Nutrition education in health services and other determinants of complementary feeding in the Eastern region of Ghana

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ABSTRACT

In Ghana, rates of undernutrition peak between 9 and 21 months of age; one major cause is inadequate complementary feeding (CF). This study examined the relationship between hospital-based CF education and caregivers' reported practices through interviews with health workers (n=24), caregivers (n=23), and Queen Mothers (n=6). Additionally, the associations among maternal HIV status, socioeconomic factors and introduction of solids were examined using data from 288 mother-infant pairs. Health workers and caregivers had good knowledge about CF initiation. However, health workers' recommendations for older infants did not consistently follow national guidelines. Barriers to CF education included limited teaching-aids and in-service training. Among caregivers, challenges included inconsistent CF messages and poverty. Sixty-two percent of mothers introduced solids before 6 months (5.2 ± 1.4 months). Mothers who introduced early were more likely to be HIV positive, have low-literacy and low-quality housing. Practical CF advice should be integrated and reinforced throughout the health system.

RÉSUMÉ

Au Ghana, les taux de malnutrition sont les plus hauts entre 9 et 21 mois; la diversification de l'alimentation (DA) inadéquate est une des causes principales. Cette étude a examiné la relation entre l'éducation fourni par les services médicaux à propos de la DA et les pratiques rapportés des parents à travers des entrevues avec des employés du ministère de santé (n=24), des parents (n=23), et des Mères Reines (n=6). Les associations entre le statut de VIH maternel, les caractéristiques socioéconomiques et l'introduction d'aliments solides étaient examinées parmi 288 pairs de mères et leurs jeunes enfants. Les connaissances à propos des aliments solides parmi les employés d'hôpitaux et les parents étaient bonnes. Mais, les messages aux hôpitaux pour les enfants après 6 mois ne suivaient pas toujours les recommandations nationales. Les obstacles pour l'éducation de la DA incluaient peu de supports pédagogiques et de formations aux hôpitaux. Les messages inconsistants à propos de la DA et la pauvreté étaient des obstacles pour les parents. Soixante-deux pourcent des mères ont introduisent la nourriture solide à leurs enfants avant 6 mois (5.2 ± 1.4 mois). Les mères qui introduisaient la nourriture solide tôt avaient un risque plus haut d'avoir le VIH, moins d'éducation et une maison de qualité inférieure. Des conseils pratiques à-propos de la DA à 6 mois devraient êtres intégrés et renforcés à travers le système de santé.

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CONTRIBUTION OF AUTHORS

The manuscripts included in this thesis were accomplished through collaborative efforts from the co-authors. The first manuscript was authored by J. Robinson, G.S. Marquis, and A. Lartey. J. Robinson developed the research questions, wrote the project proposal, and traveled to Ghana (May through August 2008) where she supervised and participated in data collection in the Manya and Yilo Krobo districts of the Eastern region of Ghana. This involved developing the semi-structured interview guides, training local staff to use the interview guides, and participating in data collection with the help of local interpreters. J. Robinson also transcribed the interviews, with the help of local interpreters, managed and analyzed the data and wrote the first manuscript. All of this was accomplished with guidance and support from the co-authors. G.S. Marquis and A. Lartey edited the first manuscript. The data collected for the first manuscript was done so solely as part of J. Robinson's thesis.

The second manuscript was part of the Research to Improve Infant Nutrition and Growth (RIING) in Ghana (2004-2008). The principal investigators for the project were: G.S. Marquis, A. Lartey, R. Perez-Escamilla and R. Mazur, with L. Brakohiapa acting as a consultant to the project. J. Robinson worked together with G.S. Marquis to develop the research questions included in the second manuscript of this thesis. J. Robinson also managed and analyzed data and wrote the second manuscript, with guidance from the co-authors. G.S. Marquis, A. Lartey, R. Perez-Escamilla, R. Mazur and L. Brakohiapa edited the second manuscript. The thesis supervisor (G.S. Marquis) and committee members (D.S. Allen and K. Gray-Donald) also reviewed and edited drafts of the whole thesis.

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LIST OF ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
BF	Breastfeeding
CF	Complementary feeding
cm	Centimeters
d	Days
EBF	Exclusive breastfeeding
g	Grams
GHS	Ghana Health Services
HIV	Human immunodeficiency virus
IMCI	Integrated Management of Childhood Illness
kcal	Kilocalories
kJ	Kilojoules
kg	Kilograms
L	Litres
m	Meters
min	Minutes
mo	Months
MOH	Ministry of Health
NIH	National Institutes of Health
RIING	Research to Improve Infant Nutrition and Growth
SD	Standard deviation
SE	Standard error
VCT	Voluntary counseling and testing
WHO	World Health Organization
wk	Weeks
y	Years

1. GENERAL OVERVIEW

1.1. Introduction

In Ghana, there are high rates of malnutrition among young children, with stunting, wasting and underweight peaking between 9 and 21 months of age (Ghana Statistical Service, 2004). Inadequate infant feeding practices contribute to infant malnutrition in many developing countries. In Ghana, rates of exclusive breastfeeding (EBF) have increased from 4% in 1988 to 53% in 2003 (UNICEF, 2008), however, complementary feeding (CF) remains suboptimal. Maize porridge, a common infant food in Ghana, contains about 40 kcal/100g, insufficient to meet an infant's energy needs when feeding frequency is low (Guptill et al., 1993; Kibona et al., 1995). Also, Ghanaian diets tend to be based on cereals and roots and have low variety. Only 3-7% of children's dietary energy comes from animal products, resulting in inadequate intakes of energy, iron and other micronutrients (Ferguson et al., 1993).

The WHO defines complementary feeding as the process starting when breast milk alone is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are needed, along with breast milk. The target age range for complementary feeding is 6 to 24 months of age, even though breastfeeding may continue beyond two years (WHO, 2003). Cessation of EBF and introduction of CF before this age can expose the infant's under-developed gut to pathogens, leading to poor growth and development and increased risk of death (Lartey et al., 2008; Becquet et al., 2006). Among infants whose mothers are infected with HIV, EBF for 6 months is imperative to decrease the risk of mother-to-child transmission when replacement feeding is not affordable, feasible, adequate, sustainable and safe (WHO, 2003).

Hospital funding and staff time are often directed to HIV care, leaving little time for CF education and monitoring (Raisler and Cohn, 2005; Timpo, 2007). While caregivers receive nutrition information from hospital staff, family members also provide feeding advice, childcare assistance, and financial support (Bentley et al., 2005). The present

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study examined the availability and quality of hospital CF education, and the relationship between infant feeding practices and caregivers' access to education, social support, employment, and HIV status.

1.2. Study rationale

Recent research has shown that rates of exclusive breastfeeding have improved in Ghana over the past two decades (Timpo, 2007; UNICEF, 2008). However, studies have shown that complementary feeding practices in Ghana remain less than ideal (Becquet et al., 2006; Doherty et al., 2007; Ferguson et al., 1993). Reasons for this are not well understood. The influences affecting infant feeding in Ghanaian communities are multi-factorial and include HIV infection, and socioeconomic factors, among others. Young children living in households directly affected by HIV have poorer nutritional status than other children in their communities (Bond et al., 2002; Hebbing and Hardy, 2007). Also, hospital funding and staff time are often directed to HIV care, leaving little time for complementary feeding education and monitoring (Raisler and Cohn, 2005; Timpo, 2007). While caregivers receive nutrition information from hospital staff, family members also provide feeding advice, childcare assistance, and financial support (Bentley et al., 2005). Socioeconomic factors may also affect complementary feeding by limiting the amount and quality of education in hospital-based and community clinics, as well as influencing the choices that caregivers make about what to feed their children (Raisler and Cohn, 2005; Bond et al., 2002).

Further research is needed to investigate the actual practices in health services and the role that these play in complementary feeding in the communities. Also, a better understanding of the socio-environmental influences on infant feeding may come from investigating the perspectives of health workers, mothers, fathers and other community members who may influence child care in Ghana. Barriers and facilitators to change and suggestions for improvement should come from those involved in infant feeding, for a more local and contextual viewpoint. The success of breastfeeding programmes in Ghana has shown that health initiatives can be successful if implemented systematically

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throughout health facilities (Timpo, 2007). Similar initiatives are now needed to address the barriers to complementary feeding in Ghana. Greater insight into the factors that affect child-feeding practices in Ghana will help to shape recommendations for improvements. Additionally, suggestions from health workers and community members will better inform recommendations from a local perspective. Ultimately, understanding the facilitators and the barriers to good infant nutrition has major implications for the health and well-being of Ghana's people.

1.3. Rationale for methodology

While quantitative data are beginning to emerge on infant feeding in HIV-affected areas of sub-Saharan Africa, few qualitative studies have examined the experiences of mothers involved in caring for infants in this context. Furthermore, most previous studies in sub-Saharan Africa have focused on the experiences related only to breastfeeding, but not complementary feeding. Also, little research has been done to examine how the experiences of health care providers and the social environment of health services in Ghana affect the care provided to mothers and their infants. To date, there are no studies on the complementary feeding educational activities in health facilities in Ghana. Further research using qualitative methods or triangulation with mixed qualitative and quantitative methods is needed (Vargas et al. 2005; Tompkins et al., 1999; Lemke, 2005).

1.4. Overall study aim

The purpose of this study is to examine the roles of health services and socio-demographic factors in complementary feeding practices in resource-constrained areas of Ghana.

1.5. Specific objectives and hypotheses

1. To investigate the factors affecting the education about complementary feeding that is provided in health services in an HIV-affected and resource-constrained setting in Ghana.

2. To examine how the experiences with health services affect Ghanaian women's complementary feeding practices using qualitative methods.

3. To evaluate the socio-demographic determinants of time of introduction of complementary foods in Ghana, using quantitative and qualitative methods.

Hypotheses related to objective 3:

i) Caregivers with greater social support are more likely to introduce complementary foods to their infants after six months than are caregivers with lower social support.

ii) Caregivers who are HIV positive are more likely to introduce complementary foods to their infants before six months than are caregivers who are HIV negative.

iii) Caregivers who work away from the home are more likely to introduce complementary foods to their infants before six months than caregivers who work in the home.

1.6. Qualitative Research Questions

For health-care providers and influential community figures

a. What complementary feeding education do mothers receive? What influences the content of this education and how it is offered?

b. How do experiences with health services affect infant feeding in the home?

c. How can health services improve to help improve infant feeding practices in the communities? What are the barriers and facilitators to change?

d. How do the beliefs, attitudes and experiences relating to infant feeding compare among mothers, fathers, health care providers and influential community members? How does this affect feeding practices in the home?

e. How do experiences with health services affect infant feeding in the home?

f. How can health services improve to help improve feeding practices?

g. What is the socio-environmental context of complementary feeding? What are the facilitators and barriers to optimal infant care?

h. How do the beliefs, attitudes and experiences relating to infant feeding compare among mothers, father, health care providers and influential community members? How does this affect feeding practices in the home?

i. How do the beliefs, attitudes and experiences relating to infant feeding differ between mothers and fathers? How does this affect feeding in the home?

1.7. Explanation of the conceptual framework

Complementary feeding practices affect child growth and development (WHO, 2003). In this study, some of the factors that will be examined that affect complementary feeding practices in Ghana include health education, social support, HIV infection, socioeconomic determinants, and maternal factors such as beliefs about complementary feeding, maternal health and availability of time (Figure 1.1). In health services, nurses and other health care staff are often the main education providers and have the most contact with mothers (Timpo, 2007; Bentley et al., 2005; Nti et al., 2007). While nurses receive post-secondary education on infant feeding, health assistants receive much of their knowledge about infant feeding from brief on-the-job training and from observing nurses. Health assistants, who have the least education and training, often have the most contact with mothers. With additional training, health assistants could help with educational activities related to complementary feeding in areas where nutrition education is limited due to nursing shortages. Doctors are usually the primary educators on infant nutrition when a child is malnourished. Malnourished children are referred to doctors by nurses, and are also followed up by nurses. For these reasons, the relationships and

communication channels in health care systems is of interest when examining the actual nutrition education offered to caregivers, as well as the barriers and facilitators to optimal complementary feeding.

A mother's level of social support affects how her infant is fed in many settings (Burke, 2004; Hebbing and Hardy, 2007; Bentley et al., 2005). The social support may come from family or community members. The presence of a supportive husband or male partner may improve complementary feeding practices. A male partner may assist with financial support, care giving and feeding the child. He may also go to health centers with the mother and receive information from nurses or other staff on infant feeding (Bentley et al., 2005; Burke, 2004; Raisler and Cohn, 2005). However, the presence of male partners could also have a negative impact on child feeding practices. Animal source foods and other higher-quality foods may be diverted away from young children to older family members such as fathers (Colecraft et al., 2006). Extended family members such as grandmothers or other female relatives sometimes accompany mothers to the health center and listen to the feeding advice given by nurses. Extended family members also assist in care giving of young children and may give advice to mothers based on their own experiences (Burke, 2004; Hebbing and Hardy, 2007; Bentley et al., 2005). Mothers with greater financial support may not have to work as many hours, thus freeing up their time to care for and feed their infants. Alternatively, if mothers do have to leave the home for work, they may be able to leave their infant in the care of a relative if one is available. In this way, greater social support may also indirectly improve complementary feeding. Queen Mothers are influential women in the Eastern Region of Ghana, they are the female equivalents of chiefs, and they have been leaders in HIV education and orphan care. Queen Mothers usually know the women in their communities and sometimes assist them after birth to attend postnatal clinics. Furthermore, Queen Mothers often provide nurses with information on the mother's health, and Queen Mothers sit in on private counselling that nurses provide to mothers so that they can receive information on infant feeding.

Infants whose mothers are infected by HIV have poorer nutrition and health outcomes than children of uninfected mothers in the same communities (Bond et al., 2002; Raisler and Cohn, 2005; Buskens and Mkhatswa, 2007; Hebbing and Hardy, 2007). Also, a mother's HIV status may affect the financial and child care support that she is given by her family and other social networks (Hebbing and Hardy, 2007; Raisler and Cohn, 2005). Finally, in the setting of this study, resource constraints and other socioeconomic factors affect complementary feeding by possibly limiting the amount and quality of educational materials in health care systems, as well as influencing what mothers choose to feed their infants (Raisler and Cohn, 2005; Bond et al., 2002).

Figure 1.1. Conceptual framework of the factors affecting complementary feeding practices

Legend

☐ Predictor variables of interest		⌐¬ Main outcome variable of interest	
�..⌡ Secondary outcome variable		→ Relationships of interest	
- -► Communication routes of interest		▬ Basic context affecting all variables	

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2. LITERATURE REVIEW

2.1. Introduction

Malnutrition in infancy and childhood is prevalent in Ghana. Inappropriate complementary feeding may be one of the major causes. Examining the factors that influence infant feeding decisions will help to inform recommendations to improve the health and nutrition of the Ghanaian population. The following review of the literature examines the current nutritional status indicators and feeding practices of infants and young children in Ghana. Factors that influence complementary feeding practices are investigated, including health and nutrition education, social support for caregivers, gender and HIV-related issues, resource and economic constraints, as well as maternal factors.

2.2. Malnutrition in Ghana and sub-Saharan Africa

Sub-Saharan Africa is currently the only region in the world where the numbers of underweight children have increased in the past decade. Under-nutrition, defined by Black et al. (2008) as stunting, severe wasting and intrauterine growth retardation, has been estimated to cause 2.2 million deaths globally among children less than five years of age. To improve child survival in sub-Saharan Africa, and to give young children the best possible start in life, better nutrition and child-feeding practices must become a priority (Persson, 2005; Chopra & Darnton-Hill, 2006; Bourne et al. 2007).

Recent anthropometric indicators of health and nutritional status show high rates of malnutrition among infants and young children in Ghana. In 2003, 33% of children less than five years of age were stunted (height-for-age <-2 standard deviations (SD)), 22% were underweight (weight-for-age <-2 SD), and 7% were wasted (weight-for-height <-2 SD). Furthermore, the prevalence of stunting has increased in the past few years (Ghana Statistical Service, 2004).

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In rural areas of Ghana and other sub-Saharan African countries, child malnutrition appears to be worse than in urban centres (Fotso and Kuate-Defo, 2006; Ghana statistical Service, 2004). Children from rural areas are more likely to be stunted (34.5% rural vs. 20.5% urban), underweight (25.4% rural vs. 15.4% urban), and anaemic (80% rural vs. 68% urban) (Ghana Statistical Service, 2004).

Throughout sub-Saharan Africa, inappropriate feeding of infants in the first two years of life is one of the major causes of child morbidity and mortality. Without adequate energy, protein and micronutrients during the developmental stages of infancy and early childhood, children are ill-equipped to handle the opportunistic infections that are common in sub-Saharan Africa, including diarrheal diseases, malaria, and acute respiratory infections (Fields-Gardner and Ayoob, 2000; Young, 1997; Ikeogu et al. 1997; Nathoo et al., 1996).

2.3. Infant feeding and the situation in Ghana and sub-Saharan Africa

2.3.1. Breastfeeding

Poor child health has been attributed to inappropriate breastfeeding practices in much of sub-Saharan Africa. The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life, and continued breastfeeding for up to two years and beyond (WHO, 2003). In recent years, Ghana has seen a large improvement in the rates of exclusive breastfeeding, subsequent to policy changes implemented throughout the health care system, such as the Baby Friendly Hospital Initiative. This has resulted in improvements in infant health and survival (Timpo, 2007; Edmond et al., 2006).

2.3.2. Complementary feeding

While breastfeeding practices have improved dramatically in Ghana in recent years, complementary feeding practices remain less than ideal. The nutritional quality of typical

early foods in sub-Saharan Africa, such as diluted porridge, is often low (Kibona et al., 1995). In Nigeria, typical maize porridge for infants was found to contain 40 kcal/100 g, which is likely insufficient to meet an infant's energy needs given the usual low frequency of feeding (Guptill et al., 1993). Furthermore, rather than supplementing high-quality breast milk with complementary foods, mothers often replace breast milk with diluted porridge and other low energy, low nutrient infant foods. In Ghana, most of the energy in young children's diets comes from cereals and roots. Only 3-7% of energy comes from animal products, resulting in inadequate intakes of total energy and high-quality protein, as well as iron and other micronutrients (Ferguson et al., 1993; Brakohiapa et al., 1988). Diets in many areas of sub-Saharan Africa also tend to have low variety and nutritional quality, largely owing to poverty and other factors affecting household food security (Golden, 1991; Bourne et al., 2007; Chopra and Darnton-Hill, 2006; Ferguson et al., 1993; Timpo, 2007).

The timing of introduction of foods is also important. Solid foods are sometimes introduced too early, exposing the infant's undeveloped gut to pathogens in the food. Alternatively, foods may be introduced too late, and thus the infant may not receive adequate energy and nutrients for optimal growth and development (Becquet et al., 2006; Asenso-Okyere et al., 1997; Caulfield et al., 1996; Doherty et al., 2007; Ferguson et al., 1993; Brakohiapa et al., 1988; Raisler and Cohn, 2005). In developing countries, inappropriate choices in the types and timing of foods introduced when infants are no longer fully breastfed lead to poorer growth, development and chance of survival (Lartey et al., 2008; Doherty et al., 2007; Becquet et al., 2006; Gray, 1996; Kwaku et al., 1998). In Uganda, introduction of complementary foods before 6 months was associated with a three-fold increase in stunting (OR 3.35, 95% CI 1.19-9.45) (Engebretsen et al., 2008).

The transition period when complementary feeding begins is a particularly vulnerable time for infants. The WHO recommends that solids should be introduced at the time when the infant's nutritional requirements can no longer be met by exclusive breastfeeding (WHO, 2003). The WHO also recommends the following for feeding behaviours. Adequate complementary feeding requires sufficient energy, protein and micronutrients

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to meet the infant's increasing needs. For infants to be fed safely, good hygiene and appropriate food storage and preparation are required. Also, for infants to be fed properly, responsiveness of the caregiver to the child's cues for hunger and satiety and other feeding needs, is necessary. Caregivers need to continue to actively encourage infants and children to consume adequate and nutritious foods, especially during times of illness. Accurate information, skills and support from family, community and health services are crucial for optimal complementary feeding. Malnutrition is caused more often by inadequate and inaccurate knowledge about the appropriate foods and feeding practices needed than by an absolute lack of food. Community-based interventions that use locally available and affordable foods are suggested for improving complementary feeding practices, and ultimately child nutrition and health, worldwide (WHO, 2003).

2.3.3. The situation in Ghana

Unlike the situation with breastfeeding, there are no health care programmes in Ghana or in the rest of sub-Saharan Africa that are focused solely on improving complementary feeding (Raisler and Cohn, 2005; Timpo, 2007). Other possible factors that affect infant feeding in HIV-affected communities of sub-Saharan Africa include poverty, low maternal education, stigma and gender inequalities, social and family support, chronic infectious diseases, and low availability and quality of health services (Golden, 1991; Bourne et al., 2007; Chopra and Darnton-Hill, 2006; Ferguson et al., 1993; Timpo, 2007; Bentley et al., 2005; Raisler and Cohn, 2005). These factors are discussed below.

Complementary feeding practices in Ghana have not been well studied to date. Also, the education on complementary feeding provided in health centers remains largely unknown. While Ghanaian mothers receive much of their information on infant feeding from nurses and other health care staff, the quality of care may be less than optimal. Staffing and training in many health care settings is inadequate to meet the increasing demands in communities affected by the HIV epidemic. This overburden of health workers may compromise the amount and the quality of time spent with mothers relating to infant feeding and care (Nguyen et al., 2009). The influence of health services and

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socio-environmental factors on complementary feeding in Ghana requires further investigation.

2.4. Nutrition education for young children in developing countries

2.4.1. Nutrition education programmes in developing countries

Nutrition education provided by health care staff and trained counselors has the potential to improve caregivers' knowledge and practices related to infant and young child feeding (Timpo, 2007). The following interventions that promoted complementary feeding were seen to improve child nutrient intake and growth. In Peru, a cluster-randomized trial of a nutrition education programme for children less than two years of age aimed to improve the quality and coverage of an existing programme in six government health centres, compared with six control centres. The intervention resulted in 31% of participants compared to 20% of controls (p=0.03) receiving nutrient-dense thick foods at lunch at 6 months of age. Fewer infants in the intervention failed to meet their dietary requirements for energy at 8 months (18% of participants compared to 27% of controls (p=0.04)), iron at 9 months (93% of participants compared to 99% (p=0.047)), and zinc at 9 months (77% of participants compared to 87% of controls (p=0.012)). As a result, at 18 months of age, children in the intervention group were less likely to be stunted than controls (5% compared to 16% respectively (OR=3.04, 95% CI 1.21, 7.64)) (Penny et al., 2005).

Nutrition education provided in health centers can also improve not only the intake of specific foods and nutrients, but also the overall diet and feeding behaviours. An intervention study in rural communities of India using monthly nutrition education on complementary feeding, given by trained counsellors, resulted in improvements in feeding frequency (intervention children were more likely than controls to be fed solids at least four times a day (OR = 4.35, 95% CI = 1.96, 10.00), dietary diversity (intervention children were more likely than controls to receive a more diverse diet OR = 3.23, 95% CI = 1.28, 7.69), as well as intake of specific foods suggested by health workers (intervention children were more likely than controls to receive bananas OR = 10.00, 95%

CI = 2.78, 33.3) (Kilaru et al., 2005). Furthermore, a study in Lesotho including monthly group nutrition education and individual counselling in a clinic setting had a positive impact on maternal knowledge about weaning practices and feeding strategies during times of illness, when comparing mothers' post-intervention questionnaire results to baseline (Ruel and Habicht, 1992; Ruel et al., 1992). However, the study in Lesotho also showed that growth monitoring, while commonly used in nutrition education programmes, only contributed slightly to increasing the effectiveness of the nutrition education (Ruel et al., 1992). While the study in Lesotho was large, (575 mother-child pairs received nutrition education and growth monitoring and 201 mother-child pairs received only nutrition education), there was no control group against which to compare the effect of the nutrition education programme itself. Another intervention study in Senegal used grandmothers as trained counsellors to teach mothers about breastfeeding and complementary feeding. The intervention resulted in timelier introduction of solids and better breastfeeding practices among mothers who were counselled; knowledge about appropriate complementary foods was also better among grandmothers and mothers after the intervention (Aubel et al., 2004). However, the majority of the results from the study in Senegal focused on breastfeeding, rather than complementary feeding, and few quantitative measurements related to changes in complementary feeding practices were available.

To date, few studies have thoroughly examined the associations between nutrition education and complementary feeding practices. More research is needed to better understand this relationship. While nutrition education programmes have shown the potential to improve child dietary habits and growth, regular programme monitoring, appropriate training for nutrition counselors and use of effective teaching methods, such as hands-on activities, are needed to reach the desired programme results.

2.4.2. Influence of health workers on caregiver knowledge and child feeding

In settings where mothers have little formal schooling, education on infant feeding often comes primarily from nurses and other health care staff (Timpo, 2007; Armar-Klemesu et

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al., 2000; Bentley et al., 2005; Nti et al., 2007; Raisler and Cohn, 2005; Tobias, 2001). However, the amount and quality of complementary feeding education received in hospitals and other health facilities may be minimal. In many areas of sub-Saharan Africa, where health workers are overburdened by the HIV-epidemic, support for mothers from within the health system is often lacking (Bond et al., 2002; Chopra et al., 2005; Tobias, 2001).

In interviews conducted recently with mothers in Ghana, women had good knowledge and confidence about breastfeeding, but they were concerned that they did not know which foods were appropriate for complementary feeding (Timpo, 2007). Furthermore, Timpo (2007) found that mothers sometimes reported hearing conflicting or out-dated advice from nurses about the timing of solid food introduction. As a result, many of the mothers reported low confidence about their abilities to properly feed their infants. Other studies in sub-Saharan Africa have similarly found that health care providers often give inaccurate child feeding advice (Buskens and Mkhatswa, 2007; Raisler and Cohn, 2005; Akuse and Obinya, 2002).

Thus, health workers play an important role in child feeding education in terms of imparting knowledge and providing support to caregivers. However, recent studies suggest that complementary feeding education may be limited, and health workers likely require more training in this area.

2.4.3. Training health care staff for improved effectiveness in nutrition education

While increasing initial training of health staff has been shown to improve nutrition services and education, high staff turnover can be a challenge. Frequent, in-service refresher courses and greater nutrition education for medical professionals during college training may decrease the effect of high staff turnover on the quality of nutrition services (Robert et al., 2007). Robert et al. (2007) evaluated the health centre intervention in Peru that aimed to improve existing nutrition education, and found that increased hospital-wide staff training resulted in significant improvements in delivery of both existing and new

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educational activities. Findings from interviews with health workers in Tanzania, involved breastfeeding education, suggest that better and more on-going training for health staff would improve delivery of nutrition education and mothers' uptake of knowledge and skills (Burke, 2004). A study in Nigeria found that about three-quarters of medical and non-medical health care workers gave mothers inaccurate recommendations about infant feeding, and suggested that more initial and ongoing training in young child feeding are needed for both medical and non-medical staff (Akuse and Obinya, 2002). However, the study in Nigeria focussed mainly on breastfeeding, not complementary feeding, and drew its results from questionnaires completed by health workers rather than observations. Another study in Nepal also showed that both initial and ongoing training for community health workers a few times per year helped improve knowledge of health staff and delivery of nutrition education, related to prevention and cure of vitamin a deficiency (Curtale et al., 1995). The study in Nepal has also shown that providing health care staff with increased supervision, educational materials and training on how to use them improves delivery of nutrition education services, as well as learning and behaviour changes among caregivers (Curtale et al., 1995).

The amount and frequency of health care staff training appears to affect delivery of nutrition education and its reception by caregivers. However, few studies have investigated the training that health workers receive related to complementary feeding, and in Ghana this remains to be examined. Other predictors of the success of nutrition education, including use of teaching aids and style of teaching, are discussed below.

2.4.4. Effective education methods in developing countries and learning theory

2.4.4.1. Educational materials and hands-on learning in developing countries

In Peru, an intervention in government health centres including counselling with simple messages, participatory complementary feeding demonstrations and growth monitoring resulted in more total visits to health facilities by study participants and their infants than controls (an average of 17.6 visits compared to 14.1, respectively (P<0.001)), as well as

more total visits to food preparation demonstrations (6.9 sessions over 18 months compared with 5.4, respectively (P<0.001)). Furthermore, caregivers participating in the study were more likely to receive nutrition advice than controls (51.5% compared with 24.3%, respectively (P=0.02)) (Waters et al., 2006; Robert et al., 2007). Hands-on cooking demonstrations and taste-testing were found to be the most influential educational activities for improving complementary feeding behaviours among caregivers (Robert et al., 2007).

A study in Senegal evaluated the success of a nutrition education project in which grandmothers were trained in breastfeeding and complementary feeding and then promoted good infant feeding practices to the mothers in their families and community. The participatory education activities, including songs, stories and discussions, were effective at improving grandmothers' nutritional knowledge and the advice they gave. Mothers' nutritional knowledge and feeding practices also improved, but the results were largely based on breastfeeding practices, rather than complementary feeding (Aubel et al., 2004).

2.4.4.2. Learning theory

Most health centres in developing countries use a top-down or transmission-persuasion approach to nutrition education. In a top-down approach, health workers tell caregivers messages about child feeding, and it is assumed that these messages will result in increased caregiver knowledge, followed by improvements in caregivers' child feeding behaviours. However, participatory methods of nutrition education, rather than transmission-persuasion methods, have been shown to be more effective at changing infant feeding behaviours. Participatory education directly involves mothers and their family in demonstrations, problem-solving, discussions and other hands-on activities (Aubel et al., 2004; Ticao and Aboud, 1998). A study by Connors et al. (2001) explained that both personal and environmental factors influence behaviour in a reciprocal manner. Furthermore, cognitive thoughts can initiate behaviour change by affecting both personal and environmental factors. Using social learning theory, educators can find personal and

environmental factors that affect a desired behaviour such as consumption of a specific food, and suggest ways in which those factors can be used to promote the desired behaviour (Connors et al., 2001). For example, a study based on social learning theory used a cooking class in a programme for nutrition education. The intervention included an environmental component by providing recipes and cooking equipment. The hands-on classes were designed to improve expectations about cooking and self-efficacy in food preparation. Modeling from the cooking instructors was also used as an educational tool. The intervention resulted in significantly improved attitudes about cooking compared to controls who participated in an observation-only cooking demonstration, but there was no difference in food choices between the two groups (Levy and Auld, 2004). While this study showed the benefits of participatory nutrition education in terms of changes in attitudes, there was no difference in food choices (or behaviours) between the two groups. Also, this study was performed in the United States, and its applicability to developing countries may be limited.

The level of specificity of nutrition messages may also affect a recipient's uptake of knowledge and changes in behaviour. Educational messages can be general, or they may be individualized and tailored to each participant's needs and situation (Brinberg et al., 2000). General information has the advantage of likely being simple, easily understood and retained. However Contento et al. (1992) found that a general nutrition education programme was successful at changing children's knowledge and attitudes about food, but not food choices or behaviours. Tailored nutrition messages may be more successful at changing individuals' behaviours. Campbell et al. (1994) reported that in the United States, using tailored messages about decreasing fat consumption resulted in more decrease of fat consumption when compared to a control group receiving general messages. Similarly, Brinberg et al. (2000) found that study participants who received tailored messages about fibre increased their fibre intake significantly more than did three groups of control participants receiving general messages (the mean increases in fibre intake were 14.9 g, compared to 8.0 g, 6.5 g and 7.6 g, respectively).

Nutrition messages that are tailored may also help address the socioeconomic realities and challenges that caregivers face in many developing countries. Adequate support for mothers to properly feed their infants requires that health workers teach women how to prepare nutritious complementary foods, while also emphasizing lower-cost ingredients to make recommendations more practical for mothers (Colecraft et al., 2004; WHO, 2003). A review study in sub-Saharan Africa found that nurses are generally encouraged to individualize the recommendations that they give to mothers about infant feeding. However, health workers actually spent very little time with mothers discussing the personal circumstances that affected how the mothers fed their infants (Raisler and Cohn, 2005). While the study by Raisler and Cohn (2005) addressed breastfeeding education in health centres, individualization of complementary feeding messages is likely also to be limited. Overall, the teaching style and use of educational materials and participation from caregivers in terms of complementary feeding education in Ghana remains to be investigated.

2.4.5. Integration of nutrition education in health systems in developing countries

2.4.5.1. WHO recommendations for integration of nutrition education

The World Health Organization (WHO) explains that the safety of infant feeding can be improved with adequate support, but currently health systems and communities are not providing this support (WHO, 2005). The WHO recommends incorporating nutrition into training for all health, community and home-based care workers, with development of specific skills such as nutritional assessment and counselling, and programme monitoring and evaluation. The WHO also recommends improving the conditions of service and coverage of health workers, especially dietitians and nutritionists, to deliver nutritional services (WHO, 2005). The goal of the WHO is to integrate nutrition within public health care. Nutrition should also be integrated into HIV-related activities, including programmes for the prevention of mother-to-child transmission of HIV, nutrition monitoring and dietary counselling for HIV-infected mothers and their families. The

WHO has also stressed that nutrition education should be integrated into all areas of maternal and child health care (WHO, 2007).

2.4.5.2. Integration of nutrition education with other health services

Studies in health centers in Peru and India have shown that for nutrition education messages to be effective, they must be clear, concise and feasible. When a few simple messages are provided to caregivers consistently by all health staff, they are able to improve mothers' knowledge and practices (Bhandari et al., 2005; Robert et al., 2007; Penny et al., 2005). Furthermore, opportunities for teaching caregivers about infant feeding include any and all contacts with health personnel, such as consultations when children are ill, immunization sessions, weighing sessions and community outreach activities (Bhandari et al., 2005). By integrating nutrition messages into other health services, caregivers may receive more frequent and consistent information. Using multiple channels for education results in more consistent messages and greater behaviour change. A community randomized study in India was conducted with four intervention communities and four control communities to examine whether increased frequency of health worker contacts could improve complementary feeding and breastfeeding practices among caregivers. Health workers were trained to counsel mothers at multiple contacts, including weighing sessions, immunization sessions, clinic visits for child illness, and home visits. The intervention resulted in increased contacts between mothers and health care staff between birth and 18 months. The increased integration of nutrition counselling into regular child health care sessions resulted in more frequent meals (4.4 among participants compared to 3.9 among controls (p=0.001)), as well as greater energy consumption (1556 kJ among participants compared to 1025 kJ among controls (p<0.001)) at 9 months of age (Bhandari et al., 2005). Also, with increasing number of contacts between mothers and health workers, energy intake was higher (3807 kJ for participants compared to 2577 kJ for controls (p<0.001)), use of fortified cereals was greater (49.6% of participants compared to 31.7% of controls (p<0.001)), and use of undiluted milk was higher (60.5% of participants compared to12.9% of controls), among infants at 18 months. There was also a small but significant increase in length among

participants compared to controls (difference in means 0.32 cm, 95% CI 0.03, 0.61) at 18 months (Bhandari et al., 2005). By integrating complementary feeding education into ongoing services, the feasibility of providing nutrition education was increased in this study.

Another nutrition intervention in India, entitled the Integrated Child Development Services, was found to achieve better coverage of the target population and resulted in a significant decline in malnutrition among preschool children compared to groups of children who received nutrition, health care and education through separate (non-integrated) programmes. Programme coverage was 43.7% for intervention children compared to 23.6% for the children not involved in the intervention (p<0.001). Also, the prevalence of moderate malnutrition was 17.4% among intervention children compared to 19.8% among controls (p<0.001), and the prevalence of severe malnutrition was 6.4% among intervention children compared to 8.4% among controls (p<0.001) (Tandon, 1989). The study by Tandon (1989) demonstrated the positive impact that nutrition education can have when integrated with other health programmes, however the nutrition education of this intervention targeted children aged 3 to 5 years old, but not children under 2 years old. More research is needed to assess the level of integration of complementary feeding education in health systems in Ghana and other developing countries, and the impact on service delivery and child feeding.

2.4.6. Resource constraints in health systems and cost-effectiveness of nutrition education programmes in developing countries

Health services in much of sub-Saharan Africa are under-funded. Moreover, the limited funding available has been primarily directed to combating the HIV epidemic, and infant feeding has received little attention (Raisler and Cohn, 2005). However, several studies in resource-constrained areas have shown that nutrition education programmes aimed at improving young child health can be cost-effective endeavours. These are described below.

A study in Peru showed that a complementary feeding education intervention, requiring additional costs for training, educational materials (such as recipes fliers and flipcharts) and travel expenses was cost-effective (6.12$US per child reached). Also, improving training of existing staff, but without using additional staff, was shown to improve feeding practices in the community and be sustainable for the health facilities (Waters et al., 2006; Robert et al., 2007). A breastfeeding promotion programme in Ghana has been estimated to cost 7.80$US per DALY[1] (Chee et al., 2002). In Mali, the cost of an infant nutrition education programme was estimated to cost 11$US per child reached (Ross et al., 1987), and a child nutrition education programme in Nepal, including training of health workers, supervisions and provision of education materials, was estimated to cost 0.75$US per child per year (Curtale et al., 1995). Robert et al. (2007) found the additional costs of training health staff and providing educational materials to be reasonable and worth the resulting improvements in child health. Compared to the costs for other health care interventions, the cost for nutrition education is relatively low. For example, the cost for vaccines and health staff time to prevent malaria has been estimated at 5$US per case of uncomplicated malaria averted, 35$US per DALY averted, and 1057$US per death averted (Tediosi et al., 2009). While the cost of vitamin A supplementation has been estimated at 276$US per death averted and 64$US for an incremental cost per death averted in 1999 (Ching et al., 2000). Finally, improvements in current nutrition programmes, while remaining cost-effective, should focus on improving the counselling skills of health educators and increasing the amount of time and frequency of contact with caregivers.

2.4.7. Social support for caregivers provided by health workers and others to improve child nutrition

Increased support from nurses and other health workers likely improves mothers' uptake of knowledge and skills related to complementary feeding. Two studies, one in which mothers in Tanzania were interviewed and one in which mothers in South Africa,

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[1] The overall burden of disease is assessed using the disability-adjusted life year (DALY), a time-based measure that combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health (WHO, 2004a).

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Namibia and Swaziland were consulted, both suggest that advice from peers and social networks related to infant feeding are valued more than messages communicated through impersonal means, such as the media (Burke, 2004; Buskens and Mkhatswa, 2007). However, both of these studies focussed on the advice that mothers received about breastfeeding, not complementary feeding.

Aside from health workers, caregivers' social networks influence child feeding practices. Additionally, other factors that influence young child feeding in Ghana include HIV, household access to resources and maternal factors. These are discussed below.

2.5. Family and social support in sub-Saharan Africa

Several studies from sub-Saharan Africa suggest that the health beliefs and level of support that mothers receive from family members affect how infants are fed. Grandmothers and other female relatives seem to have a particularly strong influence on infant feeding in these settings. Relatives may also try to care for infants by introducing foods without the knowledge and consent of the mothers (Burke, 2004; Hebbing and Hardy, 2007; Bentley et al., 2005; Aubel et al., 2004; Buskens and Mkhatswa, 2007; Tobias, 2001; Krummel et al., 2002). Additionally, the emotional and economic support of husbands and male partners has been suggested to influence maternal feeding decisions in many communities of sub-Saharan Africa (Burke, 2004; Buskens et al., 2007; Raisler and Cohn, 2005; Tobias, 2001; Talawat, 2002). For example, in South Africa husbands have decision-making power concerning the allocation of household funds and the amount of money spent on food (Buskens and Mkhatswa, 2007). Dependence on male partners for financial support, and the dominant role of male partners in food purchasing decisions, may affect an infant's nutrition and health.

In a study from Tanzania, family support and husband involvement were suggested as a major determinant of whether mothers would continue to attend on-going clinics for education on appropriate child feeding, primarily concerning breastfeeding (Burke, 2004). Qualitative interviews with mothers and health workers suggested that encouraging male

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participation in the activities related to child care may help to improve infant feeding in the communities (Burke, 2004). However, cultural beliefs about men's roles in infant care, along with daytime clinic hours and primarily female clientele, may discourage men from attending child feeding health services (Raisler and Cohn, 2005). Furthermore, the presence of male partners could also have a negative impact on child feeding. For example, Colecraft et al. (2006) reported that animal source foods and other nutritionally-dense foods are sometimes diverted away from young children to fathers and other more economically active family members. In Ghana, male perspectives on infant feeding have not been examined, and investigating the views of fathers might provide insight into the barriers and facilitators for optimal infant nutrition.

2.6. HIV in Ghana and sub-Saharan Africa

Sub-Saharan Africa has the highest level of HIV/AIDS in the world (de Wagt et al., 2005). In 2007, the Eastern region of Ghana had a higher prevalence of HIV (4.2%) than the rest of Ghana (1.9%). Exclusive breastfeeding when infant formula or other replacement for breastfeeding is not affordable, feasible, adequate, sustainable and safe, with introduction of complementary foods at six months of age, is imperative for infants whose mothers are infected with HIV to decrease the risk of mother-to-child transmission of HIV (WHO, 2003). While timely introduction of complementary foods is especially important for infants of HIV positive mothers, a study in Ghana found that the duration of exclusive breastfeeding was shorter for infants of HIV positive mothers than for HIV negative mothers (Okronipa, 2008). Furthermore, infants in communities affected by HIV, and especially in households where the mother is infected, have poorer nutrition and health outcomes (Bond et al., 2002; Raisler and Cohn, 2005; Tobias, 2007; Burke et al. 2004; Shapiro et al., 2003; Kleintjes et al., 2004; Talawat, 2002; Buskens and Mkhatswa, 2007; Hebbing and Hardy, 2007).

HIV-related stigma in communities may be propelled by stigma within health systems. Many nurses and other health workers share the fears related to HIV that are seen in the general public (Raisler and Cohn, 2005). Furthermore, the care received by mothers

regarding infant feeding may be negatively affected by prejudices among health workers. In Zambia, health services are sometimes denied to HIV-positive women (Bond et al., 2002), thus posing a barrier to good health care for mothers and their children (Bond et al., 2005; Raisler and Cohn, 2005).

2.7. Resource constraints for households in Ghana and sub-Saharan Africa

In sub-Saharan Africa, food shortages, lack of available clean water, extreme poverty, low maternal education and low access and availability of health services often result in less than adequate infant care in HIV-affected communities (Raisler and Cohn, 2005; Tobias, 2001). In rural communities in Ghana, lack of health facilities is a major barrier to proper infant feeding in the home (Timpo, 2007). Child nutrition programmes, such as Nutrition Rehabilitation Centres and food distribution programmes, are often unavailable in rural areas. Furthermore, even when these services are available, they are often ineffective at promoting continued recovery from malnutrition once the child returns home. This may be because the foods suggested are not available, affordable and accessible to the child's family, while the "street food" that are commonly consumed are not incorporated into the guidelines promoted by health programmes (Colecraft et al., 2004).

In situations where poverty and lack of nutrition programmes preclude adequate access to food, mothers may feed their infants inappropriate complementary foods that are low in energy and micronutrients (Raisler and Cohn, 2005). Furthermore, a study in Kenya found that food may be introduced at a very early age because mothers feel that their infants need to store extra energy for later times of household food shortages and times of illness (Gray, 1996). Therefore, better distribution of food through health services and community clinics might go a long way to improve infant feeding in much of sub-Saharan Africa (Raisler and Cohn, 2005).

Poverty is prevalent in many HIV-affected communities in Ghana, and may play a major role in how infants are fed. The types, amounts and frequencies of foods given to infants

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are likely affected by a mother's perceptions of household wealth and job security. For example, women in semi-rural areas of Malawi expressed that their ability to feed their infants was directly related to their husband's employment status and level of income (Bentley et al., 2005). The physical and emotional drain of working and simultaneously managing a household may impact on a mother's and infant's feeding experience (Nti et al., 2007).

These community and household-level determinants of child health should be considered when examining complementary feeding in Ghana. Additionally, maternal factors, including health, availability of time and access to resources, also affect young child feeding and should be investigated. These are discussed below.

2.8. Maternal factors affecting caregiving and child nutrition in sub-Saharan Africa

The way mothers perceive their own health status and nutritional requirements is influenced by factors such as weight loss, illness and pregnancy, among others. A mother's interpretation of her personal health status may affect her confidence to continue to breastfeed beyond 6 months and the timing of introducing solid foods (Bentley et al., 2005; Gray, 1996). Thus, more support from health care providers to improve maternal health, nutrition and self-efficacy may also help improve infant feeding and health (Raisler and Cohn, 2005; Bentley et al., 2005; Gomo et al., 2003).

Women in sub-Saharan Africa often work very long hours, while also doing most of the child-raising and household work, but have little say in household spending and food purchasing (Piwoz and Bentley, 2005; Farquhar et al., 2001; Raisler and Cohn, 2005; Tobias, 2001). In sub-Saharan Africa, female-headed households tend to be poorer, have less access to land, employment, and government services. Furthermore, the number of female-headed households is increasing (Kennedy and Haddad, 1994). Mothers are usually the primary caregivers of infants and young children, and as such, tend to make child feeding a priority. A study in Peru showed that young child food intakes were protected during times of stress (Leonard et al., 1991). Caregivers may sacrifice for their

children during times of food insecurity. Efforts to improve the status of women in sub-Saharan Africa are needed for optimal infant feeding (Kennedy and Haddad, 1994).

2.9. Summary

In summary, young child malnutrition is prevalent in Ghana, and children under two years of age are especially vulnerable. While the rates of exclusive breastfeeding have recently increased in Ghana, complementary feeding remains inadequate. The energy and micronutrient-density of common infant foods tends to be low. The influences affecting complementary feeding in Ghana are multi-factorial and not well understood. Economic resource constraints likely influence what a mother feeds her infant and what teaching aids are used in nutrition education activities. Stronger social networks may provide a mothers with greater financial and child care support. While HIV infection affects the duration of exclusive breastfeeding and the timing of introduction of solid foods.   Also, in communities affected by HIV, health care funding and staff time tend to be redirected towards HIV rather than nutrition education. Nutrition education has the potential to improve complementary feeding practices, but lack of ongoing staff training prevents some health workers from providing up-to-date and accurate information to caregivers about infant feeding. Nutrition education with simple messages used consistently throughout a health facility and through multiple channels of communication has resulted in improved caregiver knowledge, but improvements in feeding behaviours and child growth have not been consistently shown. Studies have shown that more hands-on and problem-solving education that involves tailored messages and active participation from caregivers may be effective at changing knowledge and behaviour. A better understanding of the factors affecting infant feeding from the perspectives of both caregivers and health workers will help to develop recommendations to improve health services, and thus improve the health and well-being of Ghanaian children. Furthermore, as government initiatives have helped to improve breastfeeding practices in recent years, policy changes related to complementary feeding may have the potential for a similar positive effect on infant nutrition and health status.

3. GENERAL METHODOLOGY

The present study consisted of collection and analysis of qualitative data, as well as analysis of quantitative data. The qualitative data collection was conducted from May to August 2008, while the quantitative data was collected by others from 2004 to 2008 as part of the ongoing main study entitled Research to Improve Infant Nutrition and Growth (RIING), a prospective cohort study. Hypotheses relating to the quantitative data were informed by emerging patterns found in the qualitative data.

3.1. Study site

The study sites were Manya Krobo and Yilo Krobo, two districts in the Eastern region of Ghana. Observational and interview data were collected from the 3 hospitals in these areas, from the community health centres and from the communities of Manya Krobo and Yilo Krobo. The Ministry of Health regional office provided an umbrella approval for the on-going study entitled Research to Improve Infant Nutrition and Growth (RIING) in Ghana; recruitment and interviews took place at the three community hospitals from 2004 to 2008. In addition, each hospital provided approval to work in their facilities. Each hospital was informed of this new qualitative research question and the recruitment of women and health professionals for interviews and formal approval was obtained. The services were each quite small, with only 1 or 2 doctors who work as the administrative and medical head.

3.1.1. Justification of study site

The populations of study sites were underserved, lacking adequate access to resources and health services (e.g., there were no Child Food-Distribution Programmes and no Nutritional Rehabilitation Centres in Manya Krobo and Yilo Krobo). Furthermore, these communities had high rates of poverty, child mortality and HIV/AIDS. While breastfeeding rates in Manya Krobo were high, the WHO/UNICEF guidelines for infant-feeding practices to reduce the risk of mother-to-child-transmission of HIV were not being implemented effectively, leading to inappropriate feeding and weaning practices

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and consequently lower infant survival (Lartey et al. 2008; Doherty et al. 2007). Furthermore, mothers in Ghana have "expressed concern about their inability to tell what will be appropriate for the infant to eat upon the introduction of complementary foods" (Timpo, 2007).

The quantitative data on infant-feeding practices to inform the analysis of this study, and provide a more holistic picture of the factors affecting infant-feeding decisions, were collected through a project funded by the US National Institutes of Health (NIH). All data were from Manya Krobo and Yilo Krobo, further justifying selection of this research site. The three major hospitals in the area were located in both Manya Krobo and Yilo Krobo. To examine the experiences and practices of health care providers relating to infant feeding, qualitative data from health services and communities in both Manya Krobo and Yilo Krobo were used.

3.2. Qualitative data collection

The qualitative data collection period lasted about 3 months, from mid-May to mid-August 2008 to address objectives 1 and 2. The data collected included observations in hospital-based postnatal clinics, focus group discussions with mothers of young children, and individual interviews with health workers, Queen Mothers, fathers and representatives of the Ghana Health Services (GHS).

3.2.1. Observational data

Observations in the three community hospitals of Manya and Yilo Krobo, as well as descriptive data on community life, were documented with field notes, photographs, audio and video recordings. In the hospitals, group postnatal education, weighing and vaccination sessions were observed. A field assistant, familiar with the local languages, translated the communication among health workers, as well as between caregivers and health workers.

3.2.2. Participants and sample size

Two focus group discussions were conducted with mothers of infants 6 to 24 months old, and individual semi-structured interviews were conducted with health workers, Queen Mothers, fathers, and representatives of the Ghana Health Services. Sampling was done with the intention of information saturation.

Table 3.1. Participants and duration of focus group discussions and individual interviews

Participants	Sample size (n)	Duration of interviews (min)
Focus group participants		90
Group 1: mothers of infants 6-24 mo	6	
Group 2: mothers of infants 6-24 mo	8	
Interview participants[1]		30-60
Nurses/midwives	13	
Health assistants	5	
Doctors	3	
Queen Mothers	6	
Fathers of infants 6-24 mo[2]	9	
Ghana Health Services representatives	3	

[1]One semi-structured interview was conducted with each participant
[2]Fathers were not necessarily the husbands/partners of the mothers who participated in the focus group discussions

3.2.3. Recruitment and selection criteria

Recruitment of participants combined purposeful and systematic sampling. Mothers were recruited through postnatal clinics over a period of two weeks. Clinic matrons identified eligible women, and these mothers were invited to participate in the study. For each focus group discussion, ten mothers were approached and invited to attend; six mothers attended the first discussion, and eight attended the second. To recruit fathers, the husbands/partners of the focus group women were invited to participate in an interview. Since only one father accepted, the husbands/partners of women who participated in the umbrella study Research to Improve Infant Nutrition and Growth (RIING) were also invited to participate. Eight other fathers accepted to participate, allowing for a total of 9 interviews with fathers. Criterion for participation for mothers and fathers was that their

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child was between 6 and 24 months old to enable discussion of current infant feeding experiences and plans for future feeding practices related to the introduction of solids. Mothers and fathers had to also live within a thirty minute drive of the field office.

The matrons of hospital-based postnatal clinics were asked to identify nurses and other key health workers, involved in young child nutrition and care, who should be invited to participate in the interviews. All of the thirteen nurses and five health assistants who were invited to participate accepted. As there were only one or two doctors available per hospital, all of the physicians from the three hospitals were invited to participate. Two doctors from St. Martin's hospital and one doctor from Akuse hospital agreed to an interview.

Six Queen Mothers involved in childcare and community education were identified by the Acting Paramount Queen Mother, and they were invited to participate in an interview; all six Queen Mothers accepted. Three Ghana Health Service (GHS) employees involved in young child nutrition were selected with references from RIING researchers and other participants, through snowball sampling. These potential participants were approached and invited to participate in the research study. All three of the invited GHS employees agreed to an interview.

3.2.4. Procedures for focus group discussions and interviews

Focus groups were formed with the aim of having 5-8 participants (Patton, 2002a) each and lasted approximately 1.5 hours, including translations from *Krobo* or *Ga* to English. One field assistant conducted the focus group discussions with the assistance of the primary researcher, and a second field assistant helped with translations and note taking. The development of interview questions was guided by health belief model. Interview guides focused the discussions on the socio-environmental context of complementary feeding and health practices. Barriers and suggestions for improved child care were discussed. The group interview method was used to capture participant interactions and social dynamics that may play into health beliefs and practices. Focus group discussions

were conducted in the RIING field office. A project van transported interview participants from their homes to the RIING project office.

Semi-structured individual interviews with key informants lasted 30 to 60 minutes, including any necessary translations from *Krobo* or *Ga* into English by a field assistant. Questions addressed the participant's experiences related to complementary feeding and health care, and how these affect actual practices in the community. Participants were asked for their suggestions on how to improve health care practices, as well as barriers and facilitators to change. The two field assistants were fluent in the local languages, *Krobo* and *Ga*, as well as English. The field assistants both lived in the study community and had secondary education. They had previously completed a structured training session for RIING data collection, which included theory and practice in interviewing skills, quality issues in scientific research, ethics and confidentiality issues.

Interview and focus group discussion guides (Appendices 9.2 to 9.7) were checked with field-assistants, via translating into local languages and then back-translating into English, to ensure accuracy of translation (Bowden and Fox-Rushby, 2003). Interview guides were pilot-tested during May 2008. Focus group and individual interviews were tape-recorded and translated into English, if necessary, by a field assistant. Interviews were then transcribed by the primary investigator and the field assistants. All participation was voluntary. Privacy and confidentiality were encouraged and maintained as much as possible. Informed and written consent for participant involvement, including audio-taping of the interviews, were obtained. Any photographs of study participants were used in research presentations only with the informed written consent of those involved. Refreshments were provided to focus group and interview participants to thank them for their involvement. As individual interviews were conducted in the participants' homes or workplaces, no transportation expenses were incurred by these participants. Focus group discussions took place at the field office, and transportation was provided to the focus group participants on the days of the discussions.

3.2.5. Demographic and other information

Socio-demographic information was obtained from mothers during recruitment, once informed consent was obtained. A questionnaire was used to ask the participants about level of education, wealth status (e.g., by housing materials, type of fuel used, household employment etc.), and other relevant information. During individual interviews with health care providers and Queen Mothers, information such as level of education and wealth status was asked for at the end and throughout the interviews as appropriate, so as not to interfere with the quality and depth of participant responses during discussions (Patton, 2002a; Seidman, 1991). The socio-demographic information collected was used to help describe the participants and bring context to the study findings.

3.3. Quantitative data collection

3.3.1. Participant sample and effect size estimation

Effect size calculations were based on objective 3, which is related to the quantitative data used in this study.

> *Objective 3: To evaluate the socio-demographic determinants of time of introduction of complementary foods in Ghana.*

Assumptions: 2-sided test, with type 1 error (α) of 0.05, and 80% power

A fixed sample size of 297 infants of HIV positive and HIV negative mothers was available for this analysis. Assuming 140 individuals per group, there would be an 80% power to detect a mean difference of $\pm$ 10.1 days in age of introduction of solid foods between the groups.

Table 3.2. Effect size estimation

Outcome of interest	Available sample size per group	Average age (days) of introduction of solids in study sample	Effect size Observed[1]
Age (days) of introduction of solid foods	140	158.3 ± 42.6	$\pm$ 10.1

[1] Effect size calculations were made using the programme PS Power and Sample Size Calculations, Version 2.1. 30, February 2003

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3.3.2. Selection criteria

Criteria for participation included that women were pregnant at the time of enrolment, they were offered voluntary counselling and testing (VCT) for HIV at the prenatal clinic, and if they were tested for HIV, they agreed to have their HIV status released to the researchers. HIV status was used to balance the numbers of HIV positive and HIV negative women enrolled in the study. Criteria for enrolment also included that women agreed to participate for the entire 12 months of the study and that at the time of enrolment they were free of AIDS or other physical limitations that may compromise their ability to care for their child. For mothers to continue to participate in the study for post-natal follow-up, they had to give birth to a live infant without birth defects that could hinder growth or breastfeeding. Women had to also agree to continue home visits for observation.

3.3.3. Recruitment

Pregnant women were recruited from the antenatal clinics of three community hospitals in the Manya Krobo area of the Eastern Region. A hospital staff member was responsible for the process of sample selection after completion of VCT. The objectives and procedures of the study were explained to potential participants, and the women were invited to participate. Written informed consent (either by signature or thumb-print) was obtained from the women during the time of enrolment for both themselves and their infant's participation.

3.3.4. Data collected

The major variables associated with the timing of introduction of solid foods include maternal HIV infection (Okronipa, 2008), level of social support (Burke, 2004), household socioeconomic determinants (Raisler and Cohn, 2005), maternal factors such as level of education, parity and amount of time spent working away from home (Piwoz and Bentley, 2005), as well as amount and type of nutrition education (Armar-Klemesu et

al., 2000; Bhandari et al., 2005). The present study investigated the relationships between these variables and time of introduction of solid foods. However, the amount of time that mothers spent participating in formal nutrition education activities was not assessed quantitatively in this study and warrants further investigation.

3.3.4.1. Socioeconomic and demographic information

For infants born at the health centers, their date-of-births were verified with the hospital staff. Mothers were asked for their age, level of education (years of schooling), and employment status, as well as information on their level of social support, household wealth and household demographics. Data on maternal social support[2], maternal and household socioeconomic and demographic characteristics that were collected at enrolment were used for analysis. Socio-demographic data on new household members that were collected from birth to three months were used for analysis.

3.3.4.2. Dietary surveillance data

Mothers were visited at home twice per week and were asked about their infants' intake of breast milk, liquids other than breast milk, and solids/semi-solids during their previous days. Intake data from birth to twelve months were used for analysis.

3.4. Data Analysis

The primary researcher analyzed the qualitative data obtained from the described fieldwork. Quantitative data on infant-feeding practices in Ghana, and other such relevant information, collected by other researchers and graduate students, as part of the RIING project, prior to and concurrently with the proposed qualitative fieldwork was also analyzed for this research study.

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[2] Maternal social support was defined in this analysis as the reported number of group memberships, close friends, relatives and people who help with childcare and obtaining food.

3.4.1. Qualitative data analysis

The interview and focus group code guide was developed following the qualitative data collection. During the analyses, the code guide was developed, revised, additional codes were added and some codes were combined or eliminated. The interview and focus group transcripts were coded using the guide, and the transcript coding was periodically updated as the guide was revised during analysis. The final code guide can be found in Appendix 9.1. The results were analyzed by the primary researcher and organized using Microsoft Word and NVivo version 8.0 (QSR International Pty. Ltd., 2007). The primary researcher grouped similar codes together, and also grouped different codes used together in the same context to form major concepts or themes. The initial codes and resulting themes were derived from the a priori research questions of this study. Commonly used words and phrases were also noted to help identify and describe major issues (de Negri and Thomas, 2003). Common issues among each participant group were noted for the contexts in which they were found, the specificity and intensity with which they were described, as well as the frequency of occurrence and the abundance of participants to whom the issue applied. Common issues were also noted for their occurrence across participant groups (Krueger, 1998; de Negri and Thomas, 2003; Patton, 2002b). The transcripts from the interviews and focus group discussions were reviewed several times to clarify understanding of the concepts, identify participant quotes to help illustrate issues, and to elaborate on the contexts of participant responses.

Field notes, pictures and videos of observational data were also analyzed by the primary researcher. The observations were used to identify important issues in CF education, to elaborate on and help validate the results from the interviews, and to highlight any disagreements between participant statements and observed practices. The major issues related to nutrition education and CF described in the results section were chosen according to the a priori research questions of this study, as well as patterns that emerged from the focus group discussions, individual interviews and observations.

3.4.2. Quantitative data analysis

Analysis of the quantitative data was done with SAS version 9.13 for Windows (SAS Institute, Cary, NC, USA). Descriptive analyses were used to find proportions, ranges, means and standard deviations in the data. Analyses were used to compare characteristics at baseline (or at three months) between caregivers who introduce complementary foods before 6 months and caregivers who introduce complementary foods at 6 months or later, to determine whether there were important differences among groups. Independent Student's t-tests were used to determine if age at introduction of solids was different among groups of HIV status, level of social support and location (home/away) of work.

The associations between the following variables of interest were analyzed.
The main outcome variable of interest was:

1.   Age (days) at which complementary foods were introduced.

The main predictor variables of interest were:

1. Mother's level of social support

    - groups that mother belongs to
    - relatives and friends that mother feels close to
    - people who help with obtaining food or caring for children

2. Mother's HIV status (HIV positive or HIV negative)

3. Mother's time away from home (in income-generating activity)

    - location of income-generating activity (home/away)
    - number of days spent doing income-generating activity

Survival analysis was used to compare the probability of not having solid foods introduced in the diet among infants of HIV positive and negative mothers. Multiple linear regression analysis was used to determine the effect of social support, HIV status and mother's time away from home on time of introduction of solid foods and on nutritional status. Potentially confounding variables (such as household wealth status, maternal education etc.) were controlled for in the model. Significance of association between predictor variables and outcome variables was set at $p<0.05$.

4. MANUSCRIPT 1

Complementary feeding education to mothers in health facilities of Manya-Krobo district of Ghana

Presented at the Experimental Biology (EB) conference in New Orleans, LA, USA, April 20th, 2009.

Manuscript in preparation for the journal *Nutrition Education and Behaviour*.

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4.1. ABSTRACT

Background/aim: In Ghana, the prevalence of young child undernutrition is highest between 9 and 21 mo of age; inadequate complementary feeding (CF) is one of its major causes. This study examined health service education focused on CF and its relationship with mothers' knowledge and reported practices.

Methods: Two focus group discussions were conducted with mothers of young children, who were recruited from the postnatal clinic of a community hospital in Manya Krobo (n=14). Semi-structured interviews were conducted with Ghana Health Service (GHS) personnel (n=3), doctors (n=3), nurses (n=13), health assistants (n=5), Queen Mothers (n=6), and fathers (n=9). All focus group discussions and interviews were tape-recorded and translated for coding and analysis. Interview transcripts were coded and similar codes were grouped into main theme or issues, using NVivo version 8.0 for organization. Major issues and themes were noted for the frequency and context of their occurrences.

Results: Messages on CF were provided via 10-min health talks, posters, and private counselling. While all health workers recommended starting CF at 6 mo, messages for older infants did not consistently follow Ghana Ministry of Health (MOH) feeding guidelines. Barriers to CF education reported by health workers included lack of audience-appropriate teaching aids and limited in-service training. Like health workers, mothers and fathers' knowledge of the recommended timing for CF initiation was good but, in practice, progression to a family diet was problematic. Barriers to CF among caregivers included poverty, receiving inconsistent messages about CF, and low support from health services.

Conclusion: Practical CF advice is needed and should be integrated and reinforced throughout the health system.

Key words: complementary feeding, nutrition education, health service, Ghana

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4.2. INTRODUCTION

Under-nutrition has been estimated to cause 2.2 million deaths globally among children less than five years of age (Black et al., 2008). In Ghana, there are high rates of malnutrition among infants and young children, with stunting, wasting and underweight peaking between 9 and 21 months of age (Ghana Statistical Service, 2004). Much of the problem of child malnutrition can be linked to poor diet, and among infants, diet is composed of breastfeeding and complementary feeding (CF). While inappropriate breastfeeding practices contribute to malnutrition in many developing countries, Ghana has recently seen large improvements in the rates of exclusive breastfeeding (Timpo, 2007). The rates of exclusive breastfeeding increased from 4% in 1988 to 53% in 2003 (UNICEF, 2008), due in part to increased breastfeeding education and support (Aidam et al., 2005) and policy changes such as the Baby Friendly Hospital Initiative that included increased training of health care staff and regular monitoring and were implemented throughout the Ghanaian health care system over the past few decades.

Unfortunately, similar improvements in CF have not been seen in Ghana. The typical introductory foods commonly used in Ghana include diluted porridges, like *koko*, a fermented corn porridge, and other cereal or root-based foods, while animal source foods only make up about 3 to 7% of young children's diets (Fergusson et al., 1993; Brakohiapa et al., 1988). Ghanaian infants also tend to have little variety in their intake (Timpo, 2007). In general, the diets of infants and young children in Ghana are low in energy and micronutrients like iron, compared to their increasing needs.

The timing of introduction of foods is also important. Solid foods are sometimes introduced too early, exposing the infant's undeveloped gut to pathogens in the food. Alternatively, foods may be introduced too late, and thus the infant may not receive adequate energy and nutrients for optimal growth and development (Becquet et al., 2006; Doherty et al., 2007). In developing countries, where infectious diseases are prevalent, inappropriate choices in the types and timing of foods introduced when infants are no

longer fully breastfed lead to poorer growth, development and chance of survival (Lartey et al., 2008; Doherty et al., 2007; Becquet et al., 2006).

The World Health Organization (WHO) recommends that solid foods should be introduced at 6 months, the time when the infant's nutritional requirements can no longer be met by exclusive breastfeeding (WHO, 2003). Caregivers also need to practice responsive feeding to encourage adequate intake and development of optimal eating behaviours in infants and young children. The WHO also explains that accurate information, skills and support from family, community and health services are crucial for optimal CF. Malnutrition is caused more often by inadequate and inaccurate knowledge about the appropriate foods and feeding practices needed than by an absolute lack of food availability. Community-based interventions that use locally available and affordable foods are suggested for improving CF practices (WHO, 2003).

In Ghana, poverty and food insecurity affect many households and play a role in determining what caregivers feed their children. Low maternal literacy is also a problem, as it has been associated with poorer hygiene practices and nutrition knowledge (Raisler and Cohn, 2005; WHO, 2003; Armar-Klemesu et al., 2000). In the Manya Krobo area, nutrition-related programmes are limited, as there are no food distribution programmes or child malnutrition rehabilitation centers. Also, in existing health centers, funding and staff time are often redirected to HIV education and care, leaving little time and focus for CF education and monitoring (Raisler and Cohn, 2005; Timpo, 2007). While caregivers receive nutrition information from hospital staff, family members also provide feeding advice, childcare assistance, and financial support (Bentley et al., 2005).

The influences affecting infant feeding in Ghanaian communities are multi-factorial and have not been well-studied to date. A better understanding of the socio-environmental influences on CF may come from investigating the experiences of health workers, mothers, fathers and other community members who influence child care in Ghana. Barriers and facilitators to change and suggestions for improvement should come from those involved in infant feeding, for a more local and contextual perspective. The success

of breastfeeding programmes in Ghana has shown that health initiatives can be successful if implemented systematically throughout health facilities (Timpo, 2007). Similar initiatives are now needed to address the barriers to CF in Ghana. Greater insight into the factors that affect CF practices in Ghana will help to shape recommendations for improvements. The present study examined the availability and quality of hospital-based CF education and its influence on caregivers' knowledge and reported feeding practices. Barriers and facilitators to CF education and caregiver practices were also investigated through interviews and observations.

4.3. METHODS

The qualitative data collection period lasted approximately 3 months, from mid-May to mid-August 2008. The data collected included observations in hospital-based postnatal clinics, focus group discussions with mothers of young children, and individual interviews with health workers, Queen Mothers, fathers and representatives of the Ghana Health Services (GHS).

4.3.1. Observational data collection

Observations in the three community hospitals of Manya and Yilo Krobo, as well as descriptive data on community life, were documented with field notes, photographs, audio and video recordings. In the hospitals, group postnatal education, weighing and vaccination sessions were observed. A field assistant, familiar with the local languages, translated the communication among health workers, as well as between caregivers and health workers.

4.3.2. Focus group discussions and interviews

Two focus group discussions were conducted with mothers, and individual semi-structured interviews were conducted with health workers, Queen Mothers, fathers, and

representatives of the Ghana Health Services, involved in young child nutrition. Details about the procedures for focus group discussions and interviews are shown in Table 4.1.

4.3.2.1. Recruitment and selection criteria

Recruitment of participants combined purposeful and systematic sampling. Sampling was done with the intention of information saturation. Mothers of young children were recruited through the postnatal clinic at St. Martin's hospital over a period of two weeks. St. Martin's was chosen because it was the closest of the three study hospitals to the field office used by the umbrella study Research to Improve Infant Nutrition in Ghana (RIING), where the focus group discussions took place. Transportation was provided for participants to and from the RIING field office on the days of the focus group discussions. Clinic matrons identified eligible women, and these mothers were invited to participate in the study. The expectation was that these women would have recent experience with introducing solids and would have received information from health care providers on infant feeding. For each focus group discussion, ten mothers were approached and invited to attend; six mothers attended the first discussion, and eight attended the second. Reasons for not attending included going to market and visiting family out of town.

To recruit fathers, the husbands/partners of the focus group women were invited to participate in an interview. Since only one father accepted, the husbands/partners of women who participated in the RIING study were also invited to participate. Eight other fathers accepted to participate, allowing for a total of 9 interviews with fathers. Criterion for participation for mothers and fathers was that they had a child between 6 and 24 months old to enable discussion of current infant feeding experiences and plans for future feeding practices related to the introduction of solids. Caregivers who also had older children were included along with first-time caregivers to allow discussion of previous experiences with complementary feeding and how this affected their current feeding practices. Caregivers had to also live within a thirty minute drive of the field office.

The matrons of hospital-based postnatal clinics were asked to identify nurses and other key health workers, involved in young child nutrition and care, who should be invited to participate in the interviews. All of the thirteen nurses and five health assistants who were invited to participate accepted. As there were only one or two doctors available per hospital, all of the physicians from the three hospitals were invited to participate. Two doctors from St. Martin's hospital and one doctor from Akuse hospital agreed to an interview.

Queen Mothers are the female equivalents of chiefs in the Manya Krobo area. These women have played a large role in HIV education as well as caring for orphans in the communities. Six Queen Mothers involved in childcare and community education were identified by the Acting Paramount Queen Mother, and they were invited to participate in an interview; all six Queen Mothers accepted. Ghana Health Service (GHS) employees involved in young child nutrition were selected with references from RIING researchers and other participants, through snowball sampling. These potential participants were approached and invited to participate in the research study. All three of the invited GHS employees agreed to an interview.

4.3.2.2. Procedures for focus group discussions and interviews

Focus groups were formed with the aim of having 5-8 participants (Patton, 2002a) each and lasted approximately 1.5 hours (Table 4.1), including translations from *Krobo* or *Ga* to English. One field assistant conducted the focus group discussions with the assistance of the primary researcher, and a second field assistant helped with translations and note taking. The development of interview questions was guided by health belief model. The focus group discussion guide was developed to better understand experiences with infant feeding, mothers' experiences with hospital clinics, and barriers to CF. The questions were open-ended to encourage discussion among the women and to explore any issues further (Krueger, 1998). The group interview method was used to capture participant interactions and social dynamics that may play into health beliefs and practices. The

women were encouraged to express their own views even if they differed from the view of other participants.

Semi-structured individual interviews with key informants lasted 30 to 60 minutes, including any necessary translations from *Krobo* or *Ga* into English. Questions addressed the participant's experiences related to complementary feeding and hospital-based education and care, and how these affect actual practices in the community. The two field assistants were fluent in the local languages, *Krobo* and *Ga*, as well as English. The field assistants both lived in the study community and had secondary education. They had previously completed a structured training session for RIING data collection, which included theory and practice in interviewing skills, quality issues in scientific research, ethics and confidentiality issues.

Interview and focus group discussion guides (Appendices 9.2 to 9.7) were checked with field-assistants, via translating into local languages and then back-translating into English, to ensure accuracy of translation (Bowden and Fox-Rushby, 2003). Interview guides were pilot-tested during May 2008. Focus group and individual interviews were tape-recorded and translated into English, if necessary, by a field assistant. Interviews were then transcribed by the primary investigator and the field assistants. All participation was voluntary. Privacy and confidentiality were encouraged and maintained as much as possible. Informed and written consent for participant involvement, including audio-taping of the interviews, were obtained. Any photographs of study participants were used in research presentations only with the informed written consent of those involved.

4.3.2.3. Demographic and other information

Socio-demographic information was obtained from focus group and interview participants after informed consent was obtained. A questionnaire was used to ask the participants about level of education, wealth status (e.g., by housing materials, type of fuel used, household employment etc.), and other relevant information to help bring context to the study findings.

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4.3.3. Analyses of findings

The interview and focus group code guide was developed following the qualitative data collection. During the analyses, the code guide was developed, revised, additional codes were added and some codes were combined or eliminated. The interview and focus group transcripts were coded using the guide, and the transcript coding was periodically updated as the guide was revised during analysis. The final code guide can be found in Appendix 9.1. The results were analyzed by the primary researcher and organized using Microsoft Word and NVivo version 8.0 (QSR International Pty. Ltd., 2007). The primary researcher grouped similar codes together, and also grouped different codes used together in the same context to form major concepts or themes. The initial codes and resulting themes were derived from the a priori research questions of this study. Commonly used words and phrases were also noted to help identify and describe major issues (de Negri and Thomas, 2003). Common issues among each participant group were noted for the contexts in which they were found, the specificity and intensity with which they were described, as well as the frequency of occurrence and the abundance of participants to whom the issue applied. Common issues were also noted for their occurrence across participant groups (Krueger, 1998; de Negri and Thomas, 2003; Patton, 2002b). The transcripts from the interviews and focus group discussions were reviewed several times to clarify understanding of the concepts, identify participant quotes to help illustrate issues, and to elaborate on the contexts of participant responses.

Field notes, pictures and videos of observational data were also analyzed by the primary researcher. The observations were used to identify important issues in CF education, to elaborate on and help validate the results from the interviews, and to highlight any disagreements between participant statements and observed practices. The major themes related to nutrition education and CF that are described in the results section were chosen according to the a priori research questions of this study, as well as patterns that emerged from the focus group discussions, individual interviews and observations.

4.4. RESULTS

4.4.1. Participant Demographics

Demographic characteristics of the main participant groups are shown in Table 4.2. The mothers interviewed ranged in age from 21 to 36 years old. They had zero to twelve years of schooling, and half of the mothers had not completed primary school. Most women had one or two children, but parity ranged from one to five children. The infant on whom the women were focusing during the focus group ranged from 6 to 17 months olds, with the majority of infants being younger than 12 months old. The fathers who participated in the study were older than the women on average, and they were more educated, with two thirds of the fathers having completed secondary school.

The nurses, midwives and health assistants, ranged in age from 21 to 61 years, with head nurses and midwives being older and health assistants and lower level nurses generally being younger. All but one health assistant had completed secondary education, and all nurses and midwives had completed two to four years of post-secondary education. The health workers had zero to five children, and those who had children often referenced their experiences with their own children as sources of information on complementary feeding.

Major themes related to complementary feeding in Ghana

This study examined nutrition knowledge and education, related to complementary feeding, from the perspectives of caregivers and health workers. The results have been organized into themes. The first few themes draw out the discrepancies between caregivers and health workers on the important guideline behaviours related to complementary feeding, including timing, diversity, frequency and amount. Then, converging and diverging data sources, reasoning and the resulting conflict are described. Finally, a summary of what was discovered about nutrition education offered by health

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services and other sources is given. These topics are discussed below, and a few participant quotes[3] are used for illustrative purposes.

4.4.2. Discrepancies between caregiver and health worker knowledge on important guideline behaviours related to complementary feeding

Ghana Ministry of Health (MOH) guidelines

The MOH recommends that complementary feeding should begin at 6 months of age, with thick porridge and finely mashed foods twice daily, in addition to continued breastfeeding. Then, from 7 to 8 months, infants should be fed a variety of foods similar to the family's diet; these foods should be mashed or soft enough for the child to handle, and feeding can be increased to 3 times daily in addition to breastfeeding. The MOH recommends that children continue eating a variety of family foods from 9 to 11 months, but by now the amount and frequency should be increased, and the texture can be progressed to chopped. These guidelines can be seen in greater detail in Table 4.4.

4.4.2.1. Knowledge about timing

While all health workers recommended initiating CF at 6 months, messages for older infants did not consistently follow MOH feeding guidelines (Table 4.4). Like health workers, mothers and fathers' knowledge of the recommended timing for CF initiation was good but in practice, progression to a family diet was problematic. Specifically, reported feeding practices did not usually follow the WHO/MOH guidelines to begin introducing meat, vegetables and fruit at 7-8 months.

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[3] English language errors in participant quotes have been corrected, as they were those of the translators and did not reflect the linguistic skills of the participants in their mother tongues.

Caregivers' knowledge about timing

Most mothers had good knowledge about the MOH/WHO recommendation to begin complementary feeding at six months, once exclusive breastfeeding ended. However, for a few of the women who participated in the focus group discussions, time of CF introduction was also a problem. Two of the women reported that they had started giving porridge and stews to their infants at 3 and 4 months of age, and that introduction of complementary foods before six months could also be healthy for children. In contrast, two other mothers explained that their children refused foods other than breast milk until 9 and 10 months, respectively. A few other women also agreed that children who were only fed breast milk for eight or nine months could also stay healthy. On the other hand, other caregivers explained that waiting longer than about nine months to a year to introduce solid foods caused growth faltering.

> *If you don't give anything, it will affect the child. So you have to prepare [food] for the child because you are the mother (Mother 1).*

> *I started at eight months because at first the child wouldn't take anything. But if [the child is] nine months old or more, there will not be enough breast milk anymore. So you see that the children will fall sick if you only breastfeed them and don't give them any foods (Mother 11).*

Fathers tended to have knowledge that differed the most from WHO/MOH guidelines about the optimal time to introduce CF, reporting that infant porridge or family foods (including stews and rice) should be started anywhere from 4 months to 2 years.

Health workers' knowledge about timing

Knowledge about CF practices was discussed at length in the interviews with health care workers. During both the individual interviews and the observed group health talks, nurses and health assistants recommended uniformly that infants should begin CF at six

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months with porridges, following the WHO/MOH guidelines (Table 4.4). However, health workers' recommendations about the time at which infants could be introduced to family foods (including meat, fish, vegetables, fruits, and rice among others) did not consistently follow WHO/MOH feeding guidelines. In general, higher level health workers (including head nurses) gave more accurate recommendations, such as beginning to include family foods around seven to nine months. Conversely, health assistants and some nurses gave more varied recommendations concerning when to introduce family foods. These lower level staff tended to advise that family foods should be introduced to infants later (close to one year) than suggested by the WHO/MOH.

4.4.2.2. Knowledge about dietary diversity

Caregivers' knowledge about dietary diversity

Mothers and fathers reported that maize porridge was the most common food giving to their infants. For some mothers, especially those with children less than 9 months, porridge was the only food other than breast milk that their children ate. A few mothers also mixed soya bean powder or another nutrient-dense additive into the porridge. Among both mothers and fathers, the starch portion of their children's meals was the main focus and viewed as the most important. Caregivers reported giving a variety of starchy foods (including mashed yam, soft banku (corn dough) and rice) to their infants soon after having begun CF. However, further diversification of young children's diets was often delayed until the child was close to one year old. While some mothers introduced their children to stews, containing vegetables and fish or beans, as first complementary foods, most caregivers held off feeding their children vegetables until eight to twelve months. Similarly, most caregivers started introducing meats after their infant was one year old, and almost all mothers reported introducing mashed fruits to their infants after one year. Overall, young children had little variety in their diets, especially before one year.

Health workers' knowledge about dietary diversity

The delayed diversification of infants' diets reported by caregivers parallels the recommendations given by several health workers. Most health care staff advised starting CF with porridge containing added fish powder, soya bean powder or peanut paste, similar to mothers' reported practices. Then, many health workers advise that foods like meat, eggs and vegetable stew should be introduced to children close to twelve months old. On the other hand, some health workers (usually higher level nurses) did suggest that infants' diets could include a variety of family foods beginning around seven to nine months. There was also limited diversity in the vegetables suggested by health workers, namely onions, tomatoes and sometimes contomire (a green leafy vegetable), as well as the fruit, usually just oranges and bananas. The Ghana MOH guidelines for CF advise that infants need a varied diet for good health and growth. However, diets in Ghana were observed to have low variety in general, particularly in semi-rural areas such as Manya Krobo. So it is not surprising that there is low variety in young children's intake, as well as in foods recommended by health workers.

4.4.2.3. Knowledge about frequency and amount

While the Ghana MOH has specific guidelines for the suggested amounts and feeding frequencies of infants by age group, these aspects of complementary feeding were hardly commented on by either caregivers or health workers. Reasons for this are discussed in 4.4.4. Reasoning and decision making about complementary feeding for caregivers and health workers.

4.4.3. Converging and diverging sources of information on complementary feeding for caregivers and health workers

Sources of information for caregivers

1) Health services

Most women cited the hospital[4] as one of the major sources of their knowledge on complementary feeding. Furthermore, the first of the two focus groups came to the consensus that the hospital was their most important source of information on CF. In the three hospitals of Manya Krobo district, complementary feeding education[5] messages were provided via short group education talks, private counselling[6], posters and clinic visits. These are each described briefly below. For mothers, the most important hospital-based sources of information on CF were group health talks and private counseling. Among fathers, some reported learning about CF from the hospital, but this was not a major source of their knowledge on child feeding.

> *I don't attend anything specific concerning feeding… No no, it's only the women, and when I go, they don't ask me anything… So whenever it is time for the hospital, [my wife] goes, and I go to the office (Father 3).*

1a) Group health education talks

Health education talks were given primarily by nurses working in postnatal clinics. Sometimes, health assistants[7] also assisted with the health education talks, particularly at Akuse hospital where nurses were few in number. The group health talks addressed

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[4] Note that the mothers who participated in focus group discussions were recruited from hospital-based postnatal clinics and had attended at least one postnatal weighing and counselling session

[5] Process by which knowledge is transmitted, and may include individual counselling, group discussions and hands-on activities among others

[6] Private discussion between a health care provider and a caregiver, during which health and nutrition advice are given by the health worker

[7] Health assistants, also known as orderlies, were present in the postnatal clinics of the three study hospitals (St. Martin's, Atua and Akuse). The main responsibilities of health assistants included weighing children, clerical work and cleaning.

primarily the current needs of the age group of infants whose mothers were present. For example, if most mothers brought infants close to six months old, foods seen as appropriate for CF introduction, such as maize porridge, were discussed. The CF advice given to mothers in the observed health talks generally complied with WHO/MOH recommendations. However, discussion of progression to a family diet was limited. This was especially so in St. Martin's hospital, where education sessions for mothers with infants six months and above (including CF) were combined with those for mothers with infants less than six months (focussing on breastfeeding). Reasons for this are explained in 4.4.4. Reasoning and decision making about complementary feeding for caregivers and health workers.

In general, the portion of the group health talks dedicated to CF only lasted 5 to 15 minutes, which was about a third of the time used for group breastfeeding education (Table 4.3). The teaching methods used most frequently for group CF education included lecture by a nurse, questions and answers and sometimes group repetition. In general, the group education on CF was less interactive than the breastfeeding education.

1b) Private counselling sessions

Private counselling sessions were conducted at each postnatal clinic following group health education talks and child weighing. Mothers whose children were growing poorly, or who voiced concerns about their children's health, were seen for private counselling. These sessions usually lasted about ten to twenty minutes and were conducted in the nursing offices of the postnatal clinics. During private counselling, a nurse discussed child health issues with the child's mother, including the child's growth, nutritional status, and recent illnesses. Health assistants also gave individual counselling on occasion, particularly when a regular nurse was absent. Private counselling was not directly observed due to confidentiality issues since participants' HIV status was discussed. The content of what was discussed with mothers during private counselling was assessed through interviews with health care staff.

1c) Posters

Posters were visible in all three hospital-based postnatal clinics. They were provided by the Ghana MOH a few times per year and were created by the MOH and the WHO/UNICEF. The nurses working in the postnatal clinics placed these large[8] posters in their clinics. Representatives of the Ghana Health Services explained that the posters reflected the WHO's recommendations for young child health and nutrition and the MOH's child health promotion activities[9]. For example, many of the posters that were displayed in the postnatal clinics showed pictures and phrases promoting exclusive breastfeeding for 6 months, followed by the inclusion of family foods, with iron-rich foods, vitamin A supplementation, the use of iodized salts, and hand-washing. While these were practical recommendations, most posters were in English and their pictures were not used as teaching aids in observed health education talks. Overall, caregivers did not cite posters in hospital clinics as important contributors to their knowledge about CF.

1d) Clinic visits for child illness

Some caregivers also learned about CF from doctors, when they brought their children to hospital to treat an illness or severe growth faltering. However, doctors were in short supply and were therefore not seen by many caregivers. In general, doctors were not a major source of CF information for caregivers compared to nurses and other more frequently seen sources.

> *The doctor talks about feeding. That's where we learned about*
> *[complementary feeding], when we went for the child's eye problem (Father 1).*

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[8] Most posters measured approximately 1m^2
[9] The Ghana Ministry of Health promotional activities targeted problems that were identified by the Ghana Demographic and Health Survey

2) Family and friends

Besides hospital clinics, female relatives were also cited by mothers as a major source of knowledge on complementary feeding and young child care. The participants of the second focus group agreed that the hospital was a good source of information, but that their own mothers were their primary source of knowledge on CF. Several fathers also reported receiving information from their parents, usually their mothers or another female relative.

> *For me, where I learned it from is from my mother. The last born was young, so when they started feeding the last born, then I learned it from that (Father 2).*

3) Queen mothers

Some of the Queen Mothers acknowledged that mothers receive CF information from the hospital, but most Queen Mothers saw themselves as the primary, if not the only, source of information on infant feeding for caregivers in the community. The Queen Mothers reported counselling women on infant feeding during home visits, and also held community meetings to teach child care. Some Queen Mothers also accompanied mothers to the hospital for postnatal education activities. These activities were targeted especially to families affected by HIV. The Queen Mothers reported that they learned about CF from hospital staff, NGOs, other Queen Mothers, female relatives and their own experiences preparing food for and feeding children.

> *The mothers in this particular area, they come to learn from the Queen… So if we take these mothers in the community, we can tell them what they are to do. And we talk to them, and we teach them (Queen Mother 2).*

In contrast to the views of the Queen Mothers, the women who participated in the focus group discussions did not attribute their knowledge about CF to information received from Queen Mothers. This is discussed further in 4.4.5. Conflicting information.

4) Personal experience

Some of the mothers learned about CF through their own experience feeding young children. These mothers observed their children's behavioural and physical cues to determine when and which foods to give their infants. This is discussed further in 4.4.4. Reasoning and decision making about complementary feeding for caregivers and health workers.

5) Formal education

Fathers also referenced school, usually secondary school, as the source of their knowledge on infant feeding. In contrast, none of the mothers mentioned learning about child feeding from school.

> *About feeding, I don't attend anything specific concerning feeding. But, I make use of [what] they say in school about feeding; we learn about foods and then personal hygiene (Father 5).*

6) Media

The media was also sometimes cited a source of CF information for fathers. One man explained that in his community, many parents received their child care information from the television. In contrast, mothers did not mention learning about infant feeding from television or other media.

> *They see one of those [foods] on television that would be good for their children; they practice on it (Father 3).*

A representative of the Ghana Health Services (GHS) confirmed that there has been a recent increase in promotional messages conveyed through the media about child feeding.

The FM stations in the regions, they do something also [on complementary feeding] in the local languages. When I go out to the regions, I do hear that (GHS personnel 2).

Sources of information for health workers

1) Health centre postnatal clinics (on-the-job learning)

Nurses and midwives cited experience with their clients' children as a major source of their knowledge about complementary feeding. Health assistants also explained that much of their knowledge about complementary feeding came from learning on-the-job. Assistants learned by watching nurses give group health talks to mothers and from posters and other resources available in the clinics.

> *With working experience. I've been here long... about thirty five years. So we have passed through so many challenges (Nurse 1).*

> *We learned from the nurses, when they teach the mothers. Where we learnt it most is from here [the clinic] (Health assistant 1).*

2) Personal experience

A few nurses and midwives, generally those who were older and had multiple children, also reported that they learned about infant feeding from personal experience with their own children. However, health workers reported that personal experience helped them learn about infant feeding primarily in terms of breastfeeding, rather than complementary feeding.

3) In-service training

On-going training was not a major source of information for health care staff in terms of knowledge about CF. Few staff members attended trainings on a regular basis, and while CF was discussed to some extent in trainings about lactation management (breastfeeding) and prevention of mother-to-child-transmission (PMTCT) of HIV, CF had not yet been the main focus of in-service training in the Manya Krobo district. This is discussed further in 4.4.6.3. In-service training for health workers.

4) Formal education

Nursing and midwifery involved two years of post-secondary education. The heads of the postnatal and child welfare clinics had training in both nursing and midwifery, with the exception of the head of Akuse hospital, who received training as a dietary technician at the post-secondary level. Doctors also had several years of post-secondary training. Doctors, nurses and midwives had all received some formal education on complementary feeding and general nutrition. Health assistants usually had secondary school education, where they received some limited information on general health and nutrition.

4.4.4. Reasoning and decision making about complementary feeding for caregivers and health workers

<u>Reasoning for health workers concerning which advice to provide to caregivers</u>

1) Health workers' beliefs about progression of infants' diets

Group CF education in postnatal clinics was generally given to suit the current needs of the infants whose mothers were in attendance. Some health care staff explained that they do not want to teach caregivers about how to feed beyond the child's current stage for fear that mothers may introduce the more advanced foods too early. For example, rather than tell a mother with a six month old child to begin feeding porridge, then progress to

family foods over the next few months, only porridge would be mentioned, and discussion of family foods would be saved for a later visit from the mother. Furthermore, health workers usually advised a slow (delayed in comparison to WHO/MOH guidelines Table 4.4) progression for infants' diets. The primary reason for this was that more advanced foods, including meat, thick stews and fufu (a firm plantain and cassava dough), were believed to be too difficult to digest for an infant's undeveloped gut. Another common reason among health care staff was that infants younger than one year old had difficulty chewing many family foods.

2) Poverty and health workers' complementary feeding advice

Health workers explained that their reason for not providing mothers with strict recommendations on feeding frequencies and amounts was related to the financial constraints faced by mothers. For example, one nurse commented that the MOH's recommendation for infants to be fed meat, fish or beans daily was not realistic for many mothers in the community. Nurses generally found meat expensive, and so most nurses recommended that mothers give their young children meat only when they felt they could afford it.

Similarly to caregivers, nurses and doctors also suggested that lack of money was a barrier for optimal CF among caregivers, but that the deeper root causes were teen pregnancies (adolescent mothers were reported to have more trouble feeding their infants) and having several children, which often made household finances tighter. Finally, many nurses also reported that low education and HIV or other illness posed a barrier to good CF in the communities.

> *A young girl, drops out from school…and becomes pregnant. Of course, she will not get adequate help financially… you can just imagine that the health of her child and herself will suffer (Doctor 1).*

Reasoning for caregivers concerning which source of complementary feeding information to follow

1) Acceptability of messages received by caregivers and perceived credibility of sources

1a) Health services

Most women who participated in the focus group discussions explained that they knew when to begin CF because they had attended postnatal sessions and the nurses had told them to start at six months. Most (but not all) caregivers agreed that hospital staff were credible sources of information on infant feeding.

> *Complementary feeding should be done according to the nurses' suggestions to make the child brilliant, growing, and healthy (Mother 3).*

Among the mothers interviewed, knowledge about the recommendation to breastfeed exclusively for six months was very good among women due to the emphasis on exclusive breastfeeding throughout health services, and thus knowledge among women about when to start CF also tended to be good. However, the reasons that mothers gave for waiting six months to start CF were sometimes inaccurate.

> *At five months old, there are flames in the stomach, so we were told not to give water... and koko (Mother 4).*

Providing bold and imaginative statements about early introduction of complementary foods could be interpreted as a means used by some nurses to frighten mothers into breastfeeding their infants exclusively for six months. Furthermore, caregivers' beliefs that introduction of family foods should be delayed also paralleled beliefs commonly held by health workers and other community members. Some nurses and health assistants had told mothers incorrectly that fibrous foods and tough meats, even if mashed or chopped, could not be digested by infants until almost the second year of life.

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The types of foods that were recommended to mothers in health services were generally well accepted because they were based on locally available and commonly eaten foods. However, suggestions of feeding practices that required a greater amount or an unusual preparation were not well received by caregivers. For example, health workers often suggested to mothers that infants should not eat spicy foods because it would irritate their stomachs and cause growth faltering. Thus, health workers advised that hot pepper (which was abundant in Ghanaian cuisine) should either be avoided in cooking or be added to a family's meal only after a portion had been removed for the infant. Yet, caregivers explained that hot pepper was traditionally added at the beginning of cooking, and so the health workers' advice was not practical. Instead, some caregivers reduced the total amount of hot pepper used in family meals if their infant reacted adversely to the spice.

In another example, mothers appeared frustrated with suggestions from nurses for special foods (not common in the family diet) to feed a young child. Mothers explained that buying ingredients to prepare a separate meal for their infants was too costly and time consuming. Suggestions of making a portion of the family meal into an appropriate texture for the child may be more acceptable and practical for caregivers. The wide variation in caregivers' knowledge concerning the time at which meat, vegetables and other nutrient-dense foods should be introduced likely reflected the inconsistencies in recommendations that nurses and others provided about these foods.

1b) Family and others

Some women knew when to start CF because they had learned from their mothers, viewing their own mothers as the most credible source of information. A few caregivers also learned from family members to look for developmental signs in their children to know when to introduce new foods. A few women reported that they turned to their own mothers for advice on CF when they received too many conflicting messages from different health workers. In contrast, some mothers explained that they did not listen to the feeding suggestions of their family and friends when it differed from health workers' recommendations. A few mothers explained that family members gave more varied and

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inconsistent advice about when to start CF, compared to nurses. For example, mothers reported that some grandmothers recommended that solid foods could be started as early as three months, while other family members suggested starting solid foods at eight months or later.

> *Many people advise us, our mothers, old women, but we don't take this advice. In the past, infants were given foods early, so we argue with them because we are taught differently in hospital (Mother 4).*

Even after probing for more details on where mothers received their information on CF, no sources other than health workers and relatives were mentioned. This may have been because the mothers who participated in the focus group discussions counted family members and health workers as the most credible sources of information on childcare. Additionally, mothers may be exposed to fewer sources of information on nutrition. For example, some fathers who were interviewed cited school as their primary source of information on CF, whereas since several of the women had not completed primary school and some had not received any formal schooling (Table 4.2), this was a less likely source of information for them.

2) Child's physical and developmental cues

Some caregivers used responsive feeding cues to know when to begin complementary foods. For example, one father explained that his wife knew to introduce complementary foods because the infant would cry due to hunger when the breast milk was no longer sufficient. While most caregivers knew that six months was the advised age at which to start CF, some mothers suggested that earlier introduction would not cause harm to the baby, and that there was no real reason to wait until six months. One of these mothers explained that she began feeding porridge to her child at three months and used her observations of his health and growth as guidelines for whether to continue feeding complementary foods.

At three months old, I started koko with fish powder; I didn't encounter any problems… and [my child] became strong. All the children that I've had started at three months old (Mother 9).

Observations of children's physical and developmental cues became an even more important source of information for mothers to know when and how to progress their children's diets towards family foods. Some women suggested that they knew that their infants could start taking more advanced foods when their teeth came in. Some of the fathers also agreed that appearance of teeth was an indicator that children were ready to eat family foods.

Let's say ten months going, when the teeth start to come out, and the child can even chew, then its ok, so you can start the family food (Mother 4).

Other mothers explained that she would know when her infant was ready for new foods or textures when the child showed eagerness to eat these foods. The infant might try to take some of the family foods from her mother's meal. One father also suggested that sometimes during mealtime, his child tried to eat some of the foods from his plate, showing that the infant was interested and ready.

Before we realize that they are ready, I will be eating, and the children will come and want to take some of the food that I am eating. With that food, I know that the child can take it (Mother 7).

Caregivers also adjusted the amounts and frequency of feeding according to their children's growth and physical cues (such as crying indicating hunger, and head turning indicating refusal to eat). Mothers generally did not find that rigid guidelines about amounts to feed young children were practical. More individualized recommendations for complementary feeding, based on children's development, growth and indicators of hunger and satiety may be more useful.

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Overall, most caregivers attributed their knowledge about the time to begin CF to health workers' messages, but their reasons for knowing when to diversify their infants' diets were mainly based on observations of the children. Physical signs such as the appearance of teeth, and developmental and behavioural signs such as the ability to grab foods served as cues for caregivers to feed their infants new foods and textures. These observational skills were sometimes learned from family members, but were not taught in hospital-based CF education activities. Also, since health workers reported inconsistent recommendations about how to progress CF beyond six months, child observations may have been a more credible source of information on which caregivers could base their feeding decisions.

3) Poverty

The focus group discussions with mothers revealed that infant refusal or dislike of new foods or textures and consistencies was a major deterrent for introduction and progression of CF. Interviews with health workers also confirmed that this was a common complaint among mothers. Furthermore, when infants refuse a food, mothers were usually advised to try other foods until the infant accepted. This was found to be difficult for caregivers due to the cost of buying a greater variety of food and having to waste uneaten infant foods, as well as the preparation time needed to prepare additional foods.

> *Sometimes the child will not take [the food]. And you are told [by the nurses] to try another. You only have like a thousand cedis[10], so you cannot go and buy [ingredients] to prepare another [meal] (Mother 4).*

Also, on the issue of financial constraints, sometimes, even though mothers knew that a certain food would be good for the infant, such as micronutrient-dense animal-source foods, they chose not to purchase these and instead fed lower-cost cereal porridge or other

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[10] On July 1, 2007, old Ghana cedis (GHC) were replaced by new Ghana cedis (GHS). Now, 1000.00 GHC are equivalent to 1GHS (also equivalent to 0.70 $US). However, the mothers who participated in this study, like many Ghanaians, referred to the old Ghana cedis (GHC) in their comments.

similar inexpensive starchy food. Thus, economic constraint was a commonly reported reason among caregivers for young children having low variety in their diets.

> *My child, I know what she should take, but I do not have the money to prepare the food for her. So I just give koko or something like that… They say add all this milk, I know if I add it, it will be good for the child, but because you don't have the money, you just prepare the koko without the milk (Mother 1).*

Several of the Queen Mothers also suggested that lack of money may be a barrier for caregivers in feeding and caring for young children. A few mothers and most fathers also mentioned that the foods recommended in hospital were too costly and were a barrier for optimal infant health.

> *This is Africa, today's rich man is tomorrow's beggar, you know? So I can't say I'm always I'm able to get the food for them (Father 6).*

4.4.5. Conflicting information

Receiving conflicting information about CF was a reported problem for several mothers and fathers. Information received from family members and health care providers often differed on aspects including the time of CF initiation, as well as how and when to progress towards a family diet.

> *Sometimes, if you leave your baby in the care of an older woman, she will try to feed the baby before six months or give medicines. So you just take it and say you will give it later out of respect, but you don't actually give it (Mother 5).*

When asked how they resolved this conflict, some mothers explained that they just choose to listen to only one source, either the hospital workers or their relatives. Other mothers followed whichever advice was given most consistently among health workers and family members. Several grandmothers and nurses recommended that the

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introduction of meat should be delayed because young children could not digest it properly. Therefore, it was not surprising that many mothers reported following this advice. In contrast, some of the recommendations about CF given only by grandmothers (not health workers) were less commonly followed by mothers. For example, some grandmothers advised that eggs should not be consumed by children during times of illness or following injuries, but the mothers did not report practicing this. Additionally, some mothers and fathers used their children's behavioural cues to determine which advice to follow when they received too many conflicting messages. While other caregivers tried all of the suggestions given to them, and then pursued the "best practice".

> *We test both and see which one works (Father 6).*

Another source of conflicting information was related to the differing view of the Queen Mothers' role in CF education held by mothers and the Queen Mothers themselves. While Queen Mothers often viewed themselves as the primary educators of women on child feeding and care practices, none of the mothers who participated in this study attributed their knowledge about infant feeding to the Queen Mothers.

> *We don't attend that kind of thing. We don't go [to the Queen Mothers' talks] (Mother 1).*

Some mothers explained that they were too busy to attend community talks given by Queen Mothers. Other women preferred to seek advice from their own mothers, friends or the hospital nurses. Some mothers found that the advice given by Queen Mothers was not credible because it conflicted with the advice they received from health care providers. One mother explained that the Queen Mothers suggested giving complementary foods soon after birth, but this was not advised by health care providers.

> *Some people in the community started giving koko or cerealac one week after birth while breastfeeding. They were taught by Queen Mothers that early feeding*

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does not give any harm to the infant, but nurses have told us that we should wait

until six months or else the child won't be healthy (Mother 2).

4.4.6. Discoveries about nutrition education offered by health services

The main barriers for CF education in hospital-based postnatal clinics included a lack of audience-appropriate teaching aids, limited use of participatory teaching methods, limited in-service training for staff, and low contact and support for caregivers. Each of these is discussed below.

4.4.6.1. Teaching materials

Health workers commonly reported that teaching aids such as sample foods, measuring utensils, posters and other visual aids such as pictures in the growth monitoring booklets, were the most effective means of teaching mothers, who often have little education, about infant feeding.

> *What helps me when we are teaching them? It's the visual aids... Because when*
> *you talk, blah blah blah, they easily forget. But when the things are there, then*
> *most of what you say, they take it. So when you talk, show a sample of it (Nurse 2).*

Mothers agreed that visual and hands-on teaching aids helped them to learn about CF. However, sufficient and audience-appropriate teaching materials were not available in hospital clinics, according to health workers and caregivers. Sample foods used to be available for demonstrations and given to mothers (as incentives for clinic attendance), but these were no longer in the hospital budgets. Also, some health staff suggested that more demonstrations of food preparation, using sample ingredients and measuring utensils, would help mothers to understand and retain more information.

Materials are a problem for us. We don't have materials. So, in teaching, I have to use my discretion and use the practical way [demonstrate] to help the person understand what I'm saying (Nurse 4).

Another problem with most of the posters and the growth monitoring booklets was that nutrition messages were written in English, but most women only spoke the local languages and few women could read. Additionally, some of newer posters available at the Ghana Health Services (GHS) and the MOH had not yet been distributed to the hospitals in Manya Krobo. This is explained further in 4.4.6.3. In-service training for health workers. Furthermore, some of the available teaching resources (including posters about complementary foods and pictures in growth monitoring booklets) may be underused. Health workers did not refer to the posters on CF in observed group health talks, and caregivers did not seem to pay attention to posters in general. This may be because CF posters were commonly displayed in obscure areas such as the walls behind seating areas and in corners. This was partly because wall space was limited (most clinics were partially open to the outside). Also, much of the available wall space was already covered with posters about malaria, HIV, and other important health topics. The posters on CF may have been ignored due to the general overabundance of posters in hospital clinics and limited staff time to explain the posters' messages. Nurses explained that sometimes teaching aids were not used because mothers were assumed to know how to prepare complementary foods.

Our weighing cards [growth monitoring booklet] have pictures that we can use. But normally we don't use them because we all know the foods that we use here [in Ghana]. When you mention the name [of a food], the mother can picture what you are saying (Nurse 5).

4.4.6.2. Teaching style and methods

According to clinic observations and health worker reports, the teaching methods that improved delivery of nutrition education and mothers' acceptance of messages included

modeling and hands-on participatory activities. Peer modeling was reported by nurses as an effective teaching method for infant feeding. A few health workers used mother-infant pairs who were successful at CF as examples to follow for mothers who were struggling. Women who were having trouble with CF were reportedly shown these healthy-looking babies and told how to achieve this with their own children.

> *Maybe use other babies as a reference, and tell them that this baby was like that*
> *[unhealthy] before, and now he takes this [food] and he has grown well (Nurse 1).*

Additionally, peer modeling was observed (and reported by hospital staff and mothers) to be an effective teaching technique for breastfeeding. Mothers came to the front of the postnatal clinic during group education talks to demonstrate proper breastfeeding. The nurse would then ask the group if the positioning was correct or incorrect and how to improve it. The mothers appeared to be more engaged and attentive during this interactive activity than during lectures. In general, the group education talks about CF were less interactive than those addressing breastfeeding. While group CF education was delivered primarily through a lecture and a short question and answer period, breastfeeding education included demonstrations, hands-on practice by the mothers, use of large breastfeeding pictures, and more time for questions and answers. The teaching style used in nutrition education likely affected mothers' learning and retention of the health messages. Participatory teaching methods, such as cooking classes or demonstrations of how to feed responsively[11] may also be effective ways to teach CF.

4.4.6.3. In-service training for health workers

Limited staff training on CF may have contributed to the small focus on CF (compared to breastfeeding) in hospital postnatal clinics. In general, only the higher-level staff members attended training workshops. Also, the staff workshops appeared to be held infrequently.

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[11] Aboud et al. (2008) defines responsive child feeding as behaviours where a mother interprets signals from the child and responds quickly and reciprocally to those signals.

In-service training, as for that, once in a while. The last one, when was that? I can't remember! It's been a long time. Last year? I've forgotten (Nurse 6).

Furthermore, staff trainings have addressed many childcare issues including diarrheal diseases, hygiene, HIV and breastfeeding. However, both hospital workers and GHS representatives explained that CF had not yet been the main theme of any staff workshops in the Manya Krobo district.

At the moment, complementary feeding is covered in the lactation management course, and also in the integrated HIV and infant feeding counselling. We haven't gone ahead to do a training specifically on complementary feeding with our health workers (GHS personnel 1).

The Ghana Ministry of Health had begun training sessions on CF at the regional-level, but the training materials (including counseling cards and posters on CF) had not been disseminated to many of the districts. Representatives of the GHS explained that regional nutrition officers and a few health workers from each district were assembled for an initial training on how to counsel caregivers on CF, using simple, user-friendly counselling cards. During the training, the health workers practiced counselling and were given feedback in an interactive learning session. The counselling cards were to be distributed to the districts by regional officers. However, this dissemination process had not been completed in most regions.

We had the training with the counselling cards... [we] told them to find out what the mother can do, and build on that. It was a hands-on thing... So far I know it is only the Western region that has been able to train all the districts. Others have done part; some haven't done anything at all (GHS personnel 2).

The GHS representatives suggested that better dissemination of teaching materials could be achieved through more frequent workshops for health workers. Also, increased

monitoring and evaluation of hospital-based CF education were recommended to help improve programme delivery.

> *At the hospital level, I think we need to do more monitoring… and see whether the information has rolled down, and whether these materials worked or not (GHS personnel 1).*

4.4.6.4. Amount and quality of contact between health workers and caregivers

Infrequent and short duration of contacts between health workers and mothers may have negatively affected mothers' uptake of CF messages. Nurses and other health care providers explained that there was limited time available for nutrition education because other topics also needed to be discussed with mothers, including hygiene, childhood illnesses, and family planning. Nurses also explained that other responsibilities (such as growth monitoring, vaccine distribution and clerical work) took much time and effort, leaving insufficient time for complementary feeding education. Also, while mothers came frequently to postnatal clinics for child weighing and vaccinations when their infants were younger than six months, few mothers with older infants were observed at postnatal sessions. Infrequent contact between health workers and mothers may contribute to mothers' uncertainties about how to progress from infant porridges to family foods.

Furthermore, group CF education appeared to be less of a priority than group breastfeeding education. While group health talks on breastfeeding were generally given weekly, talks on CF were usually given about once a month (Table 4.3). Also, the exact time of the health talks was not fixed, but rather varied to accommodate the staff's other responsibilities. Health talks on CF were sometimes skipped if few mothers attended or if the nurse who usually gave the talk was absent. As a result, the schedule for group health talks on CF was difficult to predict. Mothers generally worked long hours and had many responsibilities (Piwoz and Bentley, 2005; Farquhar et al., 2001), so knowing the schedule of hospital activities could have helped caregivers plan ahead and increased attendance at group education activities.

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Low support from health services may be another possible deterrent for clinic attendance among mothers. Some caregivers complained that they disliked or avoided going to the hospital because they were ill-treated and sometimes punished by health care staff. One mother explained that nurses sometimes made mothers wait longer for their private counseling as a punishment for requesting to be seen early. A few of the caregivers also voiced that nurses often shout and seem impatient with the mothers' questions. This may show tensions between caregivers and health care staff caused by attitudes of superiority held by some staff.

Health workers also tended to reward mothers who had greater support from family and community members. Few fathers accompanied their wives to postnatal education sessions, but health workers reported that the women who did bring their husbands were given priority for weighing and private counselling. Similarly, Queen Mothers reported that women who were accompanied by Queen Mothers to hospital clinics were seen first for private counselling. A few health workers explained that this was a way of encouraging fathers and other support people to participate in child feeding education activities. However, the approach used by health workers of rewarding mothers who have more support may have been counterproductive. The mothers who did not have anyone to accompany them for child health care and education may have become discouraged and less likely to attend hospital-based activities.

4.4.7. Summary of what mothers felt they needed for optimal complementary feeding

<u>Increased use of teaching aids and participatory methods in hospital clinics</u>

Caregivers and health workers agreed that more practical CF advice and education activities were needed. Mothers suggested that demonstrations of food preparation would help them feel more confident about the textures, consistencies and ingredient amounts to use in complementary foods. Some mothers also felt that they needed more guidance on

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how to know when and how to progress their children's diets towards family foods. Education on responsive feeding strategies in hospital-based clinics may address this need. Several mothers also proposed that health workers should reinstate the practice of providing mothers with sample foods, such as soya bean powder and weanimix (mixed infant cereal containing grains, peanuts and soya beans). Mothers and fathers both emphasized that they wanted CF advice to focus on a variety of affordable and easily accessible foods.

<u>Increased support from health services</u>

Increased support from health workers was a common request among mothers. Some women felt that the amount of time during which they were counselled individually was insufficient, while others felt that they were not given enough time to ask questions during group education. Many mothers also explained that the attitudes of health workers made them feel unimportant. Increased training for health workers on how to counsel mothers about CF, as well as communication skills, may help mothers feel more supported by health workers.

<u>More consistent messages</u>

Caregivers commonly seemed frustrated and confused about the abundance of conflicting CF messages that they received. Simple and consistent messages should be reinforced by all staff members throughout the health system. Also, increased programme monitoring may help ensure that CF messages given in hospital are consistent. Greater involvement in CF education from family members (such as grandmothers who often provide advice and childcare) may also improve the consistency of CF messages that mothers receive.

4.5. DISCUSSION

The present study examined health service education focused on CF and its relationship with caregivers' knowledge and reported practices. The results of the qualitative analysis

showed that while knowledge about timing of CF initiation was good among health workers and caregivers, progression to a family diet was problematic. Recommendations from health workers on CF for older infants did not consistently follow WHO/MOH guidelines, and caregivers reported having difficulty advancing their infants' diets. Slow uptake of complementary foods and low dietary diversity are likely causes of poor growth among infants less than twelve months old. However, in the second year of life, nutrient-rich breast milk becomes a smaller part of the diet and is increasingly replaced by complementary foods. Consumption of nutrient-poor, low energy complementary foods in the second year of life is likely a contributor to growth faltering among children under two years old.

The amount of time spent on CF was minimal in all three community hospitals. Furthermore, the information that was given on CF was usually tailored to suit the needs of the attending group of caregivers. Teaching on a need-to-know or current-needs basis may be a problem because while many mothers were observed to attend postnatal clinics when their infants were six months old or less, few mothers attended postnatal sessions as the infant grew older. This was observed during recruitment of mothers for focus group sessions at St. Martin's hospital. While there were often a few dozen women at the clinic on any given day, less than half a dozen would be mothers of infants six months or older, and of those women, almost all had infants less than about 9 months old. As the infants age, mothers attended weighing sessions and health education less frequently. So, many mothers were possibly not receiving information on how or when to progress their infants diet towards a family diet. Furthermore, scheduled health education talks were not always given, and the exact time of group health talks varied from week to week within each hospital. This may be problematic, as women were more likely to miss group CF education sessions when the schedule was unpredictable. The teaching style for CF during group health talks was generally much less interactive than the methods used for teaching breastfeeding. Studies in Peru and Senegal have documented that while lecture-style teaching is common for nutrition education in developing countries, a more interactive and hands-on approach results in greater behaviour change among caregivers (Waters et al., 2006; Robert et al., 2007; Aubel et al., 2004; Ticao and Aboud, 1998).

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Health workers in this study reported on the recommendations that they gave during private counselling. In general, recommendations for introduction of CF at six months followed WHO/MOH guidelines, but advice for older infants did not consistently follow the international and national recommendations. Higher level nurses gave more accurate information, while health workers with less training generally recommended delaying introduction of family foods until the infant was close to one year old. This was likely because the recommendations for progression of CF are complex and were generally not well known. On the other hand, the WHO/MOH recommendations for older infants may not be followed by health care staff because of widely held beliefs among health workers and other community members that foods such as meat and vegetables are difficult for infants to digest and should be introduced much later than the recommended 7 months of age. Other studies in sub-Saharan Africa have reported that nurses and other health workers, who have not received recent training, give mothers inaccurate advice about child feeding that is based on out-dated recommendations or cultural beliefs (Buskens and Mkhatswa, 2007; Raisler and Cohn, 2005; Akuse and Obinya, 2002; Timpo, 2007). Also, many health workers explained that meat and other high-cost foods were not affordable for all caregivers at the frequency recommended by the WHO/MOH, which was likely a key reason that advice given by health workers did not always comply with the WHO/MOH recommendations.

Similarly, mothers and fathers had good knowledge about CF introduction, but in practice, progression to a family diet was a problem, likely due to inconsistencies in the information that they received from health workers and family members about feeding beyond six months. Good knowledge among health care staff and caregivers that CF should being at 6 months of age was likely due to the emphasis on exclusive breastfeeding for six months in Ghanaian hospitals and the resultant high level of knowledge about exclusive breastfeeding among Ghanaian mothers (Aidam et al., 2005; Timpo, 2007). However, since less of a focus was paid to CF in Ghanaian health services, knowledge about WHO infant feeding guidelines beyond six or seven months was lacking among many health care staff and caregivers in this study. A previous study in the Eastern

region of Ghana also found that while mothers had good knowledge about the recommended duration of exclusive breastfeeding, they had low confidence in their ability to feed their infants complementary foods due to lack of knowledge about when and how to introduce new foods (Timpo, 2007). Other studies in sub-Saharan Africa have also shown that in areas where maternal education is low, knowledge and confidence about young child nutrition is generally low (Armar-Klemesu et al. 2000; Kalanda et al., 2006; Enbretsen et al., 2007), but can be influenced by health education (Njom Nlend et al., 2007; Armar-Klemesu et al. 2000). Improving the knowledge and educational practices of health workers, as well as other influential community members such as grandmothers and Queen Mothers, through community-based training and monitoring could translate into better knowledge and CF practices among caregivers.

While the hospital was cited by many caregivers in this study as important sources of information on CF, grandmothers were reported to give much advice on CF. However, grandmothers and Queen Mothers were reported to give information on CF that conflicted with recommendations received in hospital. Other studies have also found that older women gave CF recommendations that did not always follow current WHO guidelines (Buskens and Mkhatswa, 2007; Raisler and Cohn, 2005; Timpo 2007; Aubel et al., 2004). Grandmothers, Queen Mothers and other influential community member may benefit from being included in CF education activities.

Grandmothers, fathers and other relatives were found to rarely attend child care and nutrition activities in the community hospitals. However, several health workers explained that women, whose spouse and other family members attend child health sessions, were more likely to practice optimal child feeding. Studies in Senegal and Tanzania have similarly shown that there is an association between attendance of grandmothers, husbands and other family members at child nutrition education activities and better caregiver feeding behaviours (Aubel et al., 2004; Burke, 2004). The fathers interviewed in this study may not have been representative of all fathers of children under two years old in the Manya and Yilo Krobo districts. While two-thirds of the fathers interviewed reported attending at least one hospital postnatal education session, hospital

staff reported that in general very few men attend postnatal education with their wives. Further studies that assess the knowledge and involvement of fathers in infant feeding may be warranted.

In the hospitals, teaching aids, including sample foods, measuring utensils and pictures were reported by health workers as being most effective for CF education, but teaching aids were usually unavailable due to insufficient funds in hospital. Also, posters, growth monitoring cards for mothers, and other visual aids were generally in English, which was problematic for the majority of caregivers who did not speak English and had low literacy (Ghana Statistical Service, 2004; Armar-Klemesu et al. 2000). Demonstrations and participatory teaching methods have been found to be used effectively for breastfeeding education in the hospitals in this study. While hands-on activities were not observed for CF education in this study, studies in Peru have found that demonstrations, taste-testing, problem-solving discussions, and support groups in health services have helped improve the knowledge and practices related to CF among caregivers (Waters et al., 2006; Robert et al., 2007).

In-service training for health care staff in Manya Krobo has not focused on CF. Furthermore, most staff members, especially lower-level staff members who had the most contact with caregivers, attended in-service training infrequently and irregularly. Studies in Mali, Ghana, Peru and Nepal have found that ongoing training can greatly improve nutrition and health services with little additional cost to the health facility (Chee et al., 2002; Ross et al., 1987; Waters et al., 2006; Robert et al., 2007; Curtale et al. 1995). Training materials for CF education have been developed by the MOH/GHS, but they have not been used in Manya Krobo. Personnel from the MOH/GHS have suggested that increasing promotion and monitoring of CF activities are needed to improve current child health services.

In the communities, financial constraints have also been reported by caregivers as barriers for optimal CF. The cost of preparing special infant foods may be diminished by encouraging caregivers to feed their infants family foods that are made to be of an

appropriate texture for the child. Studies in Lesotho and Peru have found that when health centers recommended locally available and affordable animal-source foods, such as egg and chicken liver, infants' diets and nutritional status were greatly improved (Ruel and Habicht, 1992; Ruel et al., 1992; Penny et al., 2005). Similar recommendations in the hospitals in Manya Krobo could potentially have a similar positive effect on CF practices and child health.

Changes to the way that CF is taught may be warranted. Teaching more practical feeding strategies may be more effective and better remembered by health workers and mothers than a complex set of guidelines for amounts, textures and types of foods to be introduced at specific ages. Responsive feeding strategies, including learning to read children's physical, developmental and behavioural signs and how to respond to those signs (Aboud et al., 2008), should also be incorporated into health messages about when and how to progress CF. Learning to tailor child feeding and care according to the child's needs is a valuable and transferable skill that may be more useful to caregivers than learning a fixed set of rules about feeding.

The WHO guidelines for Integrated Management of Childhood Illness (IMCI) focus on the well-being of the whole child, through preventive and curative health strategies that are implemented by families and communities as well as by health facilities (WHO, 2009). In the home setting, IMCI encourages caregivers to provide nutrition and care in accordance with the needs of their young children by learning to interpret their children's signs and symptoms, as well as seeking appropriate health care when necessary. IMCI promotes integration and coordination among health services and involves local governments to adapt health strategies to local circumstances (WHO, 2009). An evaluation of the IMCI programme in Egypt, Kazakhstan, Indonesia, Mali, Peru and Zambia showed that IMCI training was effective at improving health worker performance and motivation, the quality of care delivered to children, and caregiver satisfaction (WHO, 2004b). A similar approach to complementary feeding education, that trains health care providers and caregivers how to look for, assess and react to children's signs, may be more practical and effective. While CF recommendations have recently been

adapted to the Ghanaian context to include local foods, CF education needs to become more integrated into health services. A study in India showed that integrating CF messages into other health services, including immunization sessions, weighing sessions and community outreach activities, resulted in improved feeding behaviours among caregivers and better growth among their children (Bhandari et al., 2005). Tandon (1989) also found that in India, a nutrition intervention programme that was integrated into the health system provided better coverage of the population and resulted in a significant decrease in young child malnutrition.

In summary, more practical CF advice and educational activities, such as cooking demonstrations, that focus on locally available and affordable foods, and that include family members, would help to improve current child health services in Manya Krobo. A greater focus on responsive feeding strategies may also help to improve CF education and caregiver practices. More frequent in-service training for all levels of health care staff that focuses on CF, could also improve knowledge and recommendations related to CF given in hospital settings. Finally, more consistent CF messages throughout health services, as well as programme monitoring, are recommended to improve child health services and infant feeding at the community level.

Table 4.1. Procedures for focus group discussions with mothers and interviews with health workers, Queen Mothers, fathers and representatives of the Ghana Health Services in Manya Krobo district in the Eastern region of Ghana

Participants	(n)	Length (min)	Location	Compensation	Interview focus
				Interview	
Focus group participants					
Group 1: mothers of infants 6-24 mo	(6)	90	· Field office in Kpong, Eastern region[1]	· Snack, bar of soap	· CF & hospital experiences
Group 2: mothers of infants 6-24 mo	(8)			· Toy for infant	· Barriers to CF
Interview participants[2]					
Hospital health workers		30-60	· Hospital office at participant's workplace	· Bag of rice, 1L of oil	· Hospital CF education
Nurses/midwives	(13)				· Barriers to CF education
Health assistants	(5)				
Doctors	(3)				
Queen Mothers	(6)	30-45	· Queen Mothers' Association office	· Bag of rice, 1L of oil	· CF experiences · Barriers to CF
Fathers of infants 6-24 mo[3]	(9)	30-45	· Participant's home or workplace	· Snack, bar of soap	· CF & hospital experiences · Barriers to CF
Ghana Health Services representatives	(3)	30-60	· Participant's office, Accra	· None	· CF promotion activities · Barriers to CF

[1]Transportation was provided to an from the field office on the days of the focus group discussions
[2]One semi-structured interview was conducted with each participant
[3]Fathers were not necessarily the husbands/partners of the mothers who participated in the focus group discussions

Table 4.2. Demographic characteristics of mothers, fathers and health workers interviewed in Manya Krobo, in the Eastern region of Ghana

	Mean	±	SD
Maternal[1]			
Age (years)	29.1	±	5.6
Education (years)	6.9	±	3.9
Parity(#)	2.2	±	1.3
Age of index child (months)	9.8	±	3.2
Paternal[2]			
Age (years)	36.2	±	5.5
Education (years)	11.9	±	2.3
Number of children(#)	2.8	±	0.8
Age of index child (months)	12.1	±	4.1
Nurses, midwives, health assistants[3]			
Age (years)	44.5	±	12.2
Education (years)	13.4	±	1.0
Parity(#)	1.9	±	1.3

[1]n=14
[2]n=9, not necessarily the husbands/partners of the mothers interviewed
[3]n=18, excludes doctors because age data was not available

Table 4.3. Time spent on complementary feeding during observed group health education talks in three hospital-based postnatal clinics of Manya Krobo, in the Eastern region of Ghana during data collection period from May to August 2008

Hospital	Number of group health talks given[1]		Total number of group health talks observed[2]		Average length of group health talks[3]	
	Total (#/mo)	Talks including CF (#/mo)	Total (#)	Including CF (#)	Average of all talks (min)	Average time on CF (min)
St. Martin's	8	4	4	3	40	5
Atua	8	1	3	1	30	15
Akuse	4	1	1	1	15	10

[1]Reported by head nurse of each postnatal clinic
[2]Number of health education talks observed by primary researcher, from May to August 2008
[3]Observed by primary researcher between May and August 2008

Table 4.4. Age (months) at which nurses, midwives and health assistants recommended introducing complementary foods in the postnatal clinics of three community hospitals in Manya Krobo, in the Eastern region of Ghana

Food	Age (mo) recommended by nurses & health assistants	WHO/MOH recommendations
Koko	6	6 months - Thick porridge or finely mashed foods
Tombrown	6	FOODS/AMOUNTS: 1 ladle porridge with 1 tsp oil and 1 tsp fish powder or groundnut paste
Weanimix	6	
Cerealac	6	FREQUENCY: 2 times/day plus breastfeeding
Soya bean powder	6	
Herrings, ground	6	
Peanut paste	6	7-8 months - Mashed foods
Palm oil	7-8	FOODS/AMOUNTS: 1 ladle porridge with 1 tsp oil and 1 Tbsp fish powder or groundnut paste; 1/2 ladle rice or banku or mashed yam with 1 ladle stew or soup containing 1 Tbsp mashed fish or meat or beans; 2 Tbsp mashed fruit or vegetables
Egg	6-12	
Mashed yam	7-9	
Rice	7-12	
Beans & plantain	7-12	FREQUENCY: 3 times/day plus breastfeeding
Banku	8-12	
Fufu	8-12	9-11 months - Finely chopped or mashed foods, finger-foods
Soup	8-9	
Vegetable & fish stew	7-12	FOODS/AMOUNTS: 2 ladles porridge with 1 tsp oil and 1 Tbsp fish powder or groundnut paste; 1 ladle rice or banku or mashed yam with 1 ladle stew or soup containing 1 Tbsp mashed fish or meat or beans; 2 Tbsp mashed fruit or vegetables
Meat, ground	7-12	
Fruit, juice or mashed	6-12	
Fruit pieces	12-24	FREQUENCY: 3 times/day plus 1 snack plus breastfeeding

Reference: WHO, 2003; Ghana Health Service, USAID, Ghana Sustainable Change Project. (2008). The Best Protection a Mother Can Give. *Poster provided by Ghana Health Service.*

5. BRIDGE

Poor complementary feeding (CF) practices may hinder child growth and development. Timing of CF initiation and quality of complementary foods may be affected by multiple issues, including CF education in communities, which was examined in Manuscript 1, and household socioeconomic and environmental factors, which will be expanded upon in Manuscript 2. Manuscript 1 examined health service education focused on CF and its relationship with caregivers' knowledge and reported practices. Hospital-based health workers were found to provide clear recommendations about the timing for CF initiation, but advice for older infants did not always follow WHO guidelines. Similarly, caregivers were found to have good knowledge about CF introduction, but progression to a family diet was a problem. Manuscript 2 goes on to examine the association between household socioeconomic and demographic factors and the timing of introduction of solid foods. Independent predictors of time of CF initiation are also examined using multiple linear regression models.

6. MANUSCRIPT 2

Maternal HIV status and level of social support are associated with the timing of complementary feeding initiation in HIV-affected communities of Ghana

Manuscript in preparation for the *American Journal of Public Health*.

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6.1. ABSTRACT

Background/aim: In Ghana, the prevalence of young child undernutrition is highest between 9 and 21 mo of age; inadequate complementary feeding (CF) is one of its major causes. This study examined household socioeconomic and environmental factors and their association with the timing of introduction of solid foods in 288 mother-infant pairs participating in a longitudinal study in HIV-affected communities.

Methods: Pregnant women were recruited from antenatal clinics in three community hospitals in Manya Krobo in the Eastern region of Ghana, were offered voluntary counselling and testing (VCT) for HIV, and were followed for 12 months after delivery. Enrollment of HIV positive (n=127) and HIV negative (n=161) women was done with the aim of maintaining an approximate HIV positive to HIV negative ratio of 1. Household socioeconomic and demographic data, and infant feeding and anthropometric data were collected during regular home visits.

Results: Overall, solid foods were introduced at 5.2 ± 1.4 mo in this population. Sixty-two percent (n=183) of women introduced solids to their infants before 6 mo, while only 27% (n=79) introduced solids before 5 mo. Mothers who introduced solids to their infants before 6 mo were more likely to be HIV positive ($p<0.001$) and be poorer, as indicated by lower education ($p=0.003$), having non-permanent walls ($p=0.021$), no home electricity ($p=0.022$), and fewer household electrical appliances ($p<0.01$). There was a tendency for mothers who introduced solids before 6 mo to work more days per week and work in or near the home; however these findings were not significant. After controlling for maternal socioeconomic status, economic activities, level of social support, and infant anthropometric measurements, maternal HIV infection was found to be associated with a 16 day earlier introduction of solid foods ($p=0.003$), while receiving childcare assistance from a friend ($p=0.008$) and having better economic status, as indicated by using a stove (rather than wood or charcoal) ($p=0.039$), were associated with a 16 day later introduction of solid foods.

Conclusion: Interventions to improve infant health and nutrition should address more basic issues including poverty and maternal literacy, as well as facilitate social support among caregivers through mother-to-mother support groups or other activities, especially in HIV-affected and resource-poor communities.

Key words: complementary feeding, HIV, social support, Ghana

6.2. INTRODUCTION

Under-nutrition has been estimated to cause 2.2 million deaths globally among children less than five years of age (Black et al., 2008). In Ghana, there are high rates of malnutrition among infants and young children, with stunting, wasting and underweight peaking between 9 and 21 months of age (Ghana Statistical Service, 2004). Much of the problem of child malnutrition can be linked to poor diet, and among infants, diet is composed of breastfeeding and complementary feeding (CF). While inappropriate breastfeeding practices contribute to malnutrition in many developing countries, Ghana has recently seen large improvements in the rates of exclusive breastfeeding (Timpo, 2007). The rates of exclusive breastfeeding increased from 4% in 1988 to 53% in 2003 (UNICEF, 2008), due in part to increased breastfeeding education and support (Aidam et al., 2005) and policy changes such as the Baby Friendly Hospital Initiative that included increased training of health care staff and regular monitoring and were implemented throughout the Ghanaian health care system over the past few decades.

Unfortunately, similar improvements in CF have not been seen in Ghana. The typical introductory foods commonly used in Ghana include diluted porridges, like *koko*, a fermented corn porridge, and other cereal or root-based foods, while animal source foods only make up about 3 to 7% of young children's diets (Fergusson et al., 1993; Brakohiapa et al., 1988). Ghanaian infants also tend to have little variety in their intake (Timpo, 2007). In general, the diets of infants and young children in Ghana are low in energy and micronutrients like iron, compared to their increasing needs.
Also, Ghanaian mothers reported knowing that adding micronutrient-rich animal source foods to infant porridges, such as ground fish powder, would be beneficial for their infants (manuscript 1). However, mothers reported that in practice, giving these foods was difficult due to financial and time constraints (manuscript 1). Furthermore, while caregivers had good knowledge about the recommended time to introduce complementary foods, studies have reported that the duration of exclusive breastfeeding is less than the 6 months recommended by the WHO (Timpo, 2007; Aidam et al., 2005).

The timing of introduction of foods is also important. Solid foods are sometimes introduced too early, exposing the infant's undeveloped gut to pathogens in the food. Alternatively, foods may be introduced too late, and thus the infant may not receive adequate energy and nutrients for optimal growth and development (Becquet et al., 2006; Doherty et al., 2007). In developing countries, where infectious diseases are prevalent, inappropriate choices in the types and timing of foods introduced when infants are no longer fully breastfed lead to poorer growth, development and chance of survival (Lartey et al., 2008; Doherty et al., 2007; Becquet et al., 2006).

The World Health Organization (WHO) recommends that solid foods should be introduced at 6 months, the time when the infant's nutritional requirements can no longer be met by exclusive breastfeeding. Caregivers also need to practice responsive feeding to encourage adequate intake and development of optimal eating behaviours in infants and young children. The WHO also explains that accurate information, skills and support from family, community and health services are crucial for optimal CF. Malnutrition is caused more often by inadequate and inaccurate knowledge about the appropriate foods and feeding practices needed than by an absolute lack of food. Community-based interventions that use locally available and affordable foods are suggested for improving CF practices (WHO, 2003).

In Ghana, poverty and food insecurity affect many households and play a role in determining what caregivers feed their children (Raisler and Cohn, 2005; WHO, 2003). Low maternal literacy is also a problem, as it has been associated with poorer hygiene practices and nutrition knowledge (Armar-Klemesu et al., 2000). Furthermore, infectious diseases, including diarrheal diseases, upper respiratory infections, and malaria, are prevalent and have an effect on child nutritional status (Raisler and Cohn, 2005; Bentley et al., 2005; WHO, 2003). In the present study, the association between time of introduction of solid foods and level of maternal social support, location and time allocated to maternal economic activities, maternal HIV status and maternal socioeconomic status was examined.

Assistance with child care and financial support often comes from husbands, grandmothers and other relatives and friends. Furthermore, Grandmothers and other female relatives may provide mothers with feeding advice or may feed children while the mother is away (Timpo, 2007; Bentley et al., 2005; Burke, 2004; WHO, 2003). As such, social support may be an important determinant of CF. In many communities of sub-Saharan Africa, mothers work long hours on farms or in other forms of employment to help buy food for their children (Raisler and Cohn, 2005; Tobias, 2001; Timpo, 2007). The physical and emotional drain of working and simultaneously managing a household may impact on a mother's and infant's feeding experience (Nti et al., 2007). Furthermore, when mothers work away from home, and leave their infants in the care of others, they may have less control over what and how the infants are fed, which has been reported to negatively affect child nutrition (Gartner et al., 2006). Finally, HIV affected households are often poorer and have less access to services. Exclusive breastfeeding when replacement feeding is not affordable, feasible, adequate, sustainable and safe, with introduction of complementary foods at six months of age, is imperative for infants whose mothers are infected with HIV to decrease the risk of mother-to-child transmission of HIV (WHO, 2003). The influences affecting infant feeding in Ghanaian communities are multi-factorial and have not been well-studied to date. A better understanding of the socio-environmental influences on CF may help shape recommendations for improvements.

6.3. METHODS

6.3.1. Study site

The study sites were Manya Krobo and Yilo Krobo, two districts in the Eastern region of Ghana. The present analysis is part of the project entitled Research to Improve Infant Nutrition and Growth (RIING). Recruitment and interviews were conducted from 2004 to 2008 at the three local hospitals. The services are each quite small, with only 1 or 2 doctors who work as the administrative and medical head.

The populations of the study sites are underserved, lacking adequate access to resources and health services; there are no Child Food-Distribution Programmes and no Nutritional Rehabilitation Centres in Manya Krobo and Yilo Krobo. Furthermore, these communities have high rates of poverty, child mortality and HIV infection. In 2007, the Eastern region of Ghana has a higher prevalence of HIV (4.2%) than the rest of Ghana (1.9%). While breastfeeding rates in Manya Krobo are high, CF practices remain less than ideal (Timpo, 2007; Aidan et al., 2005).

6.3.2. Recruitment and follow-up

Pregnant women were recruited from the antenatal clinics of three community hospitals in the Manya Krobo and Yilo Krobo areas of the Eastern Region. Criteria for participation included that women were pregnant at the time of enrolment, they were offered voluntary counselling and testing (VCT) for HIV at the prenatal clinic, and if they were tested for HIV, they agreed to have their HIV status released to the researchers. HIV status was used to match numbers of HIV positive, HIV negative and "HIV unknown" (women who refused testing) in the RIING study. For the present analysis, only HIV positive and HIV negative women were included. Criteria for enrolment also included that women were at least 18 years old, agreed to participate for the entire 12 months of the study, and that at the time of enrolment they were free of AIDS or other physical limitations that may compromise their ability to care for their child. For mothers to continue to participate in the study for post-natal follow-up, they had to give birth to a live infant without birth defects that could hinder growth or breastfeeding. Women had to also agree to continue home visits for observation. Only the field supervisor had access to participants' medical records. Ethical approval was obtained form the institutional review boards at McGill University, the University of Ghana, Iowa State University, and the University of Connecticut. Written informed consent (either by signature or thumb-print) was obtained from the women during the time of enrolment for both themselves and their infant's participation.

6.3.3. Data collection

6.3.3.1. Socioeconomic and demographic information

For infants born at the health centers, their date-of-births were verified with the hospital staff. Mothers were asked for their age, level of education (years of schooling), and employment status, as well as information on their level of social support, household wealth and household demographics. Data on maternal social support[12], maternal and household socioeconomic and demographic characteristics that were collected at enrolment were used for analysis. Socio-demographic data on new household members that were collected from birth to three months were used for analysis.

6.3.3.2. Dietary surveillance data

Mothers were visited at home twice per week and were asked about their infants' intake of breast milk, liquids other than breast milk, and solids/semi-solids during their previous days. Intake data from birth to twelve months were used for analysis.

6.3.4. Data analysis

The main outcome variable of interest was the age at which solid foods were introduced. Age of introduction of solids was calculated using the first day that solid or semi-solid foods were given. The main predictor variables of interest are as follows: mother's HIV status, mother's level of social support (measured by number of adult females and males living with mother, number of groups that mother belongs to, number of relatives and friends that mother feels close to, and number of people who provide food and assistance with child care), mother's time away from home in an income-generating activity (measured by job location and number of days spent working), and household socioeconomic characteristics.

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[12] Maternal social support was defined in this analysis as the reported number of group memberships, close friends, relatives and people who help with childcare and obtaining food.

This analysis included 297 infants who had participated in the RIING study for 12 months. Descriptive analyses were used to find proportions, ranges, means and standard deviations in the data. Analysis was used to compare characteristics at baseline between caregivers who introduce complementary foods before 6 months and caregivers who introduce complementary foods at 6 months or later, to determine whether there were important differences among groups. Independent Student t-tests were used to determine if age at introduction of solids was different among groups of HIV status, level of social support, location and amount of work, and socioeconomic status. Survival analysis was used to compare the probability of not having solid foods introduced in the diet among infants of HIV positive and negative mothers.

Multiple linear regression analysis was used to determine the effect of social support, HIV status and mother's time away from home on time of introduction of solid foods and on nutritional status. The *a priori* conceptual framework (Figure 1.1) and observations during data collection guided which variables were tested in the regression model. The independent variables found to be statistically significant or approaching significance were tested in the model and are listed in Table 6.4. The method of backward elimination was used to eliminate non-significant variables one by one until a final model was obtained. Variables with a p-value <0.05 were retained in the final model. In fitting the model for introduction of solids, the exposures occurred before an outcome, in an effort to avoid reverse causality. For example, maternal HIV status at enrollment, during pregnancy, predicted the first day that solid foods were introduced. No outliers were discarded from the analyses. Data analysis was done with SAS 9.13 for Windows (SAS Institute, Cary, NC, USA). Results are reported as mean ± SD, unless otherwise mentioned, and significance was reported at a level of 0.05.

6.4. RESULTS

6.4.1. Study population

For the present study, 327 infants of women who were either HIV positive (n=151) or HIV negative (n=176) were included in analysis. Of these women, 15 left the study area, 8 withdrew due to lack of interest, and 6 had infants who died before completing the study, leaving a total of 297 women who gave birth to live singletons and were followed for 12 months; 131 women were HIV positive and 166 were HIV negative. Of these 297 mother-infants pairs, 288 had completed questionnaires on maternal and household demographic and socioeconomic characteristic, 274 had completed questionnaires on level of social support, 270 had complete data on infant anthropometric measurements, and 186 had completed questionnaires on maternal economic activities.

Maternal age ranged from 18 to 48 years with a mean age of 28.8 ± 6.7 (Table 6.1). Parity was at a maximum of ten live births. Ten percent of women had no formal schooling, and about one third did not reach secondary school. Mothers who introduced solids before 6 months were more likely to be HIV positive than mothers who introduced solids after 6 months (Table 6.1). Mothers who introduced solids before six months were also more likely to be poor, as indicated by lower education, no household electricity, household walls made of non-permanent materials, and lack of a refrigerator, a television, a CD player, a DVD player or an electric fan (Table 6.1).

6.4.2. Infant feeding practices

Almost all infants were breastfed. Only 4 mothers (1%) in the whole sample never breastfed, and all of these women were HIV positive. Exclusive breastfeeding duration in this sample was 4.2 ± 2.1 months, ranging from no exclusive breastfeeding to exclusive breastfeeding for 8.3 months. The median age at which exclusive breastfeeding ended was 5.0 months.

Early introduction of solids was common. Sixty two percent (n=183) of women introduced solids to their infants before six months of age. However, much of this early introduction occurred during the infants' fifth month of age. Only 27% (n=79) of the participants introduced their infants to solids before five months of age. About one third (n=100) of women introduced their infants to solid foods between six and seven months. Late introduction of solids was relatively uncommon. Ten women (3%) introduced solid foods after their infants were 7 months old. Solids were introduced at 5.2 ± 1.4 months, ranging from 0.4 to 8.5 months. Overall, the median age of introduction of solid foods was 5.7 months. Among mothers who introduced solids before 6 months, the median age of introduction was 5.1 months, and among mothers who introduced solids after 6 months, the median age of introduction was 6.1 months.

Overall, HIV positive mothers introduced solid foods to their infants an average of 21.5 days earlier than did HIV negative mothers (Figure 6.1). The mean time of first introduction of solid foods among infants with HIV positive mothers was 144.8 days with Kaplan-Meier probability estimates (95% CI=135.9, 153.7). Among infants with HIV negative mothers, the mean time of introduction was later, at 166.3 days (95% CI=161.0, 171.6) (p=0.01).

6.4.3. Timing of introduction of solid foods and maternal economic activities

Over 60% of mothers held a job for which they received money (Table 6.2). Almost 90% of the women who worked were self-employed. About 45% of mothers worked in or near their homes, while the remainder worked away from their homes, either in their own communities or in other communities. Overall, almost 50% of mothers worked five or more days per week. Women who introduced solids to their infants before six months tended to work in their homes and more days per week. Mothers who introduced solids before six months worked 3.5 ± 2.9 days per week, while mothers who introduced solids after six months worked 2.9 ± 2.6 days per week.

6.4.4. Timing of introduction of solid foods and maternal social support

Overall, women reported feeling close to an average of 3 relatives, ranging from zero to twenty close relatives (Table 6.3). The women also reported feeling close to an average of only one friend, ranging from zero to ten friends. The participants reported belonging to an average of 2 groups, with 11 groups being the maximum. There was a non-significant tendency for mothers who introduced solids to their infants before six months to not belong to any groups. In general, women received food assistance from an average of 3 people, ranging from zero to eight. The women also reported receiving help with child care from an average of 3 people, ranging from one to eight. Mothers who introduced solids at six months or later tended to receive help with child care from friends more than did mothers who introduced solids before six months.

6.4.5. Independent predictors of timing of introduction of solids: results of multiple linear regression

6.4.5.1. Maternal HIV status and socioeconomic and demographic factors associated with earlier introduction of solids

Maternal HIV status was found to be associated with earlier introduction of solid foods in multiple linear regression. Having a mother who was tested as HIV positive during pregnancy was significantly associated with an estimated 16 days earlier introduction of solid foods (Table 6.5), independent of other risk factors. Type of cooking fuel used was found to be associated with earlier day of first introduction of solid foods in multiple linear regression. Living in a household that used a gas, electric or kerosene stove for cooking, an indicator of better economic status was significantly associated with an estimated 16 days later introduction of solid foods, compared to living in household using charcoal or wood for cooking fuel.

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6.4.5.2. Maternal social support factors associated with earlier introduction of solids

Maternal social support was found to be associated with timing of introduction of solid foods in multiple linear regression. Mothers who had a friend who helped with child care introduced solid foods to their infants an estimated 16 days later than mothers who did not have a friend who assisted with child care (Table 6.5).

6.5. DISCUSSION

The present study examined the determinants of timing of introduction of solid foods among infants in HIV-affected communities in Ghana. The results of this analysis show that approximately 14% of the variation in time (day) of CF introduction was explained by maternal HIV status, household economic status and level of maternal social support. This low explanatory power may be due to co-linearity among related variables. Low explanatory power could also be due to a lack of inclusion of another determinant of time of CF introduction in the model. For example, mothers' attendance at hospital-based CF education was not included in this study, but is likely a determinant of time of CF introduction.

The mean age at which solid foods were introduced was 5.2 months. In general, non-breast milk liquids were introduced prior to solids. The timing of introduction of solid foods appears to be more in accordance with the WHO recommendations in Ghana than in other sub-Saharan African countries. In Malawi, the mean age of introduction of solids was 4.5 months, ranging from 1.2 to 13.8 months (Kalanda et al., 2006). Most notably, Kalanda et al. (2006) found that over 65% of infants had received complementary foods by 3 months. While some mothers in the Eastern region of Ghana were found to introduce solids very early, within the first few weeks of life, most mothers (73%) introduced solids to their infants after 5 months of age. Also, introduction of solids later than 7 months was relatively uncommon and did not appear to be a problem in this population. A study in Senegal found that while water was introduced to 85% of infants in the first 3 months of life, complementary foods were fed to 62% of infants before 6 months (Gupta et al.,

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2007). The proportion of infants given complementary foods before 6 months in Senegal was very similar to that found in the present study.

Early introduction of solids, implying cessation of exclusive breastfeeding before 6 months of age, may be more harmful to children than late introduction. Early initiation of CF causes increased risk of transmission of HIV and infection with diarrheal diseases, respiratory infections and other childhood illnesses (WHO, 2003; Kalanda et al., 2006; Okronipa, 2008). However, infants who begin solid foods later may not be receiving adequate amounts of iron, zinc and other micronutrients; iron-deficiency anemia and other micronutrient deficiencies are prevalent among young children in Ghana (Ghana Statistical Service, 2004; Adu-Afarwuah et al., 2008; WHO, 2003). Demographic and Health Survey data have shown that the rates of exclusive breastfeeding for children less than six months have increased over time (Ghana Statistical Service, 2004; UNICEF, 2008). Efforts to improve the rates of exclusive breastfeeding such as the Baby Friendly Hospital Initiative, which implemented hospital-wide staff training and monitoring, have resulted in improved breastfeeding practices as well as more appropriate timing of introduction of complementary feeding in Ghana (Aidam et al., 2005; Timpo, 2007).

In the present study, the 6 month cut-off was used primarily for statistical reasons, as introduction of solid foods slightly before or after this time is of little clinical significance. Furthermore, a study in Honduras showed that there was no difference in growth between groups of infants who were introduced to hygienically prepared, nutritionally adequate complementary foods at 4 or 6 months of age (Cohen et al., 1995). However, in the setting of the present study in Ghana, the complementary foods used were likely of low nutrient and energy content (Ferguson et al., 1993), and hygiene and water quality may have been suboptimal (Okronipa, 2008). The mean age of introduction of solid foods found in this study was very close to the six months recommended by the WHO (2003), which is much better than the findings from other sub-Saharan African countries (UNICEF, 2008). However, mother-infant pairs who deviated significantly from the mean, introducing solid foods within the first few weeks of life or after 8 months, may

be cause for concern. Reasons for such extremes in time of solid food introduction should be further investigated.

Compared to mothers who introduced solids after six months, mothers who introduced solids before six months were more likely to be HIV positive. Being HIV positive was also associated with a 16-day earlier introduction of solid foods in linear regression, and HIV positive mothers were found to introduce solid foods an average of 21.5 days earlier than uninfected mothers using Kaplan-Meier probability estimates. Two to three weeks is a relatively small difference in time of CF initiation and is not likely a major contributor to growth faltering in young children. However, Figure 6.1 shows that HIV positive mothers consistently introduced solid foods to their infants earlier than did HIV negative mothers, which is of clinical importance. Infants who receive very early introduction of solid foods are at greater risk of morbidity from infectious diseases (Couvadia et al., 2007; Coutsoudis et al., 1999; WHO, 2003), and more infants of HIV positive mothers were introduced to solids at a very young age (in the first three or four months), compared to infants of uninfected mothers. Another study has similarly reported that cessation of exclusive breastfeeding is earlier among HIV positive women than HIV negative women in Ghana (Timpo, 2007). While timely introduction of complementary foods is especially important for HIV-infected mothers to reduce the risk of mother-to-child transmission (WHO, 2003), women who are HIV positive introduce solids earlier. In Cameroon, mothers who were HIV positive were also found to introduce complementary foods earlier, before 6 months (Njom Nlend et al., 2007). In the Cameroon study, most HIV positive mothers chose to use replacement milks rather than breastfeed, as was recommended by health workers. Women reported having difficulty affording the replacement milks and then introduced infant porridges early. The results of the present study also found that women who introduced solids before 6 months, were more likely to have lower economic status and less education. Similarly, Kalanda et al. (2006) found that in Malawi, maternal illiteracy was associated with early complementary feeding (OR=2.1, 95% CI 1.3, 3.2). Njom Nlend et al. (2007) also found that level of maternal education was associated with infant feeding choices (p = 0.002). In Eastern Uganda,

higher maternal education was similarly found to be protective against prelacteal feeding with porridge and other non-breast milk foods (Engebretsen et al., 2007).

Mothers in this study who worked were primarily self-employed. There was a tendency for mothers who introduced solids before six months to work in or near the home compared to mothers who introduced solids at six months or later. There was also a tendency for mothers who introduced solids before six months to work more days per week than mothers who introduced solids at six months or later. In Ghana, women who work outside of the home are primarily market traders and farmers (Timpo, 2007), and carry their infants on their backs while they work. Observations during data collection for manuscript 1 suggest that women do not usually bring food with them when they leave their houses (data not shown). Breastfeeding, however, may be more practical for women while working, as it does not require carrying any additional objects or foods. In contrast, women who work in or near their homes have easier access to solid foods for their infants during the day, which may account for the earlier introduction of solids among women who work at home compared to those who work outside of the home. On the other hand, the results show that women who work more days per week tend to introduce solids earlier. This finding could signify that women who work more are leaving their infants in the care of others, such as grandmothers and other female relatives, in which case feeding complementary foods to infants rather than breastfeeding while the mother worked would be likely. A study in Senegal has also reported that women who work and leave their children in the care of other have less control over what is fed, resulting in poorer child intake and nutritional status (Gartner et al., 2006). Similarly, a study in Kenya found that early introduction of CF was high, with 46% of mothers introducing complementary foods before one month; returning to work was one of the main reasons (Lakati et al., 2002).

Higher level of maternal social support, including belonging to at least one group and having a friend who helped with childcare, had a tendency to be associated with timelier introduction of solids. However, there was no difference in the number of close relatives, friends and group memberships by timing of introduction of solids. It is possible that

belonging to one social group provides sufficient contact with others to facilitate discussion and receipt of advice on infant care, as well as promote maternal confidence and self-efficacy for good infant feeding practices. Kools et al. (2006) have reported that support from significant others and greater self-efficacy[13] for infant feeding were significant determinants of longer duration of breastfeeding. Furthermore, having a friend who directly helps with child care may be more important than the number of friends that one has in terms of promoting optimal complementary feeding practices. Other studies have also found that greater social support from friends and family members improves infant feeding practices (Timpo, 2007; Bentley et al., 2005; Burke, 2004). Additionally, it is possible that some social support may negatively affect mothers' feeding practices. In a study in Ghana, high-quality foods were diverted away from young children to fathers and other family members (Colecraft et al., 2006). Further studies should investigate the effect of social support on time of CF introduction, using composite support measures.

In summary, the determinants of timing of introduction of solid foods were examined in HIV-affected communities. The results of this analysis show that even in areas where the rates of exclusive breastfeeding are high, the average time of introduction of solid foods is still before the recommended 6 months. HIV infection, lower household socioeconomic status, and lower social support were found to be important predictors of timing of introduction of solids. Public health policies aimed at improving infant health and nutrition should also facilitate social support among mothers through mother-to-mother support groups and practical and interactive nutrition-related activities to promote timely CF initiation, especially in HIV-affected and resource-poor communities.

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[13] Self-efficacy is the belief that one is capable of performing in a certain manner to attain certain goals (Ormrod, 2006; Kools et al., 2006).

Figure 6.1. Survival analysis for the probability of not having solid foods introduced in the diet among 296 infants of HIV positive and HIV negative mothers in Ghana
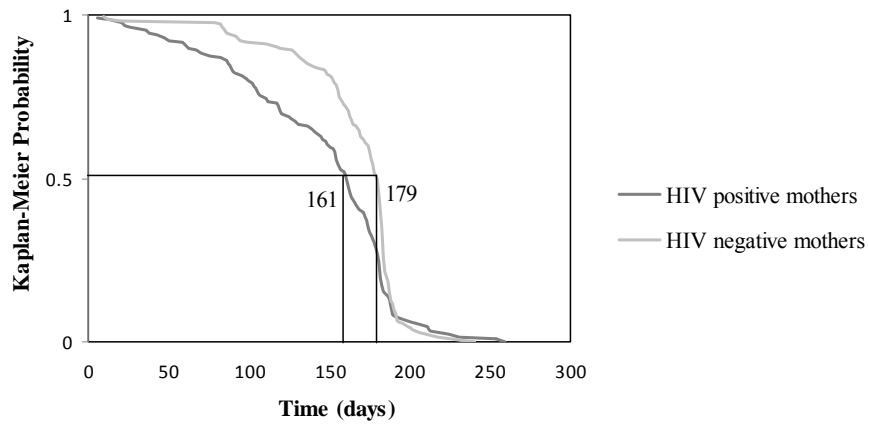
Table 6.1. Demographic and socioeconomic characteristics of Ghanaian mothers living in HIV-affected communities by timing of introduction of solid foods

	Time of introduction of solid foods			
	Whole sample N=288	<6 mo N=183	≥6 mo N=105	p-value[1]
	Mean ± SD			
Maternal age (y)	28.8 ± 6.7	28.8 ± 6.2	28.9 ± 7.5	0.842
Parity (#)	1.6 ± 1.5	1.6 ± 1.6	1.5 ± 1.4	0.551
Rooms in house (#)	2.6 ± 2.1	2.6 ± 2.3	2.6 ± 1.9	0.861
Household size (#)	5.9 ± 2.2	5.8 ± 2.0	6.0 ± 2.5	0.668
	N (%)			
HIV status				**<0.001**
HIV positive	131 (44.1)	97 (51.9)	34 (30.9)	
HIV negative	166 (55.9)	90 (48.1)	76 (69.1)	
Maternal education[3]				**0.003**
None	30 (10.3)	23 (12.4)	7 (6.7)	
Primary	71 (24.5)	48 (25.9)	23 (21.9)	
Secondary & higher	189 (65.2)	114 (61.6)	75 (71.4)	
Main wall material				**0.021**
Permanent[5]	255 (88.5)	156 (85.2)	99 (94.3)	
Non-permanent[6]	33 (11.5)	27 (14.8)	6 (5.7)	
Owner of household				0.069
Mother/her household	57 (20.0)	40 (21.9)	17 (16.2)	
Extended family	106 (36.8)	71 (38.8)	35 (33.3)	
Non-family members	125 (43.4)	72 (39.3)	53 (50.5)	
Electricity in home				**0.022**
Yes	227 (78.8)	137 (74.9)	90 (85.7)	
No	61 (21.2)	46 (25.1)	15 (14.3)	
Main cooking fuel				0.057
Charcoal	216 (75.0)	140 (76.5)	76 (72.4)	
Wood	32 (11.1)	23 (12.6)	9 (8.6)	
Other[7]	40 (13.9)	20 (10.9)	20 (19.0)	
Household possessions				
CD player	60 (20.8)	29 (15.8)	31 (29.5)	**<0.001**
DVD player	62 (21.5)	31 (16.9)	31 (29.5)	**0.018**
Television	146 (50.7)	78 (42.6)	68 (64.8)	**<0.001**
Refrigerator	95 (33.0)	51 (27.9)	44 (41.9)	**0.018**
Electric fan	183 (63.5)	104 (56.8)	79 (75.2)	**0.001**
Telephone	121 (42.0)	70 (38.3)	51 (48.6)	0.091

[1]Student's t-test for continuous data and McNemar's test for categorical data were used for comparison of groups by introduction of solids
[3]Level of school started, but not necessarily finished
[4]Unmarried or married and not living with husband
[5]Bricks, Cement/block, Mixture of mud and cement, Corrugated iron/zinc
[6]Mud, Tile, Asbestos
[7]Gas cooker, electric stove, kerosene stove

Table 6.2. Maternal economic activities in past three months by timing of introduction of solid foods in HIV-affected communities of Ghana

	Time of introduction of solid foods						
	Whole sample N=186		<6 mo N=108		≥6 mo N=78		p-value[1]
	N (%)						
Economically active[2]	133	(71.5)	86	(79.6)	47	(60.3)	0.321
Self-employed	116	(62.4)	76	(70.4)	40	(51.3)	0.261
Own equipment	61	(32.8)	39	(36.1)	22	(28.2)	0.821
Have employees	14	(7.5)	8	(7.4)	6	(7.7)	0.725
Location of economic activity							0.074
In or near home	59	(44.4)	43	(50.0)	16	(34.0)	
Away from home	74	(55.6)	43	(50.0)	31	(66.0)	
	Mean ± SD						
Days worked per week (#)	3.13 ± 2.8		3.50 ± 2.9		2.85 ± 2.6		0.098

[1]Student's t-test for continuous data and McNemar's test for categorical data were used for comparison of groups by introduction of solids
[2]Work for which money was received

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Table 6.3. Social support level of mothers living in HIV-affected communities of Ghana by timing of introduction of solid foods

	Time of introduction of solid foods						
	Whole sample N=274		<6 mo N=174		≥6 mo N=100		p-value[1]
	Mean ± SD						
Close relatives[2,3] (#)	3.07 ± 2.7		2.97 ± 2.7		3.24 ± 2.7		0.424
Close friends[2] (#)	1.3 ± 1.3		1.24 ± 1.1		1.41 ± 1.6		0.350
Group member[2] (#)	1.95 ± 1.5		1.95 ± 1.5		1.93 ± 1.5		0.810
Individuals who provide food assistance[2,4] (#)	3.39 ± 1.3		3.36 ± 1.3		3.44 ± 1.5		0.658
Individuals who help with child care[2,4] (#)	3.41 ± 1.3		3.41 ± 1.3		3.40 ± 1.4		0.917
	N (%)						
Belongs to no groups[2]	30	(11.0)	23	(13.3)	7	(7.0)	0.082
People who provide food assistance							
Spouse	236	(86.1)	153	(87.9)	83	(83.0)	0.276
Relative in house	170	(62.0)	110	(63.2)	60	(60.0)	0.601
Friends	71	(25.9)	42	(24.1)	29	(29.0)	0.446
Neighbour	47	(17.2)	25	(14.4)	22	(22.0)	0.124
Relative outside house	131	(47.8)	78	(44.8)	53	(53.0)	0.195
Other[5]	6	(1.1)	4	(1.2)	2	(1.0)	0.869
People who help with child care							
Spouse	204	(74.5)	131	(75.3)	73	(73.0)	0.588
Relative in house	199	(72.6)	129	(74.1)	70	(70.0)	0.397
Friends	78	(28.5)	43	(24.7)	35	(35.0)	0.087
Neighbour	62	(22.6)	38	(21.8)	24	(24.0)	0.717
Relative outside house	116	(42.3)	73	(42.0)	43	(43.0)	0.921
Other[5]	7	(1.1)	6	(1.1)	1	(1.0)	0.885

[1]Student's t-test for continuous data and McNemar's test for categorical data were used for comparison of groups by introduction of solids
[2]Data were not available for one <6mo participant
[3]Number of relatives other than spouse, parents and children to whom participants reported feeling close
[4]Includes spouse, relatives in house, friends, neighbours, relatives outside house, co-workers, employer, other institutions
[5]Co-workers, employer, other institution

Table 6.4. Candidate predictor variables of timing of introduction of solids outcome used in multiple linear regression

Maternal socioeconomic and demographic variables	Maternal economic activities
HIV status	Location of economic activity
Maternal education	Number of days worked per week
Ownership of household	
Household electricity	**Maternal social support**
Main material for walls	Number of close relatives
Main cooking fuel	Number of close friends
Possession of television	Belonging to a group
Possession of telephone	Friend helps with child care
Possession of refrigerator	

Table 6.5. Multiple linear regression: variables associated with the age (d) at which solid foods were first introduced in 288 Ghanaian infants living in HIV-affected communities

Variable	Estimate[1]	SE	p-value
HIV status			
HIV positive	-16.401	5.473	0.003
HIV negative (ref)			
Main cooking fuel			
Stove (gas, electric, kerosene)	16.065	7.747	0.039
Charcoal or wood (ref)			
Friend helps with child care[2]			
Yes	16.029	6.014	0.008
No (ref)			
(Constant)	172.398	9.072	<0.001

[1]Model: R^2=0.144, p<0.001, Adjusted for maternal socioeconomic status (maternal education, ownership of household, household electricity, main material for walls, main cooking fuel, possession of television, telephone and refrigerator), maternal economic activity (location of maternal economic activity and number of days worked per week), and level of maternal social support (number of close relatives, number of close friends, belonging to a group, having a friend who assists with childcare)
[2]Friend does not include family members

7. GENERAL CONCLUSIONS AND POLICY IMPLICATIONS

Poor complementary feeding practices, including inappropriate time of introduction and low energy and nutrient density of infant foods (Kibona et al., 1995; Guptill et al., 1993), are major causes of the high rate of young child malnutrition from 9 to 21 months of age (Ghana Statistical Service, 2004). This was the first study to examine the relationship between health service education focused on CF and caregivers' knowledge and reported practices and also documented the maternal, infant and socioeconomic and demographic factors associated with the timing of introduction of solid foods in this setting. HIV infection, low socioeconomic status, and low maternal social support were important determinants of timing of introduction of complementary feeding (CF). While the knowledge among caregivers interviewed in the qualitative part of this study about the recommended time of cessation of exclusive breastfeeding and CF initiation at 6 months was generally good, progression of the infants' diets to a family diet was problematic. Slow uptake of complementary foods may cause growth faltering before 12 months. Then in the second year of life, breast milk becomes a smaller contributor to the diet compared to complementary foods, and the nutrient-poor, low energy foods used are likely insufficient for adequate growth. Since early introduction of solids was found in this population, efforts to promote exclusive breastfeeding for 6 months and then introduction of nutrient-dense complementary foods should continue to be a priority.

The mean age of introduction of solid foods in this study' population was 5.2 months, earlier than the WHO's recommended 6 months (WHO, 2003). This finding is similar to reported time of introduction of solids in other studies in sub-Saharan Africa (Timpo, 2007; Gupta et al., 2007). Efforts to improve the rates of exclusive breastfeeding such as the Baby Friendly Hospital Initiative have resulted in improved breastfeeding practices as well as more appropriate timing of introduction of complementary feeding in Ghana. Demographic and Health Survey data have documented over time an increased rate of exclusive breastfeeding for children younger than six months (Ghana Statistical Service, 2004). The Baby Friendly Hospital Initiative was an intervention in which all hospital staff (including non-medical staff) was trained in the WHO recommended practices for

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breastfeeding. This initiative emphasized hospital-wide change and also included monitoring and evaluation (Penny et al., 2005). A similar effort to improve CF practices should be implemented throughout the community hospitals and community health centers.

Six months was used as a cut-off to separate cases and controls primarily for statistical reasons, as introduction of CF slightly before or after this time is of little clinical significance. A study in Honduras showed no difference in growth between infants who were fed hygienically prepared, nutritious complementary foods at 4 versus 6 months (Cohen et al., 1995). However in the present study, the complementary foods used were likely of low nutrient and energy content (Ferguson et al., 1993), and hygiene practices may have been suboptimal (Okronipa, 2008). The mean age of introduction of solid foods found in this study was very close to the six months recommended by the WHO (2003). However, mother-infant pairs who deviated greatly from the mean may be cause for concern. Reasons for such extremes in time of CF initiation should be further investigated.

Introduction of complementary feeding was found to be earlier in this study for HIV positive mothers than for HIV negative mothers. Being HIV positive was associated with a 16 day earlier introduction of solid foods. Another study in Ghana has similarly reported that HIV positive mothers cease to breastfeed exclusively earlier than HIV negative mothers (Timpo, 2007), which is a problem because cessation of exclusive breastfeeding earlier than six months increases the risk of mother-to-child transmission of HIV (WHO, 2003). In Cameroon, mothers who were HIV positive were also found to introduce complementary foods earlier, before 6 months. Most HIV positive mothers chose to use replacement milks rather than breastfeed, as was recommended by health workers. Women reported having difficulty affording the replacement milks and then introduced infant porridges early (Njom Nlend et al., 2007). Infant formulas and other commercially available infant foods are often promoted to mothers in sub-Saharan Africa through health centers and the media. However, these foods tend to be costly and unaffordable to mothers when used for an extended period of time, which may explain the

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finding in the present study that mothers who introduced solid foods before 6 months were more likely to have a lower socioeconomic status than those who introduced later.

The cost of preparing special infant foods may be diminished by encouraging caregivers to feed their infants family foods that are made to an appropriate texture for the child. Other studies have found that when health centers recommended locally available and affordable animal-source foods, infants' diets and nutritional status were greatly improved (Ruel and Habicht, 1992; Ruel et al., 1992; Penny et al., 2005). Similar recommendations in the hospitals in Manya Krobo could potentially have a similar positive effect on CF practices and child health.

Mothers who worked in or near the home tended to introduce solids before 6 months compared to mothers who worked away from home. This is likely because mothers in Ghana who leave the home for work carry their infants on their backs, which makes breastfeeding more practical than carrying foods and feeding utensils, while mothers who work at home have easier access to infant foods. It was also found that mothers who worked more days tended to introduce solid foods earlier. This may because mothers who worked more may have left their children in the care of others. A study in Senegal reported that women who work and leave their children in the care of others had less control over what was fed, resulting in poorer child intake and nutritional status (Gartner et al., 2006).

The results of the qualitative part of this study showed that the hospital was a main reported source of information on CF for caregivers. However, the amount of time spent on CF education was minimal in the postnatal clinics that were observed when compared to the time spent on breastfeeding education. Also, few mothers were observed to attend postnatal sessions beyond 6 months, likely resulting in limited receipt of messages about feeding for older infants as teaching about CF was done on a current-needs basis. The teaching style for CF was less interactive than the teaching methods used for breastfeeding. Teaching about CF tended to be a lecture by nurses, whereas breastfeeding education included demonstrations. Other studies have reported that lecture-style teaching

is common in nutrition education in developing countries, but that a more hands-on approach results in greater behavior change (Waters et al., 2006; Robert et al., 2007; Aubel et al., 2004; Ticao and Aboud, 1998). While hands-on activities were not observed for CF education in this study, studies in Peru have found that demonstrations, taste-testing, problem-solving discussions, and support groups in health services helped improve the knowledge and practices related to CF among caregivers (Waters et al., 2006; Robert et al., 2007). Also, hands-on teaching methods used for breastfeeding education, such as demonstrations, have appeared to be successful in this study population. The Ghana Health Services have developed teaching aids for CF education, including flip charts with pictures and suggested messages about CF. Use of these teaching aids during health care staff training sessions and during group education sessions in postnatal clinics may improve learning and retention of CF messages among caregivers. Monitoring and evaluation of the use of these flips charts would help to assess their usefulness. Concerning cooking classes and taste-testing, most postnatal clinics are small and lack the required facilities for cooking demonstrations. Taste-testing and demonstrations of which ingredients and utensils to use could however still be done in postnatal CF education sessions. On the other hand, cooking classes may be more suited to community health centers, markets, churches and other areas where women gather. Responsive feeding strategies should also be incorporated into health messages about when and how to progress CF (Aboud et al., 2008). Learning to tailor child feeding and care according to the child's needs is a valuable and transferable skill that may be more useful to caregivers than learning a fixed set of rules about feeding.

Health workers suggested that CF should begin at 6 months, but messages for older infants did not always follow WHO guidelines, especially among lower level health workers who receive infrequent in-service training. Similarly, caregivers had good knowledge about CF initiation but not about feeding for older infants. Another study in Ghana has reported that nurses who received infrequent on-going training gave inaccurate advice to mothers, and that mothers reported low confidence about their abilities to feed complementary foods (Timpo, 2007). Improving the knowledge and educational practices of health workers could translate into better knowledge and CF practices among

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caregivers. In-service training for health workers in this study's population has not focused on CF. Other studies have found that ongoing training can greatly improve nutrition and health services, resulting in greater child growth and survival, with little additional cost to the health facility (Chee et al., 2002; Ross et al., 1987; Waters et al., 2006; Robert et al., 2007; Curtale et al. 1995).

While health workers were cited as a major source of CF information, relatives were also a primary source of CF information for many caregivers. However, relatives and friends were often reported to give information on infant feeding that contradicted information received from health workers. Other studies have also reported that older women give CF recommendations that do not follow WHO recommendations (Buskens and Mkhatswa, 2007; Raisler and Cohn, 2005; Timpo 2007; Aubel et al., 2004). This study found that while relatives were not often involved in child nutrition education activities, their involvement could improve CF practices by improving their knowledge about CF and decreasing the amount of conflicting information that mothers receive, as well as providing greater support and encouragement for mothers when choosing what and how to feed their children. Furthermore, the present study found that the level of maternal social support was a significant predictor of time of CF introduction. Having a friend who assisted with child care was associated with a later age of introduction of solid foods. There was also a tendency for mothers who belonged to at least one social group to introduce solids after 6 months, whereas those who belonged to no groups tended to introduce solids before 6 months. Other studies have also found that greater social support from friends and family members, especially when education of family members and elders was involved, improved infant feeding practices (Timpo, 2007; Aubel et al., 2004; Bentley et al., 2005; Burke, 2004). Other intervention studies to improve CF practices in similar settings should aim to involve family members in nutrition education.

In conclusion, practical CF advice is needed and should be integrated and reinforced throughout the health system. Furthermore, interventions to improve infant health and nutrition should facilitate social support among caregivers, especially in HIV-affected and resource-poor communities.

7.1. Study strengths

This is the first study that has used triangulation with mixed qualitative and quantitative methods (Varga et al., 2005; Tompkins et al., 1999; Lemke, 2005) to examine the experiences of mothers involved in complementary feeding in Ghana and the roles that hospital nutrition education, social support, maternal employment and HIV play in these experiences. Triangulation of different data sources increases the validity of research findings by giving multiple perspectives on one topic (Patton, 2002b). Within the first part of this study, there was a high degree of triangulation, using information reported by caregivers and health workers, as well as observations, to reach conclusions about the associations among CF education, knowledge and practices. Additionally, there was some lesser triangulation between the qualitative data and the quantitative data, used to make conclusions about reasons for the time at which caregivers begin CF.

The methodological strengths of the qualitative part of this study include the following. The use of observational data along with interview and focus group data helped validate results and highlight areas where the data conflicted. Interviews with health care staff, fathers, Queen Mothers and GHS personnel were conducted individually to reduce the possible influences that others may have on participant responses. Due to the small numbers of health care staff and GHS personnel, almost all eligible participants were interviewed, which increases the likelihood of having attained information saturation with these participant groups. Focus group discussions with mothers were conducted to encourage interactions among mothers and observe group dynamics. Mothers were encouraged to voice their opinions even if they differed from those of other participants. Two female field workers who were familiar with the local languages facilitated and translated during interviews. The presence of two field workers helped to ensure accuracy of translation and increase the validity of the data. All focus group discussions and individual interviews were tape-recorded, translated verbatim into English if conducted in *Krobo* or *Ga*, and transcribed, reducing the possibility of errors from poor recall.

The methodological strengths of the quantitative part of this study include the following. Infant feeding data were recorded two times per week during home visits, which reduced possible errors from poor maternal recall. Thus the exact day of first introduction of solid foods was calculated with considerable accuracy. The child anthropometric measurements were taken in duplicate to decrease random errors. Furthermore, the length board and digital baby scale were calibrated weekly to reduce systematic errors. Field workers were trained, and the questionnaires were standardized and tested in the field to reduce inter-observer variability. Also, only the field manager had access to the participants' medical records, and bias caused by knowledge of the participants' HIV status was minimized as much as possible in the field. To avoid the phenomenon of reverse causality, the exposure variables, such as number of friends that a mother has, occurred before the outcomes of interest, such as age of introduction of solid foods. In the regression models for example, data on maternal social support and household socioeconomic and demographic characteristics that were collected at enrolment were used to predict the time of introduction of solid foods.

7.2. Study limitations

The limitations of the qualitative part of this study include the following. Private counselling sessions were not observed in hospital postnatal clinics due to confidentiality issues since participants' HIV status is discussed during private counselling. While health care staff reported on the recommendations that are given during private counselling, the teaching styles, use of teaching aids, and duration of private counselling sessions would have been better assessed through direct observation. Also, the presence of the primary researcher may have affected the content and teaching style of group CF education. Therefore, while CF education appears to be limited in the hospital setting, the amount and quality of CF education that mothers receive may actually be less than was found in this study. A larger sample of observations from each hospital may have decreased the effect of the observer through desensitization, but time constraints prevented this. Among caregivers, self-reported feeding practices and beliefs could possibly be biased by social desirability (Hebert et al., 1995), particularly in the focus group discussion setting.

Associations between CF education and changes in caregiver's knowledge were not assessed in the present study. Other studies have used pre-education interviews and post-education interviews with caregivers to assess changes in knowledge attributed to hospital-based educational activities (Penny et al., 2005; Robert et al., 2007) Also, the present study did not assess the association between CF education and caregiver behaviour change. Further studies should examine the associations between CF education, changes in caregiver knowledge and changes in caregiver feeding behaviours. The fathers interviewed in this study may not have been representative of all fathers of children under two years old in the Manya and Yilo Krobo districts. While two-thirds of the fathers interviewed reported attending at least one hospital postnatal education session, hospital staff reported that in general very few men attend postnatal education with their wives. Also, the fathers who were interviewed in this study tended to be more educated, having 12 years of schooling on average. While fathers were not generally found to be directly involved in child feeding, they were involved in household financial and other decisions that affected their children's diets. Another study in Ghana has similarly shown that male household heads were influential in mothers' decisions to participate in child nutrition activities as well as mothers' success in economic activities (Hagan et al., 2008). Further studies that assess the knowledge and involvement of fathers in infant feeding may be warranted.

The limitations of the quantitative part of this study include the following. Infant morbidity and infant HIV status were not included in this analysis. The timing of initiation of CF may be affected by child illness and infection. A study in Kenya has documented that child illness has been associated with earlier introduction of solids, possibly due to the belief among caregivers that sick children need additional nourishment (Gray, 1996). Gray (1996)'s findings were based however on mother's recalled reasons for introducing foods other than breast milk. Other studies should confirm these findings using prospective and longitudinal methods. Another limitation in this study comes from the assumption that participants who were tested as HIV negative during pregnancy remained negative throughout the twelve months of follow-up. It is, however, possible that HIV negative women became HIV positive during the course of

the study. Change in HIV status could have affected maternal health and child care abilities and thus affected the time of introduction of solid foods, which would have decreased the ability of this analysis to detect a difference between groups of HIV status. Thus, the effect of maternal HIV status on the timing of introduction of solid foods may be actually be greater than was found in this study. Also, changes in socioeconomic characteristics that occurred after enrolment but prior to CF initiation were not analyzed in this study. Changes in social support or other factors could have affected a mother's decision about when to introduce solids. The association between change in socioeconomic factors and CF practices should be examined in future studies.

7.3. Recommendations for future studies

Future studies should examine the following.

1. The CF education given in health facilities and its relationship with caregiver knowledge and reported practices in similar populations to confirm and build on the findings of the present study.

2. The associations between recommendations given in hospital clinics, the information retained by caregivers and changes in CF practices. The possible mechanisms by which behavior change occurs should be further studied.

3. The association between economic status and timing of CF initiation in other HIV-affected communities to confirm the findings of the present study. Possible mechanisms should be further investigated.

4. The association between socioeconomic and environmental factors and the energy and nutrient-density of complementary foods.

5. The mechanisms by which HIV infection influences the timing of introduction of solid foods.

8. LITERATURE CITED

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9.1. Interview and focus group code guide

Interview guide questions	Common answers	Codes
Who gives care in hospital?	**Care provider**	
	Nurse	NURSE
	Midwife	MIDWF
	Dietitian	DIETIT
	Health assistant/orderly/clerk	ASSIST
	Doctor	DOCTOR
	Not involved/useful	NOINVOL
	Communication between health staff, referrals	HOSPCOM
	Support, encouragement, help, follow-up	HOSPFU
What is your role in infant feeding/complementary feeding? How has your job (activities/recommendations) changed with regard to infant feeding?	**Teaching methods**	
	Private counselling, community outreach, home visits	PRIVCOUNS
	Health talk	HTALK
	Teaching aids (practical and visual)	TEACHAID
	Counselling from queen mother	QPRIVCOUNS
	Health talk form queen mothers	QTALK
	Educator is respected as authority figure	AUTHORITY
	Participant's job focus/ involvement	
	Breastfeeding focus/involvement	FOCUSBF
	Complementary feeding focus/involvement	FOCUSCF
	Other focus	FOCUSOTH
	Involvement in food preparation, cooking	COOK
	Hospital changes	
	Busier/increased number of patients	HBUSIER
	Physical space	HSPACE
	Time care is given	
	Address infant's current needs	CARENOW
	Malnutrition, growth, monthly weighing	GROWTH
	Illness	INFHEAL
	Malnutrition rehabilitation	REHAB
As infants grow, their eating changes. Can you tell me about how an infant's eating changes? (Can you tell me about complementary feeding?)	**Foods**	
	Family diet	FAMFOOD
	Local foods	LOCFOOD
	Afford it	MONEY
	Affect infant's stomach	INFHEAL
	Thickness, consistency, heavy, light, dilute	THICK
	Nutrient-density, empty calories	CFQUAL
	Breast milk	BMILK
	Pepper	PEPPER
	Infant porridge - Koko, Tom brown	INFPRDG
	Commercial formula - Lactogen, Cerealac	CFORMULA
	Local infant supplement - Weanimix	LFORMULA
	Animal source foods - meat, eggs, fish, milk	ASF
	Starch - yam, banku, fufu, plantain, rice	STARCH
	Plant-source protein foods – Beans, groundnuts	PPROT
	Palmnut, palm oil	PALM
	Soup, stew	SOUP
	Tomato, onion, contombre, agushi, garden eggs, okra	VEGE
	Fruit	FRUIT
	Texture- ground, mashed, soft, pieces, hard, soft	TEXTURE
	Variety, balanced diet	VARIETY
	Water	WATER
	Timing and frequency	
	Introduction	CFINTRO
	Progression	CFPROG
	Frequency of feeding	CFFREQ
	Early CF introduction	CFEARLY
	Late CF introduction	CFLATE
	Amount	CFAMT

	Consequences of too early/late	
	Child illness, affect child	INFHEAL
	Malnourished, growth	GROWTH
	HIV transmission	HIV
	Denial of occurrence, no problem	NOPROB
	Problems in CF	
	Nutrient-density, quality	CFQUAL
	No animal source foods (protein)	ASF
	Lack knowledge, education	EDUKNOW
	Too expensive	MONEY
	Traditional/cultural beliefs	TRADIT
	Unsure/delayed answer/avoid question	AVOID
How did you learn about complementary feeding?	**Sources of information**	
	Senior secondary school	INFOSSS
	Post-secondary education	INFOPSE
	Formal hospital training programme	INFOHPRG
	Experience with own children	INFOCHILD
	On-the-job	INFOJOB
	In-service training	INFOTRAIN
	From own mother or relative	INFOMOM
	Media, health promotion campaigns	INFOMEDIA
	From health facilities	INFOHOSP
	Queen mothers	INFOQU
Can you describe a mother who did a great job of nourishing their infant (recently)? Can you describe someone who did a poor job of nourishing their infant (recently)?	**Facilitators and benefits of CF in community**	
	Infant grew well, healthy	INFHEAL
	Mothers listen to nurses, follow advice	MLISTEN
	Responsive feeding, active feeding	CFRESP
	Community growth promotion, local development	LOCDEVEL
	Mother support groups	SUPPORT
	Barriers to CF in community	
	Denial of problem, no problem	NOPROB
	No family planning (teen or multiple pregnancies)	FAMPLAN
	Lack of money, employment	MONEY
	Low education, knowledge	EDUKNOW
	Lack of time of mother	MTIME
	Lack of time of father	FTIME
	HIV	HIV
	Lack of support, problems with family involvement	SUPPORT
	Infant illness	INFHEAL
	Maternal or family illness, family health	FAMHEAL
	Infant refusal/dislike	INFREFUSE
	Not coming (attending) to hospital (no knowledge)	HATTEND
	Maternal laziness	MLAZY
	Distance, rurality	DIST
	Food security	FDSEC
	Hygiene, food handling	HYGIENE
	Gender equity	GENDER
	Nurses' reaction to CF problems	
	Try a different food, variety	VARIETY
	Weighing	WEIGHT
	Hygiene	HYGIENE
	Home visits, outreach, one-on-one counselling	PRIVCOUNS

What facilitates teaching mothers about complementary feeding? What are the challenges?	**Facilitators to CF education**	
	Enjoying teaching, caring about clients, motivated	MOTIV
	Speaking same language as mother	LANG
	Teaching aids	TEACHAID
	Gifts to mothers as incentive	GIFT
	Experience with own child	INFOCHILD
	Demonstrations	DEMO
	Interactive teaching, relationships with mother, counselling skills	INTERACT
	Barriers to CF education	
	Lack of teaching aids, materials	TEACHAID
	Women don't come to hospital	HATTEND
	Increasing number of clients	HBUSIER
	Inadequate space and privacy for counselling	HSPACE
	Insufficient staff	STAFF
	Co-workers lack motivation	MOTIV
	Language barrier	LANG
	Insufficient salary for health workers	HPAY
	De-centralization, dissemination to regions	DISSEM
	Funding	MONEY
	Technical and knowledge support	INFOSUPP
	Follow-up and evaluation of programmes	EVALFU
	Non-CF priorities	MOTIV
	Hospital system poorly organized	HDISORG
What are your suggestions for how a health workers could give a mother the care and advice she needs to successfully complementary feed her infant?	Separate, defined jobs, nutrition department or clinic	FOCUSJOB
	More staff	STAFF
	More space, larger offices/clinics	HSPACE
	More teaching materials	TEACHAID
	More frequent in-service training	INFOTRAIN
	More motivation from co-workers	MOTIV
	Help from NGOs	NONGG

9.2. Glossary of local Ghanaian foods

Local food name	Description
Koko	Fermented corn porridge
Banku	Fermented corn and cassava dough made into a dumpling
Fufu	Thick dough made of mashed plantain and/or mashed cassava
Kenkey	Steamed dumpling made with fermented corn dough
Tombrown	Porridge mix consisting of sorghum and other grains, as well as soya bean
Weanimix	Cereal mix consisting of grains, peanuts and soya beans
Contomire	Green leafy vegetable

Commercial infant foods	
Lactogen	Infant milk-based formula
Cerealac	Infant cereal

9.3. Focus group procedure guide - Mothers

1) Welcome

Thank you all for taking the time to attend our focus group meeting. You have been invited because you are all mothers of infants aged 6-24 months, and you are participating in a study about child feeding practices.

2) Introductions and Icebreakers

Meet and introduce the person beside you (name, infant's age/name, favourite experience/memory with infant) OR song/dance. Introduce moderators. Prayer

3) Review Agenda and Duration of Interview

4) Review Goals of Meeting

The purpose of this meeting is to find out about the instructions that you have received in health clinics, and from family, friends or any other sources, concerning infant feeding, particularly the introduction of foods other than breast milk. This meeting is also to discuss your experiences with health services, and to find out what difficulties (if any) you have with feeding your infants. This information will help the people who make policies and recommendations to provide better care for your babies' health.

5) Review Ground Rules

A series of questions will be asked, and each question will be followed by discussions. Please feel free to express yourself, while also allowing everyone to have their turn. During your turn, you may respond directly to the question or to someone else's comment, while maintaining respect for the opinions of others. You may also choose not to answer. All of the questions and discussions will be translated throughout the meeting. Please take your time to respond, and ask for clarifications at any time. Each of your opinions is important to the study. So, please feel free to express your own views even if they differ from those of other members of the group. At the end, we will review what has been said to make sure that we understand your opinions.

The meeting will be audio-recorded. The tape-recording will only be used to help remember the discussion and not for any other purpose. Only the researchers will listen to the tapes.

6) Questions and Discussions

7) Wrap-Up

8) Thank Participants for Time

9) Refreshments and Group

9.4. Mothers focus group guide

Opening – present and past experiences to set context
1. Would a few of you like to share what a typical day is for you?

Knowledge, opinions – complementary feeding
2. As infants grow, their eating changes. Can you tell me about your infant's eating?
    Probes
    ♦ When should foods be introduced?
        • How does one know? What would you tell another mother to look for when she is thinking of starting foods other than breast milk?
        • When is too early? Too late? How do you know?
        • Consequences of too early/late?
    ♦ Which foods?
        • Are there any "wrong" types of foods? Consequences?
    ♦ Infant's diet up to 2 years?

3. How did you learn about complementary feeding (how to feed your infant)?
    Probes
    ♦ When and where did you receive this information?
    ♦ Conflicting information?
        • How do you resolve that conflict?

Opinions, experiences – facilitators and barriers to infant feeding
4. Tell me about some of the challenges to feeding infants.
    Tell me about women whom you know who have been successful at feeding their infants.
    Probes
    ♦ Are these typical examples or are there other reasons?

Opinions, experiences – health care
5. Can you tell me about your experiences with health services? (quickly re-focus on infant)
    Probes
    ♦ The role of health services in providing info about complementary feeding?
        ♦ What info?
        ♦ Who gives info?
        ♦ When?
        ♦ Which teaching materials are used?
    ♦ Interactions with health care providers?
    ♦ Is there room for questions/clarifications?
    ♦ Is the information received from health services consistent? Conflicting info?
        ♦ How do you resolve that conflict?
        ♦ Consistency - similar experiences for other participants?
    ♦ Are there any problem areas?
        ♦ Why do you think this might be?

Opinions – closing suggestions
6. Do you have any suggestions for what might help mothers to successfully complementary feed (feed foods other than breast milk) their infants?
    Probes
    ♦ How can health services improve?
        • What info is missing/would be useful?

7. That covers the questions that I wanted to ask. Your comments have been very helpful. Is there anything else that you would like to add? Any questions?

9.5. Fathers interview guide

Opening – present and past experiences to set context

    1.Would a few of you like to share what a typical day is for you?

Knowledge, opinions - complementary feeding and infant care

    2.Can you tell me about food in the household?

        Probes

- Activities related to food and nourishment
  - Who - mother's role/father's role?
  - What types of foods?
    - Probe for each type of food – tell me about starch/meat/sauce/vegetables…
  - Ever difficulty with having enough food? Or the preferred types?

    3.Tell me about your roles/experiences related to feeding your infant.

        Probes

- What types of food?
- Understanding of how to feed infant up to 2 years?
  - When should you introduce foods other than breast milk? How do you know? Consequences of too early/late?
  - Are there "wrong" types of foods? Consequences of giving these?

    4.How did you learn about infant feeding?

        Probes

- When and where did you receive this information?
- Conflicting information?
  - How do you resolve that conflict?

Opinions, experiences – facilitators and barriers to infant feeding

    5.Can you describe a family in your community who has had difficulties feeding their infant?

    Can you describe a family who has been successful at feeding their infant?

        Probes

- Why do you think the family was successful/had difficulties?
- Probe for reasons beyond $

Opinions, experiences – health care

    6.Can you tell me about your experiences with health services?

        Probes

- Interactions with health care providers?
- Do you ever go with wife? With the baby?
- In terms of care for your infant? complementary feeding?
- Are there any problem areas? Why do you think this might be?

Opinions – closing suggestions

    7.Do you have any suggestions for what might help parents to successfully feed their infants?

        Probes

- How can health services improve?
  - What info is missing/would be useful?

    8.That covers the questions that I wanted to ask. Your comments have been very helpful. Is there anything else that you would like to add? Any questions?

9.6. Health care provider interview guide

Opening – present and past experiences to set context
1. Can you tell me about a typical day at work for you?
> *Probes*
> - Job title
> - Years working in this position

Experiences – interactions between health care providers and mothers
> 2.   What is your role in infant feeding/complementary feeding?

How has your job (activities/recommendations) changed with regard to infant feeding?
> *Probes*
> - Which materials are used to teach mothers?
> - When is this care given (with regard to infant's age)?
> - By whom is care given?
>
> 3.   Who else is involved in infant/complementary feeding?
>
> *Probes*
> - Roles of doctors? Nurses? Other health workers?

Knowledge, opinions - complementary feeding
> 4.   Can you tell me about complementary feeding?
>
> *Probes*
> - When should foods be introduced? How does one know?
>   - When is too early? too late? Consequences of too early/late?
> - Which foods?
>   - Are there "wrong" types of foods? Consequences?
> - Infant's diet up to 2 years?
>
> 5.   How did you learn about complementary feeding?
>
> *Probes*
> - When and where did you receive this information?
>   - Education (years, type)
>   - Training - In-service training (frequency, content)
>   - Other sources of info

Opinions, experiences – facilitators and barriers to infant feeding
6. Can you describe a mother who did a great job of nourishing their infant (recently)?

Can you describe someone who did a poor job of nourishing their infant (recently)?
> *Probes*
> - Why do you think she did a great/bad job? What helped her?
> - Are these typical examples or are there other reasons?

Experiences, opinions – facilitators and barriers to optimal health care
7. What facilitates teaching mothers about complementary feeding?

What are the challenges?

Opinions – closing suggestions
> 8. What are your suggestions for how a nurse/health worker/doctor could give a mother the care and advice she needs to successfully complementary feed her infant?

9.   That covers the questions that I wanted to ask. Your comments have been very helpful. Is there anything else that you would like to add? Any questions?
   If you think of anything else – contact info.

9.7. Queen Mothers interview guide

Opening – present and past experiences to set context
1. Can you tell me about what you are working on in the Queen Mother's Association?
> *Probes*
> ♦ Position within matriarchal system? Years in this position

Experiences – setting context, complementary feeding
2. What activities are Queen Mothers doing that are related to infant feeding?
What activities related to infant feeding were done before?
> *Probes*
> ♦ When? Who is involved?

Knowledge, opinions - complementary feeding
3. As infants grow, their eating changes. Can you tell me about how an infant's eating changes? (Can you tell me about complementary feeding?)
> *Probes*
> ♦ When should foods other than breast milk be introduced? How does one know?
> > ♦ When is too early? too late? Consequences?
> ♦ Which foods?
> > ♦ Are there "wrong" types of food? Consequences?
> ♦ Infant's diet up to 2 years?

4. How did you learn about complementary feeding?
> *Probes*
> • When and where did you receive this information?
> > ▪ Education/Training? (years, type)

5. In your opinion, where do mothers receive their information about complementary feeding?
> *Probes*
> • Are these sources of info reliable? (rate the source for reliability)

Opinions, experiences – facilitators and barriers to infant feeding
6. In your community, do you think some mothers have difficulty feeding their infants?
Can you think of some mothers who are very successful with feeding their infants?
> *Probes*
> ♦ Why do you think they are having difficulty/success?
> ♦ What is different about mothers who have difficulty and success?
> ♦ Are these typical examples or are there other reasons?

Opinions, experiences – health care
7. Can you tell me about your experiences with health services?
> *Probes*
> ♦ The role of health services in complementary feeding?
> ♦ Are there any problem areas? Why do you think this might be?

Opinions – closing suggestions
8. Do you have any suggestions to help mothers to successfully complementary feed their infants?
> *Probes*
> ♦ How can health services improve? What info is missing/would be useful?

9. That covers the questions that I wanted to ask. Your comments have been very helpful. Is there anything else that you would like to add? Any questions?
If you think of anything else – contact info.

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9.8. GHS personnel interview guide

1. Tell me about a typical day's work
      -# years in position
      -job title

♦ Tell me about your role in/activities related to complementary feeding and infant feeding. How has this changed (past yr? 5yrs? 10yrs?)
    -what, when, where, how?
    -which teaching materials?
    -in the Eastern Region (Manya Krobo, Yilo Krobo)?

♦ Tell me about complementary feeding in Ghana and in the Eastern Region.
    -what are the challenges?
    -what facilitates complementary feeding promotion?

♦ Tell me about your role in the hospitals/health centres in terms of complementary feeding. How has this changed (past yr? 5yrs? 10yrs?)

♦ Who is responsible for teaching/promoting complementary feeding in the community hospitals/health centres?
    -how are they trained?
        -training manuals/materials?
        - in-service education?
            -how often?
            -who gives seminar?
            -topics?
    -how are they evaluated?
    -what are the actual teaching practices in the hospital?
        -who, what, when?

♦ Where else do mothers and fathers learn about complementary feeding?
    -school?
    -media?

♦ What are your suggestions for improvement in complementary feeding?
    -in hospitals?
    -in community?

♦ Those are all the questions that I have. Thank you for your comments. They have been very helpful. Is there anything else that you'd like to tell me? Any questions?

9.9. Focus Group Interview - Informed Consent Form

Title of Study: The Roles of Health Services and Household Characteristics in Complementary Feeding in the Eastern Region of Ghana

Researcher: Jasna Robinson
Supervisors: Grace Marquis, Ph.D., School of Dietetics and Human Nutrition, McGill University
Anna Lartey, Ph.D., Dept. of Nutrition and Food Science, University of Ghana

Introduction

You are invited to take part in a research study. Please take your time to decide whether you would like to participate. You may ask questions at any time.

The purpose of this study is to understand what affects child-feeding practices.

Description of Procedures

If you agree to participate in this study, your involvement will include taking part in a group interview, lasting a maximum of 2 hours. This interview will be audio-recorded.

During the interview, you will be asked about child-feeding and health practices, as they relate to you and your community. You may skip any questions that you do not wish to answer or that make you feel uncomfortable.

Photographs may be taken during the interview or at other times during the study. Photographs may be used in presentations to the public to help describe the procedures and the community where the study took place.

Risks

There are no risks to you for participating in this study.

Benefits

There is no direct benefit to you for participating in this study; however, the information gained will hopefully benefit communities similar to yours by providing insights about the factors affecting child-care.

Compensation

Any travel expenses necessary for you to participate in this research project will be covered for you by the study.

Participant Rights

Your participation is completely voluntary. You may choose not to participate or to leave the study at any time, without penalties.

Confidentiality

All records that may be used to identify you or that contain information about you will be kept confidential. You will be assigned a unique code number, and this code will be used on forms and interview transcripts instead of your name. Only the study's researchers will have access to the documents linking your name to your code. Documents and audio-tapes will be kept in a locked cabinet, and electronic computer files will be password protected.

Upon completion of this study, the files linking your name to your code number will be destroyed. Any published results will keep your identity confidential, and your name will not be linked to interview quotes. Pictures of you will only be used with your consent and only for educational presentations, and your name will not be linked to any photographs.

Questions or Problems?

You are encouraged to ask questions at any time during this study. For more information about this research project, please contact :

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Telephone: 613-829-3558	H9X 3V9, Canada	Legon, Ghana
	Telephone: 514-398-7839	Telephone: 21-513294

Participant Signature

Your signature indicates that you agree voluntarily to participate in this study, that the study has been explained to you, that you have had enough time to read the consent form and that your questions have been answered to your satisfaction.

I agree to be tape-recorded __YES __NO   I agree to be photographed __YES __NO

I agree that the photographs may be used as described above ___YES ___NO

Participant Statement

I understand the purpose of this study and know about the risks and benefits associated with this research project. I understand that I am free to withdraw at anytime without any penalty or prejudice. I understand how confidentiality will be maintained and how the data will be used. I freely consent and voluntarily agree to participate in this study.

_____   _____
          Participant's Name (Printed)   **Date**

_____
          Participant's Signature/Thumb-Print

Researcher Statement

I certify that the participant has been given adequate time to read and learn about the study and that all of their questions have been answered. The participant understands the purpose, procedures, potential risks and benefits associated with this study and has voluntarily agreed to participate.

_____   _____
           Researcher's Signature   **Date**

9.10. Interview - Informed Consent Form

Title of Study: The Roles of Health Services and Household Characteristics in Complementary Feeding in the Eastern Region of Ghana

Researcher: Jasna Robinson
Supervisors: Grace Marquis, Ph.D., School of Dietetics and Human Nutrition, McGill University
Anna Lartey, Ph.D., Dept. of Nutrition and Food Science, University of Ghana

Introduction

You are invited to take part in a research study. Please take your time to decide whether you would like to participate. You may ask questions at any time.

The purpose of this study is to understand what affects child-feeding practices.

Description of Procedures

If you agree to participate, your involvement in this study will include an audio-recorded interview, lasting up to 1½ hours. You may refuse tape-recording or ask to stop the tape at any time.

During the interview, you will be asked about child-feeding and health practices, as they relate to you and your community. You may skip any questions that you do not wish to answer or that make you feel uncomfortable.

Photographs may be taken during the interview or at other times during the study. Photographs may be used in presentations to help describe the procedures or the community where the study took place.

Risks

There are no risks to you for participating in this study.

Benefits

There is no direct benefit to you for participating in this study; however, the information gained will hopefully benefit communities similar to yours by providing insights about the factors affecting child-care.

Compensation

Any travel expenses necessary for you to participate in this research project will be covered for you by the study.

Participant Rights

Your participation is completely voluntary. You may choose not to participate or to leave the study at any time, without penalties.

Confidentiality

All records that may be used to identify you or that contain information about you will be kept confidential. You will be assigned a unique code number, and this code will be used on forms and interview transcripts instead of your name. Only the study's researchers will have access to the documents linking your name to your code. Documents and audio-tapes will be kept in a locked cabinet, and electronic computer files will be password protected.

Upon completion of this study, the files linking your name to your code number will be destroyed. Any published results will keep your identity confidential, and your name will not be linked to interview quotes. Pictures of you will only be used with your consent, and your name will not be linked to any photographs.

Questions or Problems?

You are encouraged to ask questions at any time during this study. For more information about this research project, please contact :

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	Telephone: 514-398-7839	Telephone: 21-513294

Participant Signature

Your signature indicates that you agree voluntarily to participate in this study, that the study has been explained to you, that you have had enough time to read the consent form and that your questions have been answered to your satisfaction.

I agree to be tape-recorded __YES __NO   I agree to be photographed __YES __NO

I agree that the photographs may be used as described above ___YES __NO

Participant Statement

I understand the purpose of this study and know about the risks and benefits associated with this research project. I understand that I am free to withdraw at anytime without any penalty or prejudice. I understand how confidentiality will be maintained and how the data will be used. I freely consent and voluntarily agree to participate in this study.

_____   _____

Participant's Name (Printed)   **Date**

_____

Participant's Signature/Thumb-Print

Researcher Statement

I certify that the participant has been given adequate time to read and learn about the study and that all of their questions have been answered. The participant understands the purpose, procedures, potential risks and benefits associated with this study and has voluntarily agreed to participate.

_____   _____

Researcher's Signature   **Date**