated in the DHS survey in 2000) (2). However, a prevalence of malnutrition of 35% is still very high compared to international norms.

This study was conducted in October, just after the main meher harvest. Hence the level of malnutrition was probably lower than at other times of year because food was relatively plentiful. This may explain the difference between the DHS result and our result – the DHS survey was conducted in a very bad year (2000). Also, no disease outbreaks or epidemics were recorded in the area at the time of this survey.

5.2 The relationship between malnutrition and age

As children in Gubalafto get older they are more likely to be malnourished (see figure 3). There is a large increase in the rate of malnutrition between 5 and 10 months: the prevalence of malnutrition jumps from less than 5% to more than 40%. After 10 months the prevalence remains roughly stable, fluctuating around 45%.



The pattern of the development of malnutrition shown in figure 3 is typical of much of the developing world. A very similar pattern of increasing age and malnutrition is described by the recent Ethiopian Demographic Health Survey (DHS), which was countrywide (2).

5.3 Determinants of malnutrition by age

Up to 6 months: breastfeeding

Breastfeeding pattern is the most important determinant of malnutrition in children aged less than 6 months in Gubalafto. Children who are exclusively breastfed are significantly less likely to be malnourished than those who are not. Children who are not exclusively breastfed are 5 times more likely to be malnourished than those who are (see table A3 in Annex 6 for details).

Box 1: Breastfeeding

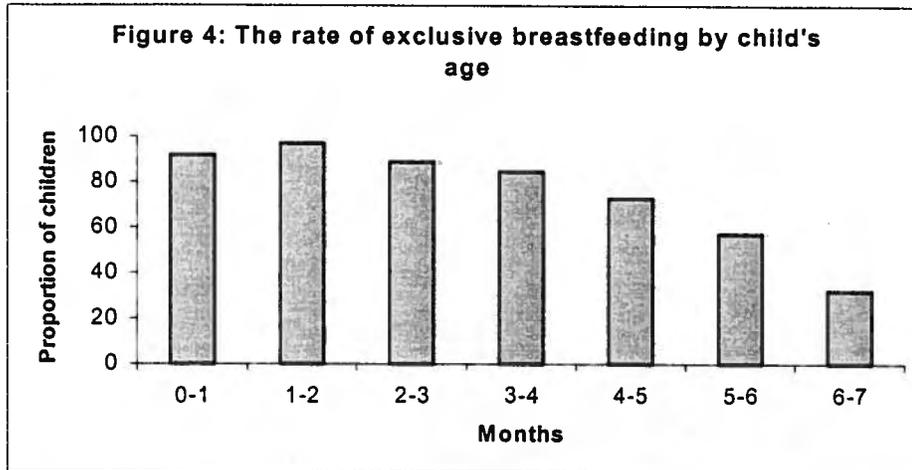
Breastfeeding is the most significant contributor to overall health and nutrition during the first year of life. Breastmilk contains all of the nutrients that an infant needs for the first six months. It is also more easily digested than any substitute.

Breastmilk contains anti-bacterial and anti-viral agents that protect an infant against infectious diseases. It strengthens the child's immune system and reduces the risk of many common ailments. Moreover, it is clean and free of bacteria and hence cannot make an infant ill.

Two main patterns of breastfeeding are recognised: exclusive and predominant. Exclusive breastfeeding means that the child receives no other food or fluids, not even water. Infants who are breastfed but also receive water, water-based drinks (sweetened or flavoured water, teas, infusions), fruit juice, or oral rehydration salts solution are defined as predominantly breastfed. No other liquids (including animal milks) or solids are allowed in this definition.

WHO recommends that all children are exclusively breastfed from 0-6 months.

The rate of breastfeeding is high in Gubalafto: almost ninety percent of the women interviewed for the survey were predominantly or exclusively breastfeeding their children at age 6 months. However, the rate of exclusive breastfeeding begins to fall off after two months and is only about 60-70% by the time the child is 5 months old (see figure 4)⁵.



Exclusive breastfeeding depends not only on a mother knowing that exclusive breastfeeding is best, but also on her being able to spend enough time with her child to provide sufficient breastmilk. Our results show that among women with children aged 0-6 months, those who spent more than two hours away from their child were significantly less likely to exclusively breastfeed their children than those who spent less time away from home. Thus any woman who has to spend a lot of time away from her child, for example to go to the market, may not be able to breastfeed her child exclusively.

Breastfeeding pattern is probably the most important determinant of malnutrition in the less than six months age group. However, a positive association was also found between maternal nutritional status and children's nutritional status. Women who had a larger mid-upper arm circumference (MUAC) had better nourished children. This result is a common finding throughout the developing world. The relationship can be probably be explained by the fact that malnourished women give birth to low birth weight babies who remain low weight for age as they grow (8).

Five to ten months: complementary feeding and diarrhoea

Five to ten months is a critical period in the development of a child. It is also the time when most of the malnutrition among children in Gubalafto develops. At this age, the child should start to receive complementary foods. The start of complementary feeding carries many risks in Gubalafto: many children do not receive ideal complementary foods and are exposed to contaminated substances.

⁵ Note that the proportion of women exclusively breastfeeding in month zero is less than that in month one. In Amhara it is common practice for women to give rancid butter and sugar to their children in the first few days of life (4). Hence there is a decrease in exclusive breastfeeding during this time.

Box 2: Complementary feeding

Complementary foods ("weaning" foods) should be given to infants, in addition to breastmilk, at about the age of 6 months. Children of this age have very high calorie requirements per kilogram of bodyweight.

Young children have small stomachs and can only eat small amounts of food, so the ideal complementary food is energy dense and easily digestible. If you give small children bulky, low energy foods, then they will fill-up quickly but they will not get enough energy from the meal. An ideal weaning food is a porridge with oil, or sugar added to it. Because children of this age have such small stomachs they should also be given food very frequently.

The staple food in Gubalafto, like most of N. Wollo, is injera⁶. The most commonly prepared weaning foods are kita⁷ and chibito⁸. Chibito and kita differ from injera because they are not fermented: this means that they can be stored for longer. All three foods are far from ideal weaning foods: they are too bulky and low in energy.

Unfortunately, the traditional complementary foods used by mothers in Gubalafto are not ideal for young children: they are low in both energy and other nutrients (see box 2). This almost certainly contributes to the increase in malnutrition at this age. Kita is probably the most popular complementary food because of a mixture of economic and educational shortcomings in the household. Interviews with women revealed that many did not know the ideal properties of weaning foods. However, others stated that they could not afford either the time or the resources to produce ideal complementary foods such as porridge with oil.

In addition to feeding children inappropriate weaning foods, a substantial proportion of women delay introducing complementary foods to their children in Gubalafto. Some 20% of mothers of children aged 8-10 months reported giving only breastmilk to their child in the 24 hours prior to the interview. This is clearly an inappropriate feeding pattern. Children require complementary foods at around 6 months, and to delay this until 10 months will mean that the child does not receive enough food for proper growth.

Diarrhoea is significantly associated with malnutrition in children in the 6-10 month age group. The introduction of new, complementary, foods often leads to diarrhoea even if the foods are hygienically prepared. This is because it takes the infant's gut some time to get used to digesting substances other than breastmilk. The introduction of contaminated foods can also lead to diarrhoea. Unfortunately, it is likely that much of the weaning foods eaten by children in Gubalafto are contaminated, particularly if they have been prepared by a person who is unaware of the importance of hygienic preparation of food, or is using contaminated water.

During focus group discussions about weaning foods, women reported that one of the main reasons they delay giving complementary foods to the child is to avoid diarrhoea. Economic constraints were also cited by some of the poorer groups: breastmilk is cheaper than complementary foods.

⁶ Injera is a pancake like thin bread, usually made from teff or wheat.

⁷ Kita is a flat, thick bread made from sorghum or teff or wheat.

⁸ Chibito is similar to kita, but with seasmé and linseeds added.

One other important factor probably explains the increase in diarrhoea and the consequent increase in malnutrition in this age group. Children learn to crawl at about 6 months. Children who crawl around the house and compound are more likely to come into contact with contaminated substances than very small infants who do not move around as much (see box 8 for a description of hygiene in Gubalafto).

From 11 to 24 months: education, illness and wealth of the household

Although 5 to 10 months is the period when most of the growth faltering starts among the children living in Gubalafto, the 11-24 months period is also important because this is a period when the children could, theoretically, catch-up lost growth. Factors that cause malnutrition in this age group are preventing the child from catching-up lost growth. Thus it is useful to find out what is causing malnutrition at this age and to try and intervene appropriately at this time too.

A variety of factors are associated with malnutrition among children aged 11-24 months. These include household wealth, child's illness status, hygiene practices, feeding practices and maternal formal education and maternal nutrition.

All the associations are in the expected direction (see table 1 below). For example, children living in better-off households are less likely to be malnourished, children living in households which use soap at least once a week are more likely to be better nourished etc. (The statistical associations between all of these factors are shown in table A3 in annex 6).

Table 1: Factors associated with malnutrition in children aged 11-24 months

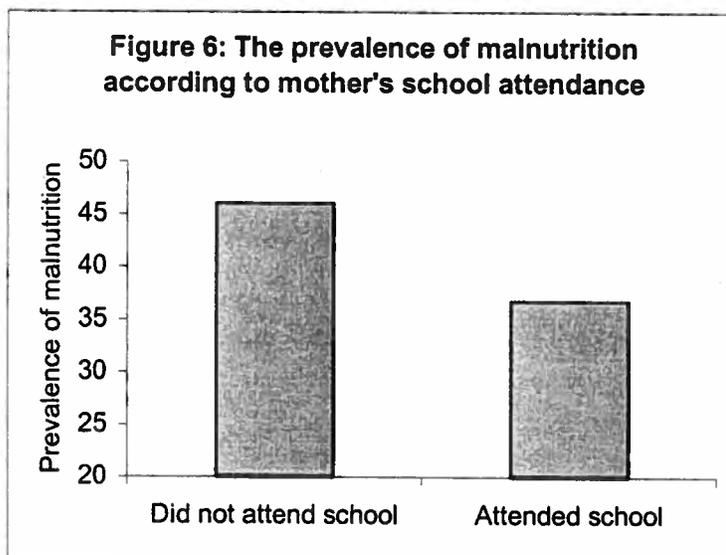
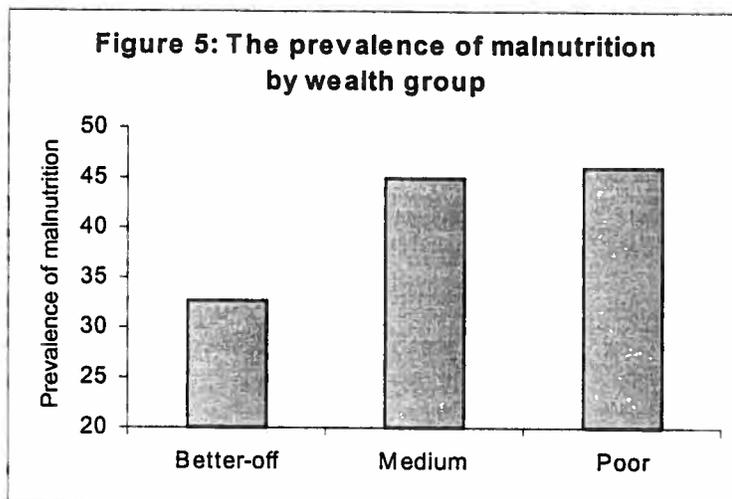
Factors that are positively associated with children's nutritional status	Factors that are negatively associated with children's nutritional status
<ul style="list-style-type: none"> ➤ Increased wealth ➤ Soap in the household at the time of interview ➤ Household uses soap more than once per week ➤ Mother educated ➤ Mother scores highly on maternal knowledge test ➤ Mother's nutritional status is better 	<ul style="list-style-type: none"> ➤ Child ill in past 24 hours

Of course, many of the factors shown above are inter-related. For example, mothers who are educated are likely to score higher on the knowledge test. Thus multiple regression analyses were conducted. In multiple regression analyses looking at all children aged 11 months or more, wealth group, child's illness and maternal education and MUAC remained significantly associated with malnutrition in multiple regression analyses (see annex 7 for the regression tables). This means that these variables are independently associated with the risk of malnutrition: a poor child with an educated mother has a higher risk of being malnourished than a better-off child with an educated mother has.

Of the factors that we have measured maternal MUAC has the strongest association with child's nutritional status. This association can be explained in two ways. Firstly, as described in section 4.2, maternal nutritional status during pregnancy influences birthweight. In turn, birthweight is an important determinant of early child growth

(particularly in the first two years of life) (8). Hence the relationship between maternal and child nutritional status. An alternative explanation is that there is no real association between maternal MUAC and child's nutritional status, but that we are seeing the two linked together because of other, unmeasured, factors which are positively influencing the nutrition of both women and children in the same household. For example, households that are closely related to the PA health worker may receive benefits from this relationship (such as good advice on diet or health matters) that we have not measured.

It is probable that wealth status and maternal education are also major determinants of malnutrition in children aged 11-24 months in this community (see figures 5 and 6).



Given the cyclical nature of the association between illness and malnutrition (see box 3), it is not possible to state whether illness determines malnutrition or vice versa from the results of this study⁹.

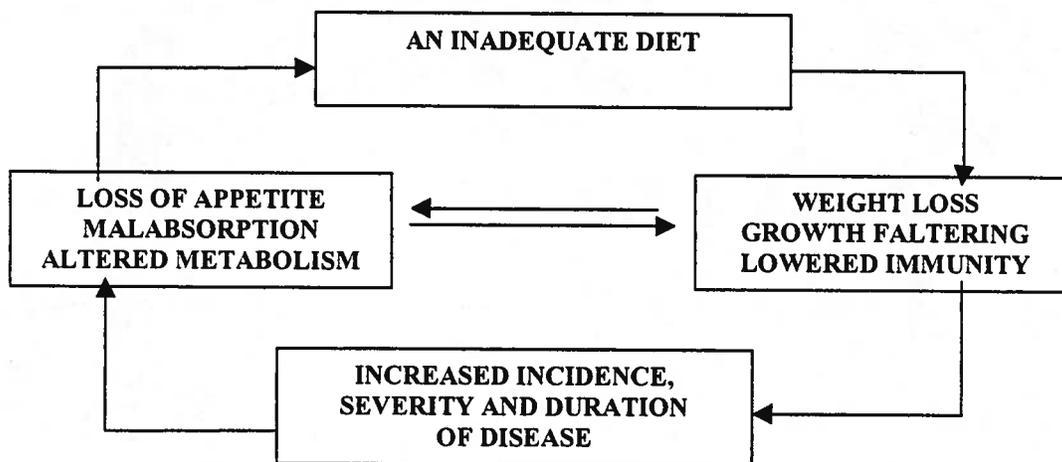
⁹ If we wanted to look more closely at the relationship between illness and malnutrition in Gubalafto we would need to undertake longitudinal studies. This survey was cross-sectional.

Box 3: Malnutrition and illness

Health and nutrition are closely linked. Deficiencies in energy, protein and vitamin A, in particular, are associated with a lowering in immunity. This means that malnourished children will suffer increased incidence, severity and duration of diseases like measles and diarrhoea. Death rates among children who are severely malnourished are about six times greater than among those who are healthy and well nourished in the same population (and 20 to 50 times greater than the rate in better-off and prosperous countries).

In addition to the effect of nutrition on disease, the presence of disease leads to further malnutrition, through malabsorption of nutrients, altered metabolism, loss of appetite and by affecting feeding practices. Thus, the relationship between malnutrition and infection is circular and cyclical.

The malnutrition/infection cycle (9)



The rest of this results section will focus on the effects of wealth and education on children's malnutrition in Gubalafto.

5.4 The Wealth effect

What does being better-off in Gubalafto mean?

Household wealth is associated with children's nutritional status among children in Gubalafto. Some of the links between wealth and nutritional status are clear: better-off households have better access to food and higher cash incomes than poor or medium households. According to women from all wealth groups, this allows the better-off households to have a better quality diet, better access to medical care and more money to spend on essential non-food items such as schooling, clothing and hygiene products (see box 4).

Box 4: Wealth in Gubalafto: results of food economy studies

The most important distinguishing factor between the wealth groups in Gubalafto is the ownership of oxen. Better-off households have a pair, medium households have one and poorer households have none.

Oxen are extremely important in this community as they allow a household to plough its land. Households who own only one ox must pair up to plough their land. Households who do not own any oxen must rent them off other households. Payment for the rental agreement is usually about 50% of the harvest yields. Thus the better-off groups receive not only their own harvest but a proportion of other households' harvests too. The poorer groups, however, are often unable to obtain sufficient food to feed themselves given that land holdings in the area are so small and that they have to give so much away (4).

SC-UK's food economy studies have found that better-off households have different diets, income and expenditure than poorer households. The poor households in Gubalafto are normally dependent on food aid for 25% of their food needs in an average year, whereas the better-off are able to obtain enough food for their needs. Previous research has also shown that poorer households have less money to spend on education, clothing, health care, food and other essential purchases (4, 5).

Another, less obvious, advantage that better-off women have is that they are able to spend more time at home with their young children than the poor or medium groups. Table 2 shows the schedule of women from different wealth groups in a typical day during the quiet agricultural season. Both groups undertake the tasks in normal text. For example, both groups clean their houses early in the morning. Tasks that are undertaken by different groups are highlighted. For example, poor or medium women collect dung or firewood for sale, but the better-off do not.

Table 2: Mother's daily activities according to wealth group

Time	Poor/ medium	Better-off
6:00-10:00	Clean house	Clean house
	Prepare & consume breakfast	Prepare & consume breakfast
	Fetch water	Fetch water
	Wash children	Wash children
	Collect dung / firewood for sale	
	Go to market to sell	
10:00-2:00	Collect firewood	Collect firewood
	Process cereal for grinding	Process cereal for grinding
	Prepare injera & wot	Prepare injera & wot
	Wash clothes	Wash clothes
	Spin cotton & make baskets	Spin cotton & make baskets
2:00-6:00	Cook wot & injera	Cook wot & injera
	Fetch water	Fetch water
	Prepare snack for children	Prepare snack for children
	Clean house	Clean house
	Collect dung / firewood for sale	
6:00-10:00	Have dinner & coffee	Have dinner & coffee
	Wash children & feet	Wash children & feet
	Prepare dough for next day	Prepare dough for next day
	Give fodder for animals	Give fodder for animals
	Spin cotton	Spin cotton
	Help children study	Help children study

The major difference in the activities of the two groups is that poor and medium women spend more time away from the house raising cash through activities such as collecting and selling firewood and dung (see box 5). We estimate that women from the poorer groups spend, on average, 7 hours for 3 days a week raising cash through these activities. Women from better-off group stay at home, often spinning cotton and making baskets, during this time. This means that, on average, the poorer women are away from their houses, and young children, about 20 hours a week more than the better-off women.

Box 5: Women's activities that bring in cash

All women are involved in agricultural work, particularly during the weeding season. Women are also involved in cash-producing activities both inside and outside of the home throughout the year. There are a number of options for women to raise cash, however some of these options are limited to specific wealth groups. In general, the poorer households have to engage in petty trading to obtain their income because they have a shortage of initial capital. This involves more physical labour and more time away from the home. Whereas, better-off households can make more sales from their own production and hence remain at home.

In Gubalafto, firewood is obtained either from specially planted eucalyptus trees or trees grown on the farm. The collection of firewood from the bush is forbidden (and there is only very limited amounts of firewood available). Poor households have only limited access to firewood: thus they are forced to make agreements with better-off households. Better-off households provide their trees to the poor. The poor men cut the trees into pieces. Both women and men carry the pieces to the market where they sell the wood. The proceeds are shared between the better-off and poor households. A similar agreement is made for ageda (sorghum residue). The poor sell ageda, which is used as animal fodder and fuel, on behalf of the better-off.

The sale of animal dung has become an important source of cash income in recent years. The increase in this activity is considered a sign that the general food security situation in Gubalafto is deteriorating. Women from poor households (and about a third of women from medium households) collect and sell dung. Women from better-off households do not engage in this laborious activity, which is also considered humiliating.

Sales of milk, butter and livestock do not contribute much to the cash income of poor and medium households because they do not own enough animals. However, these sales do account for a substantial proportion of better-off households' budgets. Women are solely responsible for butter, milk, egg and chicken sales.

Post-partum (after delivering a child) women from poorer groups have to leave their home to undertake various activities earlier than the better-off women (table 3). For example, better-off women do not undertake farm work activities if they have an infant of less than 6 months, but women from poorer households start to work on the farm after about 3 months. This means that poorer women have to leave their children at a younger age than better-off women do. This finding was confirmed by the quantitative study results: among mother's of children less than 6 months, poorer women reported being away from their child on average for longer than richer women.

Table 3: Numbers of days post-partum after which women leave their homes to undertake certain activities

	Better-off	Medium/poor
Fetch water	40 days	30 days
Go to the market	140 days	90 days
Do farm work	180 days	120 days

These findings have important consequences. When a mother has to leave her child in the house someone else has to look after him. Normally this will be either the grandmother or a teenage child (see box 6). But the best person to look after an infant who needs to be breastfed is his mother. If the mother is away for a long time she cannot breastfeed, unless she has expressed milk before leaving (a practice that is unheard of in Gubalafto). If we want to try and improve exclusive breastfeeding rates and decrease the amount of inappropriate feeding practices we need to find a way to keep poorer women at home for longer post-partum. Older children (6-24 months) also need to be minded by someone. At this age children should be receiving both complementary foods and breastmilk.

Box 6: Looking after children when the mother is away

When a mother has to leave her child in the home (it is extremely difficult to collect dung or firewood and carry a child) other household members take responsibility for childcare. First choice for this task is a young female child, then the grandmother, father and finally, a neighbour.

Although grandmothers and teenagers can, and do, look after very young children our discussions revealed that they need more support to do this effectively. In particular, some of their infant feeding and caring practices are less than optimal. Some of the grandmothers even reported feeding the child with tella (a type of home made beer). Moreover, teenagers who need to look after younger siblings are prevented from going to school and grandmothers often find themselves exhausted by the task. As a result neither group may be as devoted to looking after the child as the mother. In Gubalafto, fathers are normally as busy as the mothers and hence are unavailable to care for the child.

Another less obvious advantage for children living in better-off households is that their mothers are significantly better-nourished than poorer mothers are. As described in section 4.3, better-nourished women give birth to heavier weight babies. But this is not the only advantage of having a better-nourished mother. Women who are well nourished are less likely to become ill and will have more energy to care for their children.

How does wealth influence the causal factors involved in the development of malnutrition?

We have just described what being better-off in Gubalafto means for a mother: better access to food, higher cash income, more time at home and a better nutritional status herself. Table 4 shows the relationship between wealth and some of the factors that are involved in the development of malnutrition in Gubalafto. The table gives

proportions for each characteristic by wealth group. All the associations shown are statistically significant.

Table 4: Relationship between household wealth and various factors involved in the development of malnutrition in children aged more than 6 months (proportions shown)

	Better-off (n=122)	Mid (n=371)	Poor (n=543)
Child had any illness in past 24 hrs	24%	32%	32%
Child drank milk in past 24 hrs	32%	23%	15%
Household has soap	61%	38%	40%
Household use soap more than once a week	52%	52%	31%
Mother attended school	30%	21%	21%
Mother scored well on maternal knowledge questions	55%	41%	42%

Wealth and illness

Children from better-off households were less likely to have been ill in the 24 hours prior to the interview. This association can be explained through several different mechanisms:

- Better-off households have a higher cash income, so if the child does get sick they are more likely to be able to afford medical care (see box 7). Proper medical care will reduce the length and intensity of the illness.
- Women in better-off households have more time to care for a sick child than women from poorer households do.
- Better-off households are more likely to be able to afford measures that prevent illnesses developing. In this study we found a significant association between wealth and soap use. But there are plenty of other examples. Better-off households are more likely to be able to afford a mosquito net, which helps to prevent malaria. They may also have access to fuel, which means that they will be more likely to afford to boil water.
- Children in better-off households have a better quality diet than poor children do. In general, malnourished children are more likely to become ill than well-nourished children are. Illnesses last longer and are more intense in malnourished children.

Box 7: Healthcare in Ethiopia

In Ethiopia, on average, only 49% of the population have any access to modern health care services, i.e. live within 10 km of a healthcare facility. In some rural areas the coverage falls to 25%. On average, Ethiopians visit a government health facility only once every four years, while they are sick nearly eight times per year. This is due to a lack of health infrastructure, the poor quality of services where they exist, and the inability of many people to pay for treatment.

SC(UK) believes that the most important constraint to improving healthcare in Ethiopia is the absolute lack of resources in the sector. The Government health expenditure was just US\$1.50 per capita in 2000, compared to the US\$30-40 per capita that WHO estimates is necessary to provide essential services. Moreover, both cost recovery and the privatisation of health services has led to deeper inequity in health service provision. Safety net mechanisms are failing. SC(UK) has found that rural households, particularly poorer households, cannot afford healthcare in many circumstances (10).

Our findings from Gubalafto reflect these more general findings. Some 40% of women did not seek any medical treatment for their child when he had diarrhoea and 57% of women did not seek any treatment for their child's fever. Women in better-off households were more likely to seek treatment. However, women from all wealth groups complained about the cost of buying medicine, the poor quality service and the distance to the health centres.

Wealth and infant feeding practices

Household wealth can affect infant feeding practices through numerous routes. Some of these include:

- Better-off women produce more food on their own farm and are more likely to be able to keep it (i.e.: not use it to pay back debts). This means that, in a normal year at least, they are not dependent on food aid to obtain their staple food (4).
- Better-off women have higher expenditure on foods such as oil, sugar and vegetables (4). Hence, in theory at least, they can provide better complementary foods for their children. For example, they can buy oil, sugar or vegetables to add to some porridge.
- Better-off women spend more time with their children, thus they can provide more frequent meals.
- Better-off women have a higher income to help them prepare food hygienically. For example, women from higher income groups are more likely to be able to afford soap, or firewood that is needed to boil water.

Another example is animal milk. Table 4 shows that children living in better-off households are more likely to drink animal milk than children living in poor or medium households are. One glass of cow milk provides approximately 130-140 kcal (11). If a child aged 6-12 months requires 820 kcal/per day (12), a cup of milk can make a big difference. In focus group discussions women from all wealth groups stated that they would like to provide animal milk for their young children and that the only reason that they did not give milk is that it was not available to them. Better-off households are more likely to own milking cows than poorer households (see above) and hence their children are more likely to receive milk.

Wealth and hygiene practices

Better-off households are more likely to own soap than poor households as well as more likely to use it at least once a week. Other hygiene practices affected by wealth are:

- Better-off women can afford to buy other products that improve their families' hygiene environment, for example soap and new water containers.
- Better-off women have more time to spend cleaning their houses.
- Animals normally live in the same house as humans, although in some cases the animals are kept separately. This leads to a poor health environment and relatively high levels of diseases such as diarrhoea. Better-off households are more likely to be able to afford a second, separate, animal house.

Box 8: Hygiene and sanitation in Gubalafto

In general, hygiene is very poor among all wealth groups in Gubalafto woreda. None of the households visited had a latrine: all women reported that adults and older children's faeces were passed in fields near to the house. Children's faeces are thrown away in the garden around the house.

It is estimated that only about 15% of the population have access to safe water, the remaining 85% collect water from unprotected springs and a river. Most of the women reported collecting 7 litres of water/person/day for cooking and cleaning the house. Washing of children and clothes takes place in springs or the river. The average time taken to collect water was 45 minutes.

Furthermore, animals and humans live together in Gubalafto. The animals are kept inside the house at night for warmth and protection. This clearly makes keeping a house clean more difficult. Only households with a large number of big animals (the richest of the better-off) have a second house specially for animals.

Wealth and maternal nutritional status

In Gubalafto, maternal nutritional status (as measured by MUAC) and wealth are significantly associated. Women from better-off households have a larger mid-upper arm circumference than women from poorer households have. This finding is common in other parts of the developing world (13) and can be explained by many different factors. Some of the associations are:

- Women in better-off households produce more food and are able to buy more food than women living in poorer households (4). This probably means that the better-off mothers have a better diet than poorer mothers have.
- Women in better-off households probably have to work less strenuously on their farm (because they employ other people to do the work) and also have less off-farm work (they do not collect dung or firewood to sell). This will result in the better-off women using less energy and hence, all other things being equal, getting fatter than poorer women.
- Better-off women are less likely to be ill than poorer women because they can afford both preventative and curative measures for illness. If they are less sick then, other things being equal, they are less likely to be thin than poorer women are.

- Better-off women give birth to heavier babies (8). Heavier babies grow into better-nourished children, who in turn grow into better-nourished adolescents. Female adolescents give birth to children and the whole cycle starts again. This phenomenon, where malnourished grandmothers produce malnourished grandchildren, is thought to be one of the major problems of malnutrition in the developing world. As it is probable that girls from better-off households marry men from better-off households the cycle of malnutrition continues. In Gubalafto, it is probable that the better-off women came from better-off households themselves and hence that they were better nourished as children than their poorer neighbours.

Wealth and maternal education/knowledge

In Gubalafto, wealth and maternal education and knowledge are associated. Better-off women are significantly more likely to have attended school and also score significantly higher on the knowledge tests. From the data in this study it is not possible to state with any certainty whether wealth leads to improved maternal education and knowledge or vice versa (i.e.: that education or knowledge leads to increased wealth). What is clear is that both factors are extremely important in the development of malnutrition.

It is possible that the association between wealth and maternal knowledge may go some way to explaining some of the relationships described above. For example, not only do better-off women have more money and time to prevent their children developing diseases, but they are also better-educated to do so.

5.5 Educational effects

Children whose mothers attended school are less likely to be malnourished than the children of uneducated mothers. This finding is common throughout the developing world: educated women are less likely to have malnourished children than uneducated women (14).

In our study there are also significant associations between maternal education, the use of soap, the uptake of vaccination and maternal knowledge score. There were no significant associations between maternal education and feeding practices or illness.

The explanation for the association between maternal education and better hygiene or uptake of vaccination services is clear. Educated mothers are more likely to understand the benefits of vaccinating their children, thus they are more likely to make the effort to get their children vaccinated (although vaccination is free of charge it does carry a cost in terms of time taken to attend the EPI programme).

A similar argument can be applied for the use of soap: educated mothers are more likely to know the causes of diarrhoea. Thus they are better informed about the advantages of good hygiene and are more likely to prioritise soap use than uneducated mothers. However, the use of soap is also dependent on being able to afford it. Analysis of soap use in our dataset shows that it is associated independently ($p < 0.001$) with both household wealth and maternal educational status. Thus soap use is an example where both knowledge and income are important. The same is true for complementary foods – better-off households are more likely to be able to afford the time and the ingredients to prepare suitable complementary foods, but knowledge is also a prerequisite.

Maternal knowledge

The results of the six questions asked about for maternal knowledge are given in table 5. Many mothers are ill-informed about several important factors. These results are similar to those found in the DHS survey (2). More worryingly, they are very similar to results found by SC(UK)'s health surveys undertaken in 1996 (6), despite both Government and NGO efforts to improve maternal knowledge in the area.

Table 5: Results of maternal knowledge questions

	Proportion of mothers answering correctly
Causes of diarrhoea	30%
Have heard of ORS	51%
Correct age to start complementary feeding	49%
Give young children green vegetables	68%
Causes of malaria	31%
Give children with diarrhoea more breastmilk	14%

Maternal knowledge score was associated with both household wealth and maternal education. However, maternal knowledge was not directly associated with nutritional status. This finding is somewhat contrary to expectations: one might expect that maternal knowledge score and maternal formal education would have the same type of associations with nutritional status. Indeed, women from Gubalafto gave "maternal ignorance" as one of the most important reasons for poor hygiene and poor infant feeding practices.

There are two possible explanations for the lack of association between maternal knowledge and nutritional status in this dataset. Firstly, maternal knowledge is notoriously difficult to measure (15). It is very likely that although some knowledge of the six topics listed above are important for infant caring practices the six questions alone do not adequately capture the whole of "maternal knowledge". Thus the relationship between maternal knowledge and nutritional status cannot be captured.

An alternative explanation is that maternal formal education empowers women more than just giving them knowledge, possibly by allowing them to make more decisions in the household, or allowing them to become richer. If this is true then we would expect to see a relationship between maternal formal education and nutritional status through the empowerment of women. However, we would expect the relationship between maternal knowledge and children's nutritional status to be less strong. We speculate that both of these explanations are probably at work in Gubalafto.

5.6 Community priorities to improve the nutritional situation in Gubalafto

During the focus group discussions we asked mothers and community leaders to tell us what they thought were the most important causes of malnutrition in Gubabafito¹⁰. The results of this (proportional piling) exercise can be seen in table 6.

¹⁰ This exercise was carried out after the women had a full discussion about the possible causes of malnutrition. They were then asked to rank lack of food, disease and lack of care in order of importance.

Table 6: Community ranking of the major causes of malnutrition in Gubalafto

	Poor mothers	Better-off mothers	Community leaders
Lack of food	41%	32%	51%
Disease	25%	27%	27%
Lack of care	34%	40%	22%

These results clearly show that poorer mothers and community leaders believe that lack of food is the most important determining factor in the development of malnutrition in Gubalafto. Better-off mothers, however, believe that the lack of care is a more important factor.

We also asked the different groups what intervention they would prioritise in order to improve the nutritional situation of their children. The first six priorities of each group are shown in table 7.

Table 7: Community ranking of priority intervention to improve malnutrition in Gubalafto

	Poor mothers	Better-off mothers	Community leaders
Food	1	4	3
Health care	2	1	1
Family planning	3	3	5
Health education	4	2	4
Safe water	5		2
Money	6		
DDT spray		5	6
Vaccination		6	

Unsurprisingly, poorer mothers rank relief food as the most important intervention to improve malnutrition in their children, but better-off mothers only ranked food as their fourth priority. Improved healthcare was also ranked highly by both groups of mothers and the community leaders. Health education was ranked as the fourth most important intervention by poor mothers, but second most important by better-off mothers. Safe water was also considered important by both the poor mothers and community leaders. Interestingly, family planning was highly rated (third) by both female groups, but less so by the men.

These results, which are similar to those obtained by SC(UK) in surveys in 1996 (6), show that the community's needs are still extremely basic. They are asking for improved food and healthcare: basic rights of all children.

6 Study conclusions

- For children under six months, the most important factor associated with malnutrition is breastfeeding pattern. The ability to exclusively breastfeed depends on whether or not a mother can spend sufficient time with her child as well as the knowledge that exclusive breastfeeding is best for children aged 0-6 months. Women who spend more than two hours away from their children aged less than six months are significantly less likely to exclusively breastfeed than other mothers are.

- Malnutrition increases very rapidly between 5-10 months in this population. This is partly explained by the introduction of inappropriate weaning foods. Up to 20% of women delay introducing weaning foods until the child is 10 months old. Diarrhoea is highly associated with malnutrition at this age.
- Above the age of 10 months, household wealth, maternal education and nutritional status, and child's illness status in the 24 hours prior to interview are all significantly and independently associated with children's nutritional status.
- Household wealth affects many of the underlying causes of malnutrition including children's illness, feeding and hygiene practices in the household. These associations can be explained by the fact that women living in better-off households have increased access to food, higher cash incomes to spend on health, education and hygiene and more time to spend caring for their child.
- Mother's educational status is associated with vaccination status as well as hygiene practices in the household. These associations can be explained by the fact that educated women are likely to be better-informed about caring practices than uneducated women. Educated women may also have more decision making power in the household than uneducated women.
- Poor mothers from Gubalafto prioritised food as the most important intervention to improve their children's nutritional status. Improved healthcare, family planning services, health education and access to clean water were the next most important priorities for this group. Better-off women prioritised healthcare and family planning over food as interventions.

7 Recommendations

In light of the results of this study and discussions with woreda officials and the community, we have come up with the following recommendations to improve malnutrition among children aged 0-24 months in Gubalafto.

Timing of any intervention

- The most critical period in the development of childhood malnutrition in Gubalafto is between 5-10 months. Efforts to prevent malnutrition must be focused at, or before, this time.

Wealth

- Wealth, or rather poverty, is an over-riding factor in the development of malnutrition that has to be addressed in order to improve the situation of young children in Gubalafto. Every effort must be made to improve the food and cash income of the poorer groups in the community either through income generating activities or social support mechanisms.
- In particular, women from all wealth groups should be enabled to spend at least the first six months of their child's life at home with their child in order to be able to exclusively breastfeed the child. Different methods to encourage women to stay at home during this critical period need to be considered. One idea is to provide women with the cash or food equivalent of what they earn outside the house so that they do not leave the house for long periods of time (more than two hours). Alternatively, women could be encouraged to take part in an income generating activity that they can undertake at home so that they do not have to leave their children.

Education

- The female formal education enrolment rate should be increased to improve care for future generations. Appropriate information on caring practices should be made part of the syllabus of all schools.
- Given that it will be very difficult to improve maternal formal education rates for the current generation of mothers, fathers, grandmothers and adolescents who do not attend school it is important to try and improve this group of peoples' knowledge about caring practices now. Special attention should be given to breastfeeding, weaning practices and the prevention and treatment of diarrhoea.
- A useful way to transfer information about child caring practices is through an behaviour-change campaign. Different messages need to be aimed at different population groups through informal education sessions.
- Growth monitoring, if properly implemented, is another method to reach the mothers of young children and advise them on how best to care for their children. However, growth monitoring by itself is ineffective if the mother is too poor to be able to act on the advice she is given.
- Given that the vast majority of the households in this area are defined as poor or medium (80%) programmes aiming to improve the nutritional situation of this community must look carefully at interventions that can improve the situation for these groups, not only the better-off. Poorer groups may not benefit from health, nutrition or hygiene education if they cannot afford to carry out the advice. Thus it may be necessary to provide inputs to these groups as well as education in order that they can improve their situation.

Health

- Illness, particularly diarrhoea, is a major contributing factor to malnutrition for children in Gubalafto. Both preventative and curative measures need to be improved in this area.
- An intervention to increase the proportion of households using clean water should lead to a decrease in the prevalence of diarrhoea and malnutrition. Both physical inputs (for example, pumps and hand wells) and education about sanitation are required.
- Poor households in Gubalafto find it difficult to obtain treatment for their sick children. If malnutrition rates are to improve this group needs to have improved access to healthcare. The current exemption system is not working well and other methods to target free healthcare should be examined. One suggestion is to provide all children under two and their mothers with free essential drugs (preventative and curative).

Maternal nutrition

- The association between maternal and child malnutrition is very strong in this study. Thus efforts to improve maternal nutritional status, particularly during pregnancy, should be made.

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Annex 1: PA lists and sample size calculations

The following PAs were included in the survey. Population figures were provided by the woreda Administrative office.

PA name	Population size
Gedober	6,808
Jarssa	5,090
Amayemecha	5,067
Woyinye	9,482
Anova	5,075
Golla Mechare	3,351

Sample size calculations were based on the following equation (16):

$$N = \frac{\{u\sqrt{[\Pi_1(1-\Pi_1) + \Pi_2(1-\Pi_2)]} + v\sqrt{[2\Pi(1-\Pi)]}\}^2}{(\Pi_2 - \Pi_1)}$$

where,

N= sample size for each group

Π_1 = proportion in first group

Π_2 = proportion in second group

U = one sided percentage point of the normal distribution corresponding to 100% - the power, for example if power = 90%, (100% - power)=10% and u=1.28

V= percentage of the normal distribution corresponding to the required (two-sided) significance level, for example if significance level = 5%, v=1.96

$$\Pi = \frac{(\Pi_2 + \Pi_1)}{2}$$

Based on previous SC-UK estimates of wealth groups in the study area, it was estimated that 1,500 children should result in 263 better-off children, 525 medium children and 712 poor children (4). This sample size allowed demonstration of a 10% difference in the prevalence of malnutrition between each wealth group assuming there is a dose response relationship. Tests for trends in mean measurements require smaller sample sizes and hence the sample allowed us to detect smaller changes between mean anthropometric indices for the different groups.

Annex 2: Defining characteristics of wealth groups in Gubalafto as identified by the community

Table A1: Characteristics of wealth groups in Gubalafto

Assets	Better-off	Medium	Poor
Oxen	2	1	-
Cows	2	1	1 (yerbee)
Calf	0-1	0-1	1 (yerbee)
Hefer	0-1	-	-
Sheep	2-3	1	2-3 (yerbee)
Goat	2-3	1	2-3 (yerbee)
Donkey	1	1	-
Chicken	3	3	3
Other characteristics			<ul style="list-style-type: none"> ➤ Involved in yerbee (looking after other HH's animals) ➤ Rent out their land and labour to better-off HHs ➤ Contract their land on annual basis ➤ Involved in daily labour and selling firewood ➤ Landless HH ➤ HH with disabled heads

Annex 3: Household questionnaire

PA: _____

Gott name: _____

Team Number _____

Date of survey (ethiopian): _____

Name of Head of HH: _____ HH number: _____

GENERAL INFORMATION (DATA ENUMERATOR AND MEASURERS)		
1	How many people are there in this household?	
2	Name of child -----	
3	Date of birth of child (ethiopian calendar)	---/---/---
4	Sex of head of household (1=male, 2=female, 3=dk)	
5	Wealth group of household (1=rich, 2=medium, 3=poor, 9=dk)	
6	What is your relationship to (NAME)? (1=mother, 2=father, 3=grandmother, 4=sibling, 5=other, specify)	
7a	Have you ever attended regular school? (0=no, 1=yes, 9=dk)	-----
7b	Are you able to read easily, with difficulty or not at all? (0=not at all, 1=easily, 2=with difficulty, 9=dk)	-----
8a	Is there any soap in the house (ask to see it)? (0=no, 1= yes, 9=dk)	-----
8b	How often do you use the soap? (0=never, 1=every day, 2=at least once a week, 3=at least once in 15 days, 4=for special occasions, 9=dk)	-----
9a	Is there a dedicated water vessel in the house (ask to see it)? (0=no, 1= jerry can, 2=yes (other vessel, not jerry can), 9=dk)	-----
9b	If yes and not a jerry can, Does this vessel have its own scoop? (ask to see it) (0=no, 1=yes, 9=dk)	If have no vessel, or have a jerry can, then go to 10 -----
10	Has (NAME) had a measles vaccination? (0=no, 1= yes with card, 2=yes without card, 9=dk)	
11	Does (NAME) have a BCG scar? (0=no, 1=yes, 9=dk)	

Child's anthropometry – remember to work out NAME's age in months

Sex (1=male, 2=female)	Weight (in kgs)	Height (in cms)	Oedema (0=no, 1=yes)	Weight for age percentile (if less than or equal to 6 months)	Weight for height z- score (if more than 6 months)

Maternal anthropometry

Age of mother (years)	MUAC (in cm)	Pregnant (months) (0=no, 1=yes, 9=dk) If yes, state how many months	Lactating (months) (0=no, 1=yes, 9=dk) If yes, state how many months.

INFANT AND YOUNG CHILD FEEDING PRACTICES INFORMATION (TEAM LEADER)

12	Have you ever breastfed (NAME)? (0=no, 1=yes, 9=dk)	<i>If no, go to question 17</i>
13	How soon after (NAME) was born did you put him to the breast? (If less than 1 hour, record 00 hours. If less than 24 hours record hours else record days)	-----hours -----days
14	Since this time yesterday, have you breastfed (NAME)? (0=no, 1=yes, 9=dk)	<i>If no, go to question 17</i>
15	How many times did you breastfeed (NAME) last night between sunset and sunrise? (Write the number of times or "on demand")	----- times
16	How many times did you breastfeed (NAME) yesterday during the daylight hours? (Write the number of times or "on demand")	-----times
17	Have you ever heard of, or seen, a special product called ORS that you can get for the treatment of diarrhoea? (show packet of ORS) (0=no, 1=yes, 9=dk)	
18	Since this time yesterday has (NAME) received any of the following? (0=no, 1=yes, 9=dk)	
18a	Plain water.....	_____
18b	Sweetened or flavoured water (including sugar cane water).....	_____
18c	Tea or infusions.....	_____
18d	Infant formula.....	_____
18e	Tinned, powdered or fresh milk.....	_____
18f	Other liquids (include soups and broths).....	_____
18g	Mushy or solid foods (include cereal, porridge, stews, vegetables).....	_____
18h	ORS.....	_____
18I	Vitamins, mineral supplements, medicines.....	_____
18j	Other (specify)	_____
19	Since this time yesterday how many times has (NAME) received mushy or solid foods?	-----times
20	Since this time yesterday how many times has (NAME) received milk (not breastmilk)?	-----times

CARETAKER'S KNOWLEDGE		
21	When do you think it is best to start giving foods other than breastmilk to children? (number of months)	
22	Do you think that green leafy vegetables are good for children aged 6-24 months? (0=no, 1=yes, 9=dk)	
23	Do you think vaccinations are important for your child's health? (0=no, 1=yes, 9=dk)	
24	What causes malaria? (1=mosquito bites, 2=impure food or water, 3=exposure to cold, 4=evil eye, 5=rains, 6= other-specify, 9=dk)	
25	What causes diarrhoea? (1=dirty water/dirty food , 2=spiritual/evil eye, 3=teething, 4=other-specify, 9=dk)	
HEALTH SEEKING BEHAVIOUR		
26	<i>Only ask to children more than six months old</i> Has (NAME) had diarrhoea in the last 24 hours? (0=no, 1= yes, 9=dk)	<i>If NAME less than 6 months go to 31</i> -----
27	Has (NAME) had diarrhoea in the last month (do not need to write answer) Last time (NAME) had diarrhoea where did you seek care? (0= do not seek care, 1= traditional healer, 2= govt/private health institution, 3= pharmacy, 4= relative or friend, 5= home made treatment, 6=other (specify), 9=dk)	If not had diarrhoea in month go to question 31 -----
28	When (NAME) had diarrhoea did you give the same amount to eat as before the diarrhoea, or more, or less? (1=same, 2=more, 3=less, 9=dk)	
29	When (NAME) had diarrhoea did you give the same amount to drink as before the diarrhoea, or more, or less? (1=same, 2=more, 3=less, 9=dk)	
30	When (NAME) had diarrhoea did you continue to breastfeed? (1=same, 2=more, 3=less, 4=stop, 9=dk)	
31	<i>Ask for all children aged 0-24 months</i> Has (NAME) had fever in the last 24 hours? (0=no, 1= yes, 9=dk)	
32	Has (NAME) had fever in the last month? (do not need to write answer) Last time (NAME) had fever where did you seek care? (0= do not seek care, 1= traditional healer, 2= govt/private health institution, 3= pharmacy, 4= relative or friend, 5= home-made treatment, 6=other (specify), 9=dk)	If not had fever in month go to question 33 -----
33	Has (NAME) had fast or difficult breathing caused by an illness in the chest (not a blocked nose) in the past 24 hours? (0=no, 1= yes, 9=dk)	
34	Has (NAME) had measles in the last 14 days? (0=no, 1=yes, 9=dk)	
35	What is the longest time you were you away from (NAME) yesterday?	----- hours

Annex 4: Gott questionnaire

PA: _____

Gott name: _____

Team Number _____

Date of survey (ethiopian): _____

1	Name of nearest market (1= Woldiya, 2= Sangka, 3= other – specify)	
2	How long does it take to walk to the nearest market from the centre of the gott?	---- hours ---- mins
3	How long does it take to walk to the nearest health post (or clinic) from the centre of the gott?	---- hours ---- mins
4	How long does it take to walk to the nearest hospital from the centre of the gott?	---- hours ---- mins
5	Where do people collect water in this gott? <i>(Do not answer)</i> How long, on average, does it take people to collect water in this gott? <i>(time taken to go, take water and return)</i>	---- hours ---- mins
6	What is the water source for this gott? (1=river, 2= spring, 3 = piped water, 4= pond, 5= other – <i>specify</i>)	

Annex 5: Focus group discussion topics

Table A2: Focus group discussion topics

	Priorities	Health	Hygiene	Feeding	Education
Community leaders (key informants)	*	*	*		*
Mothers (not educated)					
➤ Rich	*	*	*	*	*
➤ Medium & poor	*	*	*	*	*
Mothers (educated)					
➤ Rich	*	*	*	*	*
➤ Medium & poor	*	*	*	*	*
Grandmothers	*		*	*	
Teenage girls	*		*	*	
Government officials (DAs, CHW, teachers,	As appropriate				

Annex 6: Statistical results of the quantitative study

Table A3: The prevalence of low WAZ according to breastfeeding pattern in children less than six months old (n=379), Chi-squared test used.

	N	Prevalence of moderate low WAZ	Significance (p)
Exclusively breastfed	312	1.9%	<0.01
Not exclusively breastfed	67	9.0%	
Predominantly breastfed*	349	1.7%	<0.01
Not predominantly breastfed	30	20.0%	

* exclusively breastfed children are included in this definition

Table A4: Relationship between nutritional status and other factors in children aged 11 months or more, chi-squared tests (n=805)

	N	Prevalence of low WAZ	Significance (p)
Wealth / food security			
Better-off HH	95	32.6%	
Poor or medium HH	710	45.4%	0.02
Illness			
Child was not ill in 24 hours prior to interview	569	41.3%	
Child was ill in 24 hours prior to interview	236	50.4%	0.02
Hygiene practices			
Soap in the house at the time of interview	341	41.1%	
Soap not in the house at the time of interview	464	46.1%	0.15
HH uses soap more than once a week	273	38.1%	
HH does not use soap once a week	532	47.0%	0.02
Feeding practices			
Child drank milk in last 24 hrs	160	45.6%	
Child did not drink milk in last 24 hrs	645	37.5%	0.06
Maternal education and knowledge			
Mother did not attend school	628	46.0%	
Mother did attend school	177	36.7%	0.03
Mother scored highly on knowledge test	364	44%	
Mother scored less well on knowledge test	441	44%	0.99

Table A5: Results of the multiple regression analysis among children aged more than 6 months (n=1022). Coefficients and (p-values) shown.

	Age of child (months)	HH Wealth (1=better-off, 2=medium, 3=poor)	Maternal schooling (0 = no school, 1= school)	Maternal MUAC (cm)	Child's illness (0= not ill, 1= ill)
WAZ	-0.016 (0.004)	-0.103 (0.02)	0.195 (0.008)	0.630 (<0.001)	-0.189 (0.005)