

Measuring Childcare Practices

Approaches, Indicators, and Implications for Programs

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and
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Food Policy
Review **6**

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Foreword

Malnutrition afflicts nearly 170 million preschool children in developing countries, or every third child under the age of five. It plays a role in more than half of all preschooler child deaths—over 5 million preventable deaths per year. Those who survive often fail to achieve their full mental and physical potential. The scourge of child malnutrition undermines both economic growth and equity.

Neither sufficient food in the community nor sufficient food in the household ensures that vulnerable young children will be adequately nourished. In addition to access to food, young children need a healthy and sanitary environment and nurturing care. The first two to three years of life are now recognized as a critical window of opportunity for interventions to ensure child survival, health, and development. It is during these very early years of life that care and feeding practices can determine who survives and who thrives.

Well-nourished and well-nurtured children grow and develop physically, cognitively, emotionally, and socially. They are more likely to do well in school and to fully develop their potential to contribute to national development than are poorly nourished or poorly nurtured children. Failure to protect and ensure child survival and development entails many costs for families, communities, and nations.

Globally, both governments and nongovernmental organizations are engaged in a variety of programs directed toward ensuring child survival and development. IFPRI's research on nutrition and household welfare contributes to these goals. But in order to monitor progress and evaluate the effectiveness of nutrition programs, staff need simple indicators to assess improvements in child care and feeding. The adoption of such indicators will facilitate the formulation and implementation of national nutrition strategies based on best practices in child survival and development.

With a strong focus on methodology, the authors of this review bridge a gap between researchers and technical program staff by describing program measurement approaches, problems, and solutions. The authors also highlight the simpler measurement methods and indicators without sacrificing measurement validity. The immediate aim of this work is to offer practical suggestions to enhance monitoring and evaluation of child nutrition programs. Ultimately, this can contribute to the overarching goals of accelerating progress in eradicating child malnutrition and achieving the Millennium Development Goal of cutting child mortality by two-thirds by 2015.

Joachim von Braun
Director General

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Summary

The role of care as a critical influence on child nutrition, health, and development has received increasing attention in the last decade. The role of care has been well elaborated at the conceptual level, but we still lack simple, valid, and reliable tools to measure many aspects of care. *Simple* methods and tools are particularly essential for use in the context of surveys and intervention programs. In this review, experience with the measurement of selected childcare and feeding practices is summarized and implications for programs are discussed. The focus is on identifying the simplest yet most valid and reliable methods and indicators to measure hygiene practices, child-feeding practices, and caregiver–child interactions during feeding. Program-relevant solutions to the methodological problems identified are highlighted throughout the review.

Continuous Monitoring Observations

Continuous monitoring (CM) observations—the systematic recording of practices by passive observers—are considered the gold standard approach for measuring the three types of behaviors reviewed. CM allows collection of detailed information on a particular area of behaviors and is also suitable for the simultaneous recording of information on more than one set of behaviors. CM observations, however, are highly time- and resource-intensive; thus they are not suitable for most survey and program applications. CM observations are also susceptible to biases from reactivity—to people behaving differently in the presence of an observer—and to normal day-to-day variability. The most effective way to reduce these problems is to repeat the observation on two or more days.

Spot-Check Observations

For the measurement of hygiene practices, this review suggests that spot-check observations are probably the second-best approach after CM. This method is particularly promising because it appears to be less reactive than CM, it is much faster to administer and thus less costly, and it appears to require less training time to achieve acceptable levels of standardization of observers. The method still needs to be validated, however, to determine whether it accurately reflects the behaviors it intends to measure.

Recall Methods

Recall methods appear to be the best alternative to CM observations currently available for measuring child-feeding practices in survey and program contexts. These methods, though widely used, have not been sufficiently validated to date. The main threat to the validity of recall methods is recall bias, which results in systematic error similar to the effect of reactivity. This problem is particularly acute when there is general knowledge of what are considered “good practices” in the population surveyed. This often leads to a systematic overreporting of positive practices, which may be particularly severe following successful education or communication interventions to modify these specific practices. Although this problem is difficult to address, suggestions are made on how to minimize it.

For the measurement of caregiver–child interactions during feeding, CM observations continue to be the method of choice. Experience with survey methods to measure these complex interactions is extremely scarce, and their potential for this purpose needs to be explored further. One exception is the measurement of child appetite. Maternal perceptions of child appetite have been assessed in a number of research contexts, using a variety of simple methods. Experience with a simple visual analogue approach to measure appetite suggests that it may be a useful tool, at least to assess recent appetite among children. Systematic validation of these tools, however, would be useful, especially to determine whether they can be used to reflect both short-term and long-term appetite.

Additional Considerations for Programming and Research

The usefulness of mixed methods was a recurrent theme in the literature reviewed on hygiene and child-feeding behaviors. The use of mixed methods takes full advantage of the complementarity between different approaches and allows comparison of results obtained using various methods. Mixed methods can also be useful for the validation of new tools and the development of simplified data collection tools. The

choice and combination of approaches should be guided by the objectives of the research, the resources available, and the characteristics of the population where they will be used.

The review also provides evidence that good (or bad) practices tend to occur in the same households, both within dimensions of care such as hygiene or feeding and across dimensions. Also, it has been suggested that a minimum number of good practices may be necessary for health benefits to be obtained. For these reasons, composite indexes or summary measures that combine various practices, or dimensions of practices, in one index may be useful. Experience with composite indicators for the measurement of hygiene and child-feeding practices appears promising, but additional research is needed to validate these indexes.

More research is needed to continue to develop and validate simple tools to measure care practices. Without these measurement tools, progress in including care considerations in programs and policies to promote child nutrition, health, and survival will be hindered.

Introduction

The critical influence of care on child nutrition, health, and development has received increasing attention in the last decade. The role of care in feeding has been well elaborated at the conceptual level, but we still lack simple, valid, and reliable tools to measure many aspects of care. *Simple* methods and tools are particularly essential for use in the context of intervention programs.

Objectives of the Review

The main objective of this review is to summarize experience and progress toward the measurement of selected care practices in developing countries, focusing on three key domains of care: hygiene-related practices, diet-related child-feeding practices, and interactions between caregiver and child during feeding. These practices are selected because they are important for child growth and development, and because most of the experience in measuring care in nutrition relates to these practices.

The review emphasizes the measurement needs of programs by focusing on the simplest available methods and indicators and by highlighting program-relevant solutions to methodological problems.

Scope of the Review

As noted, the review is limited to three domains of care. Within these three domains, the review is selective. For hygiene practices, the literature is very large, employing a variety of methods. Much progress has been made in identifying key practices, relating practices to outcomes, and developing program-ready tools. In this domain,

the focus is restricted to recent work addressing some key methodological issues, and simple measurement methods are emphasized.

In the area of diet-related feeding practices, the literature is once again vast and includes many examples of simple tools, particularly for survey research. However, despite the long use of simple tools, some key methodological issues and validation needs remain. These issues are the focus of this section of the review. We also summarize experience with different measurement approaches and the development of scales and indicators.

Studies of caregiver–child interactions during feeding, within the developing-country context, are also reviewed. This area of research is much newer than either of the previous two, and the focus of this section of the review is to identify key conceptual issues and illustrate how they have been reflected in early research in this area.

In each of these three domains, the review is also enriched by a presentation of our own experience measuring these care practices using survey methods in a study carried out in Accra, Ghana, in 1997.

Overall, the review focuses fairly narrowly on measurement issues and primarily on a variety of quantitative methods and indicators. Where relevant, we discuss the critical importance of complementary qualitative work, but we do not elaborate on these methods.¹ We hope that this review of measurement issues will be useful both to applied researchers and to technical program staff, but we make no attempt to go beyond the review to provide a resource book or tool kit for practitioners. Where available, such resources are identified as the specific domains of care are discussed.

Organization

We begin the review in Chapter 2 by describing the evolution of the concept of care as a critical influence in nutrition. Chapters 3 through 5 focus on a review of knowledge and experience (including our own) with the measurement of practices related to hygiene, child feeding, and caregiver–child interactions, respectively. The final chapter discusses implications of the findings for the measurement of care in the context of programs and identifies research priorities to further develop and validate simple tools for the measurement of care.

¹Interested readers can see, for example, Winch et al. 2000; these authors provide an annotated guide to a large number of manuals on qualitative and participatory research on child health and nutrition.

Background

The Role of Care in Nutrition

Child survival, nutrition, health, and development all depend on household food security, on a healthy environment and available health services, and on adequate care for children and women (UNICEF 1990). This three-pronged model—in which food, health, and care are each considered necessary but not sufficient—is currently widely accepted and represents a conceptual evolution from earlier and simpler models of the determinants of child welfare.

In particular, the role of care as a component of the model has received considerable attention in the last decade. Care and nurturing of children, which is as deeply rooted as any human behavior, has been intimately studied by anthropologists and others. However, recognition of the significance of care is “new” in the sense that, prior to the 1990s, much research and policy work related to child nutrition and survival ignored the role of care.

Consideration of several types of evidence led researchers and policymakers to a new emphasis on the role of care practices. Evaluations of interventions that had succeeded in improving availability of food or income or both had often shown little or no impact on child growth or nutrition. This raised questions about other constraints on child growth and nutritional status and resulted in further examination of the role of both ill health and intrahousehold distribution processes.

At the same time, the concept of “positive deviance” was emerging: It recognizes that positive care behaviors and child-oriented intrahousehold processes can promote child growth, even in impoverished environments where malnutrition

and poor growth are widespread.² Positive deviance research seeks to identify these preexisting caregiving behaviors that mitigate the negative effects of poverty and allow children to grow and flourish in impoverished environments.

In order to ensure adequate and systematic inclusion of care in research and policy efforts, UNICEF has been a leader in the development of concepts and models related to the role of care. The original conceptual model incorporating care (UNICEF 1990) broadly defined care as “the provision in the household and the community of time, attention, and support to meet the physical, mental, and social needs of the growing child and other household members” (ICN 1992). An “extended” model of care presented a more detailed articulation and made a clearer distinction between care *behaviors* and important maternal, household, and community *resources* for care (Figure 2.1).³

Some of the care behaviors identified in the model have received much attention, both in the years preceding the emergence of the model and subsequently. These include breastfeeding, complementary feeding, hygiene practices, and, to a lesser extent, health-seeking behavior. Information on other components of the model, such as interactions between caregiver and child and other aspects of psychosocial care, remains limited in the developing-country context. Part of the reason for the lack of progress in this area is the lack of consistent, validated, and reliable measurement tools to represent the complex constellation of practices that constitute “optimal care.”

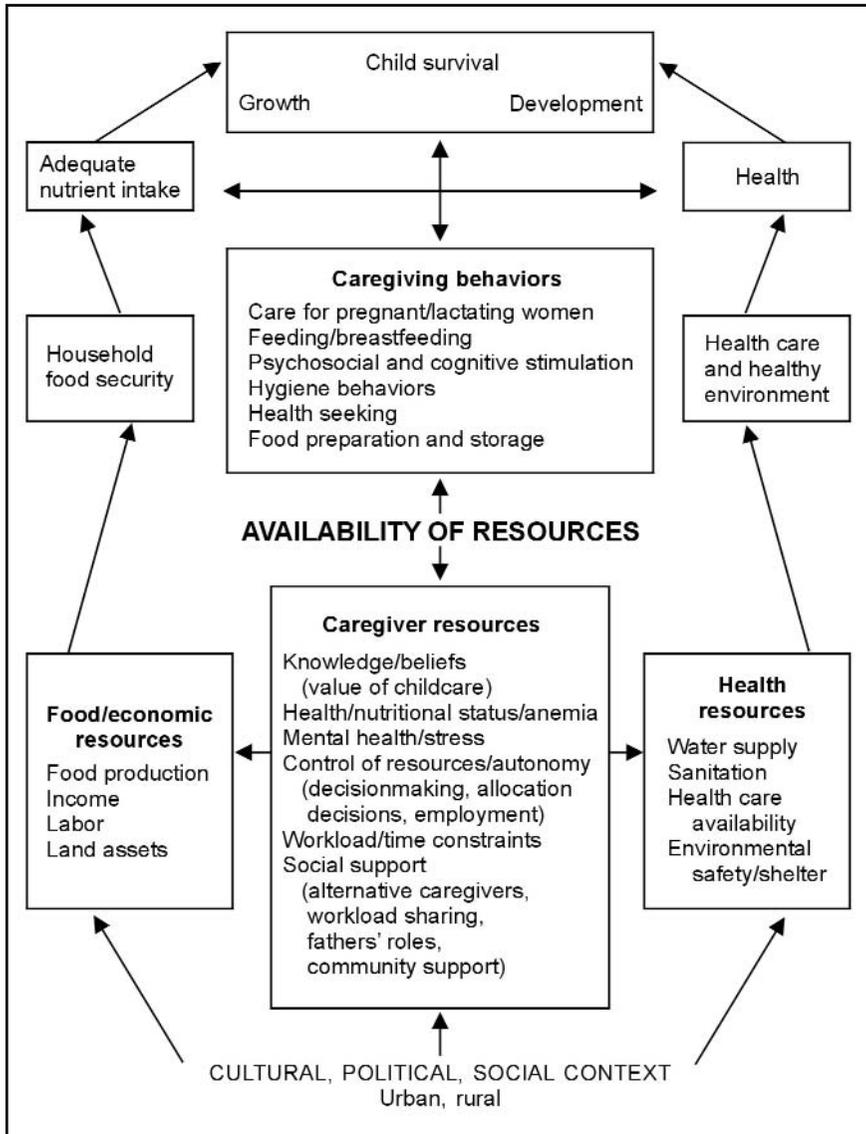
Indicators for Research and for Programs

Because this review is directed toward both researchers and practitioners, it is useful to contrast the characteristics of indicators that are important for each. There is

²See, for example, Muñoz de Chavez et al. 1974; Wishik and Van der Vynckt 1976; Mata 1980; Dettwyler 1986; Zeitlin 1991; Zeitlin, Ghassemi, and Mansour 1990; Shekar, Habicht, and Latham 1991; Guldan et al. 1993; Merchant and Udipi 1997; Dickin, Griffiths, and Piwoz 1997; and Kumar Range, Naved, and Bhattarai 1997. More recently, field experience with positive deviance approaches has been presented in a *Food and Nutrition Bulletin* supplement (*Food and Nutrition Bulletin* 2002 23:4 Supplement).

³The reader is referred to a number of documents for further discussion of conceptual issues (*Food and Nutrition Bulletin* 16 (4), 1995; Engle, Menon, and Haddad 1997; Engle and Lhotska 1999; Engle, Bentley, and Pelto 2000).

Figure 2.1 The extended model of care



Source: Engle, Menon, and Haddad 1997.

a progression in the development of indicators from exploratory research to refinement and validation. Before indicators can be useful to program managers, the following must occur:

- Theory and qualitative research should identify potentially important practices.
- Indicators that accurately reflect these practices must be developed.
- Relationships between care practices and child health and nutrition outcomes should be demonstrated in quantitative studies.
- Program managers must identify locally relevant key behaviors that are both important and changeable.⁴
- Additional work may be needed to develop indicators of these key practices that are sufficiently simple for use in programs.

Researchers and program managers both need indicators that are accurate and free of bias (that is, that are valid). With regard to other characteristics of indicators, the needs of researchers and managers can differ. As noted, program managers generally need the simplest possible indicators; this is a less critical concern for researchers. Researchers who seek to link specific practices to health and nutrition outcomes at the individual level are concerned with the reliability and precision of indicators, as well as with validity. For this purpose, indicators should be free of large amounts of day-to-day variation at the level of the individual. Managers, who need population-level indicators for baseline assessment, monitoring, and evaluation, will have less stringent needs for reliability and precision. Program managers place a priority on indicators of *changeable* behaviors and outcomes; researchers may be interested in a broader set of practices in efforts to gain a full understanding of influences on outcomes, whether changeable or not. Throughout this review, we present studies and indicators at various points along the continuum from exploratory research through refinement and validation.

⁴See, for example, Bentley et al. (1994) and Dickin, Griffiths, and Piwoz (1997) for discussions of methods for identifying key behaviors and constraints and motivations for behavior change.

Measurement of Hygiene Practices

The measurement of hygiene practices that are associated with children's health and nutrition outcomes has been the focus of a wide range of studies and recent reviews (Boot and Cairncross 1993; Cairncross and Kochar 1994; Almedom 1996; Curtis, Cairncross, and Yonli 2000; Almedom, Blumenthal, and Manderson 1997). A variety of qualitative and quantitative methods has been developed to assess hygiene practices. Many studies have mixed and sequenced the following approaches: survey methods based on recall, in-depth and key informant interviews, focus groups, other participatory rapid assessment tools, and semi-structured and structured observations involving continuous monitoring (CM) or spot checks. Microbiological methods, which consist of sampling bacteria from hands, have also been used as a proxy measure of effective hand-washing practices (Kaltenthaler and Pinfold 1995; Pinfold and Horan 1996). Important methodological insights have emerged from this wealth of experience.

The limitations of recall methods for the measurement of hygiene practices are well recognized. Several studies have demonstrated that respondents consistently and significantly overreport "good" practices (Stanton et al. 1987; Curtis et al. 1993; Odujinrin et al. 1993; Manun'Ebo et al. 1997). As a result, many researchers have employed observation methods based on CM, which involve the systematic recording of practices by passive observers. Experience with the use of CM and a simpler and faster alternative—spot-check observations—is summarized below. We focus more attention on the spot-check approach as it is far more likely to be of use in the context of programs.

Structured Observations Using Continuous Monitoring

Structured observations using CM consist of the systematic recording of practices by passive observers. Recording methods vary; observers may code a behavior as present or absent, they may record the frequency of a behavior, or they may record frequency and duration as well as other contextual factors (Bentley et al. 1994). While CM observations can provide detailed information and quantitative estimates of the prevalence of various practices, they have three disadvantages. First, they are time- and labor-intensive, and they require careful training and standardization of skilled observers. Second, a caregiver's behavior may be altered by the presence of an observer, as it is natural to want to present a good image (this is referred to as "reactivity"). Finally, even if a behavior is not altered due to the presence of the observer, it may vary from day to day. These latter two concerns have led to questions regarding the validity (whether the measurement reflects the truth) and reliability (repeatability, that is, whether repeated measurements provide the same answer) of CM observations (see Box 1 for definitions of key performance criteria for evaluating indicators and main threats to validity and reliability).

Recent studies in Burkina Faso and Nicaragua have explored the validity and reliability of CM observations through repeated observation visits to households (Curtis et al. 1993; Cousens et al. 1996; Gorter et al. 1998). The Burkina Faso report (Cousens et al. 1996) describes repeated observations of a variety of hygiene behaviors but with a particular focus on events and behaviors surrounding defecation. The Nicaragua study (Gorter et al. 1998) included observations of 46 practices, covering a variety of hygiene behaviors or proxies for behaviors (see the study description in Table 3.1 starting on page 13).

Both research groups observed that, in general, relevant hygiene practices have very low repeatability at the individual level; that is, there is a lot of day-to-day variability, as a result of both reactivity and other sources of variability. This means that studies that need an individual- or household-level measure of risk (for example, studies linking hygiene practices to outcomes such as diarrhea) will probably require more than one observation period to properly address the problem of day-to-day variability.

At the population level, the results of both studies showed good consistency between repeated measures for a number of practices, thus demonstrating low reactivity. Cousens et al. (1996), however, found that reactivity varied among the practices observed. Some practices were not reactive and had good repeatability at the population level, whereas others had poor repeatability because they were reactive. For example, the proportion of index children using a potty declined only slightly over three observations (from 68 percent to 63 percent), suggesting low reactivity. The proportion defecating on the ground, on the other hand, increased from 5 per-

Box 1: Performance criteria for evaluating indicators, and main threats to validity and reliability

Key performance criteria for indicators

- | | |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Validity | <ul style="list-style-type: none"> ● Extent to which indicator measures the “truth” or the underlying concept it is thought to measure ● Extent to which indicator is free of systematic error |
| Reliability | <ul style="list-style-type: none"> ● Extent to which estimate is replicable or can be reproduced when measure is repeated ● Extent to which indicator is free of (1) imprecision (random error), (2) day-to-day variability (independence), and (3) systematic error |

Main threats to validity and reliability (biases and errors)

- | | |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reactivity | <ul style="list-style-type: none"> ● Refers to individuals modifying their behaviors because of the presence of an observer (applies to observations only) |
| Bias | <ul style="list-style-type: none"> ● Also known as systematic error, or error in a specific systematic direction ● Consequences: <ul style="list-style-type: none"> – Main threat to validity: biases results; estimates do not represent the truth (are not valid) – Also reduces reliability |
| Random error (or imprecision) | <ul style="list-style-type: none"> ● Variability in the measurement due to random factors such as random measurement errors, random recall errors, and so forth ● Consequences: <ul style="list-style-type: none"> – Reduces reliability – Increases variance around the mean of the estimate but does not affect the mean value itself – Does not affect validity or cause bias – Increases sample size requirements |
| Day-to-day variability | <ul style="list-style-type: none"> ● Individual (or household) variability from day to day Consequences: (same as random error; see above) <ul style="list-style-type: none"> – Reduces reliability – Increases variance around the mean – Does not affect validity or cause bias – Increases sample size requirements |

cent to 16 percent, indicating reactivity. Other examples of reactive behaviors included washing the child after defecation, which declined from 95 to 85 percent over the three observations, and maternal hand washing after using the latrine, which decreased from 36 percent on the first observation to 22 percent on the third one.

Several other important behaviors did not appear to be reactive. These included whether or not the child's stools were disposed of and the site of stool disposal (latrine versus yard versus outside the yard), both of which showed little variability between visits. Interestingly, the same practice related to disposal of children's stools in Nicaragua was found to be reactive, as seen by the finding that stools were less likely to be disposed of on the second observational visit than on the first one. Not only does reactivity vary among practices, but it also varies among contexts. Thus, when selecting indicators, it is not sufficient to rely on previous studies carried out in other contexts, because the characteristics of the indicators may vary from one population to another.

In conclusion, single observations of reactive practices should not be used as the basis for population-level estimates of hygiene practices, because this will result in a systematic overestimate of the prevalence of "good" practices. If repeated observations are possible, however, it is likely that reactivity will decline, as shown by some researchers in observations of various caregiver practices (Gittelsohn et al. 1997).⁵ Box 2 presents the conclusions and recommendations on the use of CM observations for measuring hygiene practices.

Spot-Check Observation Methods

A less intrusive and possibly less reactive approach that has gained increasing popularity in recent years is spot-check observation. In this approach, a list of predetermined conditions is observed at one point in time during a home visit. In contrast to CM observations, spot checks can be performed rapidly and unobtrusively. Spot checks are intended to capture information about the product of hygiene behaviors, rather than the behaviors themselves (Bartlett et al. 1992). For example, the spot observation that mothers' hands and nails are dirty is presumed to reflect the fact that mothers do not wash their hands frequently (or carefully). Thus, spot-check observations provide information on "proxies" for behaviors and by definition do not require observation of the actual behaviors.

The main advantage of spot-check observations is that fieldworkers can make a series of observations—of people, households, compounds, and so forth—in a very short time. Depending on the number of items to be observed, spot-check observations may take only 5 to 10 minutes. Another advantage is that skilled observers can usually carry out the observation unobtrusively. As is the case for all types of observations, however, the method requires careful training and standardization of

⁵This research is summarized in Chapter 5.

Box 2: Conclusions and recommendations regarding the use of continuous monitoring (CM) observations in measuring hygiene practices

- Indicators from CM observations can be useful for measuring hygiene practices
- Potential limitations
 - Require substantial investment in training and standardization of fieldworkers
 - Data collection and analysis are time and resource intensive
 - May be prohibitively expensive and impractical in program contexts
- Main threats to validity and reliability of indicators measured by CM observation are (1) *reactivity* and (2) *day-to-day variability*

Reactivity

- Varies among practices and among contexts for the same practice
- Consequences
 - At population level, overestimate prevalence of “good” practices
 - At individual level, mask true associations between practices and outcomes because practices do not reflect the truth
- Potential solutions or ways to reduce reactivity
 - Repeat observations on different occasions because research has shown that households get accustomed to presence of observers and reactivity decreases rapidly after first visit
 - Establish good rapport between household members and observers; if possible, train observers from the community to facilitate access into homes and engender trust (Monte et al. 1997); carefully select gender of observer to ensure comfort; establish clear policies regarding handling of offers of food or other forms of hospitality to observers and level of communication recommended between observers and household members (J. Gittelsohn, personal communication)
 - Select practices that are found to be less reactive in a particular environment, based on results from prior qualitative work

Day-to-Day Variability

- Consequences
 - At the population level, variability results in reduced precision of estimates because it introduces random error, which inflates the variance
It does not result in systematic bias
 - At the individual level, variability also introduces random error and therefore reduces the chances of detecting true associations with outcomes
- Potential solution
 - Repeat observations on different days, which improves both individual and population estimates

fieldworkers in making subjective, yet consistent and reliable, judgments (Armar-Klimesu et al. 2000).

To our knowledge, no research has been undertaken specifically in order to assess the validity, reactivity, or repeatability of spot-check indicators or indices. It is possible that spot checks—by their nature less prolonged and more discreet forms of observation—might be less likely to induce behavior change. However, if households are anticipating the visit of the study team, the general level of cleanliness of individuals and of the house and compound might not represent usual conditions.

A summary of studies that have used spot-check observational methods is presented in Table 3.1. The table provides a brief summary of the study designs and the types of hygiene indicators and composite indexes used, and it also summarizes the key findings regarding analyses of validity, repeatability, and association with child outcomes where applicable. Our own experience with spot-check observations to measure hygiene practices in the context of a large survey in Accra, Ghana, is also summarized (Armar-Klimesu et al. 2000; Maxwell et al. 2000).

Types of Hygiene Practices Observed Using Spot-Check Methods

Various dimensions of hygiene were measured in the studies reviewed (Table 3.1). Indicators from the following five clusters of hygiene practices defined by Cairncross and Kochar (1994) were represented in these studies: (1) disposal of human feces, (2) use and protection of water sources, (3) water and personal hygiene, (4) food preparation and storage, and (5) domestic and environmental hygiene. Indicators to assess personal hygiene (or more specifically, proxies for these practices, such as maternal cleanliness or child cleanliness) and domestic and environmental hygiene (for example, cleanliness of floor and compound surfaces and garbage disposal) are particularly popular in spot-check observations.

Assessment of Reactivity and Repeatability of Spot-Check Methods

Only one of the seven studies reviewed assessed the reactivity and repeatability of spot-check observations of hygiene practices. The study in Nicaragua (Gorter et al. 1998) compared hygiene spot-check indicators measured on two separate observation days and showed good agreement between first and second observational visits for most indicators, suggesting low reactivity. It is still possible that for some of the most unacceptable hygiene conditions, such as the presence of human feces in the house or on the compound, reactivity could be hidden if households cleaned up before both visits. The authors did not specify whether families were informed of the exact day and time of the fieldworkers' visits, but they indicated that the purpose of the visit (observation of hygiene practices) was not revealed to families. This may have helped reduce reactivity. Additionally, reactivity does not seem to have

Table 3.1 Summary of studies that used spot-check observational approaches to measure hygiene practices

Reference/ country	Type of study	Types of spot-check hygiene indicators	Index creation	Analyses and findings	
				Validity, reactivity, reliability, and repeatability analyses	Association with childhood diarrhea (and growth)
Gorter et al. 1998 (Nicaragua)	Prospective study (172 households with children < 24 months)	Food, utensils, baby bottle covered Cleanliness of environment, floor, absence of feces Barrier against animals Garbage organized or absent, far away from house Water: storage, quantity Sanitation facilities: availability, cleanliness Child uses diapers, underclothes	...	<p><i>Reactivity:</i> Compared results of two observations. Good agreement between two measures (low reactivity)</p> <p><i>Repeatability:</i> Used Kappa statistic to assess individual- and household-level repeatability. Found low repeatability for 4 indicators (Kappa < 0.40), good for 7 indicators (Kappa 0.40–0.75)</p>	<p><i>Individual practices:</i> Four indicators were associated with absence of diarrhea: kitchen floor clean, living room floor clean, garbage organized or absent, child uses diaper or underclothes</p>
Bartlett et al. 1992 (Guatemala)	Prospective year- long study of persistent diarrhea (280 children 0–30 months of age)	Cleanliness of mother, child, siblings Water storage type Children's toys, bottles on floor Feces on the ground Fecally soiled diapers Animals in compound, house Garbage in living area	Index created for each of the 26 indicators: number of times unhygienic/ behavior observed/ number of times indicator observed; created two categories: high/low, based on individual distribution of each variable	<p>...</p>	<p><i>Multiple indexes:</i> Compared children with no persistent diarrhea (during 1 year) with those who had ≥ 1 episode. Eleven of the 26 indexes associated with diarrhea; 9 remained significant in multivariate analyses (logistic regression)</p>

Table 3.1—Continued

Reference/ country	Type of study	Types of spot-check hygiene indicators	Index creation	Analyses and findings	
				Validity, reactivity, reliability, and repeatability analyses	Association with childhood diarrhea (and growth)
Ahmed et al, 1993 (Bangladesh)	Prospective study of impact of behavioral change intervention (185 households with children 0–18 months old)	Cleanliness of child's hands, face, clothes Cleanliness of mother's sari Cleanliness of two areas on the ground where child most often played	<p><i>Composite index:</i> Sum of six variables significant in multivariate analysis</p> <p><i>Scale:</i> Average cleanliness score for the ground, child's face, hands, and mother's sari</p>	<p><i>Reliability:</i> Chronbach's alpha > 0.57</p>	<p><i>Composite index:</i> 10% of children with 0–1 unhygienic conditions had an episode of persistent diarrhea in previous year, compared with > 50% among those with 6 unhygienic conditions (dose response relationship)</p> <p><i>Composite index (scale):</i> Strong negative association between hygiene practices scale and prevalence of diarrhea (controlling for maternal education and socioeconomic status)</p> <p><i>Individual practices:</i> 45% difference in incidence of diarrhea between homes where no dirty dishes were seen on three visits, compared with those with dirty dishes on three visits (no control for confounding factors reported)</p> <p>(continued)</p>
Pinfold and Horan 1996 (Thailand)	Prospective behavior change intervention: 25 intervention and 12 control villages (4,874 households with children aged < 60 months)	Bacteria on fingertips (fecal streptococci) Cleanliness of dishes	

Table 3.1—Continued

Reference/ country	Type of study	Types of spot-check hygiene indicators	Index creation	Analyses and findings	
				Validity, reactivity, reliability, and repeatability analyses	Association with childhood diarrhea (and growth)
Merchant and Udipi 1997 (India)	Cross-sectional comparison of positive and negative deviant children (150 children aged 6–36 months)	Cleanliness of floor, storage vessels Storage conditions of food, water Cleanliness of child's nails, skin, face, clothes	Each indicator was rated as poor, average, good	...	<i>Individual practices:</i> No analysis of association with diarrhea, only with growth; linear relationship between growth and cleanliness and storage of water and food; good practices were observed in 72% of positive deviants, 56% of median growers, and 39% of negative deviants (no control for confounding factors reported)
Kallenthaler and Drašar 1996 (Botswana)	Cross-sectional, mixed method study to guide design of hygiene intervention (116 families with children less than 6 years of age)	Water storage Presence of animals Feces in compound Leftover food, infant bottles Compound conditions (4-point scale) Presence of unwashed dishes, washing water Presence of toilet	<i>Index:</i> Included compound condition; bacterial counts on plate, cloth, caregiver fingertips; distance to water source, toilet; animals in kitchen; feces in compound	...	<i>Multiple practices:</i> None were significantly associated with diarrhea <i>Composite index:</i> Significantly more diarrhea among highest compared to lowest quartile of hygiene index (no information on magnitude of effect)

(continued)

Table 3.1—Continued

Reference/ country	Type of study	Types of spot-check hygiene indicators	Index creation	Analyses and findings	
				Validity, reactivity, reliability, and repeatability analyses	Association with childhood diarrhea (and growth)
Armar-Klemesu et al. 2000 (Ghana)	Cross-sectional survey of 556 households with children < 36 months	Mother clean Child clean Diaper/bottom clean Compound swept No poultry feces No stagnant water No human feces No unwashed utensils Drinking water covered House swept No garbage container in house	Index created by summing scores for first six indicators. Each practice was rated 1 (= good) and 0 (= poor). Scores were divided into three categories (based on distribution): poor hygiene (0–3 good practices), average hygiene (4–5), good hygiene (6)	<p>Reliability: Cronbach's alpha 0.69 (good internal consistency)</p>	<p>Individual practices: Nine of 11 practices associated with lower prevalence of diarrhea (only three statistically significant: child clean, compound swept, no stagnant water)</p> <p>Composite index: Diarrhea prevalence: 40% for those with 0–3 good practices, 32% for those with 4–5 good practices, and 25% for those with 6 good practices (statistically significant)</p> <p>Multivariate analysis: Stronger association among poorer and wealthier households than average socioeconomic status</p>

been a major problem for other domestic hygiene indicators, since only about one-third of the households had clean kitchen or living room floors.

Repeatability at the individual and household levels was also assessed in the Nicaragua study by using a kappa statistic (Gorter et al. 1998). The authors state that scores from 0.40 to 0.75 generally indicate good repeatability and scores over 0.75 indicate excellent repeatability. Of the 11 spot-check indicators studied, more than half (7) were in the range of good repeatability (between 0.40 and 0.75), and only 4 had a kappa coefficient lower than 0.40 (indicating poor repeatability) (see Gorter et al. 1998 and Ruel and Arimond 2002 for a summary). There was no apparent clustering of indicators by types of behaviors for those that had low, rather than good, repeatability; indicators from all five clusters of hygiene behaviors were distributed almost equally between low and good repeatability.

Examples of the Use of Spot-Check Observations to Look at Associations with Child Outcomes

Six of the seven studies reviewed examined the association between hygiene practices measured by spot-check observations and diarrhea. The study in India (Merchant and Udipi 1997)—a positive deviance study—looked at the association with growth outcomes but did not report information on childhood diarrhea.

In Nicaragua, Gorter et al. (1998) found that many of the hygiene variables they measured through spot checks⁶ were associated with diarrhea in the expected direction (better practices associated with less diarrhea), though only four indicators reached statistical significance (Table 3.1). The absence, or the weakness, of the association between diarrhea and the various spot-check indicators at the household level may have been due to the low to moderate repeatability of some of the hygiene indicators. Additionally, as suggested by the authors in their analyses of CM observations, it is likely that there may be some threshold number of good practices required to reduce the risk of diarrhea. This would explain the lack of association with diarrhea for many of the individual practices. For example, a spotless kitchen floor and clean utensils will not protect a child who plays on the ground in an unhygienic compound. Some cluster of key practices may be necessary and better reflected by summary scales or indexes.

⁶Fieldworkers were trained in spot-check observations during a one-week workshop, followed by field training in the presence of supervisors. Fieldworkers were not told the diarrhea status of children in the households observed, and the purpose of the visit was not described to the family. Hygiene practices and conditions were observed during two visits one to two weeks apart. Diarrhea was measured using daily diarrhea calendars designed for illiterate mothers, which were collected weekly by the fieldworkers.

Bartlett et al. (1992) incorporated 26 spot-check indicators in their longitudinal study of persistent diarrhea among children aged 0–30 months in Guatemala. The 26 spot-check indicators for hygiene were based on “extensive preliminary observations” in the community and included cleanliness of the mother, child, sibling, and household environment⁷ (Table 3.1). Families were visited weekly for one year, resulting in an average of 43 observation visits per household. For each indicator, an index was calculated by dividing the number of times a condition was unhygienic by the number of times the indicator was observed for that household. These indexes were then classified as “high” or “low,” based on their respective distributions. Finally, the dichotomous variable giving a score of high or low on each condition was compared with households where the index child had no episodes of persistent diarrhea during the year and households where the child had one or more episodes.

Eleven of the 26 variables were found to be associated with persistent diarrhea in bivariate analyses; 9 of these remained significantly associated in logistic regression analyses controlling for the child’s age and a number of other potential confounders.⁸

The authors make three important points in the Guatemala report. First, they rightly note that indicators relating to the presence of fecally soiled diapers can be effects of rather than (or as well as) causes of diarrhea, and that the possibility of reverse causality should receive attention when these indicators are used. Second, and consistent with others, they note that behaviors cluster. Of the 55 possible paired correlations between the 11 conditions associated with diarrhea, they report that 38 (69 percent) were significant. Finally, the authors analyzed the cumulative effect of hygiene practices on the risk of diarrhea. They created a composite index by summing six of the nine variables that were significant in the multivariate analysis (the “dirty diaper” variables were excluded because of possible reverse causality). They found a highly significant dose–response relationship, with only 10 percent of the children with 0 or 1 unhygienic conditions experiencing an episode of persistent diarrhea in the previous year, compared with more than 50 percent of those with all 6 unhygienic conditions.

⁷To standardize fieldworkers in observational definitions, fieldworkers individually scored photographs of typical situations, which were then discussed among the group. This was followed by field observations, where fieldworkers were paired to visit households. Standardization was achieved once full concordance between pairs (and with supervisors) was achieved.

⁸The variables that remained statistically significant in logistic regression are toys or baby bottles on the floor, mother’s hands dirty, trash on the floor of the house, animals loose in the house, feces on the ground, and fecally soiled diapers on the child or on the ground.

In Bangladesh, Ahmed et al. (1993) used spot-check indicators of cleanliness in addition to structured observations and other methods in a before and after evaluation of an educational intervention. Cleanliness of the child's hands, face, and clothes, of the mother's sari, and of the two areas on the ground where children most often played were assessed at weekly visits for six months and were rated on a three-point scale.⁹ The scales were condensed for analysis to "1" if completely clean and "0" otherwise. An overall cleanliness scale was created by averaging the cleanliness scores for the ground, the child's face, child's hands, and mother's sari. Reliability of the scales was assessed using Cronbach's alpha and deemed to be satisfactory.¹⁰ Diarrheal morbidity was also assessed weekly, by maternal recall, during fieldworkers' visits. The cleanliness score was strongly and negatively correlated with the prevalence of diarrhea in multivariate models that controlled for mother's education and socioeconomic status.

Pinfold and Horan (1996) also report use of a spot-check indicator as part of the evaluation of a focused behavior change intervention in Thailand.¹¹ This intervention focused on dish washing and hand washing and used a spot check of the cleanliness of dishes, along with microbiological methods for assessing fecal streptococci on fingertips (taken as an indicator of the effectiveness of hand washing). The authors report significant improvements in intervention villages, including a 39 percent reduction in diarrheal diseases. They also report a strong association between the incidence of diarrhea and presence of dirty dishes on three visits among control households. The analysis, however, did not control for potentially confounding variables in this association and therefore should be interpreted with caution.

In Bombay, Merchant and Udipi (1997) included hygiene spot-check indicators in their positive deviance study. The authors explored the association between hygiene indicators and growth but did not study the association with diarrhea. The spot-check observations included cleanliness of the floor, storage vessels, storage

⁹No information was provided on training and standardization of fieldworkers in spot-check observations.

¹⁰Because it is often impossible for researchers to perform repeated measurements at two points in time, a variety of statistical techniques have been developed for assessing reliability. Cronbach's alpha is a widely accepted statistic for assessing the reliability and internal consistency of unidimensional scales developed from a single set of measurements (one point in time) (Carmines and Zeller 1979). Ahmed et al. (1993) did not report alphas individually for each scale but stated that all had alphas of at least 0.57 and that this was satisfactory. DeVellis (1991) suggests that an alpha of 0.60–0.65 is low, 0.65–0.70 is acceptable, 0.70–0.80 is respectable, and 0.80–0.90 is good. Carmines and Zeller (1979) suggest that alpha should be 0.80 or higher for "widely used" scales.

¹¹No information was provided on training and standardization of fieldworkers in the spot-check observation.

conditions for food and water, and an inspection of the cleanliness of the child's nails, skin, face, and clothes (Table 3.1). Each indicator was rated as poor, average, or good.¹² Results indicated linear relationships between growth status and the cleanliness and storage of water and food. Again, these findings should be interpreted with caution because controls for socioeconomic status or for the age of the child were not reported either in the design of the study (by matching subjects) or in the statistical analysis (by using multivariate analyses).

A study in Botswana (Kaltenthaler and Drasar 1996) used mixed methods to examine the association between hygiene behavior and diarrheal diseases. The spot-check indicators used in this study reflect various observations of the use and storage of water, general hygiene conditions of the house and compound, and availability of services¹³ (see Table 3.1). Individually, the spot-check indicators were not found to be associated with diarrhea. Since it appeared that hygiene practices clustered, an index was developed, combining the condition of the compound; the bacteria count on plates, rags, and caregiver's fingertips; distance to water source; toilet ownership; animals in the kitchen; and feces in the compound. The index was scored from 8 to 20 and divided into quartiles. Comparison of the lowest to the highest quartile showed significantly more diarrhea among households in the lowest quartile, though the magnitude of the difference was not reported.

Finally, in our study in Accra (Armar-Klemesu et al. 2000; Maxwell et al. 2000), 11 spot-check indicators were used to assess the general cleanliness of the house, compound, mother, and child.^{14,15} An index was created using six of the hygiene indicators observed¹⁶ (Table 3.1). A categorical variable was created based on the distribution of the index scores: 0–3 good practices were classified as “poor,”

¹²No information was reported on training and standardization of fieldworkers in spot-check observations.

¹³No information was provided about training and standardization of fieldworkers in spot-check observations.

¹⁴Fieldworkers were carefully trained and standardized in assessments of each indicator until perfect concordance was achieved between pairs of fieldworkers and between each fieldworker and the supervisor.

¹⁵In order to rate cleanliness of children and mothers, fieldworkers were instructed to focus on the appearance of their hands, nails, clothes, and hair. For children, the cleanliness of their faces was also assessed.

¹⁶Some variables had to be dropped from the index either because there was no variability in the results (such as human feces on the compound, which was observed only in 2 percent of the households) or because there were too many missing values (fieldworkers were often unable to observe aspects that required observation inside the house or in a particular room where they did not have access).

4–5 as “average,” and 6 as “good” hygiene. Cronbach’s alpha was 0.69, indicating an acceptable level of internal consistency.

Most variables were associated in the expected direction with the prevalence of childhood diarrhea measured by two-week recall; poor practices were associated with a higher prevalence of diarrhea, though few relationships reached statistical significance. As discussed, there are several possible reasons for this, including potential unreliability in spot-check indicators and the possibility that some cluster of good practices—rather than any single practice—is necessary in order to decrease risk. In this instance, the limited nature and potential unreliability of the information available on diarrhea (a single two-week recall) is also a constraint.

To verify the notion that a minimum cluster of hygiene practices is necessary to reduce risk, we looked at the association between our composite hygiene index and diarrhea by multivariate analysis, controlling for socioeconomic status¹⁷ and availability of water and sanitation services. We found that the prevalence of diarrhea in children from households with good hygiene (highest tertile) was approximately half the prevalence found among those who had poor hygiene (lowest tertile). This was true for households from the lowest and highest tertiles of socioeconomic status only (Ruel and Arimond 2002). We cannot explain why this finding was not observed among the middle socioeconomic group. See Box 3 for a summary of the conclusions and recommendations regarding the use of spot-check observations.

¹⁷Socioeconomic status was measured using an index that measured the quality of housing and assets—a proxy for household wealth (Ruel and Arimond 2002).

Box 3: Conclusions and recommendations regarding the use of spot-check observations in measuring hygiene practices

- Spot-check observations are a promising approach to assess certain hygiene practices
- Studies that have used spot-check observations provide evidence of the clustering of hygiene practices and confirm the potential usefulness of composite indexes for looking at associations with child outcomes
- Main advantages of spot-check observations
 - Relatively inexpensive and easy to measure
 - Can be done very rapidly
 - May be less subject to reactivity than continuous monitoring (CM) observations
- Potential limitations
 - Require extensive training and standardization of fieldworkers, though possibly less so than CM observations
 - Are just as susceptible to problems of day-to-day variability as CM observations
- Potential solutions to problems of day-to-day variability
 - Collect information on multiple days (if indicators are to be used for individual-level assessment)
 - Use the indicators only for population-level assessments if repeated observations are not possible and increase sample size as needed to address increased variance
- Research needs
 - Validity, reliability, and reactivity need to be tested in various cultures; triangulation between spot-checks, CM observations, and other methods would be particularly valuable to assess validity
 - Need to test, for each specific practice, whether spot checks accurately reflect actual behavior (for example, whether dirty hands reflect poor hand-washing practices)

Measurement of Child-Feeding Practices

The literature addressing the nature, determinants, and effects of a wide variety of breastfeeding and complementary feeding practices is extensive. Current knowledge and areas of consensus about optimal infant and child-feeding practices have been summarized in recent state-of-the-art reviews and guidelines (Brown, Dewey, and Allen 1998; Dewey and Brown 2002; PAHO/WHO 2003). In this section, we focus on measurement issues related to infant and young child-feeding practices. Specifically, we discuss measurement of practices directly related to the nutritional and dietary aspects of feeding, as opposed to the caring aspects, such as interactions between the caregiver and the child, which are discussed in Chapter 5. The chapter is organized as follows: first we discuss measurement approaches and a series of issues that need to be considered when measuring feeding practices. We then review our experience with the use of composite indicators and child feeding and care indexes.

Measurement Approaches

The vast majority of studies that look at feeding practices have used quantitative survey recall methods to collect information on child-feeding practices. This is true for studies that aim at documenting the prevalence of specific feeding practices (Rutstein 1996) as well as those that examine the association between feeding practices and child outcomes (Victora et al. 1989; Brown et al. 1989; Popkin et al. 1990; Marquis et al. 1997), or feeding practices and their determinants (Martorell et al. 1985; Piwoz et al. 1994; Galler et al. 1998). Even impact evaluation studies of education and

behavior-change interventions (recently reviewed by Caulfield, Huffman, and Piwoz 1999) usually rely on interview methods to record changes in behaviors, although these are particularly subject to biases from respondents reporting what they have learned as opposed to what their actual practices may be.

Observational methods (quantitative and qualitative) and other qualitative approaches (such as ethnography and various rapid assessment methods) have also been used in research on child-feeding practices. Observational and qualitative approaches are especially useful in studies that seek to document the cultural and social context in which specific practices take place, and to understand the potential barriers to modifying these practices. Formative research using a series of qualitative tools has been used extensively to guide the design of communication and behavior-change programs aimed at modifying breastfeeding and complementary feeding practices (Favin and Baume 1996; HKI no date; Dickin, Griffiths, and Piwoz 1997). The remainder of this chapter focuses on key issues related to the measurement of child-feeding practices through quantitative survey approaches and includes a discussion of the use of child-feeding and care summary indexes.

Issues to Consider in Measuring Child-Feeding Practices

What Is the Appropriate Length of Recall?

An important consideration when collecting data on feeding practices through recall is the time frame used for the recall and the related trade-offs between accuracy and representativeness of the information. For instance, the 24-hour recall method, which is the most widely used method for recording dietary information, may be more accurate (less prone to memory errors) than recalls of longer periods but may be less representative of *usual* practices.

A direct comparison of feeding patterns assessed by single-day studies (12-hour observation plus 12-hour recall) and mothers' monthly reports of usual practices showed significant disagreement between the two methods (Piwoz et al. 1995). The one-day assessment overestimated exclusive breastfeeding rates among infants younger than 4 months by 25 percent and underestimated the intake of nonhuman milk by 30 percent. Similar findings were obtained in an analysis of the Ethiopia Demographic and Health Surveys 2000, where even larger discrepancies were found among children 4–6 months old between the 24-hour recall and the 7-day recall method (Arimond and Ruel 2002). Among the urban sample, estimates of exclusive breastfeeding based on the 24-hour recall were twice as large (36 percent) as those derived from the 7-day recall (18 percent). Similar discrepancies were also reported in two other studies, one in the Philippines (Zohoori, Popkin, and

Fernandez 1993) and one in Sweden (Aarts et al. 2000), which compared single 24-hour recalls with longitudinal information. As documented in the previous two studies, the 24-hour recalls dramatically overestimated the true prevalence of exclusive breastfeeding.

The main explanation for these discrepancies is that infant feeding practices vary widely within short periods of time, rather than maternal recall being biased or inaccurate. As pointed out by several researchers (Zohoori, Popkin, and Fernandez 1993; Piwoz et al. 1995; Marquis et al. 1998), the movement from exclusive breastfeeding to mixed feeding and to the family diet does not follow a unidirectional, consistent pathway. Both maternal and child factors influence child-feeding decisions, and these decisions are reversible within short periods of time (Marquis et al. 1998). Thus, the length of the recall period affects the estimated prevalence of feeding practices because of the true fluidity of these practices during early infancy and the rapid changes occurring when mothers move in and out of certain practices. Decisions about the methodological approach and the length of recall to use (24-hour, 7-day, or longer period) should therefore be based on the specific purpose for which the data are being collected. Additionally, the length of recall used should always be reported to avoid confusion when comparing information among studies.

In addition to the true variability in feeding practices, memory and recall errors may also affect prevalence estimates assessed from different lengths of recall. A study in southern Brazil showed that the magnitude of misclassification of breastfeeding duration increased with time (Huttly et al. 1990). Compared with responses given when their infant was 11 months, 24 percent of mothers misclassified the duration of breastfeeding when interviewed at 23 months and 30 percent at 47 months. A systematic bias toward reporting longer durations of breastfeeding was observed among wealthier and more educated mothers.

Thus, the length of recall for reporting infant- and child-feeding practices should be standardized to ensure comparability among assessments. Estimates of early infant-feeding practices derived from interviews involving widely different lengths of recall among mothers of children of different ages (for example, all children under three or five years of age) should be avoided because recall periods longer than 12 months or so are unlikely to provide accurate estimates.

Other factors that may influence maternal recall include child factors (birth order, child health status) and maternal factors such as age or education (Huttly et al. 1990; Piwoz et al. 1995), whether the mother works outside the home and uses alternative caregivers, and the level of maternal control over child-feeding decisions.

Child Feeding Is a Multidimensional Concept

Child feeding, which includes breastfeeding and complementary feeding practices, comprises various dimensions, including the type, quantity, consistency and texture, and the energy and nutrient density of food; the frequency of feeding; and the diversity of the diet. Because these various dimensions are difficult to combine into one indicator, most research on feeding practices has focused on only one or two at a time. This has resulted in fragmented information, and it has prevented progress in understanding the association between overall feeding patterns (as opposed to individual feeding practices) and child health and nutrition outcomes.

For example, although there is indisputable evidence that exclusive breastfeeding protects against diarrheal infections and mortality from diarrhea (Brown et al. 1989; Victora et al. 1989; Popkin et al. 1990), few studies have considered the importance of exclusive breastfeeding combined with other recommended practices, such as early initiation of breastfeeding and feeding colostrum (Huffman, Zehner, and Victora 2001). The same is true for complementary feeding practices. Some studies have isolated the role of animal products (Marquis et al. 1997) or of individual micronutrients such as zinc (Brown et al. 2002; Zinc Investigators' Collaborative Group et al. 1999) in improving growth or reducing childhood morbidity. These studies, however, usually fail to include other dimensions of complementary feeding such as the frequency of feeding or the age of introduction of complementary foods, to name only a few.

Feeding Practices Are Age Specific and Rapidly Changing

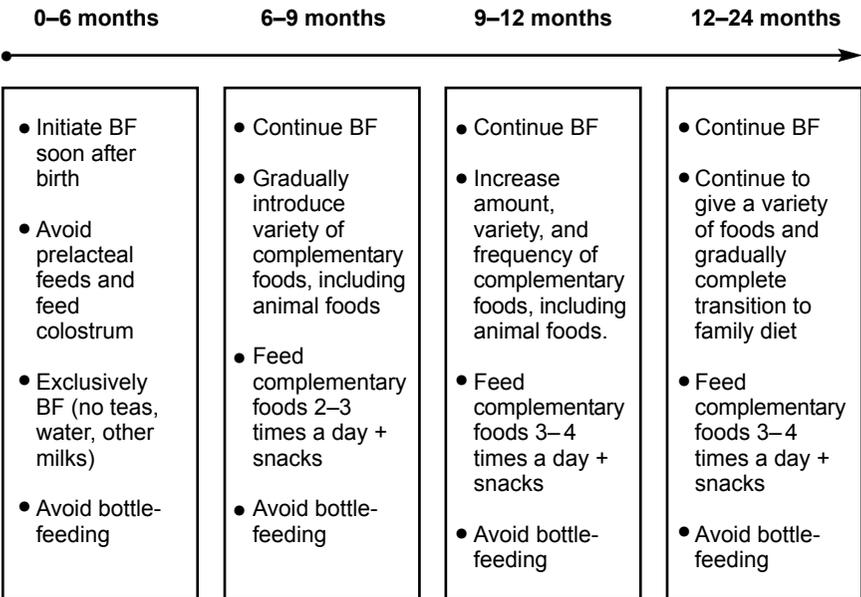
Appropriate child-feeding practices are age specific, and they are also defined within narrow age ranges. They follow a continuum from exclusive breastfeeding, starting soon after birth, to the point where the child receives the same family food as older family members, with no special modifications or additions. As seen in Figure 4.1, exclusive breastfeeding is the key feeding practice of concern up to 6 months of age, but after that, indicators reflecting the use of complementary foods (quality, quantity, and frequency) must be included. Similarly, both the introduction of complementary foods (between 6 and 12 months of age) and the transition from special foods to the family diet should ideally be accomplished gradually. Thus, in order to characterize the adequacy of child-feeding practices, one needs to take into account the various dimensions of child feeding, as well as the age-specific requirements of the child within short time periods. Again, the complexity of this task probably explains why so little is known about the association between different feeding patterns and child outcomes at particular ages.

A related problem mentioned earlier is the potential error caused by the differential recall period among mothers of children of different ages, when information

is gathered retrospectively as in most surveys. Different recall periods may result in differences in the magnitude of recall error among children from different age groups. This in turn may result in differences between the age groups in the likelihood of detecting relationships between practices and outcomes (larger errors inflate the variance and result in decreased statistical power to detect differences).

Finally, another potential problem when using recall methods is age censoring, which happens when questions are asked about practices that have not yet occurred because the child is still too young. Estimates of the prevalence of exclusive breastfeeding among 0–6-month-old infants are often derived from 24-hour recalls of mothers of all infants in this age group. It is important to realize that these estimates should not be interpreted as representing the “percentage of children exclusively breastfed for 6 months,” because many infants have not yet reached 6 months, and therefore it is not known how long they will be breastfed (Aarts et al. 2000). A common approach used to derive population estimates for censored data such as these is survival analysis.

Figure 4.1 The continuum of child feeding



Source: Adapted from Ruel and Menon (2003).

Note: BF is breastfeeding.

Another approach is to either make the questionnaire age specific or to carry out the analysis by age group and include only age-relevant questions. For example, if measles immunization is given at 9 months, mothers of infants younger than 9 months may not be asked the question. If they are asked the question, then analyses should be restricted to children 9 months and older who are eligible to receive the vaccine.

Feeding Practices Are Likely to Cluster

As discussed for hygiene practices, it is possible that child-feeding practices also cluster. That is, it is likely that a mother who initiates breastfeeding at birth and who exclusively breastfeeds for six months will also be more aware of (or more likely to seek expert information about) recommended optimal complementary feeding. By definition, a mother who exclusively breastfeeds also engages in other positive practices during this period, such as avoidance of bottle-feeding and of breast-milk substitutes. It is also very possible that practices may cluster across other dimensions of care; that is, mothers with better feeding practices may also be more nurturing and attentive to the child or may have better hygiene practices.

Little research has been done to examine whether feeding and other care practices do indeed cluster. Several recent reports document the apparent long-term impact of exclusive breastfeeding on children's growth, but without controlling for current care and feeding practices. These reports leave open the question of whether the effect is truly a long-term impact of exclusive breastfeeding or whether it is due to some clustering of good practices. Exclusive breastfeeding may be a good proxy for other positive practices occurring both during the period of exclusive breastfeeding and thereafter.

For example, a prospective study of Vietnamese children documents that early introduction of solid foods (< 3 months of age), or failure to exclusively breastfeed at that age, is associated with poor growth up to 48 months of age (Hop et al. 2000). The authors control for a variety of potentially confounding variables but do not control for current diet or other practices in the intervening years in their modeling of child growth up to 4 years. The same is true for a study carried out in Mexico, where a group of infants from a previous longitudinal six-month study was followed up at 20 months for additional anthropometric measurements (Eckhardt et al. 2001). Again, the multivariate analysis controlled for a variety of potentially confounding variables to assess the long-term effect of full breastfeeding for at least 4 months on children's growth, but failed to control for current feeding practices or feeding practices between 6 and 20 months of age. Thus, although both studies addressed the issue of potentially confounding influences, they did not control for the critically important influence of child-feeding (and other caregiving) practices

throughout the follow-up period. They may therefore have either wrongly attributed or overestimated the positive effects of exclusive breastfeeding on child outcomes, and exclusive breastfeeding may have acted as an accurate proxy for other positive practices throughout the first two years of life.

In our cross-sectional survey in Ghana, we also found that children 6–18 months of age who had been exclusively breastfed during their first 4 months of life were significantly taller than those who had not been exclusively breastfed (Ruel, Armar-Klemesu, and Arimond 2001), suggesting a long-term beneficial effect of exclusive breastfeeding. The association disappeared, however, in multivariate analyses that controlled for maternal height, education, and socioeconomic characteristics. This was due to the fact that exclusive breastfeeding in this sample was highly correlated with some maternal characteristics that were also positively related to child growth. In this population, mothers who exclusively breastfed were an elite group of more educated and wealthier mothers. Exclusive breastfeeding was closely related to higher maternal education and socioeconomic status and possibly to a series of other positive childcare behaviors.¹⁸ Unfortunately, the possible positive impact of exclusive breastfeeding on growth among children of noneducated mothers could not be analyzed in this context because very few of the noneducated mothers exclusively breastfed.

These findings highlight the difficulties of studying the impact of isolated practices such as exclusive breastfeeding, which may be proxies for other positive practices, or even in some cases for higher maternal education or socioeconomic status. Caution should be used when interpreting findings of long-term associations when information on intermediary and current practices is not available (or is not controlled for in the analysis).

The Rationale for Creating Child-Feeding Summary Indexes

Child-feeding indexes have the potential to address some of the above-mentioned concerns related to the analysis and interpretation of child-feeding patterns. In particular, indexes can be made age specific, and they can include various dimensions of feeding (and care) practices. Also, as discussed in the hygiene section (Chapter 3), if practices cluster or if there is a minimum number of good practices required to achieve long-term benefits, a composite index would be more likely to detect these associations than would measurement of any single practice.

¹⁸We have shown previously that maternal education is consistently associated with a series of positive feeding and hygiene behaviors (Armar-Klemesu et al. 2000).

Indexes can combine various dimensions of the concept studied into one variable, which can then be used to quantify relationships. In the case of childcare and feeding practices, the use of indexes allows researchers either to quantify the importance of these combined practices for child nutrition and health outcomes or to look globally at the main constraints to good practices. In addition, because of the possibility of making the various components of the index age-specific, use of this method allows the analysis to be carried out over a wider age range. This is particularly useful when sample sizes among some age groups are small and do not allow for analyses within age groups. Our experience with creating and using composite indexes is summarized below.

The Care Index in the Accra (Ghana) Study

The composite childcare index created using data from the Accra (Ghana) study includes three dimensions of care: (1) diet-related child-feeding practices (breast-feeding, use of prelacteal feedings, and timing of introduction of complementary liquids and foods in the child's diet); (2) caregiver–child interactions (who helped the child eat and how the caregiver responded to the child's refusal to eat); and (3) preventive health-seeking behavior (attendance at growth monitoring and whether the child had been immunized) (Armar-Klemesu et al. 2000). The index was restricted to children 4 months and older.¹⁹ It was made age specific by carefully selecting both the variables and the scoring system that were relevant for each age group (4.0–8.9, 9.0–17.9, and ≥ 18.0 months). The index was created for each age group by adding up the scores obtained for the different practices (see Appendix Table A.1 for variables and scoring system used). Terciles were created to form three categories of caring practices: poor, average, and good. Additional details about the methodology can be found in Ruel et al. (1999).

The index has proven to be a useful tool for examining associations between childcare and nutritional status. It allows us not only to look at bivariate relationships, but also to consider the importance of care for nutrition in multivariate models that controlled for other known child, maternal, and household determinants (Ruel et al. 1999). In addition, the index allows us to summarize the information into simple yet insightful and easily interpretable graphical representations, which can be particularly useful for advocacy.

¹⁹ In 1997, the time of the study, the recommended length of exclusive breastfeeding in the country was 4 to 6 months (as opposed to 6 months, which is the current international recommendation). We used 4 months (the lower bound) to examine complementary feeding practices in this study.

Clearly, although this index has its limitations, it should be regarded as a first step in the development of a methodology to measure and quantify different dimensions of care. To summarize the main limitations of this index, first, the amount of information available on the different dimensions was limited. For example, only two questions were asked about caregiver–child interactions during feeding, and most of the information related to child feeding during the first six months of life. As noted earlier, this latter information is subject to differential recall *bias* because differences in recall occur when mothers of children of different ages are interviewed. Second, the questionnaire did not include information on current child-feeding practices. Information on dietary quality and frequency of feeding would have been particularly useful. Finally, the age groupings were too wide, especially the 9–18 month age grouping. This is a period of transition, including rapid changes in feeding practices, and therefore it would have been preferable to divide it into at least two categories.

It is also important to note that the usefulness of a single global index, as compared with separate indexes reflecting individual dimensions—for example, in the case of Ghana, diet-related feeding practices, caregiver–child interactions, and preventive health-seeking behavior—will depend on the specific objectives for which it is used. There are clearly advantages and disadvantages to both approaches. The main disadvantage of creating multiple indexes is that it defeats one of the main purposes of creating an index, which is to combine various dimensions into a single variable and to assess globally the association with child outcomes. The advantage of creating multiple indexes is merely the converse; that is, by splitting the index into its individual dimensions, one can evaluate the role of each of the dimensions for child outcomes and also assess relationships among the various dimensions.

In a follow-up analysis of the Accra study, the care index is split into two separate indexes: (1) a child-feeding index, which includes both the child-feeding and the caregiver–child interaction variables, and (2) a preventive health-seeking behavior index (Armar-Klemesu et al. 2000). The hygiene index described in the previous section has always been handled separately from the other two. The objective of this particular analysis is to look at the constraints to childcare practices and to determine whether the constraints are the same for child-feeding, preventive health-seeking, and hygiene-related behaviors. The findings show both differences and similarities in the constraints to good care practices between dimensions. For instance, low maternal education is consistently associated with poorer practices in all three dimensions, whereas socioeconomic factors only affect practices related to hygiene. These results illustrate that the two approaches to using indexes provide different insights and that the purpose of the analysis should guide the selection of indicators and indexes.

The Feeding Indexes Constructed Using the Demographic and Health Surveys (DHS)

Two sets of analyses were carried out to explore the feasibility of creating a child-feeding index using widely available data from the Demographic and Health Surveys (DHS). The first one involved analyses of seven data sets from Latin America, using DHS data collected between 1994 and 1998 (Ruel and Menon 2002). These are referred to as the DHS-III. The second analysis used recent (2000) Ethiopian data from a revised DHS questionnaire referred to as *DHS+* (Arimond and Ruel 2002).

The DHS data sets are attractive because the information available on child-feeding practices is relatively complete and is available for large and nationally representative samples for a number of countries. This allowed us to explore the feasibility of creating a child-feeding index using a larger number of child-feeding practices than in our previous work and to use more disaggregated age groups because sample sizes were larger. With the DHS data, we created a child-feeding index that includes the following practices: current breastfeeding (yes/no), use of bottles (yes/no), dietary diversity (child received [yes/no] selected food groups in the previous 24 hours), 7-day food frequency (number of days the child received selected food groups in the previous seven days), and feeding (or meal) frequency (number of meals and snacks received in the past 24 hours). Other aspects of feeding such as caregiver–child interactions are not included in the DHS surveys.

As in the Accra study, the index was made age-specific (both in the variables included and in their coding), but the age groupings were changed to include 6–9, 9–12, and 12–36 months of age (see Appendix Table A.2 for an example of the variables and coding system used in the Ethiopia analysis).²⁰ Feeding terciles were also derived to categorize feeding practices into poor, average, and good.

Results for both Latin American countries and Ethiopia show a significant association between the index (in this case of child-feeding practices) and child nutritional status reflected in height-for-age Z-scores (HAZ).²¹ Differences in HAZ

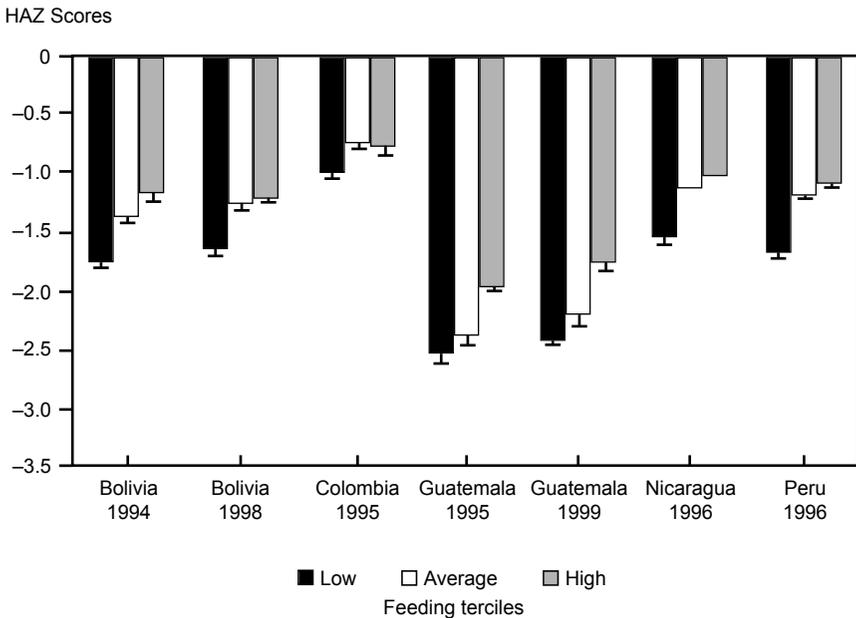
²⁰The scoring of variables used to create the child-feeding index for the Latin American countries was slightly different. The most important difference was in the coding of the dietary diversity score, which was based on a smaller number of food groups for Latin American countries than for Ethiopia. This resulted from differences between the DHS-III and *DHS+* questionnaires. The variables and scoring used for the index for Latin American countries can be found in Ruel and Menon (2002).

²¹It is important to recognize that HAZ is an indicator of long-term, chronic undernutrition and that the child-feeding index summarizes current feeding practices. We hypothesize that the association between current feeding and long-term growth exists because current practices act as a proxy for long-term practices. More specifically, it is hypothesized that mothers who currently have poor feeding practices may also have had nonoptimal feeding practices throughout the child's life, which results in a cumulative growth deficit, or low HAZ. This hypothesis is consistent with the suggestion of various researchers that "good" or "bad" practices tend to cluster.

between children from the lowest feeding tercile, compared with the highest feeding tercile, are greater or equal to 0.5 in Z-scores in five of the seven Latin American data sets (Figure 4.2); Bolivia 98 and Colombia 95 were the exceptions. In Ethiopia, the difference was 0.46. Differences in HAZ of this magnitude are considered biologically meaningful—that is, they are associated with both short- and long-term functional outcomes, especially cognitive development, fulfillment of intellectual potential, work capacity, and reproductive performance (Martorell and Scrimshaw 1995).

Differences in HAZ between child-feeding terciles also remained statistically significant in all data sets except Bolivia when multivariate analyses were used to control for potentially confounding influences such as child age, maternal education

Figure 4.2 Association between child-feeding practices and height-for-age Z-scores (HAZ) in five Latin American countries, for children aged 12–36 months (DHS data sets)



Source: Ruel and Menon 2002.

Note: Means and standard errors are presented.

and other characteristics, and household socioeconomic and demographic factors.²² Interesting country-specific interactions were also identified in the Latin American data sets between the child-feeding index terciles and specific maternal and socioeconomic characteristics (Ruel and Menon 2002). These were useful in identifying subgroups for which the association with child nutrition was larger; children in these subgroups, therefore, would be more likely to benefit from interventions to improve child-feeding practices.

In conclusion, our experience with constructing a child-feeding index with DHS data sets was successful; our analyses showed a strong association between child-feeding practices and child nutritional status in Ethiopia and in five countries in Latin America. In addition to its great potential for advocacy purposes, the method also allowed the identification of vulnerable groups (groups of children who had both low child-feeding index scores and poor nutritional status). Box 4 summarizes the conclusions and recommendations regarding the use of recall methods and summary indexes for measuring child-feeding practices.

²²Maternal characteristics included in the models were education, height, ethnicity (when available), and parity. Household characteristics were a socioeconomic status index based on household assets, housing quality, and availability of services, derived from principal component analysis; number of children less than five years of age; and area of residence. Maternal education and height and the socioeconomic index were statistically significant in almost all models, either as main effects or in interaction with the child-feeding index (Ruel and Menon 2002).

Box 4: Conclusions and recommendations regarding the use of recall methods and summary indexes in measuring child-feeding practices

- Indicators of child-feeding practices based on maternal recall are widely used and appear to be useful, at least for assessment and descriptive purposes
- Main advantages of recall methods to measure child-feeding practices
 - Simple to use and require minimum level of training
 - Data collection and processing is relatively simple and can be hand-tabulated and managed even by inexperienced program personnel
- Potential limitations of recall methods to measure child-feeding practices
 - Length of recall needs to be standardized and kept to a reasonable length to minimize memory error (we suggest 12 months or less, although insufficient information is available to make a firm recommendation)
 - Although widely used, maternal recall methods to measure feeding practices have not been sufficiently validated; their validity and reliability to measure different feeding practices needs to be established
- Potential advantages of summary indexes to measure child-feeding practices
 - Can accommodate the multidimensional nature of child-feeding practices by combining different practices into one index
 - Allow creation of indicators that are age specific within small age intervals; also allow combining of age groups in the analysis, which increases statistical power
 - May be able to detect associations better than examination of individual practices because it combines various practices; this will be particularly true if “good” practices cluster or if a minimum number of good practices are required to impact child outcomes
 - Can be useful for advocacy and communication purposes because they provide a global summary variable to represent a number of feeding practices
 - Our experience with the feasibility and potential usefulness of child-feeding indexes with the Accra and the DHS data sets suggests that this is a promising area for future development
- Research needs
 - Validation of recall methods for measurement of feeding practices
 - Assessment of optimal recall period to minimize recall error
 - Development of methods to minimize overreporting of good practices
 - Continued research to assess usefulness and limitations of child-feeding index for different purposes

Caregiver–Child Interactions during Feeding

Conceptual Issues

The recent focus on care has resulted in the study of additional child-feeding practices to those described in the previous chapter, many of which involve caregiver–child interactions. Study of these practices has been one result of identification in the conceptual care literature of several concepts that had previously received little attention in the nutrition literature. These include

- the *transactional* nature of care, including the influence of the child’s characteristics on caregiver behavior (Engle, Menon, and Haddad 1997); and
- the importance of feeding style and the role of the caregiver in ensuring adequate dietary intake through *active and responsive feeding* (Engle, Bentley, and Peltó 2000).

Related to these concepts is the problem of anorexia (poor appetite and food refusal) among young children in developing countries (Dettwyler 1989). The importance of anorexia has received increasing recognition.

Here we restrict our focus to caregiver–child interactions, though there is evidence that a variety of intrahousehold processes influence children’s intake of food, including interactions with siblings and other household members (see, for example, Gittelsohn et al. 1998). The role of a primary caregiver (usually the mother)

predominates in the first year of life, whereas the role of other family members and the child's own role in procuring food both increase in importance thereafter.²³

In this chapter, we first discuss the conceptual issues described above. We then review the limited developing-country experience with the measurement of interactions between caregiver and child during feeding, most of which is from observational studies. Finally, we summarize relevant results from our experience in measuring some of these concepts through survey methods in Accra, Ghana.

The Transactional Nature of Care

The transactional model of care suggests that a child's health, growth, and development all result from a long series of mutual interactions between the child and his or her caregivers. These interactions are influenced by a variety of characteristics of both the caregiver and the child, and they change with the developmental status of the child (Engle and Ricciuti 1995; Engle, Menon, and Haddad 1997).²⁴

Characteristics of the child may have a major influence on a variety of caregiver behaviors. The child's age, for instance, may influence behavior in a variety of ways linked both to the child's actual developmental stage and also to caregiver expectations for children of a given age. The child's gender may also be an important determinant of caregiver behavior, particularly in some cultures. Age and gender are (relatively) easily determined in a research context and have received attention. However, other less easily measured characteristics may also be important.

Children differ with respect to endowed healthiness, temperament, and social and language development. These characteristics may influence how actively and successfully the child elicits care, food, and attention. Caregivers' perceptions of the child's health, vulnerability, appetite, and growth may all influence care and feeding practices (Piwoz et al. 1994; Engle, Menon, and Haddad 1997; Engle, Lhotska, and Armstrong 1997). Characteristics of the caregiver also play a role, including caregiver responsiveness and sensitivity to the child's needs and behavioral cues (Engle and Ricciuti 1995; Valenzuela 1997).

²³We focus on caregiver-child interactions in part arbitrarily, to keep the length of the review manageable, and in part because we are particularly concerned about care practices during the most vulnerable period for infants and young children. There has been increasing recognition that the window of opportunity for intervening to prevent malnutrition is relatively narrow, occurs early in life (and in utero), and may end by the second birthday. It is during this time period that caregiver-child-feeding interactions are most critical.

²⁴This view of care—as transactional in nature—is embedded in a broader, widely accepted theory of child development (see, for example, Bronfenbrenner and Morris 1997).

In the context of care research, failure to recognize the role of child characteristics and the transactional nature of care can result in misinterpretations. For example, attempts to relate caregiver feeding practices to child growth outcomes may be confounded by the child's (often unmeasured) level of appetite. Both positive practices such as encouraging the child to eat and negative, overly controlling practices such as force-feeding may correlate with poor growth. However, this may be because both are methods caregivers use in response to the child's poor appetite and resulting lack of interest in food.

A second and related discussion in the conceptual literature addresses the *meaning* of various care behaviors and differentiates between compensatory care—"behaviors intended to return the child to [an] ...accepted state of health"—and enhancement care—behaviors that “serve to enhance further development” (Engle 1992). Examples of compensatory care would include carrying a sick child or coaxing an anorectic child to eat. Examples of enhancement care would include interacting responsively with a toddler or encouraging a healthy child with a good appetite to eat a larger variety of foods.

In a situation where compensatory care in feeding is observed (for example, Bentley et al. 1991; Engle and Zeitlin 1996) and an enhancement orientation is rare, good compensatory practices, such as urging a sickly child to eat, can correlate with poor growth and health, while “poor” or “laissez-faire” practices can correlate with good growth of healthy, resilient children.

Level of Caregiver Control of Feeding and Child Anorexia

Maternal feeding styles vary widely among and even within cultures. In a series of reports from Mali,²⁵ and drawing on ethnographic literature from other settings, Dettwyler (1989) describes a range of styles of feeding and argues that the level and nature of caregiver control of feeding may be as important as food availability or socioeconomic status in determining nutritional status. In a totally “laissez-faire” approach, young children and even older infants are allowed much autonomy in eating; they are assumed to know when they are hungry and when they are satiated. In this setting, if a child refuses food, it is not considered necessary or appropriate to force or even to encourage him or her to eat. At the other end of the spectrum, extreme parental control of feeding may involve threats, bribes, or force-feeding. Somewhere in the middle of this spectrum, an optimal style of “responsive” feeding has been described (see Box 5) (Birch and Fisher 1995; Engle, Menon, and Haddad 1997; PAHO/WHO 2003).

²⁵See Dettwyler 1986, 1987, 1989, 1991, and 1992.

Box 5: Responsive feeding behaviors

- Feed infants directly and assist older children to eat
- Allow older infants and children the opportunity to self-feed, adapting to their level of development and skill
- Be sensitive to child's hunger and satiety cues
- Feed slowly and patiently
- Encourage children to eat but do not force them
- If children refuse many foods, experiment with different food combinations, tastes, and textures
- If children refuse foods, try different methods of positive encouragement (for example, games, stories, or songs)
- Minimize distractions during meals if child loses interest easily
- Talk to and look at children while feeding

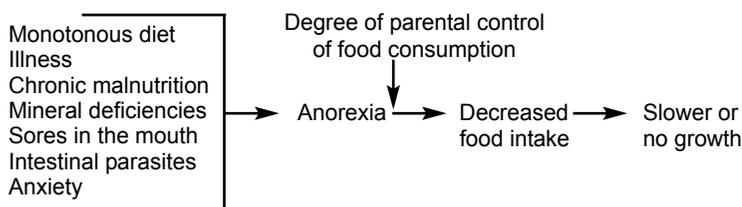
Source: Adapted from Engle, Menon, and Haddad (1997) and PAHO/WHO (2003).

Anorexia—the lack of a normal appetite, disinterest in food, or refusal to eat—has been reported among young children worldwide, even in situations where undernutrition is widespread. Anorexia may be chronic—as, for example, when caused by chronic malnutrition or subclinical infection, mineral deficiencies, or intestinal parasites—or it may be acute, as when caused by acute infections, sores in the mouth, or teething (Figure 5.1) (Dettwyler 1989; Golden and Golden 1991). Anorexia may also be classified as “nonorganic” in origin; nonorganic failure to thrive (NOFTT) has been the subject of extensive investigations, almost exclusively in the developed-country context.²⁶

Results from several studies in developing countries suggest that caregivers respond to acute anorexia with a variety of efforts to encourage children to eat (Brown et al. 1989; Bentley et al. 1991; Almroth, Mohale, and Latham 1997). While this may seem obvious, these results contrast with a commonly held view that mothers withhold food from anorectic children during illness, particularly during diarrhea (Chen 1983; Khan and Ahmad 1986; Kumar et al. 1985). Bentley et al. (1991) have also demonstrated that increased encouragement may occur when

²⁶Review of the NOFTT literature is outside the scope of this report. Caution is required in extrapolating from the NOFTT literature to the developing-country setting, where most anorexia may be attributed to organic causes. However, the NOFTT literature does provide examples of tools developed and validated for the purpose of assessing caregiver–child interactions; some of these may be adaptable. For definitions and further information on NOFTT, see Homer and Ludwig (1981); Drotar (1991); Bithoney, Dubowitz, and Egan (1992); Benoit (1993); Fomon and Wilson (1993); Frank, Silva, and Needlman (1993); and Chatoor et al. (1998).

Figure 5.1 Causes of anorexia and the potential relationship between anorexia and growth



Source: Dettwyler 1989, 693.

children are perceived as anorectic even in a setting where laissez-faire feeding is very common.

Dettwyler (1989) documents the effects of anorexia on intake, and she discusses a range of possible causes of anorexia among young children. She describes the level of caregiver control of food consumption as mediating²⁷ between anorexia and intake and highlights the fact that among children with severe problems of anorexia, parental help and control over feeding can mitigate the potentially detrimental effects of lack of appetite on growth. For children who do not experience frequent or chronic anorexia, parental involvement may not be as critical.

Measurement of Caregiver-Child Interactions during Feeding

In the extended model of care described by Engle, Menon, and Haddad in 1997, a set of constructs related to care during feeding is identified, along with preliminary suggestions for indicators. Key constructs at the caregiver level include

- *Adaptation to the child's characteristics.* This includes adaptation to psychomotor abilities and physical difficulties (for example, low birth weight babies with poor suckling ability);
- *Active and responsive feeding.* This refers to the caregiver's ability to feed responsively, including encouragement to eat, offering additional foods, providing second helpings, responding to poor appetite, and using a positive versus aversive style of interaction; and

²⁷In this model, the degree of parental control could also be conceived of as an "effect modifier," in the statistical and epidemiological sense.

- *The feeding situation.* This includes location, organization, regularity, and frequency of feeding, supervision, and distraction during eating events.

At the child level, the importance of the following characteristics is also highlighted:

- appetite and hunger,
- food preferences, and
- child characteristics preferred (or not) by caregivers (for example, gender, birth order).

For both caregiver practices and child-level variables, the indicators suggested by Engle, Menon, and Haddad (1997) are primarily derived from CM observations. In the remainder of this chapter, we first summarize research employing these observational methods to study interrelationships between feeding style and situation, caregiver–child feeding interactions, and child appetite and demand for food. We then provide a short review of work employing other approaches and conclude by describing results from our own experience with a survey approach in Accra.

Continuous Monitoring Observations

A summary of the design, hypotheses, methods, and main findings of five studies that employed CM observations to describe various aspects of the context of feeding and of caregiver–child-feeding interactions is presented in Table 5.1. Because of differences in focus (age range, hypotheses) and methodology, the studies cannot be directly compared. The studies also greatly differ in the types of indicators developed to measure feeding interactions in each context. These five studies were undertaken in developing-country contexts. Following a summary of these studies, we describe two more studies, from the United States and the United Kingdom, because the methodologies employed are relevant.

Scales to measure the constructs of “maternal encouragement to eat” and “child acceptance of food” were developed in a 12-month prospective study in Peru (Bentley et al. 1991). The study aimed at documenting whether “stages of illness” (diarrhea, convalescence, and health) affected maternal feeding behavior and child acceptance of food. Observation and analysis were at the level of each individual food or drink.²⁸ The encouragement to eat scale consisted of “verbally encourage,” “verbally pressure,” and “physically force.” The child acceptance of food scale items were “rejects food,” “appetite level,” and “asks for food.” The child acceptance of

²⁸No description is given of the training and standardization of observers or fieldworkers.

Table 5.1 Summary of recent studies that used observational methods to measure maternal child-feeding interactions and care during feeding

Reference/country	Type of study	Hypotheses	Observational methods used	Comments on methodology	Summary of key findings
Bentley et al. 1991 (Peru)	Dietary Management of Diarrhea Project (40 children 30–36 months old)	"Stage of illness" (diarrhea, convalescence, health) affects maternal feeding behavior and child acceptance of food.	12-hour structured observations over 2–4 days each of diarrhea, convalescence, and health. Observations took place over a 12-month period.	Performed a series of 3-hour observations without weighing children or food to assess reactivity of these procedures and of the more intrusive 12-hour observation. Report no difference in frequency or duration of breastfeeding between the 3-hour and the 12-hour observations.	More maternal encouragement during diarrhea than during convalescence or health. Child acceptance of food higher during health than diarrhea; also higher for liquids and semi-solids than solid foods, regardless of health status.
Engle and Zeitlin 1996 (Nicaragua)	Positive Deviance in Nutrition Research (80 children 12–19 months old)	Caregiver encouragement to eat is compensatory rather than enhancing; it is not associated with anthropometry but with anorexia or food refusal. Child interest in food is positively associated with anthropometric status.	Two 3–5 hour structured observations, approximately one week apart, during July–October, 1989. 37 behaviors were coded for each eating event. Eating events were coded as meals, snacks, or bottle-feeds.	Identity of observer was not associated with maternal or child behavior Families did not have prior notice of the first visit. They knew the observer would return the next week but were unaware of the exact day.	Active Feeding and Child Demand scales negatively correlated. Active Feeding Scale not associated with child anthropometry. Child Demand Scale positively associated with child anthropometry.

(continued)

Table 5.1—Continued

Reference/ country	Type of study	Hypotheses	Observational methods used	Comments on methodology	Summary of key findings
Gittelsohn et al. 1998 (Nepal)	Case control study of previously directly xerophthalmic children 2–5 years and their younger siblings (78 cases and 53 siblings; and 78 age- matched controls and 53 siblings).	Caregiver–child behaviors influence and are influenced by how food is allocated within the house- hold, and how the child is cared for in other ways. These behavioral patterns play a direct role in the health status of the child.	Seven daylong observations over a 15-month period, at 2-month intervals. Observers arrived early (6–7 a.m.), took a midday break, and remained until after the evening meal. Observations were event-focused, with a minimum of one record per 5 minutes. 110 behavioral codes were developed.	Efforts to reduce reactivity included initiating observations only after households were familiar with study personnel (after several contacts); the same observer was used for each given household over the entire study period. Families had no prior notice of visits. Each (blinded) observer was assigned an equal number of case and control households, to minimize effects of observer bias on case/control comparisons. In addition, reactivity was quantitatively assessed (see Gittelsohn et al. 1997).	Quality of care was more impor- tant than intra-household food distribution in determining the risk of xerophthalmia. Previously xerophthalmic children were more likely to serve themselves and have more servings; twice as likely to be treated harshly; less likely to have health needs attended. Positive health behaviors associated with more encourage- ment to eat and more frequent offers of food. Negative health behaviors associated with more frequent requests and more frequent refusals. Children who were refused food asked for food more frequently, for a longer time, and were less likely to self-serve. Children who served themselves received less encouragement to eat.

(continued)

Table 5.1—Continued

Reference/ country	Type of study	Hypotheses	Observational methods used	Comments on methodology	Summary of key findings
Guldan et al. 1993 (Bangladesh)	Positive Deviance in Nutrition Research (185 children 4–22 months at onset of study)	Maternal education will be independently associated with improved infant and child-feeding practices (with socio- economic status [SES] controlled).	45-minute structured observations, weekly for six months, for an average of 22 observations per focus child. Each possible combination of interviewer, time of day, and day of week was equally represented. Each observation period began with a "spot observation" of the conditions surrounding the child. The start of each clearly defined eating or breastfeeding activity triggered event recording (1,424 feeding and 1,914 breastfeeding observations).	...	More educated mothers were more likely to feed child inside house than in court-yard and to place child on a bed rather than on the ground; also more likely to notice when child dropped food; to feed child with cup (also with bottle); to terminate breastfeeds; child was more likely to cry at end of breastfeeding. Mothers with no education more likely to engage in economic activities when breastfeeding; children more likely to initiate feeding and feed them- selves; more likely to eat food not specifically prepared for them.

(continued)

Table 5.1—Continued

Reference/ country	Type of study	Hypotheses	Observational methods used	Comments on methodology	Summary of key findings
Ha et al. 2002 (Viet Nam)	Observational sub- study within randomized intervention trial: the Viet Nam Study to Improve Outcomes in Nutrition (VISION) (40 children aged either 12 months or 17 months)	No hypotheses stated; observational study undertaken to investigate feeding styles of Vietnamese caregivers. Objectives of this paper were to report on feasibility of videotaping, coding, and analysis scheme; and examine associations between feeding style and child acceptance of food.	Two 2-hour observations of each child, 7 days apart. Children and caregivers were videotaped in their homes. All observations in- cluded the main afternoon meal, and snacks were also observed for 29 out of 40 children. All videotapes were later coded by one observer. Coding was at the level of the "intended bite," that is, when food was brought to the child's mouth either by a caregiver or by the child. Coding scheme covered physical help given, child interest in food, and caregiver verbalization.	Videotaping was acceptable to families and reactivity, while not formally assessed, "did not seem problematic." Field- workers encouraged mothers to avoid changes in usual feeding. Coding scheme does not preserve information about sequencing of interactions; for each "intended bite" associations between caregiver and child behaviors can be reported but in this analysis it is not possible to distinguish whether caregiver behavior (help, physical restraint, verbalization) preceded or was a response to child's acceptance or rejection of food.	12-month-old children almost always received physical help with eating, while 17-month-old children fed themselves 70 percent of the time. Caregivers usually provided no verbalization. Positive verbalization was asso- ciated with acceptance of food. Negative verbaliza- tion was associated with rejection of food. Force- feeding was associated with rejection of food. Among 17-month-old children, but not among 12-month-old children, light physical restraint was associated with rejection of food.

food scale was validated against actual intakes and showed a moderately strong correlation (Spearman correlation = 0.47).²⁹

A cross-tabulation of the two scales showed a negative relationship between child acceptance and maternal encouragement, suggesting compensatory care. The authors comment that mothers in this sample were “generally passive feeders,” giving no encouragement to eat for 64 percent of all observations. However, more maternal encouragement to eat was observed during diarrhea than during either convalescence or health. Thus, it appeared that mothers in this setting were not withholding food during diarrhea, but on the contrary, they responded to anorexia with increased encouragement. Maternal encouragement was also greater with liquids and semi-solid foods than with solid foods.

As expected, child acceptance of food was higher during health and during convalescence than during diarrhea. Acceptance of liquids and semi-solid foods was higher than acceptance of solids, regardless of health status. Breast milk intake was negatively associated with child acceptance of food. Since mothers in this study responded to illness with increased efforts to feed, the authors conclude that it might be possible to promote increased feeding during convalescence, when children are more likely to accept it.

In a positive deviance study in Nicaragua, the authors hypothesized, based on their previous work, that caregiver encouragement to eat would be compensatory in nature and would therefore be associated with anorexia, but not with child growth indicators (Engle and Zeitlin 1996).

Eighty children aged 12–19 months were each observed twice over a four-month period.³⁰ For each feeding event observed (snack, bottle feed, or midday meal), 37 behaviors were coded. These included aspects related to the feeding situation; to the caregiver’s feeding style, level, and type of encouragement; and to the child’s interest in eating. Two scales were developed for each meal type: an active feeding scale and a child demand scale, yielding six scales in all. All items theoretically related were initially included in the scales, but based on reliability analysis, items were dropped in order to achieve the best possible reliability/consistency score (Cronbach’s α).

The child demand scale consisted of the same six items for meals, snacks, and bottle feeds, ranging from 0.63 to 0.66, depending on the event. These were the items: asks for food before given, interested in food at first, interested in food in

²⁹The authors use “acceptance of food” and “appetite” interchangeably in this report.

³⁰Fieldworkers were physicians and nurses; observations by each fieldworker were standardized to the first author (80 percent reliability on all codes in 10 trials), and periodic reliability checks were made throughout the study.

middle, interested in food at end, asks for more food during meal, and more than one request before meal.

The active feeding scales consisted of different items for meals than for snacks and had low Cronbach's α statistics of 0.30 and 0.36, respectively. For bottle feeds, there was only one item—encourage—and thus no scale was constructed. Items common to the meal and snack active feeding scales were encourages, serves additional food, and offers additional food. Other items in the scale for meals were threatens, demonstrates how to eat more, and orders child to eat more. Other items in the scale for snacks were spoon used by caregiver and talks to the child during eating.³¹

Descriptive results indicate that, as in the Peru study, mothers were observed to encourage their child during less than half of the eating events (39 percent). However, this varied by event, with more encouragement observed during meals (59 percent) than snacks (29 percent) or bottle feeds (21 percent). The authors report low levels of aversive control; for example, threats were used in only 5 percent of eating events. Child demand for food was greater for bottle feeds than for meals at all points in time. Child refusal at the end of the meal was common, with 65 percent of children not finishing the available food.

Also as documented in the Peru study, the two scales used in the Nicaragua study were negatively correlated. A lack of association between the active feeding scales and children's anthropometry was documented, which is consistent with the idea of active feeding as primarily a compensatory behavior. However, the lack of association may also reflect the low reliability of the scales. The child demand scale, which had a higher reliability than the active feeding scales, was significantly and positively associated with both higher weight-for-age and height-for-age.

The authors conclude that the child has a major role in determining intake, through both demand for food and food refusal. While recognizing the need for further research, they state that because children are not eating all the food available to them, increased encouragement, particularly when children are not anorectic, might result in increased intake.

The Nepal study (Gittelsohn et al. 1998) was a case-control study of previously xerophthalmic children aged 2-5 years³² and their younger siblings. A large number of behaviors were observed and from these, a number of counts, scales, and

³¹ One possible explanation for the low Cronbach's α statistics may be that the scale items reflected more than one dimension and thus would not necessarily be expected to show high correlation between items.

³² These children suffered clinical eye signs of severe vitamin A deficiency at the onset of the study.

scores were calculated.³³ In general, these were calculated at the level of the observation day and averaged across all days that a particular household was observed. This process resulted in a set of summary variables grouped as follows.

Caregiver-child feeding interaction. These variables included feeding style (for example, caregiver serves automatically or child asks, second helpings, serving refusals); encouragement to eat (additive scale of 11 behaviors); child demand and interaction with caregiver (request intensity, time gap between request and service); snacking frequency; and meal frequency.

Intrahousehold food allocation patterns. Meal serving order, channeling (proportion of foods served at the meal that the index child was offered), shared plate (score summing number of times child ate from someone else's plate), interplate food sharing (where someone takes food from his or her plate and puts it on the child's plate), and the number of people at meals where the child was served.

Four other childcare scales, not directly related to feeding, were also created: a positive social behavior scale (23 behaviors including affectionate gestures, holding, massaging, picking lice, cleaning, and so forth); a negative social behavior scale (9 behaviors including scolding, slapping, hitting, refusing to give food, fighting, quarreling); a positive health behavior scale (15 behaviors including brushing teeth, cleaning up feces in a sanitary manner, using soap to clean the child); and a negative health behavior scale (7 behaviors, including beating a child moderately or strongly, refusing requests for food in a discriminating fashion, injuries, and cleaning up feces in an unsanitary fashion).

Where Cronbach's α was reported for specific scales, it ranged from low (for example, a negative social behavior scale of $\alpha = 0.39$ and positive social behavior and positive health behavior scales of $\alpha = 0.56$) to respectable (a socioeconomic status [SES] scale of $\alpha = 0.78$). Both "serving refusal" and "encouragement to eat" scales were reported to have very low reliability (Cronbach's α not reported). The authors commented on the generally low reliability of the scales and suggested that the very low frequency of observation of many of the behaviors contributed to the scales' low internal consistency. Despite limitations in reliability of some indicators, the results provide one of the richest available pictures of the relationships among a variety of care practices. A key finding was that caregiver-child-feeding behaviors and other childcare behaviors (health and social behaviors) were more important than intrahousehold food allocation behaviors in determining the risk of xeroph-

³³ Observers were high-school graduates who were trained for three months and standardized in the use of the behavior-recording instrument.

themia in this context. The authors state that observed relationships between feeding care and social and health care suggest that child neglect in one area of care (for example, lack of automatic serving, more food refusal) is related to negative social and health-related care. They call for further research exploring how these behaviors relate to various health outcomes.

An additional contribution of this study was the assessment of reactivity of the behaviors studied using two different approaches (Gittelsohn et al. 1997). The first method was to ask observers to code specific behaviors, such as household members looking at or interacting with them, or admitting to modifying their behavior in the presence of observers. The second method was to examine changes in behaviors during seven consecutive visits. Changes in behaviors can be interpreted as evidence of reactivity. There was some suggestion of reactivity, but patterns were inconsistent across different types of behaviors. Generally, a strong drop in reactivity was found after the first visit, leading the authors to suggest that it may be necessary to discard data from the first day or to standardize it based on subsequent observations.

A study in Bangladesh (Guldan et al. 1993) examined a variety of child-feeding practices to determine which ones were associated with maternal education and whether the effect was independent from household socioeconomic factors. CM observations of children aged 4–22 months at the outset of the study were carried out over a period of six months, leading to an average of 22 observations per child.³⁴ Several types of summary measures for behaviors were calculated, including the percentage of observations in which a behavior was noted (for example, the percent of observations of eating “events” in which the child was seated on the ground) and the average number of occurrences per hour (for example, the average number of feedings per hour). Nine groups of variables were described, including both child-feeding practices (breastfeeding, complementary feeding) and behaviors related to caregiver–child interactions and feeding style (who initiates feeding, who terminates it, identity of caregiver, feeding utensils used, feeding types per hour) and to the feeding situation (location, surface on which child is fed).

Maternal education was significantly associated with better feeding practices and, as stated by the authors, with greater “seriousness of attention” or “intentionality” with regard to child feeding. They note that the negative “modern” practice of bottle-feeding also accompanied education but, on the whole, associations with education were positive.

The final and most recent developing-country example of a feeding interaction study comes from a positive deviance intervention in Viet Nam (Ha et al. 2002).

³⁴ No description is given of the training and standardization of observers or fieldworkers.

Forty children aged either 12 months or 17 months were videotaped twice during feeding in two-hour sessions. Two-person teams consisted of a photographer and a recorder; the latter recorded activities minute by minute to facilitate later coding of the tapes.³⁵ The tapes were coded at the level of each bite (whether self-fed or given), using a coding scheme based on the one developed by Bentley et al. (1991) in Peru. The scheme included coding of physical help, child interest in food, and caregiver verbalizations (see Box 6).

For both 12- and 17-month-old children, positive verbalization was observed more often among children who were coded as accepting food; this association was much stronger among the 17-month-old children. However, caregivers usually provided no verbalization (70 percent of intended bites). Force-feeding was strongly associated with rejection of food, and light physical pressure was asso-

Box 6: Coding for caregiver-child observations

Physical help

- No help offered
- Facilitated feeding or directly fed
- Used physical pressure (press down spoon in mouth or lightly restrain child)
- Force-feeding

Child's interest in food

- Eagerly accepted food (leaned forward, opened mouth, reached for hand of feeder)
- Passively accepted food (not eagerly)
- Accepted food, then subsequently rejected it (spit out)
- Rejected the food, then accepted it
- Completely rejected the food

Verbalization (caregiver)

- No verbalization
- Positive verbalization
- "Mechanical" verbalization ("open your mouth" or "eat")
- Verbal order or threat

Source: Ha et al. 2002.

³⁵ No description is given of qualifications or training for the two-person team.

ciated with rejection of food among the 17-month-old children but not among the younger children.

The main limitation of this analysis, acknowledged by the authors, is that the direction of timing was not indicated in the coding; that is, it is not possible to tell if the caregiver behavior preceded the child's, or vice versa. In other words, negative verbalizations could be a response to food rejection by the child and not the other way around. Similarly, positive verbalizations could represent praise for accepting a bite, rather than encouragement before the fact. A second limitation, also acknowledged, is that no data are available on food intake for the videotaped feeding episodes, so no conclusions can be drawn about the relationship of any of the coded behaviors to intake.

Despite these limitations, this study reflects both the conceptual evolution regarding responsive feeding and methodological progress in assessing it. It provides a well-documented model and a useful coding scheme for future studies. The age group focus is appropriate to capture the transition from caregiver feeding to self-feeding, and the analysis by age group provides useful insights. For example, positive verbalization appeared to be more important for the older children, and light physical pressure appeared to be less negative for the younger children; these results can be interpreted as illustrating developmental differences and increasing independence among the older children. This highlights the importance of narrow age ranges in this type of analysis.

This study also confirms that in-home videotaping may be feasible and useful in developing-country feeding interaction research. More experiences are needed to establish this, but it should be noted that the authors report that the methodology developed in Peru—videotaping, coding, and analysis—was easily adapted for application in Viet Nam. The authors report few refusals to participate and state that the videotaping was generally well accepted. They also report plans for future analyses to assess differences between the first and second filming, which could indicate whether or not reactivity was an issue.

Finally, we present two examples from developed-country settings. Like the Viet Nam study, these studies employed videotaping and coding of “microbehaviors” in the feeding interaction. These studies provide additional insights because in each, food intake is assessed for the observed meals. In addition, both studies report on inter-observer reliability (two observers code behaviors identically), and the second reports on individual-level correlations in behavior between two observations.

An example from the United States relates to the growing literature on parenting style, feeding interactions, and the risk of childhood obesity. While the objectives of the research and both cultural and resource differences may limit the relevance of study conclusions, it is possible that proven tools may be adaptable.

For example, Drucker et al. (1999) report excellent intra- and interobserver reliability in their use of a scale quantifying parental eating prompts during a meal. This scale is comprised of six scores, each of which is a simple count of the number of (1) physical encouragements, (2) physical discouragements, (3) verbal encouragements, (4) verbal discouragements, (5) times food is presented, and (6) times food is offered. Through observing one meal (in a laboratory setting), these researchers demonstrate strong significant relationships between the number of each type of maternal prompt and both the child's caloric intake and the length of the meal. Like the Viet Nam study, their results suggest that it may be possible to develop indicators relating to feeding interactions that are valid and yet involve shorter observation periods than some of the earlier studies. However, skill requirements, and therefore training needs, remain on a very high level.

Finally, in a study from the United Kingdom, Parkinson and Drewett (2001) report on in-home observation of two meals for 67 children aged 12–14 months; the age group was chosen to observe children in the midst of the transition between being fed by their mothers and self-feeding. The objective of the study was to develop a set of observational codes, suitable for use in the home, and to examine their reliability.

As with the previous study, the analysis was based on counts of 10 specific microbehaviors during the feeding interaction (for example, parent brings food to child's mouth, parent takes bottle or cup from child's mouth, child grasps food and is successful getting into mouth, child spits out food, and so forth). Verbal encouragements and discouragements were not included in this study. Interobserver reliability was once again reported to be very good, particularly for the most frequently used codes. In contrast to Drucker et al. (1999), these authors report no relationship between meal duration and food intake. Food intake was correlated with number of bites, and mean intake per bite was higher when the mother fed the child than when the child self-fed.

By observing two meals, the authors are able to comment on consistency across meals in these behaviors. They report that behaviors were correlated across meals but that correlations were low to moderate, indicating substantial variation in behaviors. For example, the count of the number of times the child fed him- or herself in each of the two meals showed a moderate correlation of 0.40. The authors conclude that it may be necessary to observe children at more than one meal in order to characterize these behaviors at the individual level.

Conclusions and recommendations regarding CM observations as a tool for measurement of caregiver-child interactions during feeding are summarized in Box 7.

Box 7: Conclusions and recommendations regarding the use of continuous monitoring (CM) observations to measure caregiver–child interactions during feeding

- CM observations of child-feeding interactions have confirmed the relevance of the transactional model for investigating this area of childcare and have provided rich information on care practices. This information, however, is highly context specific, and tools need to be developed for each specific context.
- Taken together, several studies suggest the relevance of identifying constellations of good caregiver practices and the usefulness of constructing scales to represent the various dimensions.
- The limited available data on reliability of scales from field studies indicate the difficulties involved in operationalizing constructs such as “encouragement to eat” or “responsive feeding.” More success has been achieved in operationalizing “child demand.”
- Further research should continue to explore the importance and the magnitude of the association between caregiver–child feeding interactions and child health and nutrition outcomes. This would help determine how crucial this information is for programs and whether continued research to develop simple measurement tools for measuring these concepts should be prioritized.
- Once key behaviors and interactions that influence outcomes are identified, further research examining the reactivity and repeatability of measures of these caregiver–child interactions will be needed.
- As highlighted for hygiene practices, the use of CM observations to characterize caregiver–child interactions is resource and time intensive at all stages, including training and standardization of fieldworkers as well as data collection and analysis. In the case of these complex behaviors, however, observations may be the only valid method of assessment.
- The use of newer technologies, such as videotaping, may provide richer data, as well as opportunities for validation of observations. Use of hand-held computer devices for direct entry of observational data is also being explored and may reduce both data entry time and coding errors.

Experience with Other Measurement Approaches to Assess

Caregiver–Child-Feeding Interactions

Very few researchers have used interview approaches, instead of or in addition to observational approaches, to measure caregiver–child-feeding interactions. A few exceptions exist such as the Nicaraguan study already described (Engle and Zeitlin 1996). In this study, CM observations were complemented by interviews where mothers were asked what they would do if their child refused to eat. The authors report that mothers who mentioned an action they would take (offer a different food, for example) were more likely to have well-nourished children than were mothers who mentioned child-related reasons (for example, child was ill, child did not like food) or those who felt there was nothing they could do. The association

between the mothers' responses to this question and nutritional status remained when socioeconomic status and education were controlled for. The authors comment that a maternal attitude showing that the mother believes that something can be done about food refusal may be viewed as a proxy for "enhancement beliefs."

Mothers were also interviewed in the positive deviance study in Bombay (Mumbai), which was described in Chapter 3 (hygiene practices). A semi-structured interview schedule covered a wide range of topics (Merchant and Udipi 1997). With regard to feeding interactions, mothers were asked how the child was fed; five categories of feeding patterns were recorded: child feeds self without supervision or encouragement, eats from same plate as siblings, feeds self but is supervised and encouraged, mother or grandmother feeds child, child is not served food.

The authors report large differences between the three groups (positive deviants, median group, and negative deviants) in feeding patterns, with negative deviants being more likely to be unsupervised and more likely to eat from a shared plate. Positive deviants were much more likely to be fed by mothers or grandmothers. However, no mention was made of controlling for age in the analysis. Since younger children grow faster, are less likely to be underweight or stunted, and are more likely to be supervised or assisted, the differences observed might have been confounded by child age.

In summary, to our knowledge, very few published reports document attempts to approach these issues using survey methods or other nonobservational methods. Results from the Accra study using cross-sectional survey methods are described below.

Experience with Maternal Recall for Assessing Child Anorexia, Appetite, or Demand for Food

In contrast to the caregiver side of the feeding interaction, the child demand side, and more specifically child appetite, has been examined using maternal reports in a number of research contexts, including iron and zinc supplementation trials, deworming projects, food supplementation trials, studies of the effect of illness on dietary intake, and others.³⁶ Among young children and infants, "appetite" is usually operationalized as food intake, and lack of appetite, or anorexia, is assessed through reported maternal perceptions. In both cases it is generally acute anorexia (food refusal, appetite, satiety, and so forth) that is being measured; we have not

³⁶ These include iron supplementation (Lawless et al. 1994); zinc supplementation (Krebs, Hambidge, and Walravens 1984; Umeta et al. 2000); deworming (Latham et al. 1990); food supplementation (Zumrawi et al. 1981); relationship of illness to poor appetite (Brown et al. 1995; Gryboski 1996); and relationship of appetite to growth indicators (Piwosz et al. 1994; Vazir, Naidu, and Vidyasagar 1998).

found any validated tools for assessing longer-term tendencies toward good or poor appetite in children in developing-country settings.

Dettwyler's ethnographic work in Mali (1989) once again provides insights. She reports that mothers identified some children as "never having much of an appetite," while others were described as "liking to eat all the time." In addition, almost every child was reported to be anorectic at some time during the study, thus illustrating mothers' perceptions of both chronic and acute anorexia. While some children were reported to be chronically poor eaters of all foods, others would refuse to eat particular foods only. Dettwyler did not explicitly address the issue of the validity of maternal perceptions of anorexia but implicitly demonstrated the validity of these reports through her case study approach to growth patterns.

Brown et al. (1995) assessed the validity of maternal reports of acute anorexia. In a longitudinal study of infants in Peru, households were visited three times each week for a year. Morbidity data and maternal perceptions of appetite were gathered at each visit; mothers were asked to describe their infants' appetite as "the same as usual," "less than usual," or "more than usual." Dietary intake data were also obtained for a subsample of infants. Overall, mothers reported the child's appetite to be "less than usual" on 15 percent of days (this varied with age, ranging from 2 percent of days for infants less than one month old to 32 percent at 11 months of age). Maternal perceptions of low appetite were strongly related to reductions in nonbreast milk energy intake. Depending on the age of the child, energy intakes from nonbreast milk sources were 25–35 percent lower on days when mothers reported poor appetite. Breast milk intake, however, declined only very slightly on poor appetite days (about 5 percent) among infants 0–6 months of age and did not decline among older infants.

Using data from the same study, Piwoz et al. (1994) demonstrate a relationship between maternal reports of poor appetite and lagging growth during infancy. Two subgroups of infants were identified; both subgroups showed slow weight gain from 1 to 2 months of age, but one subgroup (identified as positive deviants) achieved adequate weight-for-age by 12 months of age, while the other subgroup remained underweight. Comparing these two groups, the prevalence of anorexia was higher in the poor growth group in each subsequent month up to 12 months.

Reports of poor appetite were two to three times more common on days when the child had diarrhea and four times more common on days when the child had fever; 33 percent of diarrhea days were accompanied by anorexia, as were 45 percent of fever days. These results are similar to those reported from Java (Gryboski 1996), where lack of appetite was reported on 31 percent of diarrhea days and 60 percent of fever days. However, Brown et al. (1995) also reported that in their study in Peru, nearly one-third of all "new" episodes of anorexia were not associat-

ed with any symptoms. They indicated the need for further research on the factors other than symptomatic infections that influence appetite.

In a double-blind, placebo-controlled zinc supplementation trial, Umeta et al. (2000) also used maternal reports of infant appetite. Mothers of 6–12-month-old infants were visited daily and asked (1) if the child refused to breastfeed; (2) if the frequency, duration, or intensity of breastfeeding was reduced; or (3) if the frequency or amount of weaning food was reduced. Among children who were stunted at baseline, the authors report a significantly lower incidence of anorexia in children receiving the zinc supplement. This was consistent with significantly lower incidences of cough, diarrhea, fever, and vomiting and with significantly greater gains in weight and height among previously stunted infants supplemented with zinc, compared with the placebo-control group.

In summary, while only one study has explicitly addressed the validity of measuring maternal perceptions of acute poor appetite, the studies described above suggest that mothers' perceptions, operationalized in a variety of ways, relate meaningfully to other relevant indicators of appetite, such as energy intake, a variety of morbidity symptoms, and growth. However, when assessing maternal perceptions of child appetite through surveys, it should be noted that "appetite" has been assessed as a relative concept. That is, the mother is asked to compare her child's appetite to "normal" for her child or for other children the same age. In interpreting maternal reports, it is useful to bear in mind that in some contexts, poor appetite may be the norm for many children.

Experience from the Accra Survey in Measuring Caregiver-Child Interactions during Feeding and Child Appetite

One objective of the Accra study was to explore the possibility of constructing simple indexes for capturing important differences in caregiver behavior. While recognizing the limitations of survey approaches to the study of feeding interactions, it was nevertheless felt to be worthwhile to include a few simple questions relating to these interactions. The following questions were therefore included:

- Does anyone help the child to eat? If so, who?
- What does the caregiver do when the child refuses to eat?

In addition, to capture the child demand side of the feeding interaction, a simple appetite visual analogue scale was used.³⁷ Mothers were shown a line 100 millimeters long with "very poor" at the left end and "very good" at the right end and

³⁷Visual analogue scales have been validated for use by adults self-reporting hunger and satiety (Bergmann et al. 1992). As far as we know, no one has validated these scales when used for maternal reporting of a child's appetite.

were asked: How would you compare your child's appetite to that of other children of the same age?

Results from the Accra survey showed that responses to these simple questions showed variability and that variations in responses were consistent with theory. For example, caregiver feeding practices—who helped the child eat and what was done about food refusal—were strongly related to the age of the child, as would be expected. Almost all infants (less than 12 months) were helped to eat by their “principal caregiver,” and the proportion of children who were not helped by anyone increased progressively with age. Problems with food refusal were least frequent among young infants, probably because many of these young infants were not yet regularly receiving solid or semi-solid foods. The proportion of caregivers using positive encouragement to eat (coaxing, playing, offering a different food) remained fairly steady across age groups, while the proportion of caregivers reporting that they force-fed the child was highest in the 6-18-month age groups, when illness and poor appetite also peaked.

The relationship between the child's age and mother's perceptions of appetite showed a U-shaped pattern. Higher appetite scores were reported for young infants whose diet was mainly breast milk (mean score of 75 among infants less than 6 months of age) and for children 24 months and older who were likely to have completed the transition period from breastfeeding to family foods. The lowest mean appetite analogue scores were reported among children during the transition period, and especially for children between 6 and 12 months of age. This age (and up to 24 months) is also the period of highest prevalence of infectious diseases, which are known to markedly reduce appetite.

The relationship between appetite scores and feeding practices was also consistent with theory. Children with low appetite scores were more likely to receive some help with eating; this caregiver response can be interpreted as “compensatory.” When appetite scores were divided into quartiles, there was a significant association between appetite quartile and caregiver response to food refusal. For example, over half of the children who were force-fed (57 percent) had appetite scores in the lowest quartile.

In the Accra survey, the intent of the question about appetite was to get information about the mothers' perception of their child's appetite as a chronic characteristic of the child. However, our analysis suggests that responses were probably influenced by recent illnesses, because the appetite scores were significantly associated with reported symptoms of diarrhea, vomiting, and cough in the previous two weeks. It is possible that children with recent symptoms are also those who experience morbidity more often and thus have lower appetite on a more chronic basis. However, low appetite scores were also associated with lower weight-for-height, but

Box 8: Conclusions and recommendations regarding the use of survey approaches in feeding interaction research

- Outside of observational studies, very few attempts have been made to study feeding interactions. It is probable that some aspects of these interactions will never be amenable to survey approaches; however, our experience suggests that simple questions can capture some aspects and deserve further research.
- Rapid ethnographic work should be used to guide the design and interpretation of simple questions to be used in quantitative surveys. The use of qualitative methods in a number of settings may also help researchers determine if it is possible to identify a minimum set of key child-feeding interaction variables that have universal relevance. At present this remains an open question.
- Once simple, well-grounded survey questions on feeding interactions are designed, structured observations of a subsample of households could be carried out to compare findings (triangulation of findings).
- Maternal perceptions of child appetite have been assessed in a number of research contexts, using a variety of indicators. Results suggest that this is a valid and useful approach to assessing recent appetite among children. However, tools based on maternal perceptions provide “relative” information on appetite (appetite relative to usual or relative to other children); this should be remembered when employed in areas where chronic poor appetite may be the norm for many children.
- Experience with a simple visual analogue approach for maternal perception of appetite suggests that it may be a useful tool; this tool needs to be refined to distinguish between perceptions of long-term and recent appetite, and it needs to be validated against intake in both cross-sectional and longitudinal studies. Care should also be taken to assess whether the indicator is more or less valid depending on the education level of the mother.

not with lower height-for-age, which once again suggests that the appetite score may capture recent appetite.

Box 8 summarizes the conclusions regarding the use of survey approaches to measure caregiver–child feeding interactions.

Implications for the Measurement of Child Feeding, Hygiene, and Caregiver–Child Interactions in Program and Survey Contexts

This review has identified key issues of relevance for researchers and program managers regarding the selection of approaches and indicators for the measurement of hygiene, child-feeding practices, and caregiver–child interactions during feeding. These issues are summarized below, and their implications for programs are discussed. We first summarize the strengths and weaknesses of the approaches for the measurement of these practices and propose potential solutions or methods to minimize biases and errors. We conclude with a summary of the role of mixed methods and the importance of considering contextual factors when selecting indicators and methods to measure behaviors and identify research priorities for the future.

Strengths and Weaknesses of Different Approaches for the Measurement of Selected Practices

Table 6.1 summarizes the strengths and weaknesses of different approaches for measuring hygiene, child feeding, and caregiver–child interactions during feeding. Recall and continuous monitoring observation methods are summarized for all three types of practices, but spot-check observations are limited to hygiene practices, where significant experience exists.

Table 6.1 Comparison of approaches for measuring hygiene and child-feeding practices and caregiver-child interactions during feeding

Characteristics	Hygiene			Child feeding			Caregiver-child interaction during feeding		
	Recall	CM observation	Spot-check observation	Recall	Observation	Recall	Observation	Recall	Observation
History of use	Has been widely used because fast and cheap but known to be highly subject to recall bias	Has been widely used; considered standard but time- and resource-intensive	Increasingly popular; faster and cheaper than CM	Has been widely used because fast and cheap	Not popular because time-consuming and costly, but still good gold standard (can be combined with direct weighing of food for precise measurement of dietary intake)	Not widely used; very little experience; possibly not appropriate	Considered to be gold standard but time- and resource-intensive		
Risk of systematic bias: Reactivity	n.a.	Possibly high on first day; decreases thereafter; varies between practices and contexts	Thought to be lower than CM	n.a.	Possibly high on first day; depends on awareness of what "good" practices are; varies between practices and contexts	n.a.	Average to high on first day; depends on awareness of what "good" practices are; varies between practices and contexts		
Recall	High risk of overreporting of good practices; may be higher after education interventions	n.a.	n.a.	Average to high risk of over-reporting of good practices; risk may vary between practices; may be higher after education interventions	n.a.	Average to high risk of over-reporting of good practices; risk may vary between practices; may be higher after education intervention	n.a.		

(continued)

Table 6.1—Continued

Characteristics	Hygiene		Child feeding		Caregiver-child interaction during feeding		
	Recall	CM observation	Spot-check observation	Recall	Observation	Recall	Observation
Risk of random error: Measurement	Average; caused by memory failure, random data collection errors (instruments, training/skills of observers, and so forth)	Average; caused by random data collection errors (instruments, training/skills of observers, and so forth)	Average; caused by random data collection errors (instruments, training/skills of observers, and so forth)	Average; caused by memory failure, random data collection errors (instruments, poor training/skills of interviewer, and so forth)	Average; caused by random data collection errors (instruments, training/skills of observers, and so forth)	Possibly high because concepts difficult to capture by recall	Average; caused by random data collection errors (instruments, training/skills of observers, and so forth)
Day-to-day variability	Average if 24-hour recall is used; may be lower if usual behavior is recorded	Average; varies among practices	Average; varies among practices	Average if 24-hour recall is used; may be lower if usual behavior is recorded	Average; varies among practices	Unknown	Unknown
Cost and time of training	Low	High	Average to high	Low	High	Very limited experience, but low for appetite measurement	High
Data collection	Low	Very high	Low	Low	Very high	Same as above	Very high
Data processing	Low	Very high	Low	Low	Very high	Same as above	Very high

Note: n.a. = not applicable.

CM Observations

Overall, it is clear that CM observation methods continue to be the gold standard approach for measuring the three types of behaviors reviewed. CM allows collection of detailed information on a particular area of behavior and is also suitable for the simultaneous recording of information on more than one set of behaviors, especially when observers are paired. It is important to remember, however, that even if considered a gold standard approach, CM observations are susceptible to biases resulting from reactivity and to errors caused by day-to-day variability. Potential approaches to reduce reactivity and recall bias are presented in Box 9. When multiple observations are made, researchers can assess reactivity. This will help build knowledge about reactivity for various practices and in various contexts.

Spot-Check Observations

For the measurement of hygiene practices, this review suggests that spot-check observations are probably the second best approach after CM observations. This

Box 9: Suggestions for minimizing reactivity and recall bias

Reactivity

- Repeat observations on different occasions; either discard first day of data or adjust for it in analysis.
- Establish good rapport and trust between household members and observers; this can be achieved by
 - training community members to do observations,
 - selecting appropriate gender for observers, and
 - establishing clear policies regarding level of communication between observers and household members.
- Avoid informing households of exact day and time of observers' visit (instead, indicate week or general time frame only).
- Select practices known to be less reactive based on prior qualitative research.
- If observations are done following an education/communication intervention, ensure that team of observers is different from educators.

Recall bias (or overreporting of "good" practices)

- Carefully formulate questionnaires based on prior qualitative research; pretest instruments and ensure adequate training of interviewers.
- As above, dissociate team of observers from team of educators if recall follows an education/communication intervention.
- Incorporate some checks based on rapid observations imbedded in the interview process; for example, to complement questions related to exclusive breastfeeding, interviewers can be trained to look for "proxies" of nonexclusive breastfeeding such as presence of baby bottles or breast milk substitutes in the house.
- Avoid recall methods for practices known to be particularly vulnerable to the problem of overreporting of good practices in a specific context.

method is particularly promising because it appears to be less reactive than CM, is much faster to administer, and requires less training time to achieve acceptable levels of standardization of observers. The method still needs to be validated, however, to determine whether it accurately reflects the behaviors it intends to measure.

For child-feeding practices and interactions during feeding, no such approaches have been developed yet. Although it could probably be done, using spot-check observations to assess feeding practices would require more planning than it takes to assess hygiene practices, because fieldworkers would need to visit households during a feeding episode. This, in turn, would require setting up an appointment with the families, which may increase the risks of households making special preparations for the observer's visit (thus causing reactivity problems). Having to visit households during a feeding episode would also add complexity to the logistics of fieldwork and would be more time-consuming than conducting spot-check observations for hygiene, which can be done in as little as 5–10 minutes per household.

Recall Methods

Recall methods appear to be the best alternative to CM observations currently available for measuring child-feeding practices. Recall methods have indeed been widely used for the measurement of child-feeding practices, in spite of the fact that they have rarely been validated. The main threat to the validity of recall methods is recall bias, which results in a systematic error—similar to the effect of reactivity. Recall bias often occurs as a result of a voluntary misreporting of practices when the interviewees are conscious of what the “correct” answer should be. Recall bias is thus particularly severe when the population possesses general knowledge of what “good practices” are. Post-intervention evaluations of education and behavior change projects are also susceptible to this type of bias because people who have been exposed to the messages may feel pressured to report the practices they have been taught, irrespective of whether or not they have adopted them. The more successful the communication component of the project, the bigger the potential problem of recall bias. For these reasons, the risk of recall bias in measuring child-feeding practices is estimated to range from average to high (see Table 6.1). The same could be true for recall of some practices related to interactions during feeding.

Random Error and Day-to-Day Variability

The risk of random error exists in all measurement exercises and is the result of random data collection errors related to the quality of the instruments, the training and standardization of the fieldworkers, and the respondents themselves. Memory failure is also a common type of random error associated with recall methods. When truly random, this type of error results in decreased precision of the estimates,

which in turn results in reduced statistical power to detect associations at the individual level. It does not, however, systematically bias the findings.

Day-to-day variability of behaviors is another type of error, which is common across measurement approaches and types of behaviors. It affects both observation and recall methods based on a single day (such as 24-hour recalls). The consequences of day-to-day variability are similar to those of random errors: reduced precision and statistical power (unless sample size is increased) and decreased ability to detect associations, but absence of systematic bias. Approaches to reduce random errors and day-to-day variability are summarized in Box 10.

Resource Needs for Different Approaches

Finally, as noted throughout this review, CM observations are considerably more resource-intensive than recall and spot-check observation methods, which limits their usefulness in large surveys and in most program contexts. All methods require careful training, but observational approaches are particularly intensive in this regard because they often involve making subjective judgments. Fieldworkers must therefore be carefully standardized to minimize both intra- and interobserver biases (Lohman, Roche, and Martorell 1988). Data collection and processing are also

Box 10: Suggestions for minimizing random error and day-to-day variability

Random error

- Carefully select measurement tools and indicators and pretest them.
- Train and standardize fieldworkers in conducting valid and precise measurements.
- When using recall methods,
 - carefully design and pretest questions to ensure that they are well understood and interpreted by both interviewers and interviewees;
 - train interviewers in proper interview methods, including necessary (but not excessive) level of probing and methods to facilitate recall;
 - avoid long-term recalls where possible, especially if they are known to be inaccurate in measuring specific concepts; and
 - standardize length of recall to avoid different levels of memory error between subjects.

Day-to-day variability

- For observation methods, repeat observations on different days.
- For recall methods,
 - repeat the interview on different days (such as for dietary intake information); and
 - when possible, use a method to derive information on usual practices rather than or in addition to asking questions about the previous day.

very time-intensive and require extensive quality control and supervision.³⁸ The need to create complex scales to summarize the information further increases the time and cost involved. Spot-check observation methods also require extensive training and standardization, but they are very economical in terms of data collection and processing time. Recall methods generally require significantly less training time than observations, especially when they rely on simple, well-formulated, and culturally sound questions and precoded answers. They are also economical with regard to time and resources for data collection and processing.

Conclusion

In conclusion, our review indicates that simpler alternatives to CM observations do exist for the measurement of hygiene and child-feeding practices, although validation of these methods is urgently needed. For the measurement of caregiver–child interactions during feeding, CM observations continue to be the method of choice. Published reports documenting the use of survey methods to measure these complex interactions are scarce, and the potential of survey methods still needs to be explored. The exception to this is the construct of child appetite, which has been measured by maternal recall using simple tools that seem well understood by respondent mothers and easy to use. Systematic validation of these tools, however, is required, especially to determine whether they can be used to reflect both short-term and long-term appetite.

The Role of Mixed Methods and the Importance of Context

The potential usefulness of mixed methods was a recurrent theme in the literature reviewed on hygiene and child-feeding behaviors. A variety of qualitative and quantitative methods may be employed, including an array of techniques that are rapid or participatory or both (for example, focus groups, structured and unstructured key informant interviews, and community meetings), CM observations or spot checks, and various types of survey methods. As described in the previous section, each approach has its strengths and weaknesses; the use of mixed methods takes full advantage of complementary approaches and allows comparison of results obtained using various methods (triangulation of findings). Mixed methods may also permit the validation of new tools and the development of simplified data collection tools.

³⁸Methods and software packages have recently been developed to record CM observation data directly in the field, using hand-held computer devices to save data-entry time and avoid coding errors. These methods are currently being field-tested (Gittelsohn, personal communication).

The choice of approaches should be guided by the objectives of the research, the resources available, and a thorough understanding of the characteristics of the population where they will be used. For example, in many urban centers, where families are often unwilling to let observers inside their house, recall methods may have to be used to collect information on characteristics that would require observers to see inside the house. In other settings, where reactivity is known to be a particularly severe problem, spot-check methods may be more suitable than CM observations in this context, in spite of other potential limitations they may have. The same is true for recall methods, which may be more likely to be affected by recall biases in some cultures than in others or in particular subgroups of population. Differences in education levels, for example, often affect respondents' recall abilities or their skills in falsifying information. Thus, the choice of approaches for the measurement of behaviors must be guided by in-depth knowledge of the culture and population where the research is to be carried out.

The importance of qualitative work prior to the selection of approaches and indicators and to guide the design of interventions has been emphasized throughout this review. Methods such as focus groups and various types of selective interviewing have been developed and widely used for these purposes (see Dickin, Griffiths, and Piwoz 1997; Winch et al. 2000).

Research Priorities

Here we present a brief summary of key research priorities for each set of caregiving practices. More broadly, we feel that research on each set of practices is needed in a wide range of countries and cultural contexts to supplement available evidence. Such research should explore the validity, reliability, and reactivity of different approaches and tools. This would contribute to development of consensus on the methodological and measurement challenges described in this document. Finally, the research agenda should include attention to the needs of programs through development of simple, validated indicators for each set of practices. The research priorities identified in this review are as follows.

For Hygiene Practices

- Revisit recall methods and develop approaches to avoid recall bias problems, at least for some key hygiene practices.
- Validate spot-check observation methods for different aspects of hygiene practices; this will involve triangulation of methods and assessment of reactivity.

- Assess day-to-day variability in different practices and develop guidelines of the appropriate minimum number of repeated spot-check observations required to overcome errors due to day-to-day variability and reactivity.

For Child-Feeding Practices

- Validate commonly used recall methods against observations.
- Determine through validation what the maximum length of recall can be for different practices.
- Develop methods to minimize recall bias and error.
- Continue research and validation of summary indexes to determine their usefulness for different purposes.

For Caregiver–Child Interactions during Feeding

- Conduct additional observational studies documenting caregiver and child “micro-behaviors” during feeding, in order to
 - characterize these behaviors in a wider range of countries and contexts,
 - assess reactivity and reliability, and
 - determine the minimum number of observations necessary for various purposes.
- Include measurement of food intake in some of these studies in order to assess the impact of caregiver behaviors on child intake.
- Once behaviors have been identified that affect child intake, develop simple survey questions and validate by comparing with CM observations.
- Repeat validation studies of appetite questions and tools (including the visual analogue) in more settings, including paying attention to the issue of chronic versus acute anorexia.

Overall

- Develop protocols for the design of qualitative research
 - to help select and adapt tools to assess behaviors and
 - to guide the design of interventions to improve selected behaviors.

Supplementary Tables

Table A.1 Practices and scoring system used, by age group, to create the care index on (Child Feeding and Use of Preventive Health Services), Accra study, 1997

Practices included in the index	Results	Scores allocated, by age group (months)		
		4–8.9	9–17.9	≥ 18
Breastfeeding and feeding practices				
Prelacteal feeds used	Yes: 33%	Yes: -1 No: 0	Yes: -1 No: 0	Yes: -1 No: 0
Still breastfeeding	Yes: 51%	No: -1 Yes: 1	No: 0 Yes: 1	
Gave to child when he/she was 0–4 months old:				
Water	Yes: 69%	Yes: -1 No: 0	Yes: -1 No: 0	Yes: -1 No: 0
Sugar-based liquids	Yes: 26%	Yes: -1 No: 0	Yes: -1 No: 0	Yes: -1 No: 0
Infant formula	Yes: 32%	Yes: -1 No: 0	Yes: -1 No: 0	Yes: -1 No: 0
Cow's milk	Yes: 17%	Yes: -1 No: 0	Yes: -1 No: 0	Yes: -1 No: 0
Solid foods	Yes: 58%	Yes: -1 No: 0	Yes: -1 No: 0	Yes: -1 No: 0
First food offered to child				
	Unfortified cereals (koko): 60%	0	0	0
	Fortified cereals: 30%	+1	+1	+1
	Nothing special: 10%	-1	-1	-1
Does anyone help the child eat	No: 28%		No: -1 Yes: 0	No: -1 Yes: 0
What does caregiver do when child refuses to eat				
	Nothing (child left alone): 21%	-1	-1	-1
	Other (coax, play with force, change food, not a problem): 79%	0	0	0
Preventive health care services use				
Growth monitoring (past month)	Yes: 63%	No: -1 Yes: 0	No: -1 Yes: 0	No: -1 Yes: 0
DPT immunization (> 3 months)	Yes: 91%	No: -1 Yes: 0		
Measles immunization (> 9 months)	Yes: 85%		No: -1 Yes: 0	No: -1 Yes: 0

Source: Armar-Klemesu et al. 2000; Ruel et al. 1999.

Table A.2 Variables and scoring system used to create infant/child-feeding index for children aged 6–36 months, by age, Ethiopia, DHS 2000

Variables	6–9 months	9–12 months	12–36 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) ^a	None of the foods/groups One food/group Two or more foods/groups Not at all Once Two or more times	Score = 0 Score = 1 Score = 2 Score = 0 Score = 1 Score = 2	None or one of the foods/groups Two or more foods/groups Four or more foods/groups Not at all or once Twice Three times Four times or more
Frequency of feeding solids/semi-solids (past 24 hours)	Score = 0 Score = 1 Score = 2	Score = 0 Score = 1 Score = 2	Score = 0 Score = 1 Score = 2 Score = 3
Food frequency ^b	0 (no foods previous week) 1 or 2 3 or higher 0 / +9	Score = 0 Score = 1 Score = 2	Score = 0 Score = 1 Score = 2
Minimum/maximum	0 / +9	0 / +9	0 / +9

Source: Arimond and Ruel 2002.

^a Dietary diversity is the sum of: grains + tubers + milk + 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 (that is, they reflect tertiles). "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 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 to give a possible range of 0 to 14. As above, scores were assigned reflecting the age-specific distributions observed. 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.

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.

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