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Summary Indicators for Infant and Child Feeding Practices: An Example from the Ethiopia Demographic and Health Survey 2000

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EXECUTIVE SUMMARY

This document describes analysis of the infant and child feeding data available in the Ethiopia Demographic and Health Survey 2000 (EDHS). The main purpose of the analysis is to support USAID/Ethiopia in the use and interpretation of the infant/child feeding practices data. More broadly, the goal is to promote greater use of the rich information on feeding practices contained in the DHS data sets, and to demonstrate the usefulness of this information for exploring relationships between infant/child feeding practices and nutritional status outcomes.

Building on previous work, we created an age-specific infant/child feeding index (CFI), which includes five main components: 1) a breastfeeding score (mother currently breastfeeding or not); 2) a bottle use score (mother used bottles or not in the previous 24 hours); 3) a 24-hour dietary diversity score (number of food groups the child received in the previous 24-hours); 4) a score for frequency of feeding solids/semi-solid foods in the previous 24-hours (number of meals and snacks); and 5) a 7-day quasi-food group frequency score (number of days the child received selected food groups in the past 7 days). The index was made age-specific in the scoring of the different components, for ages 6-9, 9-12, and 12-36 months. The index scores range from 0-9 for all age groups, and age-specific terciles were derived.

The report presents descriptive statistics for the sample, including child nutritional status, maternal and household socio-demographic characteristics, and infant/child feeding practices. Urban-rural differences are also highlighted. Bivariate analyses are used to examine the association between the CFI and child nutritional status (height-for-age, weight-for-age, and weight-for-height). This is followed by a multivariate analysis of the determinants of height-for-age Z-scores (HAZ), to determine whether the associations described in the bivariate analyses between the CFI and child outcomes remain after controlling for potentially confounding influences. Two-way interactions between the CFI and these characteristics are also tested. Finally the CFI is “decomposed,” and its main components are tested individually for their association with child nutritional status. The main purposes of this analysis are to explore which of the components are driving the association and whether the index could be simplified for easier use.

Key findings

Prevalence of both stunting (43percent) and wasting (12 percent) is very high among Ethiopian children under three years of age, and is markedly higher among rural compared to urban children. Rural households differ from urban households in most of the socio-demographic characteristics measured. Rural households generally have more precarious living conditions, with poorer access to water and sanitation facilities, poorer

access to health care, and lower levels of education. Rural mothers also score lower on the CFI.
Breastfeeding initiation is almost universal, both in urban and rural areas. Rates of exclusive breastfeeding of infants under six months are high overall at 47 percent, and are higher among rural (50 percent) compared to urban women (35 percent). Rates of continued breastfeeding in the child's second and third year are also relatively high.

In contrast to these positive practices, complementary feeding practices are less optimal. Our analysis suggests that delayed introduction of complementary foods is a widespread problem. More than one-half of infants aged 6-9 months had not received any solids or semi-solid foods during the week preceding the survey, and this was true in both urban and rural areas. Dietary diversity also appears low, as indicated by the small number of food groups that the child had consumed either in the previous 24-hours or even over the past week. As seen in many other countries, diversity is substantially higher in urban than in rural areas among all age groups. Use of baby bottles – a practice known to dramatically increase the risk of infectious diseases among infants and young children in developing countries – is unexpectedly high among both urban (38 percent) and rural (15 percent) infants 6 months or younger.

The child feeding index (CFI) was found to be associated with child nutritional status, especially height-for-age, in bivariate analyses. Among children 12-36 months of age, the difference in HAZ between children in the highest compared to the lowest CFI tercile is 0.46 HAZ-score units, a significant size effect. When socioeconomic and demographic factors are controlled for in multivariate analyses, the size of the effect between the two extreme CFI terciles is slightly attenuated (0.35), but it is still statistically significant and biologically important.

The decomposition of the index reveals that the association between the CFI and HAZ is most strongly driven by the dietary diversity variables. Both the 24-hour recall of food groups and the 7-day recall are strongly and statistically significantly associated with HAZ among all age groups. This relationship between dietary diversity and HAZ is stronger than the relationship between the CFI and HAZ, and remains after statistical control for the same range of potential confounding factors.

Strong correlations were observed between dietary diversity measured by 24-hour and by 7-day recall. Infant/child feeding indices constructed using either dietary diversity measure singly, or both measures, were also highly correlated. Thus, it may be possible to simplify the index by using only the 24-hour food group diversity.

To illustrate how the CFI responds to changes in individual practices, we simulated a number of scenarios. For these analyses, we used a simplified CFI with four components, and did not include the 7-day recall data. We show that CFI accurately represents an averaging of the changes in individual practices.

Implications for programs

The positive infant/child feeding practices encountered in the EDHS should be strongly protected and promoted. These relate to exclusive breastfeeding during the first half of infancy and continued breastfeeding through the second year of life and beyond. Practices that require attention and that should receive priority in education and behavior-change programs include the widespread use of bottles, delayed introduction of complementary foods, and low dietary diversity throughout the first three years of life.

One objective of this research was to assess the potential usefulness of the CFI for three main purposes: 1) for making international comparisons of infant/child feeding practices; 2) for summarizing and communicating associations between practices and child nutritional status; and 3) for monitoring and evaluating programs and interventions. Our conclusions are summarized below.

For international comparisons. Because of the lack of specific international recommendations for several dimensions of infant and child feeding, the CFI as developed here cannot be used as a global indicator for international comparisons of infant and child feeding practices. In particular, in the absence of recommendations on the optimal numbers of foods or food groups that should be consumed daily or weekly, the index was derived using age- and population-specific cut-off points (based on the sample distribution). For programs, this approach has the advantage of defining "high" diversity at a level that is clearly achievable for a significant proportion of the population (in contrast to a theoretical ideal, which may be unachievable). For the purpose of international comparisons, however, this approach greatly limits the usefulness of the CFI because different cut-off points are used to derive dietary diversity terciles.

For communication and advocacy. Confirming our previous experience with the use of DHS data sets from Latin America, the creation of the CFI for Ethiopia demonstrated the usefulness of this type of composite index for summarizing various dimensions of infant/child feeding and for demonstrating important associations with child outcomes. The index is particularly valuable as an advocacy and communication tool to highlight and present graphically the size of association between feeding practices and child nutritional status.

For program monitoring and evaluation. For program monitoring and evaluation purposes, clearly individual indicators for each of the dimensions of infant and child feeding addressed by an intervention are needed. Managers and staff need to measure progress in terms of change in the specific practices targeted by the intervention. To the extent that program managers are also interested in communicating some summary measure of change in practices, a CFI may be useful. In order for an index score to be useful in this context, it must be simple to compute and sensitive to changes in practices of an achievable magnitude. A possible way to simplify the index is to drop the 7-day recall, which is highly correlated with the 24-hour recall. With regard to the responsiveness of the index, our simulations revealed that the index does respond to changes in individual practices. The size of the change in the CFI, however, represents an overall average of the observed changes in component indicators. Thus, from this analysis we conclude that:

The CFI may be useful in a program context when:
- Programs are designed to change most or all component practices
- Program managers are interested in a summary statistic, which reflects average changes across practices

The CFI is *not* useful when:
- Comparisons are needed between programs – or geographic areas – with differing baseline levels for individual practices
- Lack of change in one or more practices obscures the success achieved in changing other practices.

Recommendations for the selection of child feeding indicators for Ethiopia

Exclusive breastfeeding. The 7-day recall is recommended if precise estimates are needed, because it provides a more accurate picture of the true prevalence of this practice, particularly in urban areas. For comparing prevalence between two points in time, the 24-hour recall is adequate.

Bottle use. Use of bottles over 7-days may also be preferable to the 24-hour recall if precise estimates are required, as some mothers do not use the bottle every day. In the absence of a 7-day recall, or when the sole objective is to compare prevalence between two points in time, the use of the 24-hour recall is acceptable.

Dietary diversity. Dietary diversity is a key indicator and should be included in assessments of infant/child feeding practices in Ethiopia. In assessments of diversity, the 24-hour recall is as useful as the 7-day recall, and therefore for simplicity we recommend the use of the 24-hour recall. The “model” DHS+ questionnaire provides a useful list of food groups and is superior to the list used in the EDHS, because nutritionally similar foods are grouped together to a greater extent than in the EDHS. For comparative purposes it will be useful to maintain the food group list from the EDHS, but for other purposes the DHS+ model is superior and should be adopted.

Frequency of feeding solids and semi-solid foods. The EDHS question on frequency of feeding appeared to be subject to measurement errors. Additional efforts should focus on refining the way the question is asked, and on training fieldworkers to follow the question with sufficient probing to ensure that both meals and snacks are captured.

Summary indicators: *The CFI.* As noted previously, the CFI as constructed using the EDHS should not be used for international comparisons; under certain circumstances already described, it may be of use to program managers. In addition, the CFI is clearly a useful advocacy tool and can be used successfully to describe geographical patterns, to look at associations with child outcomes, or to examine constraints to infant/child feeding practices in a particular context.

1. INTRODUCTION

1.1 STATEMENT OF PURPOSE

This is the first of two documents describing analysis of the infant and child feeding data available in the Ethiopia Demographic and Health Survey 2000 (EDHS). Our specific task is to provide recommendations to USAID/Ethiopia staff and their partners in the use and interpretation of the DHS and similar infant- and child feeding data. More broadly, and in collaboration with ORC Macro International, we aim to promote greater use of the infant and child feeding information available in the Demographic and Health Surveys (DHS).

Building on previous work, we report on the development of an infant/child feeding index for Ethiopia, which summarizes the available information on feeding practices. We assess the extent to which this type of index may be useful for the following three purposes:

- For international comparisons;
- For looking at associations between infant/child feeding practices and child growth outcomes, and for summarizing and communicating these associations;
- For monitoring and evaluation of nutrition interventions.

1.2 INFORMATION ON FEEDING PRACTICES IN THE DEMOGRAPHIC AND HEALTH SURVEYS

The DHS are nationally representative cross-sectional surveys that have been carried out in a large number of developing countries, and in many cases at more than one point in time. These surveys constitute one of the richest sources of information currently available to examine trends in childhood malnutrition. A wide range of information on maternal and household characteristics is also available from the surveys.

The DHS questionnaire on infant and child feeding practices has evolved over the years (from DHS-I in the mid 1980s to DHS+ (1998–present)) to contain increasingly detailed information on infant and child feeding. The Ethiopia DHS is one of the DHS+ surveys and contains questions related to various dimensions of infant and child feeding practices, including breastfeeding practices and bottle use; dietary diversity (a 24-hour recall of intake of various food groups); a quasi-food frequency questionnaire (7-day recall of various food groups)[1]; and a 24-hour recall of the frequency of feeding solids/semi-solids.

DHS reports, including country reports and nutrition "chartbooks," provide descriptive information on the prevalence of selected infant and child feeding practices. The Ethiopia report (Central Statistical Authority [Ethiopia] & ORC Macro. 2001) includes six tables reporting breastfeeding practices (timing, duration, frequency, whether exclusive or not) and complementary feeding practices at different ages, for children 0-36 months. In general, however, DHS data on infant and child feeding practices have been underused both at the country level and at the level of the international nutrition community.

One constraint to better use of the infant/child feeding information in the DHS surveys may be that data on infant and child feeding practices are not as easy to process and summarize as other types of data, such as child anthropometry or morbidity. Because infant and child feeding practices include various dimensions (breastfeeding (timing of initiation, duration, frequency), the use of complementary foods (meal frequency, dietary diversity as a proxy for quality), and frequency of intake of different foods),[2] and are age-specific within short age intervals, the data are not easy to summarize across age groups, or to represent graphically in a meaningful way. Second, clear and specific international recommendations on some dimensions of feeding (e.g., diversity) are lacking, making it difficult to develop indicators and cutoff points to assess adequacy of feeding.

In the present report we attempt to extend the analysis of selected feeding practices beyond the basic descriptive level. This is done by creating a composite child feeding index, which summarizes the information from various dimensions of infant/child feeding into one variable. This variable is then used to explore associations between infant/child feeding practices and child outcomes.

This work builds on our previous experience with creating an infant/child feeding index using DHS data sets from five Latin American countries (seven data sets) (Ruel and Menon 2002). The work was a collaborative effort between the International Food Policy Research Institute (IFPRI) and Cornell University and was funded by the U.S. Agency for International Development (USAID) University Partnership Program. Our experience showed that creating a composite infant/child feeding index using DHS data sets was both feasible and useful. The index developed showed good potential for use as an advocacy tool, because it allowed us to quantify and model the relationship between

[1] We call this a *quasi*-food group frequency because the questions are asked in the form "How many *days* in the last seven days was [child] given [food group]?" not how many *times* was the child given the food.

[2] Note that in addition to the dimensions listed here, there are many other dimensions of child feeding that are not addressed in the DHS surveys because they are not easily measured through large survey methods. These include quantity and density (of energy and other nutrients), consistency of the foods, safety in preparation and storage of complementary foods, and psychosocial care and mother/child interactions during feeding.

feeding practices and child growth, and to illustrate the relationship graphically. The index could also be used to identify vulnerable groups.

1.3 ORGANIZATION OF THE REPORT

In this report we extend the previous work by developing an infant/child feeding index for Ethiopia, and by assessing its potential usefulness as an advocacy tool, for international comparisons and as a monitoring and evaluation indicator. The specific tasks undertaken were to:

1. Create an age-specific infant and child feeding index using the Ethiopia DHS;
2. Create summary variable(s) for socioeconomic status (SES) in order to control for SES in multivariate analyses;
3. Describe the geographic distribution of the child feeding index scores, and compare this to the geographic distribution of malnutrition;
4. Describe associations between the child feeding index and child nutritional status (anthropometric indicators);
5. Explore associations between maternal and household characteristics and infant/child feeding practices, with the objective of identifying characteristics which may confound the association between feeding practices and anthropometric indicators;
6. Carry out multivariate analyses to confirm whether the associations identified through bivariate analyses of feeding practices and child nutritional status remain after controlling statistically for a variety of child, maternal, and household-level characteristics.
7. “Decompose” the index and test associations between specific components of the index (or dimensions of infant/child feeding practices) and child nutritional status;
8. Compare the information available from the 24-hour and the 7-day recalls on dietary diversity and determine whether one of the two approaches could be dropped in the future to simplify data collection;
9. Carry out simulations in order to determine how the CFI score responds to varying levels of change in one, some, or all of its component feeding practice indicators.
10. Provide specific recommendations to USAID Ethiopia regarding indicators for tracking improvements in infant and child feeding practices.

The first two tasks (creation of a child feeding index and creation of SES summary variables) are described in the methods section. Results for tasks 3-9 are described and interpreted sequentially in the results section. The report concludes with a brief summary and recommendations, including the recommendations for USAID Ethiopia (task 10) as well as recommendations for additional work.

2. METHODS

2.1 DESCRIPTION OF SURVEY AND SAMPLE SELECTION

The 2000 Ethiopia Demographic and Health Survey (EDHS) was the first nationally representative population and health survey conducted in Ethiopia, and the first to be implemented in Ethiopia as part of the worldwide DHS project. The survey included 15,367 women of reproductive age (15-49 years), and was designed to provide acceptably precise information for urban and rural subsamples, and for each of 11 regions. A detailed description of the survey is available in the *Ethiopia Demographic and Health Survey 2000* report (Central Statistical Authority [Ethiopia] and ORC Macro. 2001).

The survey was designed to gather information on a range of topics, including fertility, family planning, infant and child mortality, maternal and child health, and nutrition. The present report presents additional analyses of the portion of the survey focused on infant and child feeding practices.

Because our analysis focuses on infants and children under 36 months, our first task was to create a subset of the data from the child-level file available from DHS. After children 36 months or older, twins, and those missing key data were excluded, and after one child per household was randomly selected, 4,624 children remained in the subsample.[3]

Because our analysis involved a subset less than one-third the size of the original sample, sample sizes were insufficient for some types of analysis. For example, urban-rural comparisons cannot be made within regions, since 7 of the 11 regions had less than 50 urban households.

It is also useful to understand that in this survey, households were designated as "urban" if they were found in a city or town of any size. A second level of classification is available in the data set to differentiate between the capital, small cities, towns, and rural areas. Although this level of classification would be more useful because there is a wide variation between the three categories considered "urban," small sample sizes prevent the use of this classification in most analyses.

[3]The child-level file included records for all births in the 60 months prior to the survey (10,872 births to the 15,367 women of reproductive age). Approximately 12% of these children were deceased, and an additional 35% were three years or older. We also excluded twins (there were 75 living twins), and we excluded children who were missing data either for anthropometry or for the entire 24-hour or 7-day dietary recall (557 children, or 10% of the singletons aged 0-36 months). Finally we randomly selected one eligible child per household, thus excluding an additional 398 children and resulting in a final subsample of 4,624 children. This final step avoids problems of non-independent observations within households, but does result in an underrepresentation of households with closely spaced births.

2.2 CONSTRUCTION OF THE INFANT/CHILD FEEDING INDEX

The index was created based on current feeding recommendations for children 6-36 months (Brown, Dewey, and Allen 1998; The Linkages Project 1999). Optimal feeding practices were defined for three different age groups: 6-9[4] months (breastfeeding plus gradual introduction of complementary foods); 9-12 months (same as 6-9, but increasing the amount, diversity, and frequency of complementary feeding); and 12-36 months (continued breastfeeding for as long as possible, gradual transition to the family diet and focus on dietary quality). The index was not computed for infants less than 6 months, because at this age, there is one key recommendation – exclusive breastfeeding – and there is no need to create an index to represent this single dimension. Only descriptive information is presented for this age group in the present report.

The child feeding index (CFI) included five main components: 1) a breastfeeding score (mother currently breastfeeding (yes/no)); 2) a bottle use score (child was given a bottle (yes/no) in the previous 24 hours); 3) a 24-hour dietary diversity score (child received (yes/no) selected food groups in the past 24 hours); 4) a score for frequency of feeding solids/semi-solid foods in the past 24 hours (number of meals and snacks); and 5) a 7-day quasi-food frequency score (number of days child received selected food groups in the past 7 days).

The list of variables and the scoring system used to create the infant/child feeding index for the different age groups are presented in Table 1. In general, we assigned a score of 0 to potentially harmful practices and a score of 1-3 for positive practices. As indicated above, practices were considered positive or negative based on current infant and child feeding recommendations and on available scientific evidence about their benefits or risks (WHO 1995; Brown, Dewey, and Allen 1998).

It is important to note, however, that specific recommendations have not yet been formulated for practices such as dietary diversity (e.g., how many food groups a child should receive per day), or food group frequency (e.g., the optimal frequency of intake of different food groups). Recommendations state that diets should be diverse, but do not define the number of foods or food groups that should be included in a child's diet on a given day or week. Some researchers have reported associations between specific levels of dietary diversity and nutrient adequacy or growth (e.g., Hatloy, Torheim, and Oshaug 1998; Onyango, Koski, and Tucker 1998), but at this time there is insufficient basis for a global recommendation regarding dietary diversity. In the absence of specific guidance on diversity, the scoring system and cutoff points used to create the diversity scores were based on the age-specific distribution of diversity observed in the Ethiopia DHS.

[4] For simplicity, throughout this report age ranges are presented as above; note that ranges do not overlap, and "6-9" actually represents 6-8.9 months, "9-12" represents 9-11.9 months, 6-36 represents 6-35.9 months, etc.

The main disadvantage of this distribution-based approach is that the scores cannot be normatively interpreted (i.e., unlike a score of +2 for breastfeeding, a score of +2 for 24-hour diversity does not necessarily represent an optimal practice). On the other hand, the advantage of the approach, from a programmatic standpoint, is that the level of diversity required for the highest score is clearly achievable for a significant proportion of the population (versus an "optimal" level, which, in some situations, is unachievable by most of the at-risk population).

Finally, in addition to the decisions involved in scoring each component, decisions also had to be made about the relative weight of each component in the overall score. In reality, the importance of each component relative to the others may well vary from one context to another. For example, breastfeeding, while always important, may be more critical in some contexts than in others depending on sanitary conditions and the quality of available weaning foods. There is currently neither standard guidance nor an empirical basis for weighting the various dimensions of infant/child feeding relative to one another. In the absence of such guidance, we have given each element approximately equal weight, while recognizing that this weighting is somewhat arbitrary.

Detailed information about the scoring system used for the various components of the index score is provided in the following sections.

Table 1: Variables and scoring system used to create infant/child feeding index for children aged 6-36 months, by age group

Variables	6 to 9 months	9 to 12 months	12 to 36 months
Breastfeeding	No = 0 Yes = 2	No = 0 Yes = 2	No = 0 Yes = 1
Uses bottle	Yes = 0 No = 1	Yes = 0 No = 1	Yes = 0 No = 1
Dietary diversity (past 24 hours)	Sum of: Grains + Tubers + Milk[a] + Vitamin A-rich fruits/vegs + Other fruits/vegs/juice + Animal protein foods + Legumes + Fats (received, or did not receive each food/group). Scores were assigned reflecting the age-specific distributions observed (i.e., they reflect terciles).		
	None of the foods/groups: Score = 0 One food/group: Score = 1 Two or more foods/groups: Score = 2	None of the foods/groups: Score = 0 One to two foods/groups: Score = 1 Three or more foods/groups: Score = 2	None or one of the foods/groups: Score = 0 Two or three foods/groups: Score = 1 Four or more foods/groups: Score = 2
Freq. of feeding solids/semi-solids (past 24 hours)	Not at all: Score = 0 Once: Score = 1 Two or more times: Score = 2	Not at all: Score = 0 Once or twice: Score = 1 Three or more times: Score = 2	Not at all or once: Score = 0 Twice: Score = 1 Three times: Score = 2 Four times or more: Score = 3
Food frequency (past 7 days)[b]	Each food group is scored as 0 if not given the previous week, +1 if given one to three days, and +2 if given four or more days. These scores are then summed[c] to give a possible range of 0 to 14. As above, scores were assigned reflecting the age-specific distributions observed.		
	0 (no foods prev. week): Score = 0 1 or 2: Score = 1 3 or higher: Score = 2	0 or 1: Score = 0 2 through 4: Score = 1 5 or higher: Score = 2	0 through 3: Score = 0 4 through 6: Score = 1 7 or higher: Score = 2
Minimum/maximum	**0 / +9**	**0/ +9**	**0 / +9**

[a] "Milk" in this case is all types of milk other than breast milk. The Ethiopia DHS+ 2000 survey did not include a question asking specifically about infant formula.

[b] This is actually a modified food *group* frequency, where the questions are asked in the form "How many days in the last seven days was (NAME) given [food group]?" so that the number entered for each child is the number of days, with a maximum of seven, not the number of times the child ate the food group.

[c] The list of foods summed is the same as for the 24-hour diversity score, with the exception that grains have been combined with roots/tubers to form a "staple food" variable.

2.2.1 Scoring of breastfeeding and bottle use

Breastfeeding and bottle use were scored according to current recommendations, which state that exclusive breastfeeding should be practiced up to 6 months of age and breastfeeding should be continued up to at least two years of age. Bottle use is discouraged at all ages because it can interfere with breastfeeding and introduce pathogens, thereby increasing the risk of infectious diseases. The scores used for breastfeeding and bottle use are as follows:

- A score of +2 is given for breastfeeding at ages 6-9 and 9-12 months (because it is particularly critical during the first year of life);
- A score of +1 is given for breastfeeding at ages 12-36 months;
- A score of 0 is given for *not* breastfeeding children of any age;
- A score of 0 is given for bottle use at any age, and a score of +1 is given for avoidance of bottle-feeding.

2.2.2 Scoring of 24-hour dietary diversity

As indicated above, there are currently no specific recommendations regarding the optimal number of foods or food groups that a child should consume each day at different ages. There is, however, a consensus that higher dietary diversity is desirable and that a larger number of foods or food groups can help meet daily requirements for a variety of nutrients. In the absence of a recommendation, we used the age-specific distribution of the number of food groups consumed in the past 24 hours to select the (age-specific) cutoff points to allocate scores of 0 to 2 for dietary diversity. Using the 24-hour data and the food groupings available in this data set, the number of food groups given in the past 24 hours was summed. The following food groups were used:

- Food made from grains,
- Food made from roots/tubers,
- Milk other than breast milk,
- Vitamin A-rich fruits and vegetables,
- Other fruits and vegetables, and juice,
- Meat, poultry, fish, cheese, eggs, yogurt,
- Legumes,
- Foods prepared with fat/oil/butter.

Distributions were examined within age groups, and age-specific scores were assigned; the scores of 0 to +2 reflect terciles as closely as possible (see Table 1).

2.2.3 Scoring of frequency of feeding solid/semi-solid foods in previous 24 hours

Current international recommendations for frequency of feeding exist (Brown, Dewey, and Allen 1998), but these recommendations should be used in combination with information on the energy density of the diet. For instance, if the mean energy density of the diet is 0.6 kcals/gram, a minimum of 3.7 meals (or feeding episodes) is required to attain the level of energy needed from complementary foods for infants 6-9 months of age. Similarly, at an energy density of 0.6 kcals/gram, 4.1 meals/feeding episodes are needed for infants 9-12 months of age, and 5 meals/feeding episodes are needed for children 12-24 months of age. The number of meals required for children consuming meals higher in energy density is proportionally lower for all age groups.

For diets with an average energy density lower than 0.6 kcal/gram, the number of meals required to meet energy needs from complementary foods becomes excessive (especially among 12-23-month-old children). In these situations, it is recommended that interventions designed to improve complementary feeding should start by focusing on increasing the energy density of the diet. Once the energy density is at an acceptable level (>0.6 kcals/gram), recommendations about an optimal number of feedings per day can be made.

Information on average energy density of complementary foods unfortunately cannot be collected in the DHS or other similar large surveys because it requires in-depth dietary information. In the absence of energy density information, we used the following recommendations from LINKAGES as a basis for our scoring (The Linkages Project 1999):

Infants 6-9 months, feed 2-3 times per day;
Infants 9-12 months, feed 3-4 times per day;
Children 12-36 months, feed 4-5 times per day.

The scores allocated to the frequency of feeding variable ranged from 0 to 2 for 6-9- and 9-12-month-old children, and ranged from 0 to 3 for 12-36-month-old children[5] (Table 1). The maximum scores (2 for 6-9- and 9-12-month-old children and 3 for 12-36-month-old children) were given for children who were fed the number of times recommended above. A score of zero was given when children 6-12 months of age were not fed complementary foods at all the previous day, and when older children (12-36 months) were fed complementary foods once or not at all.

The higher score (+3) for the older children was given in recognition of the increasing range in frequency of feeding, and the increasing role of complementary foods in the diet, as the contribution of breast milk declines. This additional "point" for frequency also balanced the lower score attributed to breastfeeding in this age group (+1 vs. +2 for infants 6-12 months), thus yielding the same total range of scores for the index.

[5] Just as there are concerns about insufficiently frequent feeding, there are concerns about overly frequent feeding and the potential this may have to compromise breastfeeding. This is particularly of concern in the younger age groups. However, we did not feel we had a basis for assigning lower scores to frequencies exceeding the recommendations. Few children fell into these categories (3-5%, depending on the age group).

2.2.4 Score for 7-day quasi-food frequency[6]

As with the 24-hour diversity score, this score was based on the observed distribution of the data within age groups. The 7-day information available in the DHS is the number of days the child was offered specific food groups. The same food groups as for the 24-hour recall (used to derive the dietary diversity score) are available. However, for this score, we combined two food groups – grains and roots/tubers – into a variable for staple foods. Thus, instead of eight food groups, the food frequency score uses seven food groups.

Each food group was coded zero if not given at all in the previous week, as +1 if given on 1-3 days, and as +2 if given on 4-7 days. The scores for each of the seven food groups were summed, for a total score ranging from 0-14. Once this intermediate variable was constructed, distributions were examined within age groups. As with the diversity variable, scores of 0 to 2 were assigned based as closely as possible on age-specific terciles (see Table 1).

2.2.5 Child feeding index score and terciles

The child feeding index (CFI) score, ranging from 0 to 9, was then calculated as follows by summing all of the component scores:

> Breastfeeding score + bottle use score + 24-hour diversity score +
> frequency of feeding score + 7-day quasi-food frequency score.

Finally, age-group-specific terciles were constructed for the CFI score, using the following guidelines: minimize the differences between actual percentages and 33 percent; when a choice is necessary, lump into the middle category so as not to dilute the contrast between the extremes.

2.3 CREATION OF SOCIOECONOMIC STATUS FACTORS

In order to understand and accurately represent relationships between infant/child feeding practices and child nutritional status, it is essential to control in multivariate analyses for child, maternal and household factors, which may act as potential confounding factors. The DHS data sets do not collect data on income and expenditure and thus, other proxies for household socioeconomic conditions must be used.

In the absence of income and expenditure data, several researchers have recently used factor analysis/principal components approaches to construct measures of long-term wealth (Filmer and Pritchett 1998; Stifel, Sahn, and Younger 1999) based on housing conditions, ownership of assets, and availability of basic services. We have also successfully used these types of variables to create a socioeconomic factor using DHS

[6] This is actually a modified food *group* frequency, where the questions are asked in the form "How many days in the last seven days was (NAME) given [food group]?" so that the number entered for each child is the number of days, with a maximum of seven, not the number of times the child ate a food from the group.

data from various countries in our previous work (Menon, Ruel, and Morris 2000; Ruel and Menon 2002).

The variables available in the Ethiopia data set to characterize household socioeconomic conditions are the following:

- Main source of drinking water (surface/rainwater vs. wells/spring vs. piped water),
- Toilet facility used (none, latrine, flush toilet),
- Electricity,
- Ownership of durable goods (radio, TV, telephone, electric "mitad,"[7] kerosene lamp, bed/table),
- Transportation (bicycle, car/truck),
- Ownership of cropland,
- Ownership of livestock (cattle/camels, horse/mule/donkey, sheep/goats),
- Cash crop production (yes/no),
- Ownership of own house,
- Main floor material,
- Main roof material,
- Crowding factor (number of household members per sleeping room).

Factor analysis was used in the present work as a data reduction tool, with the aim of combining the information from a variety of highly correlated indicators of socioeconomic status into a small number of factors. We were therefore looking to maximize the proportion of common variation among the variables that could be explained by the factor(s). The analysis was carried out separately for the urban and rural sample, because the characteristics that define wealth are expected to differ between urban and rural areas.

Two factors were identified in both urban and rural areas. In urban areas the two factors explained 59 percent of the variation in the variables included and in rural areas, they explained 53 percent of the variance. The selection criterion for inclusion of individual variables in the final factors was that factor loadings (defined as the correlation between the individual variable and the factor) had a value greater than 0.5 for at least one of the two factors.

The variables included in the final factors were the following:

Urban

- Source of drinking water
- Toilet facility
- Sum of all durable goods (yes/no for each)[8]
- Sum of land/livestock owned (yes/no for each)

[7] Used for cooking injera.

[8] No data are available on the quantity of goods, land or livestock owned; the data are coded yes or no for each item.

- Main floor material
- Main roof material

Rural

- Sum of all durable goods
- Ownership of cattle or camels
- Ownership of horses, mules, donkeys
- Ownership of sheep or goats
- Number of household members per sleeping room

2.4 ANALYTICAL METHODOLOGY

SPSS data files (household-, woman-, and child-level) were downloaded from the ORC Macro website. All preliminary work (e.g., selecting the subset of cases) and variable construction were performed in SPSS 10.1 for Windows. Descriptive statistics (proportions and means) were also generated in SPSS, as well as bivariate analyses.[9]

The statistical significance of differences between means was tested using t-tests (for two group comparisons) and ANOVA (for three or more groups comparisons). The Chi-square test was used to test differences in proportions. P-values smaller than 0.05 were considered statistically significant.

The multivariate analyses were performed using STATA (version 7), which allows taking into account the two-stage stratified cluster sample design.[10] The dependent variable in the multivariate analysis was height-for-age Z-scores (HAZ). The independent variables were the child feeding index and a series of child, maternal, and household characteristics that are known to be associated with child nutritional status. These included:

Child level: age and gender.
Maternal level: maternal age, height, body mass index, education (years of schooling), parity, number of prenatal visits attended (0, 1-3, 4+).
Household level: socioeconomic factors (1 and 2: each factor was categorized into terciles), number of children < 5 years of age, area of residence (urban/rural).

The child feeding index was included in the model as a categorical variable (three categories: lowest, average and highest).

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[9] Many of the bivariate comparisons made in this report should be viewed as tentative since they are likely to be confounded. These comparisons are important for descriptive purposes, to illustrate relationships in the data, and to inform decisions about the multivariate analysis. Since bivariate tests were done in SPSS, these tests also fail to account for survey design. In the case of many of the comparisons – particularly urban/rural comparisons, both the size of the observed differences and the sample size are so large, that is it highly likely they would remain significant if tested in a more complex program, accounting for sample design. Nevertheless, while we refer to the significance of these tests, findings of the bivariate analyses should be interpreted with caution.

[10] The procedure “svyreg” was used, which allows to specify the sampling weights, the primary sampling unit and the strata.

For all categorical variables included in the model, the statistical package (STATA) created dummy variables. For example, the child feeding index has three categories, and therefore three dummy variables are created as follows: dummy 1 = 1 for lowest tercile, and 0 for all other values; dummy 2 = 1 for average tercile and 0 for all other values, and dummy 3 = 1 for highest tercile and 0 for all other values. In the regression models, the statistical tests done for dummies 2 and 3 (t-test and p value), test whether their coefficients are different from that of dummy 1 (which is said to be used as the "reference"). In order to determine whether, overall, the categorical variable (in this case the child feeding index terciles) is statistically significant, we performed joint tests of statistical significance on all categorical variables that had three or more categories.

The multivariate analysis also tested all two-way interactions between the child feeding index and the child, maternal, and household variables included in the model. The purpose was to determine whether the magnitude of association between the CFI and the other factors included in the model differed according to the level of these characteristics. Adjusted mean HAZ scores were computed to obtain mean HAZ by child feeding index tercile, after adjusting by multivariate analysis for child age, maternal characteristics, and household socioeconomic factors.

Finally, in order to simulate the effects on the CFI score of varying levels of change in component indicators, a spreadsheet was constructed. Using summary statistics for each component indicator (e.g., percent still breastfeeding in each age group, percent scoring 0, 1, 2, or 3 for frequency of feeding in each age group, etc.) and using spreadsheet formulas, the CFI was calculated for a number of different scenarios. Baseline values were varied between scenarios, and levels of change in component indicators were also varied.

3. RESULTS AND INTERPRETATION

3.1 DESCRIPTION OF THE SAMPLE

Key descriptive statistics for children, mothers, and households included in the sample are presented to provide context for the more focused analysis of infant and child feeding practices. Urban-rural differences are also described and highlighted.

3.1.1 Maternal and household characteristics

Table 2 presents selected maternal and household characteristics, by area of residence. With the exception of maternal age and height, and household size, urban and rural households vary substantially on almost all basic characteristics. Differences in maternal education are particularly striking and are relevant to childcare and feeding: 38 percent of urban women report no education as compared to 84 percent of rural women; conversely, 40 percent of urban women report at least some secondary education as compared to only 2 percent of rural women.

Access to health care, as proxied by the number of antenatal visits during the last pregnancy, also varies widely between urban and rural women, as do sanitary conditions. More than three-fourths of rural women reported no prenatal visits for the last pregnancy, as compared to one-third of the urban women. Most urban women (81 percent) report having access to piped water, while only 6 percent of rural women do. Similarly, most urban women (69 percent) report having access to a latrine or toilet, while only 9 percent of rural women do. Ownership of durable goods and better housing materials are more common among urban households, while ownership of livestock and homes are much more common among rural households.

3.1.2 Child health and nutritional status

Table 3 presents selected indicators of child health and nutritional status. The large differences between urban and rural households described above are also reflected in child-level indicators.

Table 2: Selected maternal and household characteristics in the Ethiopia DHS 2000[a]

	Urban (n = 712)	Rural (n = 3912)	All (n = 4624)
Mother's age (mean)	28	29	29
Parity (mean)	3.2	4.2	4.1
Height (mean)	157.0	156.4	156.5
BMI category (%)			
Very low (< 17.0)	5	5	5
Low (17.0 to < 18.5)	15	18	18
Normal (18.5 to <25)	70	75	74
High (25.0+)	10	1	3
Mother's education (%)			
None	38	84	76
Some primary	22	13	15
Some secondary	40	2	9
Number of antenatal visits during last pregnancy: None	33	78	70
Four +	50	6	14
Mean household size	5.9	6.0	5.9
Percent of hhs with more than one child under 5	52	64	62
Percent female-headed hhs	23	12	14
Partner's occupation (%)			
Agriculture/unskilled labor	17	92	79
Sales/services/skilled labor	61	7	16
Professional/technical/managerial/clerical	21	1	5
Main source of water (%)			
Surface/rain	8	37	32
Well/spring	11	58	49
Piped	81	6	19
Sanitary facilities (%)			
None	31	91	81
Latrine	67	9	19
Flush toilet	2	0	0.4
Percent with electricity	76	0	14
Percent owning:			
Radio	69	14	24
Kerosene lamp	18	9	11
Bed or table	89	45	52
Bicycle	4	0	1
Own house	48	98	89
Percent owning:			
Cattle or camels	26	80	71
Horse, mule, donkey	7	32	27
Sheep or goats	16	41	36
Main floor material is earth/ sand/dung/wood/reed (%)	67	98	93
Main roof material is mud, thatch, reed, bamboo, plastic, or temporary (mobile) (%)	13	87	74
Mean number of people per sleeping room (crowding)	4.4	5.0	4.9

[a] With the exception of household size, all urban-rural differences are statistically significant ($p<.05$, t-tests for means and chi-square tests for proportions).

Table 3: Infant and child health and nutrition indicators in the Ethiopia DHS 2000[a]

	Urban	Rural	All
Mean age (months)	17.9	17.5	17.6
Mean HAZ	-1.22	-1.88	-1.76
Percent stunted (HAZ < -2)			
All under 3 y	29	46	43
12 - 36 mo	38	58	54
Percent severely stunted			
(HAZ <-3) All under 3 y	14	23	21
12 - 36 mo	17	30	28
Mean WAZ	-1.11	-1.81	-1.69
Percent underweight			
(WAZ <-2) All under 3 y	27	47	44
12-36 mo	33	58	53
Mean WHZ	-0.46	-0.82	-0.75
Percent wasted (WHZ <-2)			
All under 3 y	6	13	12
12 - 24 m.	8	20	18
Diarrhea in last 2 wk (%)	23	33	31
Among these:			
% who rec'd treatment	49	21	25
% rec'd medical treatment	41	11	15
Fever in last 2 weeks (%)	29	35	34
Cough in last 2 weeks (%)	30	40	38

[a] With the exception of child age, all urban-rural differences were statistically significant (p<.05; t-tests for means, and chi-square tests for proportions).

As is typical in most developing countries, urban children are generally better off in terms of health and nutritional status (Ruel, Garrett, Morris et al. 1998). Urban children are generally taller, heavier, and are less likely to have suffered from diarrhea, cough, or fever in the previous two weeks than children living in rural areas. Differences as large as 0.7 Z-scores in height-for-age and 20 percentage points in the prevalence of stunting are found between urban and rural children. Rates of wasting are high overall (12 percent of children aged 0-36 months), and reach 20 percent among 12-24 month old children living in rural areas.

Differences of close to four-fold are found in the prevalence of children who received medical treatment for recent diarrhea (41 percent in urban compared to 11 percent in rural areas), most likely reflecting the much lower access to health care in rural areas. Figures 1A and 1B show the prevalence of stunting and wasting by age, respectively. The patterns observed are familiar, with the prevalence of stunting rising sharply in the first year of life and then plateauing at around 18-24 months of age (Ruel 2001), while the prevalence of wasting peaks between 12-24 months and then declines. Rates of both stunting and wasting are high compared to other low-income countries. The 64 percent prevalence of stunting at 18 months among rural Ethiopian children is higher than the prevalence found in most African countries, as indicated by an analysis of DHS data sets from 18 African countries (Ruel 2001). Ethiopia ranks third in Africa for the prevalence of stunting at 18 months, after Madagascar and Zambia, and is at the same level as some of the poorest countries of Asia, such as Bangladesh and Nepal. Similarly, the rates of wasting in rural Ethiopia are among the highest in Africa, and are similar to those found in Niger and Benin (Ruel 2001).

Figure 1A: Prevalence of stunting by age group (Ethiopia DHS 2000)

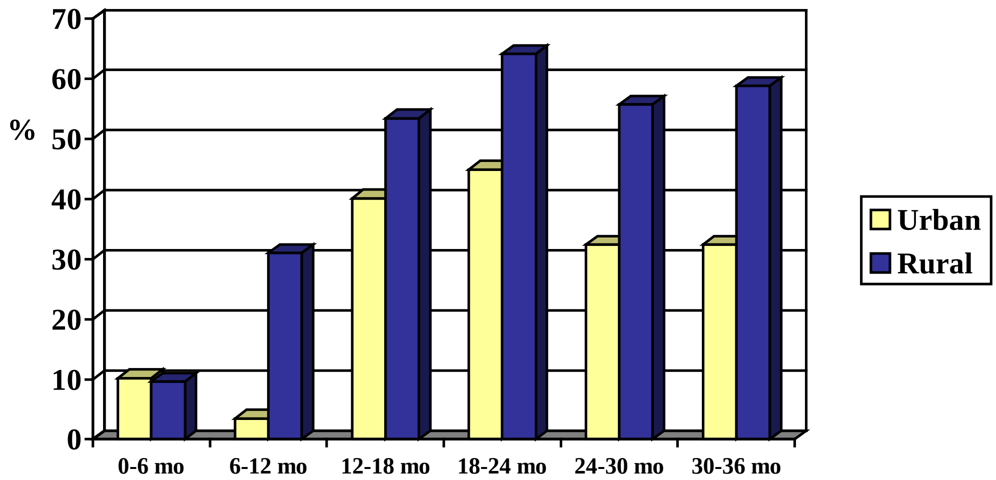
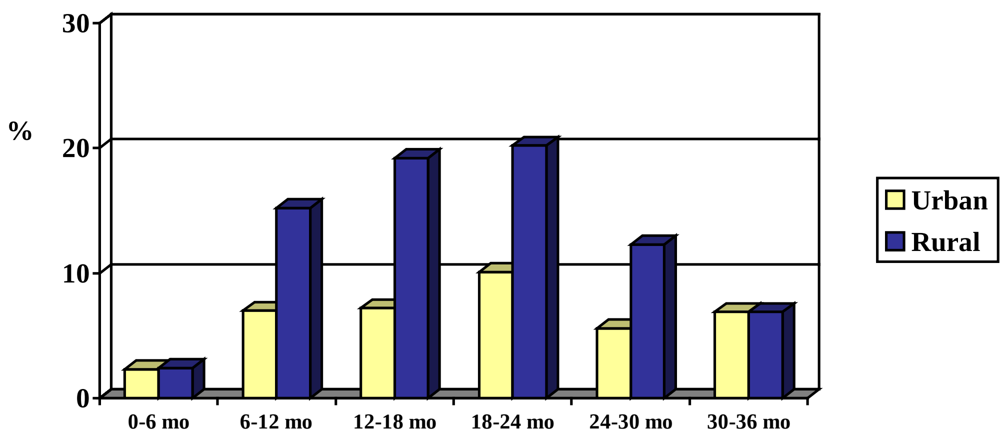


Figure 1B: Prevalence of wasting by age group (Ethiopia DHS 2000)



Figures 2A and 2B present the mean Z-scores values for the three anthropometric indicators (weight-for-age (WAZ), height-for-age (HAZ) and weight-for-height (WHZ)), by rural and urban areas, respectively. Overall, as seen for the prevalence figures, mean Z-scores for all three indicators are higher among urban compared to rural children, confirming their better nutritional status. Mean HAZ in rural areas get as low as –2.5 Z-scores between 18-24 months of age, which explains the high prevalence of stunting (60 percent) found among rural children at that age (Figure 1A). The mean WAZ curves follow similar patterns to those of the HAZ curves in both urban and rural areas. The WHZ curves, however, show different patterns. In rural areas, the mean WHZ are stable at approximately -0.5 Z-scores from 6 to 36 months of life, whereas in rural areas, a clear decline in WHZ is observed from birth and up to 18-24 months of age, reaching approximately –1.2 Z-scores at that age. Clearly, childhood malnutrition remains a severe problem in Ethiopia.

Figure 2A: Mean Z-scores by age group: Rural children (Ethiopia DHS 2000)

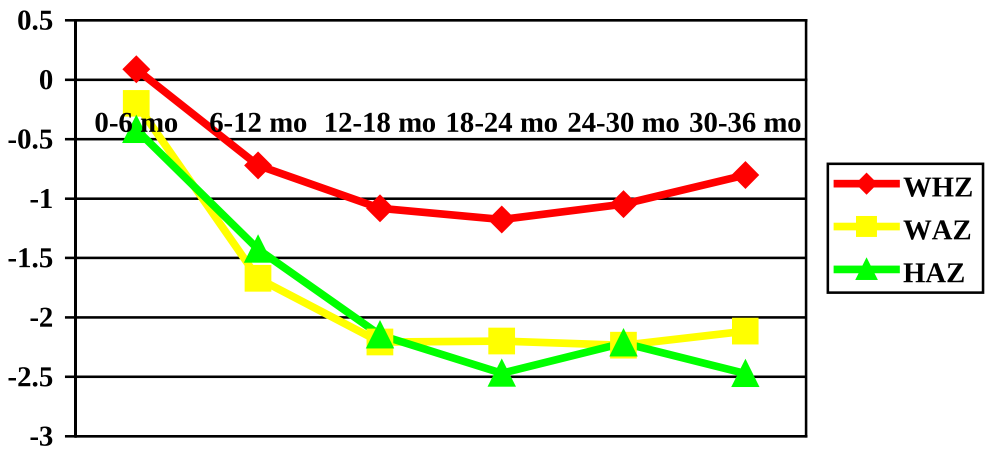
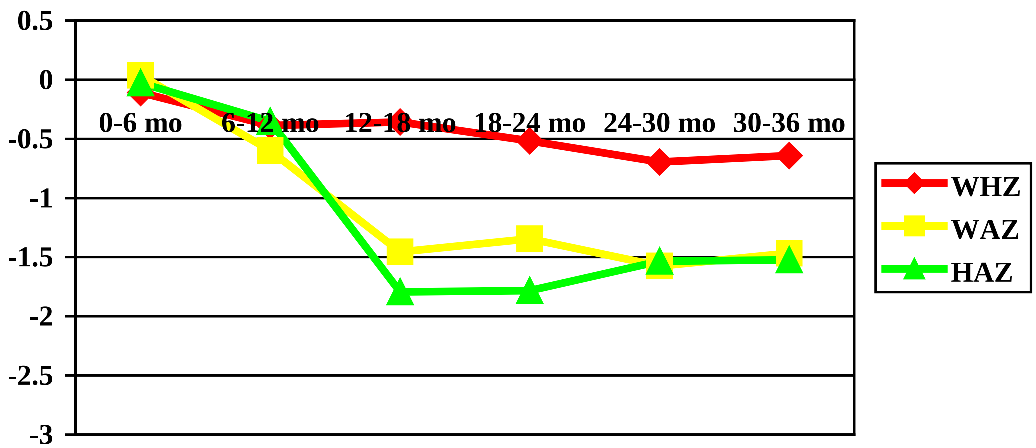


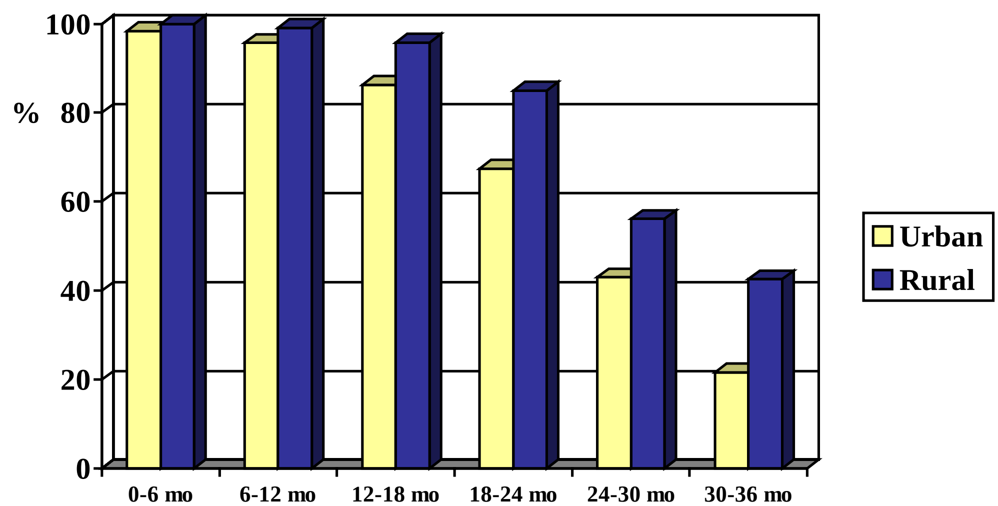
Figure 2B: Mean Z-scores by age group: Urban children (Ethiopia DHS 2000)



3.1.3 Selected infant and child feeding practices

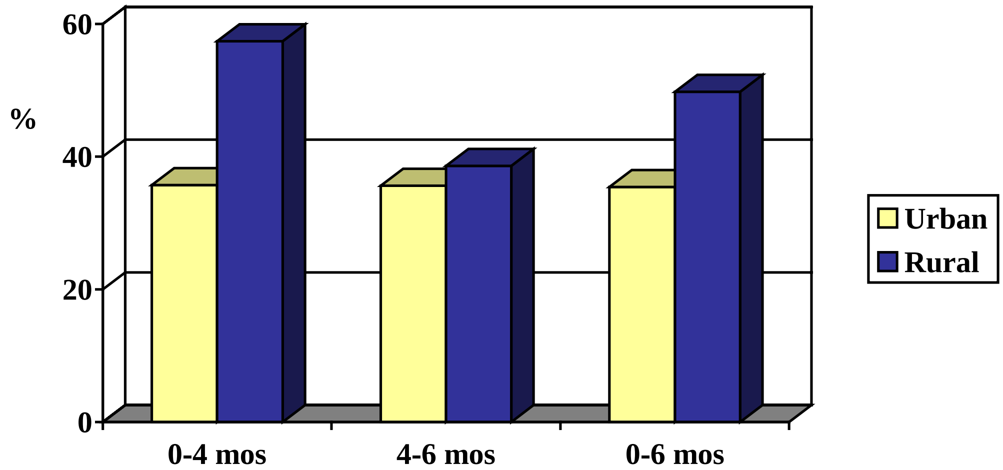
Figures 3 through 10 present the prevalence of selected key infant and child feeding practices by age group and also highlight urban rural differences.

Figure 3: Percentage of children still breastfed, by age group and area of residence (Ethiopia DHS 2000)



Breastfeeding is nearly universal throughout the first year of life for both urban and rural children. In the second and third years of life, breastfeeding rates decline, and decline more rapidly in urban areas. However, rates remain quite high overall through the second year. As illustrated in Figure 4, rates of exclusive breastfeeding are also relatively high in Ethiopia, and are higher in rural than in urban areas, particularly for infants aged 0-4 months. The rural-urban difference is not sustained in children aged 4-6 months. Overall, 50 percent and 35 percent of rural and urban children, respectively, are exclusively breastfeed from birth to 6 months.

Figure 4: Percentage of children exclusively breastfed in the previous 24 hours, by age group and area of residence (Ethiopia DHS 2000)



While breastfeeding patterns are quite favorable, several other infant feeding practices are less favorable. As illustrated in Figure 5, bottle use is widespread, particularly in urban areas.

Delayed complementary feeding in the second half of infancy is also a problem in Ethiopia. As illustrated in Figure 6, a majority of infants aged 6-9 months received no solids or semi-solids the previous day. A substantial proportion of older infants (9-12 months) also received no solids or semi-solids in the previous 24 hours (16 percent of urban infants and 27 percent of rural infants).

Figure 5: Percentage of mothers using bottle in last 24 hours, by child age group and area of residence (Ethiopia DHS 2000)

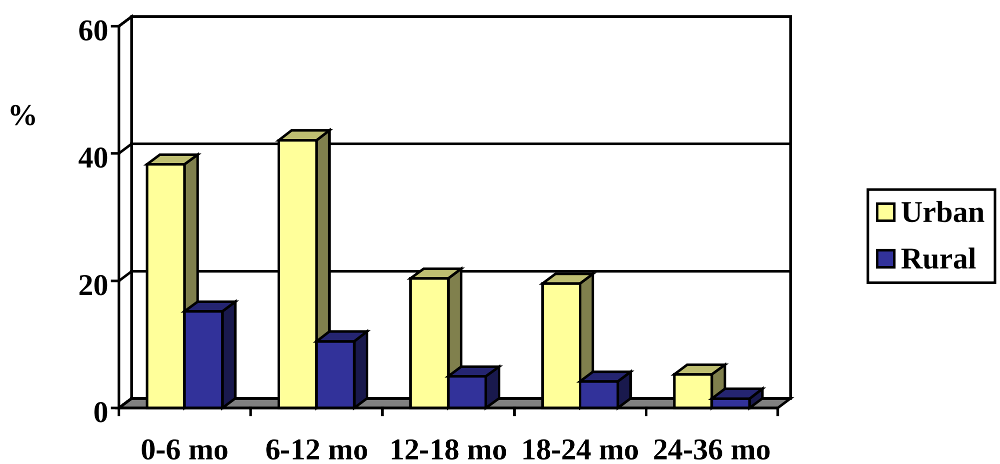
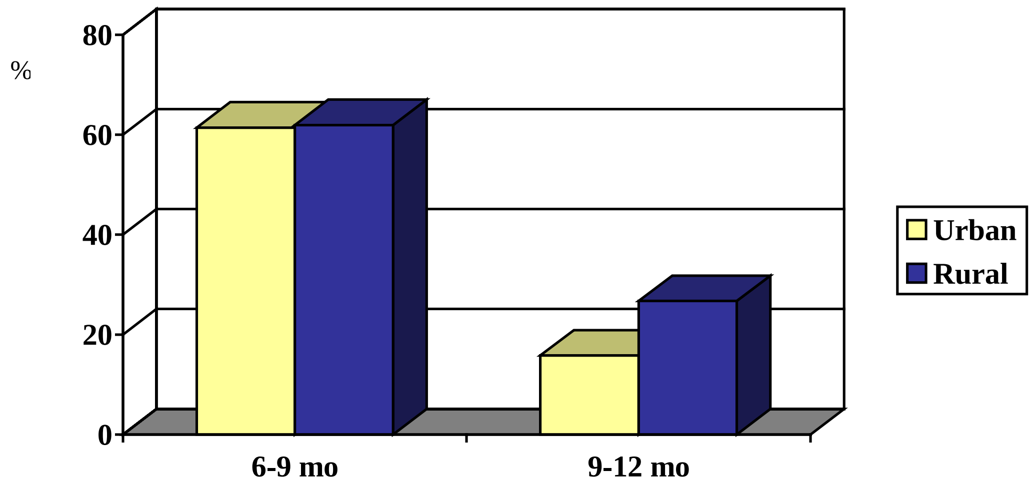


Figure 6: Percentage of children who received no solids or semi-solid foods the previous day, by age group and area of residence (Ethiopia DHS 2000)



Inadequate use of complementary foods (during the second half of infancy) is clearly an important child feeding issue in Ethiopia. In addition to the information provided by Figure 6, other variables from the questionnaire provided confirmatory evidence that delayed complementary feeding may be a serious problem in Ethiopia. The percentage of mothers who responded "none" to the question concerning frequency of feeding solids/semi-solids yesterday was even higher than the percentage of mothers reporting giving their infants none of the food groups listed in the questionnaire (reported in Figure 6).[11]

In addition, the 7-day recall provides an opportunity to compare the proportion of infants 6-12 months receiving no solids the previous day to the proportion receiving no solids the previous week. This is particularly useful for the infants aged 6-9 months, because during this early stage of the transition to solids, one hypothesis could be that they do not receive food every day, and therefore that the 24-hour recall may underestimate the proportion of children given complementary foods. This appears to be true for some urban children aged 6-9 months. During the previous 7 days, 49 percent received none of the food groups listed, while during the last 24 hours, 61 percent received none of the foods. However, among rural infants aged 6-12 months, and among the older urban infants (9-12 months), figures for the past 7 days were very similar to figures for the past 24 hours. Among the infants aged 9-12 months, who should be given complementary foods 3-4 times per day, one-quarter of all rural children and 14 percent of all urban children received none of the listed food groups in the 7 days prior to the survey.

Figure 7 shows the average frequency of feeding solid or semi-solid foods during the previous day. Women were asked "How many times was [NAME] fed mashed or pureed or solid or semi-solid food yesterday during the day or night?" Average frequencies

[11] The discrepancy between women saying no to all food groups, and the women who answered "none" to the frequency of feeding question, presents an interesting methodological question. We will return to this issue in the final section of the report.

increase with age, but they are generally low – less than twice for 9-12-month-old infants, less than three times for 12-24-month-old children, and less than four times for the older age group. Similar patterns are observed in urban and rural areas, in contrast with findings for most other feeding practices, which show significant urban-rural differences. This is also in marked contrast to urban-rural differences in diversity of food groups, which are illustrated in Figure 8 (using the 24-hour recall) and Figure 9 (using the 7-day recall). Urban children consistently received a larger mean number of foods/food groups in the previous day compared to rural children, and this was true for all age groups (Figure 8). The food groups that appeared to be mostly responsible for this urban-rural difference are the high-quality – energy and nutrient dense – foods such as animal protein foods, vitamin A-rich and other fruits and vegetables, and foods cooked with fats and oil (Figure 9).

Figure 7: Number of times the child was fed solids/semi-solids the previous day, by age group and area of residence (Ethiopia, DHS 2000)

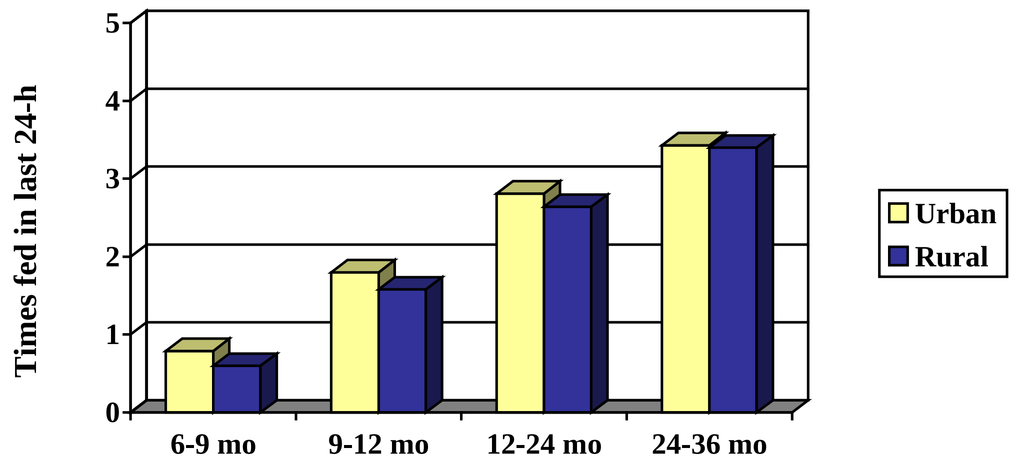


Figure 8: Number of different food groups fed to the child the previous day, by age group and area of residence (Ethiopia, DHS 2000)

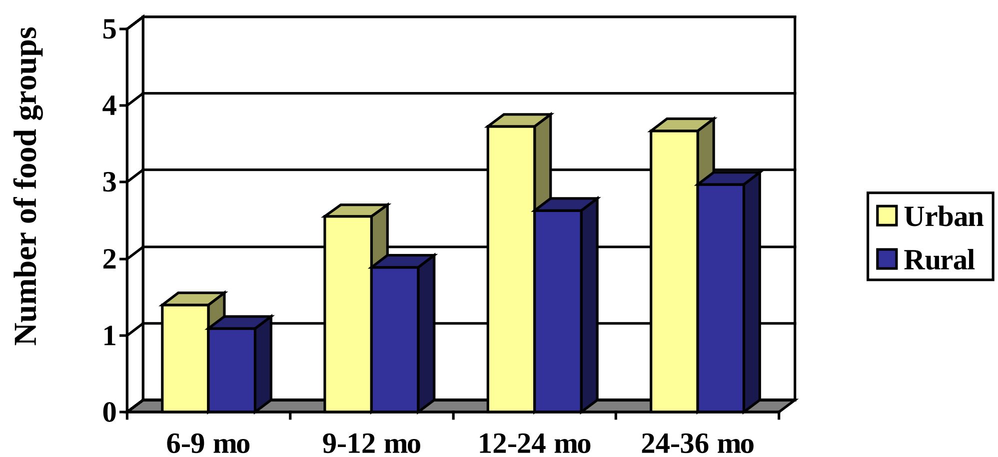
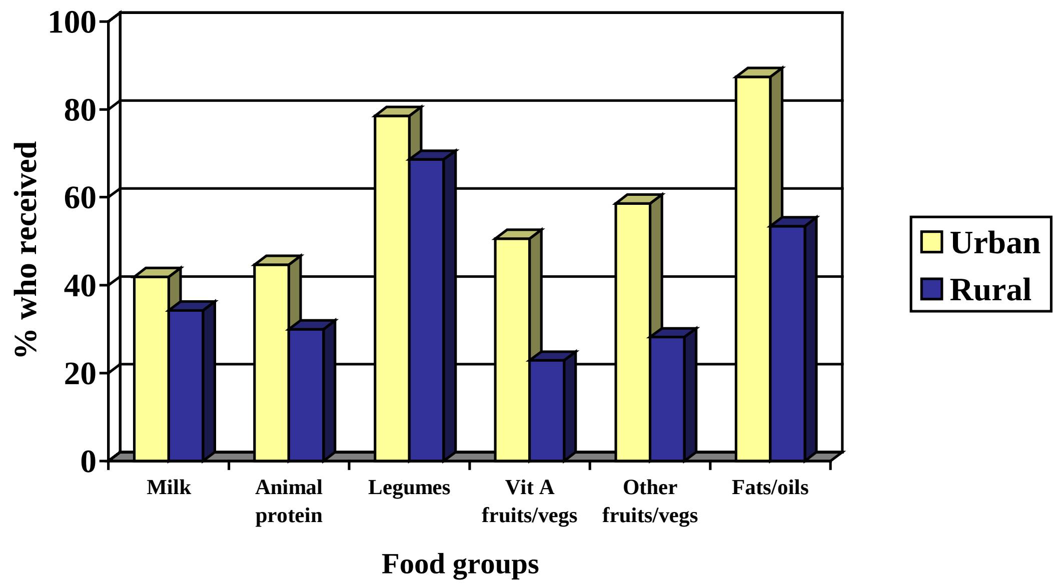


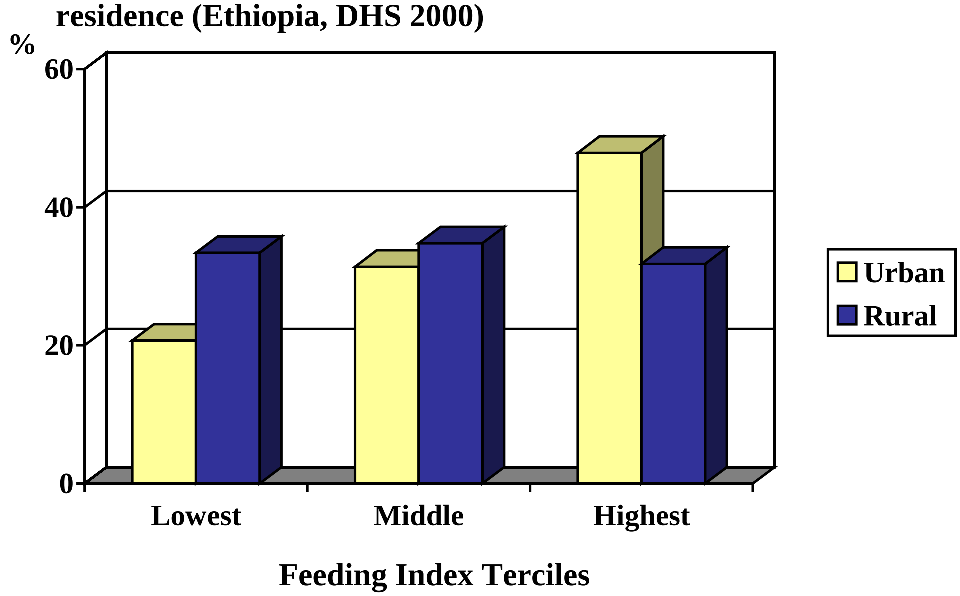
Figure 9: Types of foods given to 12-36 month old children in the past 7 days, by area of residence (Ethiopia, DHS 2000)



3.1.4 Child Feeding Index (CFI) scores

The Child Feeding Index scores also reflect urban-rural differences, with mean scores of 6.3 for urban children and 5.8 for rural children. Figure 10 shows the proportion of urban and rural children in each tercile. Since 85 percent of the sample is rural, rural children are divided more or less equally in the three terciles by design, since the terciles were derived for the urban-rural samples combined. However, urban children are less likely to fall into the lowest tercile and are more likely to fall into the highest tercile.

Figure 10: Percentage of children in each Child Feeding Index tercile, by area of residence (Ethiopia, DHS 2000)



3.1.5 Feeding practices of infants 0-6 months of age

In this section, we present additional descriptive statistics for infants less than six months of age. We also address a methodological question related to the estimation of exclusive and full breastfeeding rates – the difference in estimates obtained when a 7-day compared to a 24-hour recall is used.

There were 684 infants less than six months of age, representing 15 percent of our sample. Of these, 117 lived in urban areas and 567 lived in rural areas. Figure 11 presents early breastfeeding practices in urban and rural areas and shows the proportion of women discarding colostrum, initiating breastfeeding early, as recommended (< 1 hour) and late (> 24 hours). Early practices were slightly more favorable in the rural, compared to the urban areas, with fewer women reporting discarding colostrum, and fewer women reporting late initiation of breastfeeding. Bottle use was also markedly lower in rural areas, especially among 4-6 month old infants (Figure 12). Bottle use in urban areas is

Figure 11: Early breastfeeding practices among 0-6 month old infants, by area of residence (Ethiopia DHS 2000)

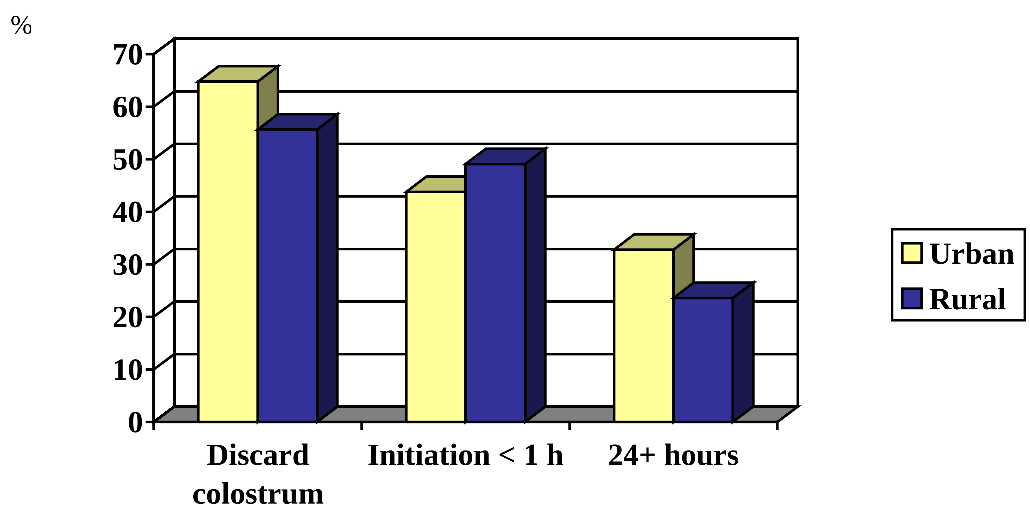
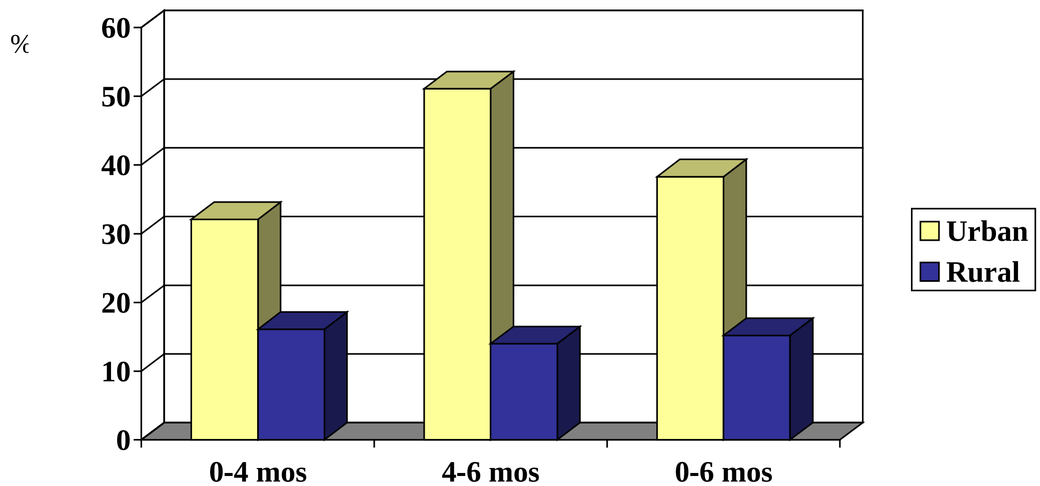


Figure 12: Percentage of mothers giving bottles to 0-6 month old infants, by age and area of residence (Ethiopia DHS 2000)



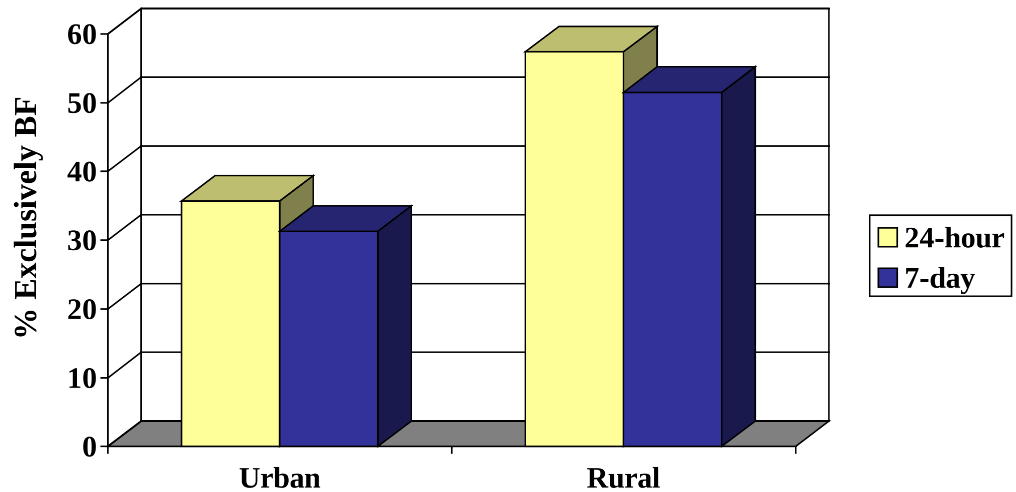
very high, with one half of the infants aged 4-6 months given a bottle the previous day. Bottle use is more common in Ethiopia than in most other African countries for which DHS data sets are available (Central Statistical Authority [Ethiopia] and ORC Macro 2001).

In positive contrast, exclusive breastfeeding is also more common in Ethiopia than in most other African countries (ibid.). Figures 13 and 14 show the prevalence of exclusive breastfeeding in urban and rural areas, and also illustrate the difference between the estimate based on the 24-hour recall and the estimate based on the 7-day recall. Most typically, estimates of exclusive breastfeeding are based on 24-hour recall data because these data are more widely available than are data from longer recall periods. However, it is well recognized that women who use bottles or who supplement early do not necessarily do so each day. If "exclusive breastfeeding" is defined to mean no other foods or liquids since birth, clearly even 7-day recalls do not capture the full picture, since practices may vary over time for a number of temporary reasons (temporary absence or illness of mother or child, seasonal differences in maternal labor, temporary presence of other caregivers in the household, etc.). Nevertheless 7-day recalls capture a bigger slice of the real picture than do 24-hour recalls, and the DHS+ data offer an opportunity to consider the difference between the two.

As shown in Figure 13, the discrepancies in the estimates for infants 0-4 months are relatively small (4-6 percent differences between the 24-hour and 7-day estimates). Figure 14 shows that the size of the discrepancy increases in the 4-6 month age group, and is particularly problematic in urban areas, where the estimate of exclusive breastfeeding based on the 24-hour recall is twice as high (36 percent) as that based on the 7-day recall (18 percent). Results for full breastfeeding[12] show a similar pattern although absolute differences in the estimates are larger. For example, among urban infants aged 4-6 months, the 24-hour estimate for full breastfeeding is 55 percent, once again twice the estimate based on the 7-day recall (27 percent).

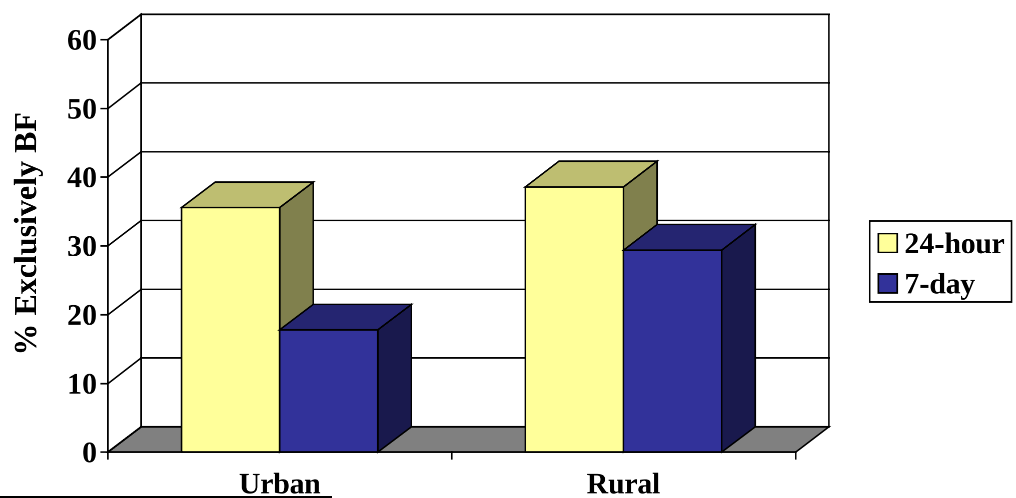
The importance of these differences in estimates will depend on the objectives of the analysis, and will be further discussed in the last section of this report.

Figure 13: Comparison of estimates of exclusive breastfeeding[a], measured by 24-hour and 7-day recalls (Infants 0-4 months of age) (Ethiopia DHS 2000)



[a] For the purposes of this analysis, infants were considered to be exclusively breastfed if their mothers: 1. Reported giving none of the liquids or solids listed on the recall; 2. Reported no bottle use yesterday/last night; and 3. Reported "none" for the frequency of feeding solids/semi-solids yesterday.

Figure 14: Comparison of estimates of exclusive breastfeeding, measured by 24-hour and 7-day recalls (Infants 4-6 months of age) (Ethiopia DHS 2000)



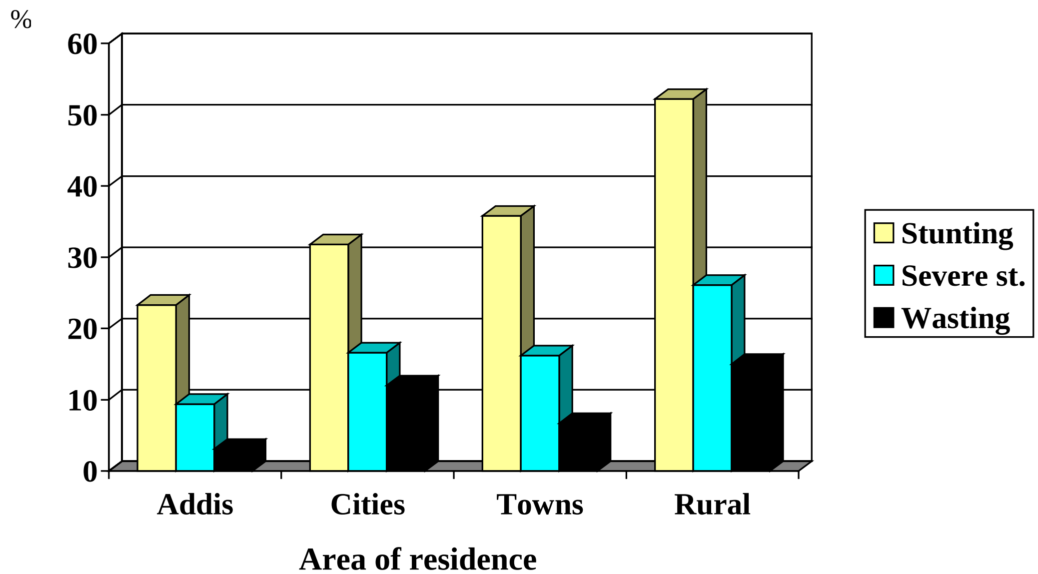
[12] Full breastfeeding was defined as exclusive breastfeeding with or without the addition of water and with or without bottle use yesterday/last night.

3.2 GEOGRAPHIC DISTRIBUTION OF INFANT/CHILD FEEDING INDEX AND MALNUTRITION

Large urban-rural differences in both anthropometric indicators and child feeding index (CFI) scores were illustrated earlier. In this section we describe regional differences in these indicators, and also illustrate differences observed between the capital, other cities, towns, and the rural areas.[13] Figures 15 through 18 show results for infants and children aged 6-36 months.

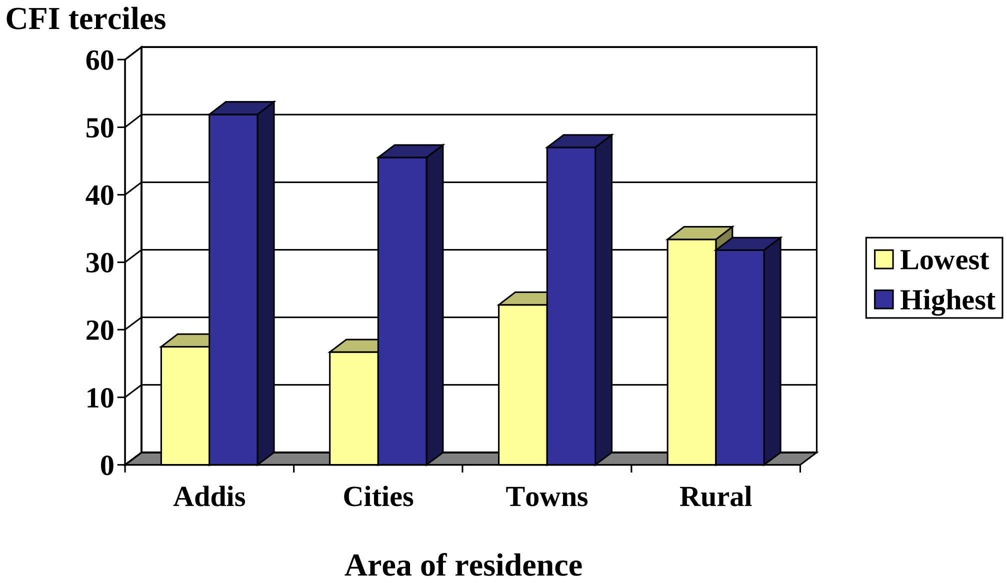
Rates of stunting, severe stunting, and wasting are all far lower in the capital city, Addis Ababa, are intermediate in smaller cities and towns, and are highest in the rural areas. Figure 16 shows parallel patterns for the child feeding index terciles – the percentage of mothers in the high CFI tercile is highest in the capital city, is intermediate in other cities and towns, and decreases to a level of approximately 30 percent in rural areas. Conversely, the percentage of mothers in the low CFI tercile moves in the opposite direction.

Figure 15: Stunting and wasting prevalence by area of residence (Ethiopia DHS 2000)



[13] Regional samples vary in size from 215 (in Harari) to 964 (in Oromiya). In seven of the eleven regions, sample sizes were in the 200-300 range; only samples from Tigray, SNNP, Amhara, and Oromiya were larger, and each of these was over 500. When comparing cities and towns to rural areas, sample sizes were approximately 230-250 each in Addis Ababa, other cities, and towns, as compared to 3,912 in the rural subsample.

Figure 16: CFI terciles by area of residence (Ethiopia DHS 2000)



Figures 17 and 18 illustrate regional patterns of stunting, and the percent of children in the highest CFI tercile, respectively. While the patterns do not entirely mirror each other, there appears to be a tendency for lower rates of stunting to be associated with higher proportions of children in the highest CFI tercile. We tested the hypothesis that there was a regional-level association between average Z-scores and average CFI scores by aggregating height-for-age Z-scores (HAZ) and CFI scores to regional means, and performing a nonparametric Spearman rank order correlation. The correlation between regional means (HAZ and CFI scores) was 0.70 and was statistically significant ($p<0.05$). The correlation between mean HAZ and mean tercile rankings for the CFI was even higher, at 0.81 (significant at the .01 level).

In comparing the patterns observed in Figures 17 and 18, three regions – Gambela, Affar and Somali – stand out from a general pattern of increasing levels of stunting with decreasing CFI scores. Among these three regions, two contain large nomadic populations; in Affar, 78 percent of rural households and 19 percent of urban households were reported to have “mobile roofs of nomads” (interviewer observation). Similarly, in Somali, 68 percent of rural households and 21 percent of urban households had “mobile roofs.” No other region had more than 2 percent of households with “mobile roofs.” Due to the high proportion of nomadic households, it is likely that these two regions differ in a number of ways from the others. Further analysis or local knowledge is needed to determine why Gambela seems to “break” the pattern.

Figure 17: Percentage of stunting by region, for children 6-36 months of age (Ethiopia DHS 2000)

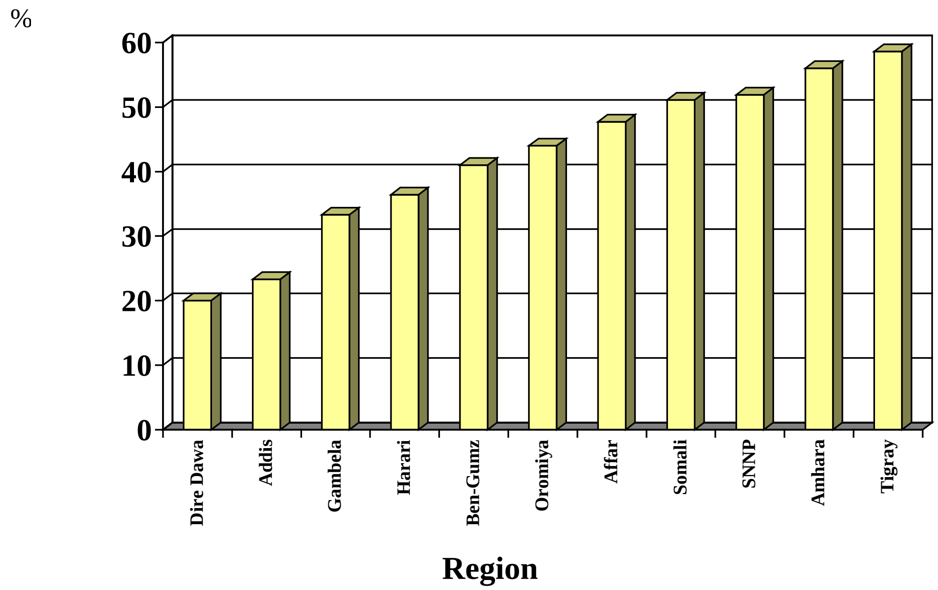
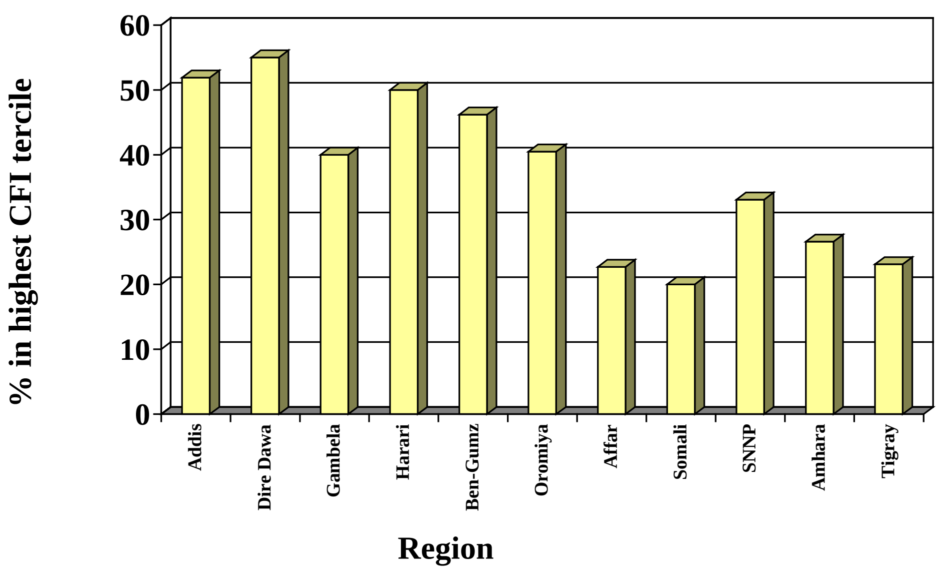


Figure 18: Percentage of children aged 6-36 months in the highest CFI tercile, by region (Ethiopia DHS 2000)



In sum, considering both the regional-level patterns and the differences between the capital, other cities, towns, and the rural areas, there appears to be an association between rates of stunting and the CFI terciles. The next sections present results of bivariate and multivariate analyses to specifically test the statistical significance and the magnitude of the association between infant/child feeding practices and nutritional status.

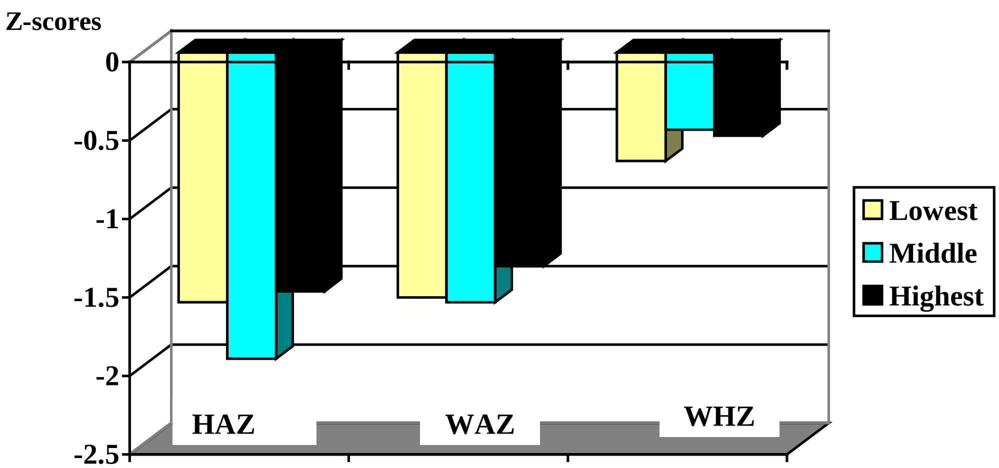
3.3 BIVARIATE ANALYSIS OF THE ASSOCIATION BETWEEN THE INFANT/CHILD FEEDING INDEX AND CHILD NUTRITIONAL STATUS

In this section we present results from bivariate analyses of the association between the child feeding index and child nutritional status. All three nutritional status indicators – height-for-age, weight-for-age, and weight-for-height, and both mean Z-scores and prevalence of stunting, underweight, and wasting are examined. The associations reported here will be further explored in the following section (3.4), where we present the results of multivariate analyses.

Results are presented separately for urban and rural areas; as will be shown, the index relates more consistently to outcomes in the rural areas. Figures 19 and 20 show the relationship between mean Z-scores and CFI terciles for children aged 12-26 months, in urban and rural areas, respectively.

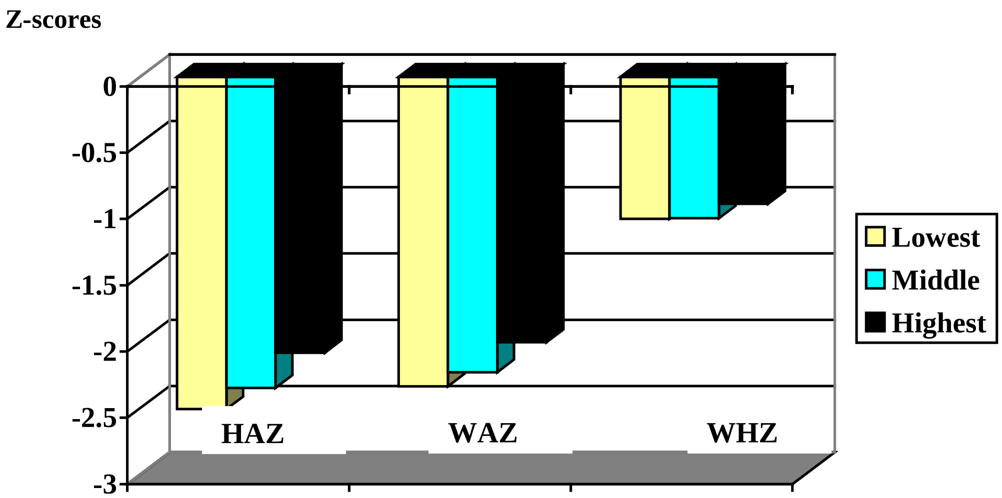
Figure 19 shows no statistically significant relationship between Z-scores and CFI terciles for urban children, for any of the three anthropometric indicators. The association between HAZ and CFI terciles in rural children (Figure 20), however, is statistically significant (ANOVA, $p < 0.05$), and shows a difference of approximately 0.43 Z-scores between the lowest and the highest CFI tercile. The size of the difference is within the range observed in the analysis of the Latin American DHS data (Ruel and Menon 2002); and is biologically meaningful.[14] Results for weight-for-age Z-scores (WAZ) are also statistically significant. No association was found between weight-for-height Z-scores (WHZ) and the child feeding index.

Figure 19: Mean Z-scores for three anthropometric indicators (height-for-age, weight-for-age and weight-for-height) by CFI tercile - <u>Urban Areas</u> (Ethiopia DHS 2000) (children 12-36 months)



[14] Differences in HAZ scores of this size have been associated with both short-term and long-term functional outcomes, especially cognitive development, fulfillment of intellectual potential, work capacity and reproductive performance, and are therefore considered biologically meaningful, or of functional significance (Martorell and Scrimshaw 1995).

Figure 20: Mean Z-scores for three anthropometric indicators (height-for-age, weight-for-age and weight-for-height) by CFI tercile – Rural Areas (Ethiopia DHS 2000) (children 12-36 months)



Figures 21 through 23 explore similar bivariate associations between the prevalence of stunting, severe stunting, and wasting, and the CFI terciles for children aged 12-36 months. In urban areas, only severe stunting is associated with the CFI in the expected direction. In rural areas, stunting, severe stunting, and wasting are each significantly associated with the CFI in the expected direction. Among rural children, the difference in stunting rates between the highest and lowest CFI tercile is approximately

Figure 21: Association between stunting prevalence and CFI tercile, by area of residence (Ethiopia DHS 2000) (children 12-36 months)

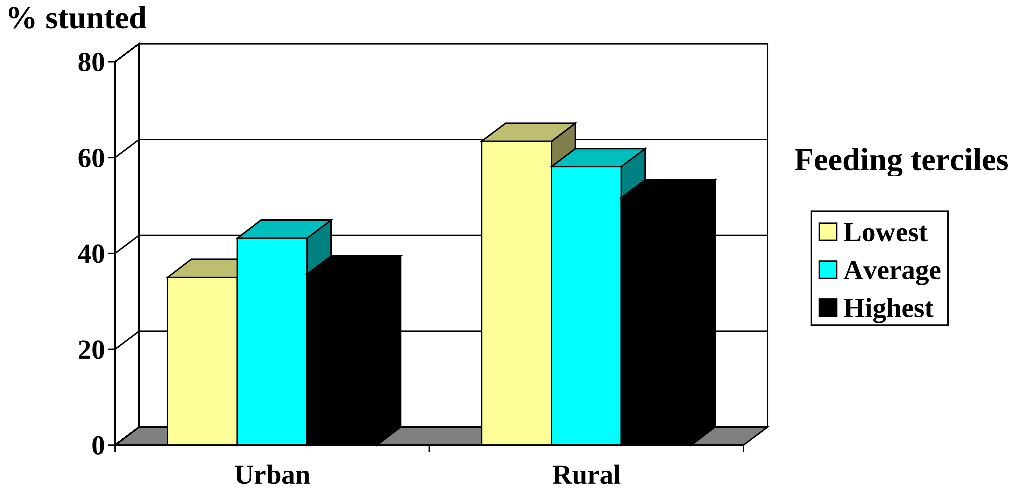


Figure 22: Association between prevalence of severe stunting and CFI tercile, by area of residence (Ethiopia DHS 2000) (children 12-36 months)

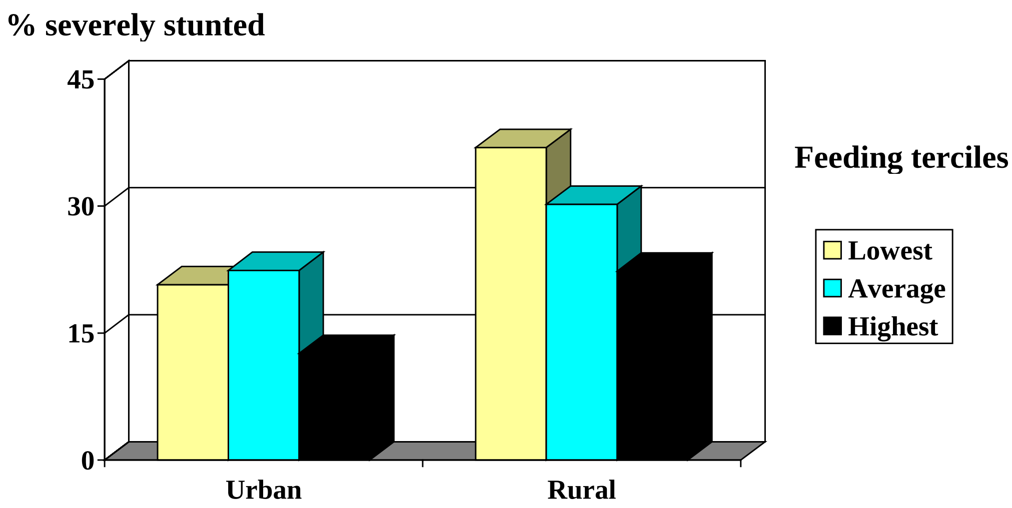
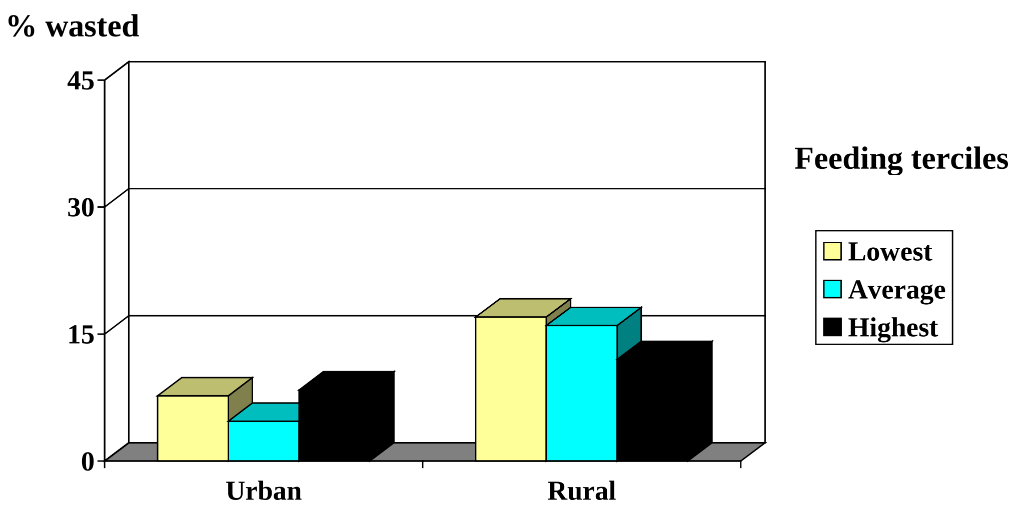


Figure 23: Association between wasting prevalence and CFI tercile, by area of residence (Ethiopia DHS 2000) (children 12-36 months)



12 percentage points; there is a 15 percentage-point difference in prevalence of severe stunting, and a 5 percentage-point difference in wasting.

In Section 3.5, we will "decompose" the index and look at bivariate associations between individual components of the index and Z-scores. This will also allow us to present some ideas as to why the index is more closely associated with growth outcomes in rural areas. Before decomposing the index, we will first report results of our multivariate analysis.

3.4 RESULTS OF MULTIVARIATE ANALYSIS

Ordinary least squares regression analysis was carried out to test whether the association between the CFI and HAZ remained when other determinants of child nutritional status were controlled for. An additional objective was to test two-way interactions between the CFI and the child, maternal, and household characteristics included in the model. The existence of two-way interactions would indicate that the magnitude of the association between CFI and the characteristic of interest (say, maternal education) varies according to the levels of this variable. So, in this example, if a two-way interaction between the CFI and maternal education was found, it would indicate that the association between CFI and maternal education is stronger for more or less educated mothers (depending on the sign of the coefficient).

The multivariate analysis confirms that the CFI is statistically significantly associated with HAZ even after controlling for a series of potentially confounding factors (Table 4 presents the regression coefficients and their statistical significance; Table 5 summarizes these findings and also shows results of analyses done separately for urban and rural areas). The joint test to determine whether the two dummy variables representing the CFI are statistically significant confirms that the association is highly significant ($p = 0.00$) in the overall model (Table 4). Not surprisingly, when models were run separately for urban and rural areas, the CFI was statistically significant only in the rural model. This finding is in line with results of bivariate analyses, which showed no association between the CFI and child anthropometry in urban areas.

The mean HAZ, adjusted for child age, maternal age, height, body mass index, education, parity, and household socioeconomic factors, show that the magnitude of difference between the lowest and the highest tercile of the CFI is similar to the size of the difference found in the bivariate analyses, although slightly reduced. The bivariate analyses (urban/rural combined) showed a difference in HAZ of 0.46 Z-scores between 12-36-month-old children in the lowest, compared to the highest tercile of the child feeding index. The multivariate analysis showed a slightly attenuated difference of 0.35 Z-scores. This suggests that at least some of the difference in HAZ found in the bivariate analysis between CFI terciles was due to the maternal and household socio-demographic factors included in the model.

Table 4: Ordinary least squares regression analysis of the determinants of height-for-age Z-scores among children aged 12-36 months (Ethiopia DHS 2000)

Independent variable	**Regression coefficient**	**P value**
Child age (18-24)	**-0.32**[a]	0.00
Child age (24-30)	**-0.12**	0.24
Child age (30-36)	**-0.29**	0.00
Child gender	-0.09	0.27
Mother's age	**0.33**	0.02
Mother's height	**0.04**	0.00
Mother's body mass index	0.04	0.07
Mother's education	0.04	0.11
Mother's partner's education	**0.03**	0.04
Parity	0.00	0.81
Attended 1-3 prenatal visits	-0.15	0.08
Attended 4+ prenatal visits	0.11	0.41
CHILD FEEDING INDEX (2ND TERCILE)	**0.10**[a]	0.19
CHILD FEEDING INDEX (3RD TERCILE)	**0.28**	0.00
Socioeconomic factor 1 (2nd tercile)	**0.20**[a]	0.02
Socioeconomic factor 1 (3rd tercile)	**0.20**	0.02
Socioeconomic factor 2 (2nd tercile)	**0.09**	0.26
Socioeconomic factor 2 (3rd tercile)	**0.17**	0.08
Number of children < 5 y	**-0.21**	0.00
Area of residence (urban/rural)	-0.12	0.45
Constant	-9.89	0.00
N	3056	
Number of strata	21	
Number of principal sampling units	525	
F	10.31	
R-square	0.12	

Note: Bolded coefficients are statistically significant ($p < 0.05$).

[a] Joint test for main effect is statistically significant. For example, child age has four categories, and therefore three dummy variables are included in the model. The joint test for main effect is the overall test, which determines the statistical significance of the three dummy variables for age. If significant, it means that age of the child is statistically significantly associated with HAZ. The same is true for all other similar variables that were included in the model as a set of dummy variables (pre-natal visits, the CFI, and the socioeconomic factors).

None of the two-way interactions between the CFI and the child, maternal, and household variables included in the model were statistically significant. It thus appears that the magnitude of differences in HAZ between feeding terciles is not conditioned by the level of any of the child, maternal, and household factors tested.

The other factors that were found to be statistically significantly associated with HAZ in the overall model (Table 4) were child age, maternal age and height, education of the mother's partner, household socioeconomic factors, and the number of children in the household younger than 5 years. These characteristics are typically found to be statistically significant in similar analyses of the determinants of child nutritional status

Table 5: Ordinary least squares regressions: Summary of significant factors in urban and rural models[a]

	Urban	Rural	All
Child age		-	+
Child sex			
Maternal age		+	+
Maternal height		+	+
Maternal BMI			
Parity			
Number of children under five years in household		-	-
Maternal education			
Partner's education	+		+
Number of antenatal care visits			
CHILD FEEDING INDEX		+	+
Socioeconomic (SES) factors		+	+

[a] The "+" indicates a positive regression coefficient, statistically significant (p<0.05), and the "-" indicates a negative, statistically significant regression coefficient. An empty cell means that the variable was not statistically significant. Note that the p-value for the SES factors in the urban model was 0.0510.

(Ruel and Menon 2002). Child gender, maternal education, maternal parity, body mass index, attendance at pre-natal visits (as a proxy for health care access) and area of residence were not statistically significantly associated with HAZ. The lack of statistical significance of "area of residence" was somewhat unexpected because large differences were found in nutritional status between urban and rural areas of this country. This suggests that a significant proportion of urban-rural differences can probably be explained by the variables that were included in the model, such as feeding practices, maternal education and socioeconomic factors.

3.5 DECOMPOSITION OF THE INFANT/CHILD FEEDING INDEX

The previous sections highlighted the potential usefulness of the CFI for summarizing infant and child feeding practices into one variable, which then can be used to carry out a variety of bivariate and multivariate analyses. This makes the CFI a potentially useful advocacy tool, because it allows users to illustrate graphically the magnitude of the association between infant/child feeding practices and child outcomes. However, if the CFI is to be used as a monitoring and evaluation indicator, the complexity of the index and its lack of transparency in regard to the variables it contains may be a drawback. For this purpose it may be more appropriate to look at the individual components of the index and to assess whether or not they change in response to the intervention.

In this section we "decompose" the index and examine the relationship between each component of the index and growth indicators. Our purpose in doing so is to gain insight into the following questions:

1. Which CFI components are driving the relationship between CFI scores and HAZ?
2. Could the index be simplified?
3. Why is the CFI index not associated with child nutritional status in the urban subsample?
4. Why is the association between the CFI and WHZ weak?

In order to answer these questions, we examined relationships between the two anthropometric indicators (mean HAZ and WHZ) and the following individual feeding practices:

- Whether the child is still breastfed
- Whether bottle was used in the last 24 hours
- Number of food groups the child consumed yesterday (eight possible food groups)
- 24-hour diversity score (three categories; see Table 1)
- Number of food groups consumed in the past 7 days (eight possible food groups)
- 7-day quasi-food frequency score (three categories; see Table 1)
- Number of times fed solids/semi-solids yesterday
- Feeding frequency score (three categories; see Table 1)

Each of these components was considered for all children 6-36 months, for urban and rural children separately, and also for each age group separately. Since both practices and mean Z-scores change with age, results are presented within selected age groupings where average Z-scores are more or less steady. Results for children aged 6-12 months were examined but are not presented here. Both practices and growth indicators change rapidly within this age group; for example, dietary diversity increases rapidly while Z-scores decline rapidly. Because of this, age is a strong confounder and interpretations of bivariate associations are particularly fraught.

As indicated in the descriptive analyses (section 3.1), HAZ and rates of stunting plateau after 12 months. For this reason, results are shown for the 12-36 month age group. In the case of weight-for-height, rates of wasting peak between 12-24 months and decline markedly thereafter. Therefore results are shown for ages 12-24 months.

3.5.1 Breastfeeding

Continued breastfeeding, which we consider to be a positive practice across all ages, is negatively associated with height-for-age Z-scores for children ages 12-36 months in the Ethiopia DHS sample. Since only 11 out of 801 infants aged 6-12 months had been fully weaned, we could not look at the association between breastfeeding and nutritional status in this age group.

A negative relationship between breastfeeding and Z-scores has been observed elsewhere, and there are a number of possible explanations (Brown, Dewey, and Allen 1998). The relationship may be confounded by socioeconomic status (*not* breastfeeding is often associated with higher socioeconomic status). An alternative explanation is that in some situations continued breastfeeding may be a maternal response to meet the needs of smaller, weaker children (Marquis et al. 1997).

Table 6 shows the size of the difference in HAZ observed in the Ethiopia sample. The difference in favor of *non*-breastfed children in HAZ is particularly pronounced in urban areas, reaching 0.8 Z-scores. In these urban areas, one or more of the explanations above may be relevant.

Table 6: Mean height-for-age Z-scores and mean age in months by breastfeeding status among children aged 12-36 months (Ethiopia DHS 2000)

Still breastfed?	Urban (n=477)		Rural (n= 2651)		All (n=3128)	
	HAZ	Age (mo)	HAZ	Age (mo)	HAZ	Age (mo)
Yes	-2.01	20.4	-2.40	21.0	-2.34	20.9
No	-1.20	26.7	-2.10	28.1	-1.88	27.7

In rural areas, an additional explanation relates to the average age of the children who are still breastfed as compared to those who are fully weaned. Table 6 also shows this difference in mean age. As see previously in Figure 2A, mean HAZ does decline *in rural areas* between 12 and 36 months. Therefore, the difference in mean HAZ between still breastfed and fully weaned children may be explained at least in part because the breastfed children are younger. That is, age confounds this comparison for rural children. However, this cannot explain the difference in urban areas, since HAZ does not decline after 12 months among these children (Figure 2B).
Lower mean WHZ is also associated with continued breastfeeding, particularly in urban areas among children aged 12-24 months (Table 7). These associations may also be explained by the socioeconomic influences and caring practices noted above. Age cannot confound these comparisons, as WHZ declines only very slightly across this age span.

Table 7: Mean weight-for-height Z-scores by breastfeeding status among children aged 12-24 months (Ethiopia DHS 2000)

Still breastfed?	Urban (n=248)	Rural (n= 1349)	All (n=1597)
Yes	-0.56	-1.14	-1.05
No	-0.01	-0.96	-0.63

The negative associations between breastfeeding and growth indicators provide a piece of the explanation as to why the CFI does not relate to growth indicators among urban children. Urban children are more likely to be weaned, and thus receive a lower breastfeeding score and a lower CFI score. Yet lower breastfeeding scores are associated with higher Z-scores, and this is particularly true in the case of urban children.

3.5.2 Bottle use

Results with respect to bottle use also provide a partial explanation of the lack of association between CFI scores and children's nutritional status in urban areas. Tables 8 and 9 illustrate this for children aged 12-24 months. Very few children over 24 months of age were given a bottle (34/1521), so results for children aged 24-36 months are not shown. In urban areas, 20 percent of the children aged 12-24 months were fed by bottle the previous day; 5 percent of rural children in this age group were fed by bottle the previous day.

Table 8: Mean height-for-age Z-scores by use of bottle among children aged 12-24 months (Ethiopia DHS 2000)

Bottle used?	Urban (n=248)	Rural (n=1349)	All (n=1597)
Yes	-1.13	-2.32	-1.74
No	-1.96	-2.30	-2.25

As with breastfeeding, a negative practice (bottle use) is strongly associated with higher HAZ among urban children aged 12-24 months. Note that there is no association between bottle use and HAZ among rural children in this age group.

Table 9: Mean weight-for-height Z-scores by use of bottle among children aged 12-24 months (Ethiopia DHS 2000)

Bottle used?	Urban (n=248)	Rural (n=1349)	All (n=1597)
Yes	-0.18	-0.74	-0.47
No	-0.50	-1.15	-1.05

Also as was the case with breastfeeding, the negative practice of bottle use is associated with higher WHZ among children aged 12-24 months. In the case of weight-for-height, the association is seen among both urban and rural children. However, bottle use is much more common among urban children. Therefore, these associations with bottle use also help explain the lack of association between WHZ and CFI scores, particularly among urban children. As is also the case with earlier weaning, bottle use is generally associated with higher socioeconomic status; better socioeconomic status is the most likely explanation for the higher Z-scores associated with bottle use.

3.5.3 Dietary diversity – 24-hour and 7-day recalls

In assessing associations between dietary diversity and Z-scores, four indicator variables were examined:

1. Number of food groups consumed yesterday,
2. 24-hour diversity score,
3. Number of food groups consumed in the last week,
4. 7-day quasi-food frequency score.

Dietary diversity is very strongly and positively associated with HAZ among rural children, regardless of which indicator is used. Dietary diversity is weakly associated with WHZ among rural children. As expected, since 24-hour and 7-day diversity are strongly correlated, associations with nutritional status indicators follow very similar patterns. For simplicity, Figures 24 through 27 show the relationship between nutritional status and the 7-day indicators (number of food groups in the last week, and the 7-day quasi-food frequency score). Only findings for rural children are presented because there were too few urban children in each category to give reliable results.
The difference in mean Z-scores between the extreme groups – children consuming no food groups as compared to 7+ in the previous week – is very large, at approximately 1.2 Z-scores. Figure 25 shows results for the quasi-food frequency score, which incorporates the number of days each food was given in the last week, and divides the observed distribution into terciles (see Table 1). When children are grouped in this way, the difference in mean Z-scores between the lowest and highest groups is still large, at 0.64 units.

Figure 24: Mean height-for-age Z-scores for rural children aged 12-36 months, by number of food groups eaten in the previous week (Ethiopia DHS 2000)

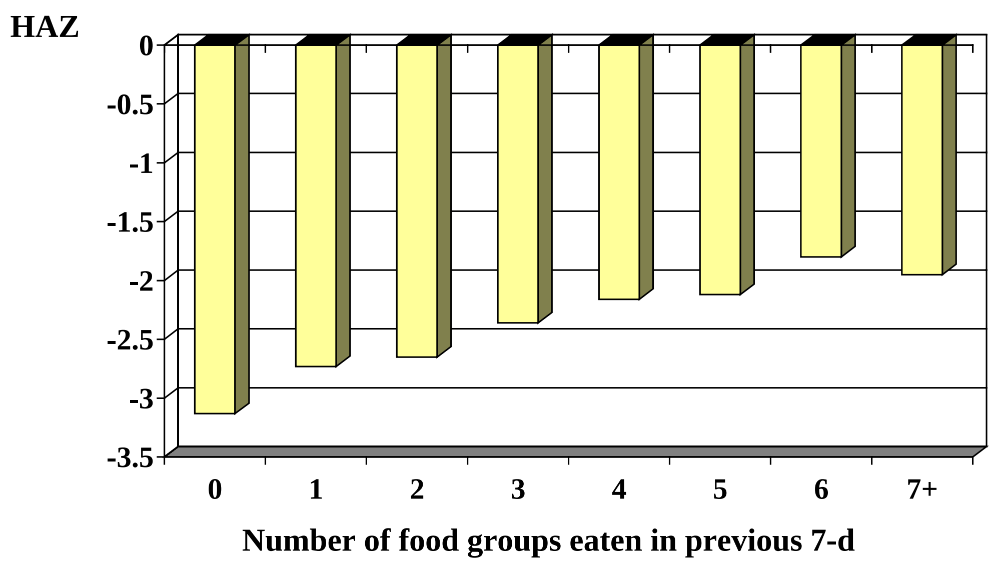
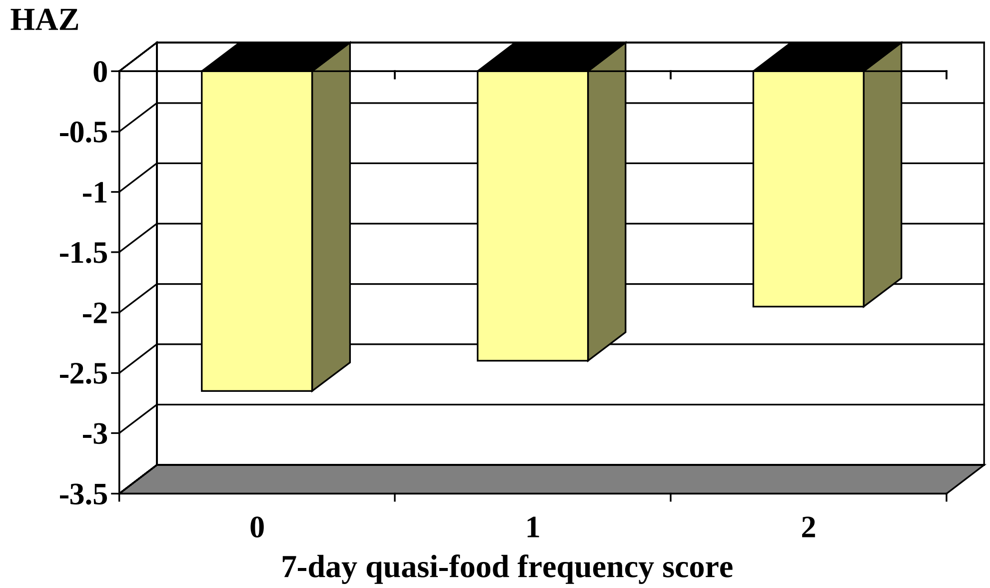


Figure 25: Mean height-for-age for rural children aged 12-36 months, by 7-day quasi-food frequency score (Ethiopia DHS 2000)



The next two figures show the much weaker associations for WHZ, using the 12-24 month age group.

Figure 26: Mean weight-for-height for rural children aged 12-24 months, by number of food groups eaten in the previous week (Ethiopia DHS 2000)

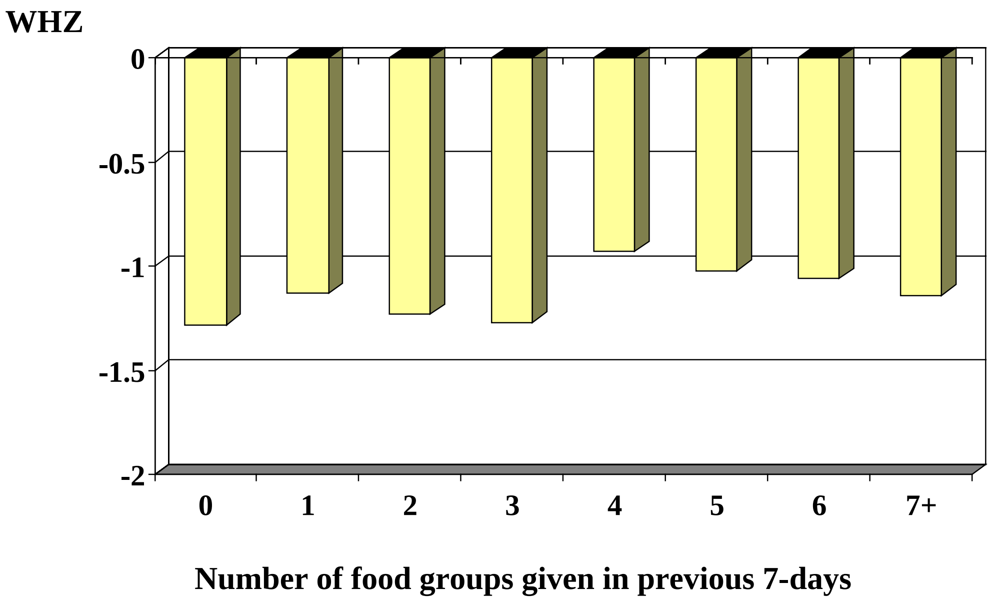
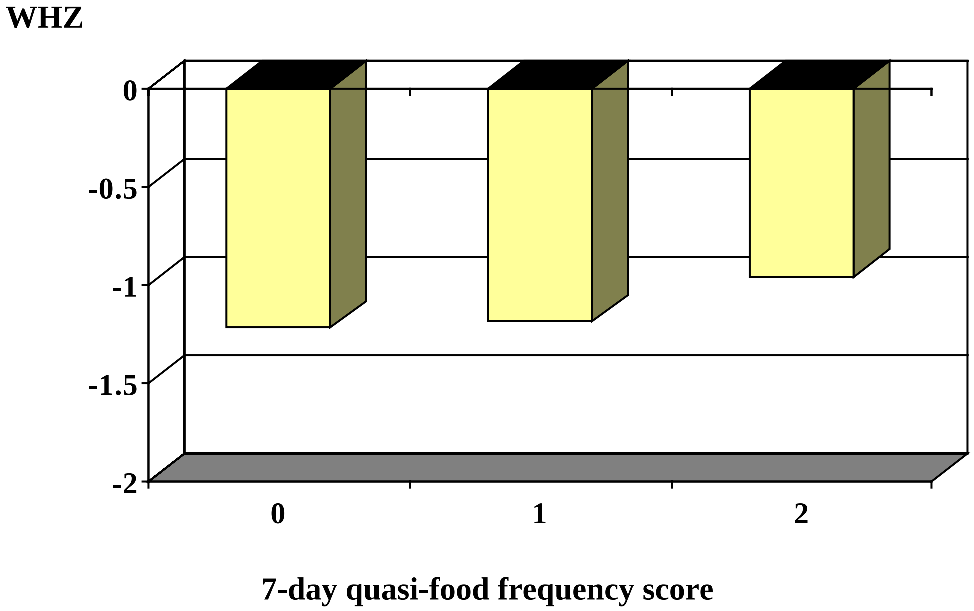


Figure 27: Mean weight-for-height for rural children aged 12-24 months, by 7-day quasi-food frequency score (Ethiopia DHS 2000)



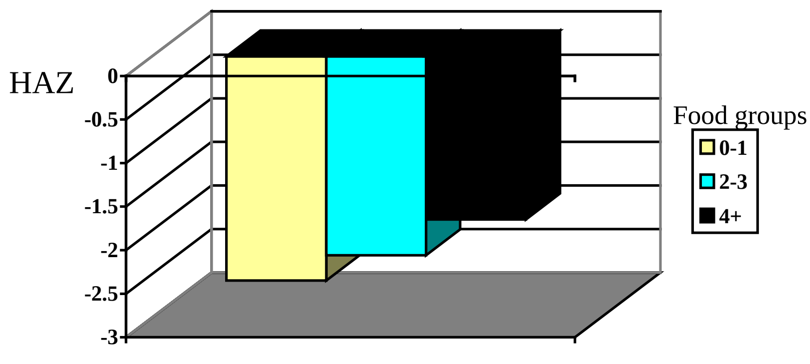
The pattern of changes in WHZ with increasing number of food groups eaten in the previous week is not consistent. Also, when the 7-day quasi-food frequency scores are used (Figure 27), the difference in mean WHZ between the lowest and highest group is small (0.26 Z-scores).
As indicated before, for urban children, sample sizes were too small to include all 8 categories. Even the 7-day quasi-food frequency score included too few children in some categories. To address this problem, the two lower categories of the 7-day quasi-food frequency score were combined (scores 0-1) and compared to the highest score (+2).

Among urban children aged 12-36 months scoring 0 or 1, the average HAZ was -2.05, compared to -1.47 among the children scoring +2 (a difference of 0.58, very similar to the difference of 0.64 units observed among rural children). When the mean weight-for-height Z-scores were compared for urban children aged 12-24 months, those scoring 0 or 1 had a mean Z-score of -0.86, as compared to -0.24 for children scoring +2.

In summary, among both rural and urban children, and irrespective of the indicator of dietary diversity used, there is a strong and positive association between dietary diversity and HAZ. The association with WHZ is significant and positive, but far weaker in the case of the rural children. It appears that the association between dietary diversity and HAZ may account in large part for the association between the CFI scores and HAZ, particularly since diversity is scored twice, from 0 to 2 for the 24-hour recall and from 0 to 2 for the 7-day recall.

One possible explanation for the strong association between dietary diversity and HAZ is that dietary diversity may act entirely as a proxy for socioeconomic status. In other words, it may be that children who are fed a higher number of food groups are children who are better off in terms of socioeconomic status, and thus also have better nutritional status. In order to verify this hypothesis, we tested whether the association between dietary diversity and HAZ remained after statistically controlling for the same range of potentially confounding factors as we examined in Section 3.5 for the CFI. The relationship remains very strong and significant when either 24-hour diversity or 7-day diversity is considered. In addition, as one would expect from the picture presented above, the relationship between diversity and HAZ is stronger than the relationship between the CFI and HAZ. Differences in adjusted mean HAZ between the lowest and highest diversity terciles among children aged 12-36 months are as high as 0.7 Z-scores (Figure 28).

Figure 28: Association between 24-hour dietary diversity (number of food groups) and height-for-age Z-scores (adjusted) among children aged 12-36 months (Ethiopia DHS 2000)



The final component of the index to be considered, frequency of feeding, may also contribute to the association, but not as strongly as the diversity indicators, as shown below.

3.5.4 Frequency of feeding solids and semi-solids

As with the diversity variables, results will be shown for 12-36 months for HAZ and 12-24 months for WHZ. For HAZ, similar patterns were seen among rural and urban children, so the Figures 28-29 show the association between frequency of feeding and HAZ for all children 12-36 months.

The difference in mean HAZ between the extreme groups is approximately 0.8 Z-scores when the eight categories are used (Figure 29). When the responses are grouped in four categories, the difference between extremes is 0.4 Z-scores (Figure 30). The association is strong and the size of the difference is once again of practical significance, though not as large as the difference observed for the extremes of diversity variables. Also, Figure 29 shows that HAZ does not increase smoothly with frequency of feeding. The suggestion of a decline in HAZ at frequencies above 4 or 5 (Brown, Dewey, and Allen 1998) was observed in a number of the subsets of the data we examined. It may reflect a situation where sick children or children with less appetite – and possibly poorer nutritional status–

are fed more often as a compensatory maternal behavior. Alternatively, as research suggests, excessive feeding frequency may displace breast milk intake and have a negative effect on growth.

Figure 29: Mean height-for-age for children aged 12-36 months, by frequency of feeding solids/semi-solids yesterday (Ethiopia DHS 2000)

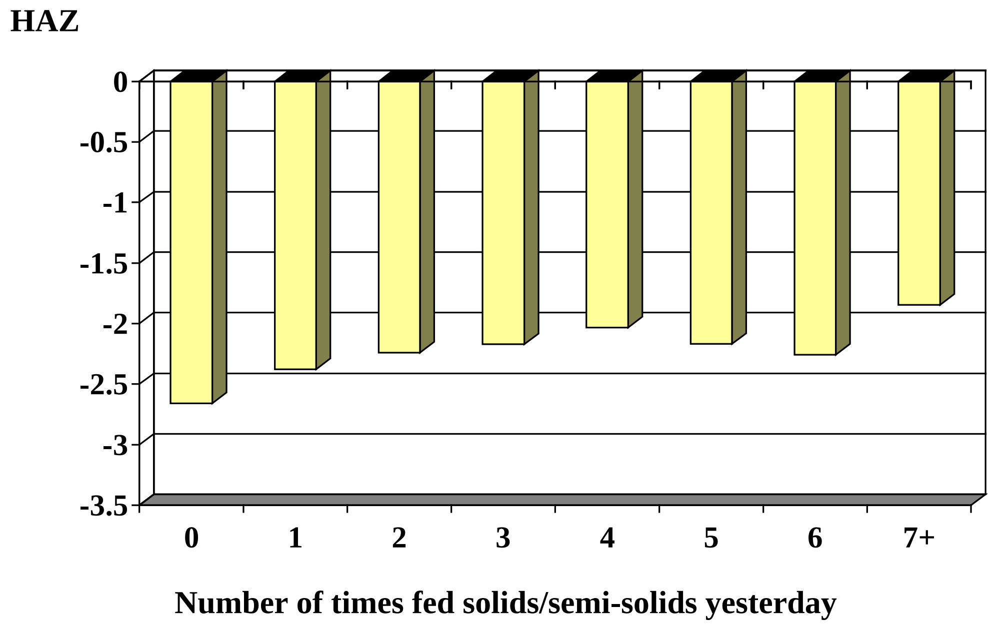
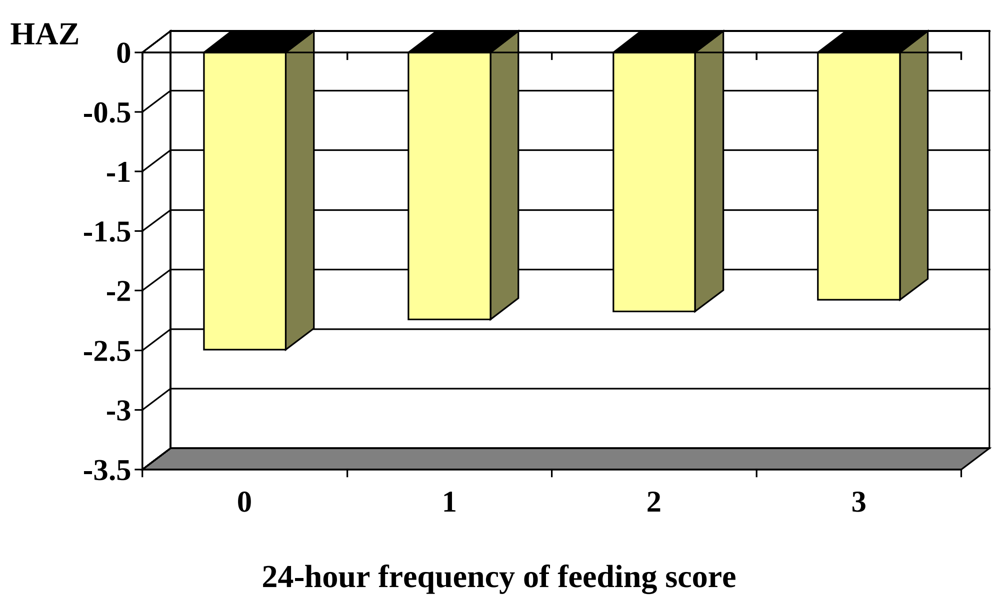


Figure 30: Mean height-for-age for children aged 12-36 months, by score for frequency of feeding (Ethiopia DHS 2000)



For WHZ, the picture is different for urban children than for rural children and thus, results are presented by area of residence. There is no association between frequency of feeding and WHZ among rural children, whereas a negative relationship is seen between frequency of feeding and WHZ among urban children. This is illustrated below in Figures 31-32. This negative association is hard to interpret.

3.5.5 Summary of "decomposition" exercise

At the beginning of this section we stated four questions; here we briefly summarize the insights gained relative to each.

1. Which CFI components are driving the relationship between CFI scores and HAZ?

Dietary diversity shows the strongest relationship with nutritional status, both because of the strength of the association, and also because diversity is counted twice in the index (once by the 24-hour diversity score and once by the 7-day quasi-food frequency score). Thus, diversity is clearly "driving" the association between the CFI and child nutritional status. Multivariate analyses confirmed that the association between dietary diversity and HAZ remains when socio-demographic factors are controlled for. Frequency of feeding is also significantly and positively associated with HAZ, but not with WHZ. Balanced against these strong positive relationships are the negative relationships between good practices and outcomes, which are observed in the case of breastfeeding and avoidance of bottle feeding.

Figure 31: Mean weight-for-height for children aged 12-24 months, by frequency of feeding solids/semi-solids yesterday (Ethiopia DHS 2000)

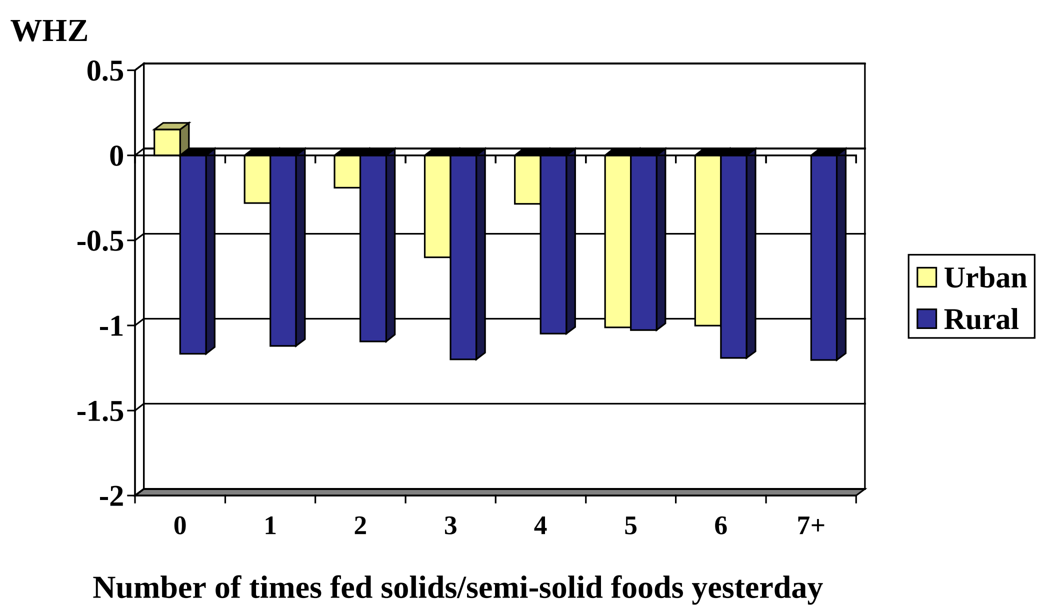
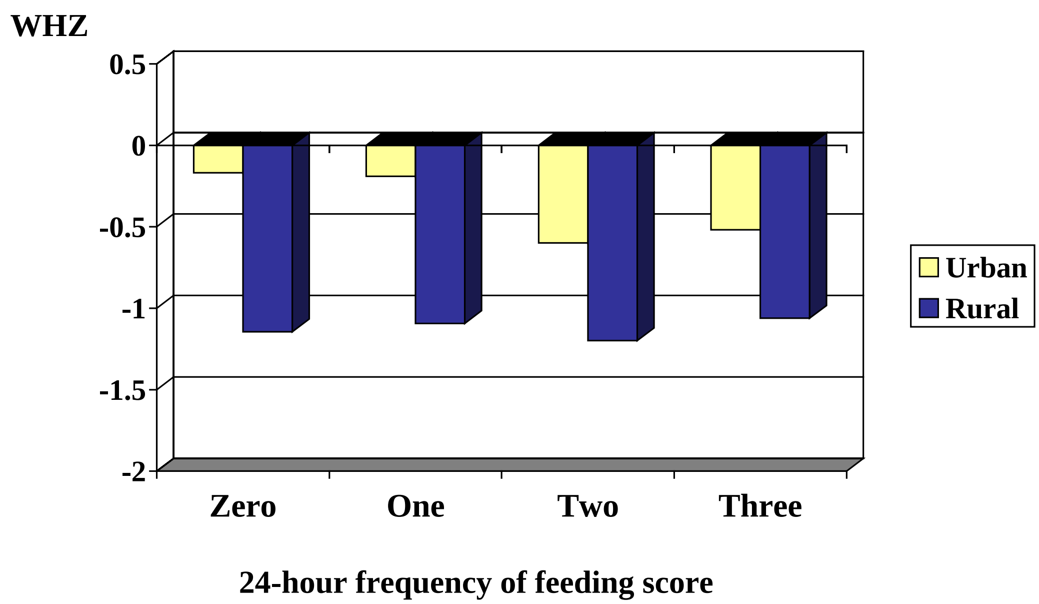


Figure 32: Mean weight-for-height for children aged 12-24 months, by score for frequency of feeding



2. Could the index be simplified?

The relationship between diversity indicators and child nutritional status is very similar whether 24-hour data or 7-day data are used. The index could be simplified by including one, rather than both of the sets of recall data.

3. Why is the CFI not associated with nutritional status in the urban subsample?

A significant portion of women in urban areas had weaned their children (31 percent, versus 20 percent of rural women), and a significant portion reported using bottles (21 percent, versus 6 percent of rural women). Thus, urban women were more likely to receive lower scores on these practices, but to have children with better nutritional status. It is likely that less breastfeeding and greater use of bottles in urban areas is associated with higher socioeconomic status (and possibly maternal education), which, in turn, is usually associated with better child nutritional status. Diversity scores are positively associated with Z-scores among both urban and rural women, but for urban children these positive associations are apparently balanced against the negative associations just described.

4. Why is the association between the CFI and WHZ weak?

The lack of a strong association between the index scores and WHZ cannot be explained by only one or two components of the index. With the exception of the diversity indicators, which had quite weak positive associations with WHZ, each component had either no association (breastfeeding and frequency of feeding, among rural children) or a negative relationship (breastfeeding and frequency of feeding among urban children, and bottle use among both urban and rural children).

While it is very likely that relationships between breastfeeding, bottle use, and growth indicators are confounded by socioeconomic differences, it is not clear why frequency of feeding is not positively associated with WHZ in the EDHS. It is also not clear why the relationship between diversity and HAZ is so much stronger than the relationship between diversity and WHZ. Illness certainly plays a role in determining weight-for-height, but the available variables (diarrhea, fever, and cough in the last two weeks) did not clarify the picture.

We will further discuss the usefulness and limitations of the index in the last section of the report. Next, we turn to a more detailed comparison of the 24-hour and 7-day recalls.

3.6 COMPARISON OF 24-HOUR AND 7-DAY RECALL RESULTS FOR INTAKE OF COMPLEMENTARY FOODS

The DHS+ offers a rare opportunity to compare results of varying length dietary recalls using nationally representative samples. Differences in estimates of exclusive breastfeeding for infants less than 6 months of age have already been discussed in section 3.1.5. For children aged 6-36 months, we made the following five-way comparison for each food group:

Proportion of children given the food group in the last 24 hours
Proportion of children given the food group in the last 7 days
Proportion of children given the food group 3 or more days in the last 7 days
Proportion of children given the food group 4 or more days in the last 7 days
Mean number of days children were given each food group*, as a proportion of 7 days*

We expected that more children would have received any given food group in the last week than in the last 24 hours. We also hypothesized that if both the 24-hour and the 7-day recall were valid (accurate), the proportion given any particular food group in the last 24 hours should have been similar to the last item listed above; that is, the mean number of days the food was received, as a proportion of 7 days. For example, if the average number of days children were given legumes was 3 days, this is 42 percent when 3 days is expressed as a proportion of 7 days. In this example, one would expect that approximately 42 percent of the children should have been given legumes the previous day, if both measures (24-hour and 7-day) were accurate, and if the previous day functions as a representative “sample” of the last week.

As expected, and as illustrated in Table 10, 7-day recalls do show a higher proportion of children receiving each food group than do the 24-hour recalls. The difference between the two types of recalls was smallest for staple foods (4 percent for grains) and was larger for foods more rarely eaten, ranging up to a 13 percentage point difference for legumes and nonmilk animal protein, and a 14 percentage point difference for fruits and vegetables. Proportions from 24-hour recalls came remarkably and consistently close to the proportion of children reported to receive each food group 3 or more days in the last 7 days; the 24-hour recall figures were 5-7 percentage points higher than the proportion of children given each food group 4 or more days.

Finally, proportions from the 24-hour recall were also consistently very close (differences of 0.5 percent to 4.3 percent) to the expected percentages (mean number of days each food group was given, as a proportion of 7 days). While the differences are quite small, they in all cases reflect higher proportions for the last 24-hours. This could reflect either slight over-reporting for "yesterday" or slight underreporting in the 7-day recall. In summary, in the EDHS 2000, the 24-hour recall seems to reflect the 7-day recall very well.

Table 10: **Comparing 24-hour and 7-day recalls for selected food groups (Ethiopia DHS 2000)**

Percent of children aged 6-36 months who received:	**Last 24 hours**	**Last 7 days**	**3 or more days in the last 7**	**4 or more days in the last 7**	**Mean number of days as a proportion of 7 days**
Grains	80	84	80	75	76
Roots/tubers	20	30	19	15	18
Legumes	49	62	50	43	45
Milk	31	38	33	30	31
Other animal protein [a]	16	29	15	9	13
Vitamin A-rich fruits or vegs [b]	13	24	12	8	11
Other fruits or vegetables	13	28	11	7	11
Foods made with oil or fat	44	53	43	37	40

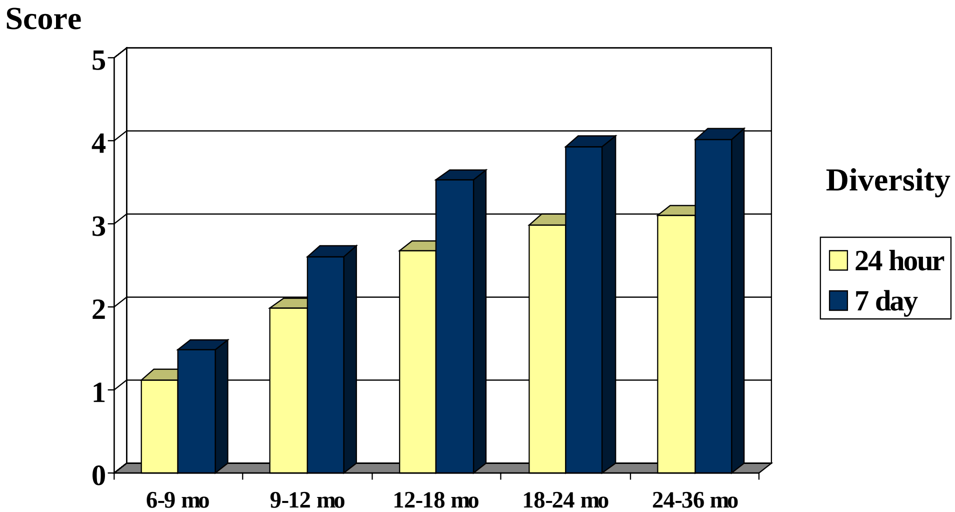
[a] In the EDHS 2000, the following animal protein foods were included in one category: meat, poultry, fish, eggs, cheese, yogurt. In the model DHS+ questionnaire, cheese and yogurt are in a separate category, and meat, poultry, fish, shellfish, and eggs are grouped together (ORC Macro, July, 2001).

[b] Similarly, in the model DHS+ questionnaire, green leafy vegetables are in a separate category from vitamin A-rich fruits (mango, papaya, other local vitamin A-rich fruits, or vitamin A-rich orange/red vegetables).

In addition to the comparisons above, we compared diversity variables based on the 24-hour recall and the 7-day recall. We compared the number of foods reported for each child (6-36 months) using the 24-hour recall with the number of foods reported over the last seven days. There were eight possible items (see Table 10), so each child could have been given 0 to 8 items the day before, and could have been given the same 0 to 8 items over the last 7 days. Figure 33 illustrates the difference in diversity between the two recalls.

As expected, the mean number of foods given the previous day among 6-36 month-old children was lower (2.7) than the number of food given within the past 7 days (3.5). The size of differences was similar across age groups (Figure 33), although it was somewhat smaller for the youngest age group (6-9 month-olds). The two variables were highly correlated (Pearson's and Spearman's correlations were each approximately 0.84).

Figure 33: Comparing 24-hour and 7-day recalls: Diversity by age group (Ethiopia DHS 2000)



Next, we created two ranking variables for the 24-hour and 7-day item scores, respectively. Because of the way the scores were distributed, they could not be neatly divided into terciles or quartiles. The following comparison was possible: low diversity (lowest 48 percent of the 24-hour scores, and lowest 52 percent of the 7-day scores); middle rank for diversity (middle 25 percent of 24-hour scores and middle 18 percent of the 7-day scores); highest diversity (highest 28 percent of 24-hour scores and highest 30 percent of 7-day scores). Using these low, middle, and high ranks, Table 11 illustrates the level of agreement in ranking, and shows that 71 percent of the cases were ranked identically by the two methods. Only 2 percent of the cases were ranked "low" by one method and "high" by another.

Table 11: Comparison of diversity rankings based on 24-hour and 7-day recalls (Ethiopia DHS 2000)

		Diversity ranking from 7-day recall		
		Low	**Middle**	**High**
Diversity ranking from 24-hour recall	Low	41%	4%	2%
	Middle	12%	8%	5%
	High	0%	6%	22%

Finally, we constructed two additional versions of the CFI, one including only the 24-hour diversity score, and one including only the 7-day quasi-food frequency score. All three versions were very strongly and significantly correlated, with correlation coefficients ranging from 0.94 to 0.96.

In the final section of the report, we will return to this comparison of the 24-hour and 7-day recalls and make recommendations concerning when the 7-day recall might be necessary. Next, in order to illustrate how the mean CFI score changes when practices change, we present a series of hypothetical scenarios.

3.7 SIMULATIONS TO ASSESS SENSITIVITY OF THE CFI TO CHANGES IN INDIVIDUAL PRACTICES

This section uses simulations to show how the CFI responds to various levels of change in individual practices, and thus to assess whether it can be a useful summary indicator to monitor progress. In this analysis, we use a CFI constructed from four component practices:

1) Continued breastfeeding,
2) Bottle use,
3) Frequency of feeding,
4) Dietary diversity, measured by 24-hour recall.

We use a diversity indicator derived from the 24-hour recall only – rather than including the indicator derived from the 7-day recall as well – because of the strong correlations between the two measures, as discussed in section 3.6. With these four component practices, the range of possible scores for the CFI is reduced from 0-9 (see Table 1) to 0-7.[15]

Before presenting the findings of the simulations, two caveats regarding the use of the CFI for program purposes need to be discussed:

Caveat 1: The CFI is only useful when programs address most or all of the four component practices: continued breastfeeding, bottle use, frequency of feeding, and diet diversity.

Some programs will not address all of these purely due to the nature of the program; others will choose not to address all four areas because of having “triaged” and selected either the worst problem practices and/or those most amenable to change. For example, if 90 percent of women breastfeed through 24 months at baseline, this is not likely to be a

[15] The Appendix also provides simulations using the EDHS 2000 “baseline” for both the full CFI as presented throughout this report (using both 24-hour and 7-day data) and for the simplified CFI, using only 24-hour data.

program focus (though one could argue that in order to prevent declines, breastfeeding promotion/support is important even here).

If most or all of the four components are not included in the program for whatever reason, then any positive change in one or two elements will be balanced by no change – or possibly even declines – in others, yielding small change in the CFI. Program managers must assess whether a summary indicator is useful when some components of the indicator are not addressed by the program.

Caveat 2: The magnitude of change possible in the CFI depends on baseline levels of each component.

Even if all four components of the CFI are addressed by the program, it is important to note that the potential for change in the CFI depends on the starting point for each indicator. If baseline levels leave little room for change (as in the example above of 90 percent continued breastfeeding), programs operating in this context will show smaller changes in the CFI than will equally effective programs operating where baseline levels leave more room for improvement. Thus comparisons *between* programs of *change* in the CFI are not really fair, unless they are made between programs that have similar baseline levels of the individual practices included in the index. Comparisons with a control group with similar baseline practices are fair, but these are rarely possible in the context of programs.

3.7.1 Simulations to illustrate changes in the mean CFI score when practices change

Simulations were performed very simply, by entering summary statistics (e.g., “percent of 12-36 month old children given bottle”) into a spreadsheet; spreadsheet formulas then yield the mean CFI score (see spreadsheets in the Appendix). Two different types of simulations were performed. One type used the EDHS 2000 data as a baseline, and the other a hypothetical baseline survey. For simplicity, only the hypothetical scenarios are presented here, and the EDHS 2000 examples are given in the Appendix.[16]

Using the hypothetical baseline, the mean CFI score was calculated for low program impact scenarios and high program impact scenarios. Low and high impact scenarios are described below. In defining low and high impact, actual changes in breastfeeding and complementary feeding that have been reported by PVOs were considered.[17] For programs lasting three to five years, the size of reported changes in practices ranged widely, from no change (or even declines in positive practices) up to very large percentage-point changes in the range of 20-40 percent. In our scenarios, we generally consider positive percentage-point changes of 5-10 percent (depending on the practice

[16] The method used is identical, but the hypothetical examples illustrate the simulations more simply and clearly, both because round numbers are used and because baseline levels allow more scenarios. The hypothetical baseline leaves more space for change (e.g., in continued breastfeeding) than does the EDHS “baseline,” and therefore illustrates high- and low-impact scenarios more clearly.

[17] Data provided by A. Swindale and P. Harrigan, FANTA Project.

and the baseline level) to represent low program impact and changes of 10-20 percent (depending on same) to represent high program impact.

In addition to low- and high-impact scenarios, which are intended to illustrate real-world possibilities, we also present one scenario where each practice in each age group changes by 5 percentage points. This last scenario is meant purely as a mathematical example of how the CFI score changes when practices change.

3.7.2 Low and high program impact scenarios, using a hypothetical baseline

For these examples we use a hypothetical survey of 900 children, 150 in the 6-9 month age group, 150 in the 9-12 month age group, and 600 in the 12-36 month age group.[18]

Continued breastfeeding:

Low baseline prevalence of continued breastfeeding for 6-12 month age-group (85 percent); moderate for 12-36 months (50 percent).

Low impact: Increases of 10 percent in each age group (e.g., increase from 85 percent to 95 percent).

High impact: Increase of 10 percent in 6-12 month group; 20 percent in 12-36 month group.

Bottle use:

Baseline prevalence of 20 percent 6-12 months, and 5 percent for 12-36 months.

Low impact: decrease of 5 percent in all age groups (e.g., decrease from 20 percent to 15 percent).

High impact: decrease of 10 percent in 6-12-month group; decrease to 0 in 12-36-month group.

24-hour food group diversity:

Since scores for this component are based on the population-specific distribution, the hypothetical baseline is 33.3 percent for each score in each age group.

Low impact: shift to lowest/middle/highest split = 20% / 40% / 40%.

High impact: shift to lowest/middle/highest split = 10% / 40% /50%.

Frequency of feeding:

Baselines differ by age group; baselines, low and high impact are shown in Table 12. Note that scores can range from 0 to 2 for the infants (6-9 months and 9-12 months), and from 0 to 3 for children 12-36 months.

[18] Hypothetical sample sizes by age group are needed because the spreadsheets calculate the mean CFI score as a weighted average of age-group specific means; see example spreadsheets in the Appendix for details.

Table 12: Frequency of feeding: Percent of children scoring 0, 1, 2 and 3 in baseline, low program impact, and high program impact scenarios by age group

	Prevalence of scores (% scoring 0 / 1 / 2 / 3)		
	Baseline	***Low impact***	***High impact***
6-9 mos	50 / 25 / 25	25 / 50 / 25	10 / 50 / 40
9-12 mos	20 / 60 / 20	10 / 60 / 30	10 / 50 / 40
12-36 mos	10 / 20 / 40 / 30	5 / 15 / 45 / 35	5 / 10 / 45 / 40

Table 13 shows the changes in CFI scores for eight hypothetical scenarios. All start with the baseline as described above; except for the last scenario, each assumes low or high program impact on some or all practices. The last scenario (#8) is a mathematical example of change in the CFI in response to a 5 percentage-point change in each practice. In this scenario, practices that have more than two possible scores (that is, frequency and diversity) are assumed to change by decreasing the percentage scoring “0” by 5 percent and increasing the percentage scoring “1” by 5 percent; there are no changes in the proportions scoring “2” or “3” in this scenario.

Table 13: Changes in mean CFI score for a range of hypothetical scenarios

	Level of impact						
	Continued breastfeeding	**Bottle use**	**Frequency of feeding**	**Food group diversity**	**Mean CFI score**	**Difference from baseline**	**% difference**
Baseline	---	---	---	---	4.36		
Scenario 1	Low	Low	Low	Low	4.95	0.59	14%
Scenario 2	High	High	High	High	5.37	1.01	23%
Scenario 3	Low	Low	None	None	4.54	0.18	4%
Scenario 4	High	High	None	None	4.62	0.26	6%
Scenario 5	High	High	Low	Low	5.03	0.67	15%
Scenario 6	High	High	High	None	4.97	0.61	14%
Scenario 7	Low	Low	High	High	5.28	0.92	21%
Scenario 8	5%	5%	5%	5%	4.57	0.21	5%

While not representing all possible combinations of impact on the various practices, scenarios 1 through 7 are meant to recognize that impact often varies between practices. Programs may have more success in changing some practices than in changing others or in changing all simultaneously. Some practices may depend “only” on changing cultural practices, while others depend both on this and on changes in access to food (e.g., changes in diversity).

The CFI score shown for Scenario 8 is nearly identical to a 5 percent increase over the baseline CFI score of 4.36 (4.36 + 5% is 4.575; the CFI as calculated from the spreadsheet with 5 percent changes in each practice is 4.574). This illustrates that in the hypothetical case where changes are equal across practices, the magnitude of change in the CFI score exactly reflects the percentage-point change in individual practices. When changes are not equal across practices, the change in the CFI represents a weighted summary of changes.

In real program contexts, baseline levels vary by practice and so do the sizes of reasonably achievable changes in practices. Also, note that our scoring system rewards changes in practices unequally; e.g., a change from a poorer to a better practice can mean a change of +1 (bottle use to no bottle), or up to +3 for a large change in frequency of feeding for older children.

Table 13 illustrates how all of these affect the size of the change in the CFI mean score. The low impact scenario results in a change of about 0.6 points in the mean CFI (corresponding to a 14 percent change from baseline), whereas the high impact scenario achieves a change of 1 point, or a 23 percent change from baseline. High impact on breastfeeding and bottle use coupled with low impact on feeding frequency and diversity yields a change in the mean CFI score (0.67 points, or a 15 percent change) that is very close to the low impact scenario. The "opposite" scenario – low impact on breastfeeding and bottle use and high impact on frequency and diversity – yields a larger change in the CFI (0.92 points, or 21 percent of baseline), close to the high impact scenario. This confirms the point made earlier about the effect that differences in baseline levels of the various component practices may have on the responsiveness of the indicator.

The simulations show that using this baseline, a change of approximately 0.6 in the CFI score indicates a low level of impact on all practices, and a change of approximately 1.0 would indicate a high level of impact on all practices. More generally, the percent change in the CFI score over the baseline CFI score represents an average of the changes in each practice.

The next and final section of this report provides a brief summary of the results of our analysis of child feeding practices in the EDHS 2000, an assessment of the potential usefulness of the CFI for a variety of purposes, and a set of specific recommendations for the selection of child feeding indicators for use in Ethiopia and for further research.

4. SUMMARY AND RECOMMENDATIONS

4.1 KEY FINDINGS

4.1.1 Descriptive results

Prevalence of both stunting and wasting is very high among Ethiopian children under three years of age, and is much higher among rural children than among urban children. Urban households differ from rural households on almost all socio-demographic characteristics measured; infant and child feeding practices differ between these households as well.

Examination of feeding practices reveals several very positive practices that should be protected and promoted. Rates of continued breastfeeding in the child's second and third year are relatively high. Rates of exclusive breastfeeding of infants under 6 months are also very high overall, and are higher among rural than among urban women. In Ethiopia, these are not unrealistic, unachievable ideal practices, but instead they are common practices that should be strongly encouraged.

In contrast to these positive practices, some other less optimal practices could be targeted for possible behavior change efforts. Bottle use is quite prevalent and is especially common in urban areas. Our analysis also suggests that many infants over six months are not receiving complementary foods. More than one-half of infants aged 6-9 months received no solids foods during the week before the survey, and this was a problem in both urban and rural areas. Dietary diversity is quite low, and average feeding frequency (number of meals and snacks) is lower than current recommendations. Diversity is substantially higher in urban than in rural areas across all age groups; frequency of feeding is also higher, but the urban-rural differences are smaller and also decline after 18 months of age.

4.1.2 Association between child feeding practices and nutritional status

The association observed between the CFI and HAZ is both statistically and practically significant, and remains so after statistical control for a range of maternal and household characteristics.

Among children 12-36 months of age, the difference in HAZ between children in the highest compared to the lowest CFI tercile is 0.46 HAZ-score units, a significant size effect. When socioeconomic and demographic factors are controlled for in multivariate analyses, the size of the effect between the two extreme CFI terciles is slightly attenuated (0.35), but it is still statistically significant and biologically important.

4.2 ASSESSMENT OF THE INFANT/CHILD FEEDING INDEX (CFI)

The CFI, which summarizes the child feeding data available in the Ethiopia DHS (EDHS), can be assessed relative to the three purposes we initially identified; that is, for making international comparisons; for summarizing and communicating associations between practices and anthropometric outcomes; and for monitoring and evaluation of programs and projects.

4.2.1 International comparisons

At this time, the lack of clear and specific international recommendations for several dimensions of child feeding constrains efforts to construct an index that could be used universally. In particular, in the absence of any recommendation on appropriate or optimal diversity over 24-hours or 7-days, we chose to use terciles derived from the observed distribution of food group diversity in the EDHS. For programs, this approach has the advantage of defining “high” diversity at a level that is clearly achievable for a significant proportion of the population (in contrast to a theoretical ideal, which may be unachievable). However, from the standpoint of developing an index useful for international comparisons, reliance on country-specific distributions for any dimension of the index is inappropriate. In order to use the index for international comparisons, the same cutoff points defining “low, average, and high” CFI must be used in each country. Until recommendations exist for optimal food group diversity, the selection of cutoff points will remain arbitrary and will lack the necessary basis for defining internationally appropriate cutoff points.

4.2.2 Linking feeding practices to outcomes

As was our experience in the analysis of Latin American DHS data, the CFI does usefully summarize associations between feeding practices and outcomes, and therefore has the potential to be used as a tool to communicate the importance of complementary feeding practices. This summary indicator can also be a useful analytic tool in modeling relationships between maternal and household resources and child feeding practices; the CFI can be used in multivariate analyses where it is possible to control for potentially confounding influences when describing associations.

4.2.3 Monitoring and evaluation

In the context of program (or project) monitoring and evaluation, clearly, individual indicators for each dimension of child feeding addressed by an intervention will be needed. Managers and staff need to measure progress in terms of change in specific, targeted practices. In the context of *monitoring*, indicators must also be simple, so that staff can rapidly gather, summarize, and interpret information. Even in a simplified form, the CFI does not meet this requirement.

In the context of *evaluation*, if program managers want to communicate some summary measure of change in practices a CFI may be useful. In order for an index score to be useful in this context, it must still be relatively simple to calculate and must also be sensitive to changes in practices of an achievable magnitude.

One possible way to simplify construction of the index would be to use only 24-hour food group diversity data. We observed very strong correlations between measures of 24-hour and 7-day diversity, and we also observed strong correlations between indices constructed with only 24-hour, only 7-day, and both 24-hour and 7-day diversity scores. Thus, the 7-day recall could be dropped because it is more time consuming and resource-intensive than the 7-day recall. Data for breastfeeding, bottle use, and frequency of feeding are relatively simple to collect, code, and use in index construction.

The issue of sensitivity to change in practices was addressed through illustrating changes in the mean CFI score for a number of different scenarios with different levels of change on each component practice. The CFI accurately reflects an average of the changes in individual practices.

We conclude that the CFI may be useful in a program context when:

- Programs are designed to change most or all component practices;
- Program managers are interested in a summary statistic to reflect overall progress towards improving feeding practices;

The CFI is *not* useful for programs when:

- Comparisons are needed between programs – or geographic areas – with differing baseline levels for individual practices
- Lack of change in one or more practices obscures successes in changing other practices.

4.3 METHODOLOGICAL ISSUES AND RECOMMENDATIONS FOR RESEARCH

Close analysis of the EDHS infant and child feeding data raised the following methodological issues for consideration and further research:

- The validity of the 24-hour recall question for frequency of feeding, and the relationship of frequency of feeding to growth indicators;
- The usefulness of the 7-day versus the 24-hour food group recall data;
- A range of issues concerning food group diversity indicators.

4.3.1 The frequency of feeding question

In the EDHS, there were fairly large discrepancies between the proportion of mothers who answered the feeding frequency question with “none,” and the proportion responding “no” to all individual solid food groups on the 24-hour food group recall. For example, looking at the 6-12 month age group where late supplementation is a concern, 54 percent of mothers responded “none” to frequency of feeding, suggesting that they had not fed the child any solids or semi-solid foods the previous day. On the other hand, only 44 percent responded “no” to the recall about whether or not they had given any of the food groups to the child the previous day. Conversely, only 2 mothers (< 0.5 percent) responded “no” to all foods listed but answered one or more for the frequency of feeding question.

These observations suggest that that frequency of feeding question may be problematically worded and/or poorly implemented (i.e., be subject to measurement error), and it would be useful to see if these results are common across the DHS in other countries. If it is true that the frequency of feeding data are subject to large measurement error, this could also contribute to the lack of clear association between frequency of feeding and growth indicators. It would also be useful to look at the shape of the relationship between frequency of feeding and growth in the DHS data across a range of countries, to examine whether or not there are negative associations at feeding frequencies higher than recommended (e.g., 6-7 times/day).

4.3.2 24-hour versus 7-day recalls for food groups

The usefulness of the 7-day food group recall as compared to (or in addition to) the 24-hour recall will depend on the specific objectives of the analysis. When precise estimates of the prevalence of exclusive or full breastfeeding are needed, the 7-day recall may be preferred. Similarly when precise estimates are needed for frequency of intake of food groups that are rarely consumed (e.g., vitamin A-rich fruits and vegetables, animal protein foods), the 7-day recall may also be preferred. However, even for these relatively rarely eaten foods, we found strong correlations between the 24-hour and the 7-day recalls (approximately 0.7 and 0.75 for animal protein foods and vitamin A-rich foods, respectively). Indicators of dietary diversity constructed from the two recalls were very tightly correlated, as were versions of the CFI that included the 24-hour recall, the 7-day recall, or both. It would be useful to assess if these very strong correlations are found across a range of DHS and other data sets where simple food group recalls are included. In particular, it would be useful to assess if the correlations remain as strong in countries where diets are commonly more diverse than are those described by the EDHS data.

4.3.3 Food group diversity indicators

Very little work has been published relating simple food group diversity indicators to nutrient adequacy or growth outcomes. We report very strong associations between simple food group diversity scores and HAZ, which remain after control for socioeconomic status. Other DHS data sets, as well as any other surveys that include similar indicators, should be examined in order to see if this can be widely observed and confirmed after controlling for SES. Much more work is also needed on the relationship between simple indicators of diversity and nutrient adequacy.

In the absence of international recommendations on diversity, we used the observed distributions of food group diversity in the EDHS to construct scores based on diversity terciles. The use of country-specific terciles makes any general use of this type of indicator inappropriate. It may be useful to examine the distribution of diversity of intake regionally to determine whether similar cutoff points would be appropriate in other countries. If so, the diversity score could be constructed in a similar fashion in various countries of a region, and regional comparisons between countries would be possible and useful.

4.4 RECOMMENDED CHILD FEEDING INDICATORS FOR USE IN ETHIOPIA

4.4.1 Breastfeeding and bottle use indicators

Exclusive breastfeeding is the key feeding practice for infants under 6 months. For infants aged 4-6 months, the EDHS data show a very wide gap between estimated prevalence based on the 24-hour recall, as compared to an estimate based on the 7-day recall. The estimates for infants under 4 months differ, but the difference is relatively small (about 5 percent).

When precise *estimates* are needed, a 7-day recall will give a much more accurate picture of the true prevalence of this practice, particularly in urban areas. When the purpose is to compare prevalence between two points in time, and precise estimates are not an issue, the 24-hour recall is adequate.

The very high prevalence of bottle use suggests not only the need to include questions on bottle use in surveys, but also the need to learn more about why women in Ethiopia choose the bottle, what liquids/semi-solids infants and children are given by bottle, and under what sanitary conditions. In projects that address early feeding practices, good understanding of local knowledge and attitudes about bottle use will be important. Regardless of whether or not bottle use is included in the construction of a summary child feeding indicator, as with exclusive breastfeeding, it will be important to track prevalence of bottle use as a single indicator. If a seven-day recall is used,[19] it would be useful to ask about bottle use over the last week, as well as or instead of use in the last 24 hours.

4.4.2 Food group diversity indicators

We recommend that either a 24-hour food group recall or a 7-day food group recall be used as a proxy indicator of diet quality in Ethiopia. Although maintaining the food group list from the EDHS may be desirable for comparative purposes, the model DHS+ list is preferable from the standpoint of nutrition information (in the model DHS+ questionnaire, infant formula is separated from "other milk," dairy foods are separated from other animal protein, and vitamin A-rich fruits are separated from vitamin A-rich vegetables).[20] When the objective is to assess diversity, the 24-hour recall is as useful as

[19] We are not suggesting a 7-day recall is needed for bottle use; rather, if a 7-day recall is performed motivated by some other data need, the question about bottle use could be included.

[20] The EDHS questions differ from the Model DHS+ questions in part because the EDHS occurred during a transitional period between the DHS III round and the DHS+ round (per Dr. A. Mukuria, personal communication).

the 7-day recall. When a clear picture of effective access (by young children) to specific high quality foods is needed, the 7-day recall is more informative.

4.4.3 Frequency of feeding indicators

The possibility of measurement error in this indicator has already been discussed. The EDHS question on frequency of feeding was developed through a long and thorough process, so it would be worthwhile to focus on how the question is asked and how follow-up probes are used in the field. When 24-hour recall data are available from the same survey, it is useful to triangulate on the issue of no solids yesterday, in order to get a sense of the possible error in the frequency question. Despite the possible measurement error, this question is very useful and it should be used in future surveys in its current form.

4.4.4 Summary indicators

The potential usefulness of the CFI has been summarized; clearly at this time, the CFI cannot be used for international comparisons, and its usefulness to programs lies mainly in its potential to summarize changes in a range of child feeding practices. In this summary form, it can show differences between geographic areas and between two points in time.

APPENDIX

Section 3.7 described changes in the CFI score for a number of different scenarios, using a hypothetical baseline, and using a simplified CFI (excluding 7-day quasi-food frequency score). In this Appendix, we first present four scenarios using the EDHS 2000 as a baseline, and then provide several example spreadsheets showing how the CFI score was calculated for these scenarios, as well as for selected scenarios presented earlier in Section 3.7.

The four scenarios using the EDHS data are:

- Low impact on all indicators; "original" CFI with both 24-hour and 7-day components
- High impact on all indicators; "original" CFI with both 24-hour and 7-day components
- Low impact on all indicators; simplified CFI with only 24-hour recall
- High impact on all indicators; simplified CFI with only 24-hour recall

Table A1 illustrates the changes in the CFI mean score for each of these scenarios; "low" and "high" impact are further described below.

Table A1 Changes in CFI mean score using EDHS 2000 as a baseline

	Mean CFI score using 24-hour and 7-day recall data	Mean CFI score using only 24-hour data
Baseline (EDHS 2000)	5.76	4.61
Low impact scenario	6.35	5.05
High impact scenario	6.84	5.40

Limiting the CFI to the 24-hour data decreases the range and spread of scores from 0-9 to 0-7, and also decreases the absolute difference observed after changes in practices. Since the units for the CFI are totally arbitrary, the absolute size of the change is not important. Using the 2nd column above we can say that when using this baseline, a change in the CFI (24-hour data only version) of about 0.4 is associated with some impact, and a change of 0.8 or more with a strong impact. Expressed another way, there is a 9.5 percent change in the mean CFI score in the low impact scenario, and a 17 percent change in the mean CFI score in the high impact scenario.

The next paragraphs describe the low and high impact scenarios used to calculate changes in the mean CFI score using the EDHS 2000. Several example spreadsheets follow (one for the low impact EDHS scenario, and several for the hypothetical scenarios discussed in Section 3.7).

Continued breastfeeding:

Note that rates for 6-9 and 9-12 months cannot be improved upon (already 98 percent).

Low-impact scenario
For 12-36-month age group, an increase in continued breastfeeding from 67 percent to 72 percent.

High-impact scenario
For 12-36-month age group, an increase in continued breastfeeding from 67% to 77%.

Bottle use:

Low-impact scenario
For all three age groups, a decrease in prevalence of 5%:

6-9 months:	18.5% down to 13.5%
9-12 months:	15.2% down to 10.2%
12-36 months:	6.3% down to 1.3%

High-impact scenario
For all three age groups, a decrease in prevalence of 10% (or to 0).

6-9 months:	18.5% down to 8.5%
9-12 months:	15.2% down to 5.2%
12-36 months:	6.3% down to 0%

24-hour food-group diversity:

Low-impact scenario
Decrease of 10% in lowest score for each age group; spread this across upper two scores so that there is a 5% increase in the middle score and a 5% increase in the upper score. For example, for infants aged 9-12 months, this represents:
A decrease from 19% to 9% in the proportion given none of the food groups;
An increase from 49% to 54% in the proportion given one or two food groups; and
An increase from 32% to 37% in the proportion given three or more food groups.

High-impact scenario
Decrease of 20% in lowest score for each age group (or decrease to 0); spread this across upper two scoring groups so that there is an increase in the middle group and a 10% increase in the upper group. For example, for infants aged 9-12 months, this represents:
A decrease from 19% to 0% in the proportion given none of the food groups;
An increase from 49% to 58% in the proportion given one or two food groups: and
An increase from 32% to 42% in the proportion given three or more food groups.

Frequency of feeding, last 24 hours:

Low-impact scenario

As above, a decrease of 10% in the prevalence of the lowest score, with increases of 5% in each of the middle and highest scores. For 12-36 month age group (where there are four possible scores) a decrease of 10% in the lowest score (0), spread across scores 1, 2, and 3. Using the 9-12 month age group as an example again, this would mean:

A decrease from 36% to 26% in the proportion not given any solids/semi-solids;
An increase from 37% to 42% in those fed solids/semi-solids once or twice; and
An increase from 27% to 32% in the proportion fed three or more times.

High-impact scenario

A decrease of 20% in the prevalence of the lowest score (or to 0), with increases in each of the middle and highest scores. For 12-36-month age group (where there are four possible scores) a decrease to 0% in the lowest score (0), decrease to 15% (from baseline 19%) in those scoring “1” and increases spread across scores 2 and 3. Using the 9-12 month age group as an example again, this would mean:

A decrease from 36% to 16% in the proportion not given any solids/semi-solids;
An increase from 37% to 47% in those fed solids/semi-solids once or twice; and
An increase from 27% to 37% in the proportion fed three or more times.

7-day quasi-food group frequency:

Low-impact scenario

As with 24-hour food group diversity, a decrease of 10% in the lowest score for each age group, with increases of 5% in each of the middle and upper scores.

High-impact scenario

A decrease of 20% (or to 0) in the lowest score for each age group, with increases in each of the middle and upper scores (10% in top score and balance in the middle).

CHILD FEEDING INDEX - Calculating scores from summary statistics
EDHS 2000 baseline, low impact scenario with both 24-hour and 7-day data

		6 to 9 months				9 to 12 months				12-36 months		
		Proportion	Score	Prop * score		Proportion	Score	Prop * score		Proportion	Score	Prop * score
Proportion still BF												
Score 1										0.716	1	0.716
Score 2		0.979	2	1.958		0.984	2	1.968				
Proportion NO bottle												
Score 1		0.865	1	0.865		0.898	1	0.898		0.987	1	0.987
24 hr diversity												
Score 0	No groups	0.265	0	0	No groups	0.089	0	0	0-1 groups	0.069	0	0
Score 1	1 group	0.406	1	0.406	1-2 groups	0.543	1	0.543	2-3 groups	0.594	1	0.594
Score 2	2+ groups	0.33	2	0.66	3+ groups	0.368	2	0.736	4+ groups	0.337	2	0.674
24 hr freq of feeding												
Score 0	0 times	0.6	0	0	0 times	0.257	0	0	0-1 times	0.029	0	0
Score 1	1 time	0.116	1	0.116	1-2 times	0.421	1	0.421	2 times	0.215	1	0.215
Score 2	2+ times	0.283	2	0.566	3+ times	0.322	2	0.644	3 times	0.361	2	0.722
Score 3									4+ times	0.395	3	1.185
7 day diversity score												
Low	Score 0	0.207	0	0	Score 0-1	0.09	0	0	Score 0-3	0.081	0	0
Middle	Score 1-2	0.398	1	0.398	Score 2-4	0.491	1	0.491	Score 4-6	0.52	1	0.52
High	Score 3-14	0.396	2	0.792	Score 5-14	0.419	2	0.838	Score 7-14	0.399	2	0.798
	Mean score for 6-9 months			5.761	Mean score for 9-12 months			6.539	Mean score for 12-36 months			6.411
				(sum of column)				(sum of column)				(sum of column)
# of kids 6-9 months	437											
# of kids 9-12 months	375											
# of kids 12-36 months	3128											
Mean score for all	6.3510888	(weighted average of the three age group scores)										

CHILD FEEDING INDEX - Calculating scores from summary statistics
Baseline for hypothetical scenarios

		6 to 9 months				9 to 12 months				12-36 months		
		Proportion	Score	Prop * score		Proportion	Score	Prop * score		Proportion	Score	Prop * score
Proportion still BF												
Score 1										0.5	1	0.5
Score 2		0.85	2	1.7		0.85	2	1.7				
Proportion NO bottle												
Score 1		0.8	1	0.8		0.8	1	0.8		0.95	1	0.95
24 hr diversity												
Score 0		0.333	0	0		0.333	0	0		0.333	0	0
Score 1		0.333	1	0.333		0.333	1	0.333		0.333	1	0.333
Score 2		0.333	2	0.666		0.333	2	0.666		0.333	2	0.666
24 hr freq of feeding												
Score 0	0 times	0.5	0	0	0 times	0.2	0	0	0-1 times	0.1	0	0
Score 1	1 time	0.25	1	0.25	1-2 times	0.6	1	0.6	2 times	0.2	1	0.2
Score 2	2+ times	0.25	2	0.5	3+ times	0.2	2	0.4	3 times	0.4	2	0.8
Score 3									4+ times	0.3	3	0.9
	Mean score for 6-9 months			4.249 (sum of column)	Mean score for 9-12 months			4.499 (sum of column)	Mean score for 12-36 months			4.349 (sum of column)
# of kids 6-9 months	150											
# of kids 9-12 months	150											
# of kids 12-36 months	600											
Mean score for all	4.3573333	(weighted average of the three age group scores)										

CHILD FEEDING INDEX - Calculating scores from summary statistics
Hypothetical scenario #5: High impact on breastfeeding and bottle use, low impact others

		6 to 9 months				9 to 12 months				12-36 months		
		Proportion	Score	Prop * score		Proportion	Score	Prop * score		Proportion	Score	Prop * score
Proportion still BF												
Score 1										0.7	1	0.7
Score 2		0.95	2	1.9		0.95	2	1.9				
Proportion NO bottle												
Score 1		0.9	1	0.9		0.9	1	0.9		1	1	1
24 hr diversity												
Score 0		0.2	0	0		0.2	0	0		0.2	0	0
Score 1		0.4	1	0.4		0.4	1	0.4		0.4	1	0.4
Score 2		0.4	2	0.8		0.4	2	0.8		0.4	2	0.8
24 hr freq of feeding												
Score 0	0 times	0.25	0	0	0 times	0.1	0	0	0-1 times	0.05	0	0
Score 1	1 time	0.5	1	0.5	1-2 times	0.6	1	0.6	2 times	0.15	1	0.15
Score 2	2+ times	0.25	2	0.5	3+ times	0.3	2	0.6	3 times	0.45	2	0.9
Score 3									4+ times	0.35	3	1.05
	Mean score for 6-9 months			5 (sum of column)	Mean score for 9-12 months			5.2 (sum of column)	Mean score for 12-36 months			5 (sum of column)
# of kids 6-9 months	150											
# of kids 9-12 months	150											
# of kids 12-36 months	600											
Mean score for all	5.0333333	(weighted average of the three age group scores)										

CHILD FEEDING INDEX - Calculating scores from summary statistics
Hypothetical scenario #8: Five-percentage point change from baseline for each practice
For scores with three or four levels, 5% fewer score 0 and 5% more receive the next higher score (i.e., move from 0 to 1)

		6 to 9 months				9 to 12 months				12-36 months		
		Proportion	Score	Prop * score		Proportion	Score	Prop * score		Proportion	Score	Prop * score
Proportion still BF												
Score 1										0.55	1	0.55
Score 2		0.9	2	1.8		0.9	2	1.8				
Proportion NO bottle												
Score 1		0.85	1	0.85		0.85	1	0.85		1	1	1
24 hr diversity												
Score 0		0.283	0	0		0.283	0	0		0.283	0	0
Score 1		0.383	1	0.383		0.383	1	0.383		0.383	1	0.383
Score 2		0.333	2	0.666		0.333	2	0.666		0.333	2	0.666
24 hr freq of feeding												
Score 0	0 times	0.45	0	0	0 times	0.15	0	0	0-1 times	0.05	0	0
Score 1	1 time	0.3	1	0.3	1-2 times	0.65	1	0.65	2 times	0.25	1	0.25
Score 2	2+ times	0.25	2	0.5	3+ times	0.2	2	0.4	3 times	0.4	2	0.8
Score 3									4+ times	0.3	3	0.9
	Mean score for 6-9 months			4.499 (sum of column)	Mean score for 9-12 months			4.749 (sum of column)	Mean score for 12-36 months			4.549 (sum of column)
# of kids 6-9 months	150											
# of kids 9-12 months	150											
# of kids 12-36 months	600											
Mean score for all	4.574	(weighted average of the three age group scores)										

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