

FACTORS ASSOCIATED WITH DELAYED COMPLEMENTARY FEEDING IN
INDIA

by

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ABSTRACT

Morium B. Bably: Factors associated with delayed complementary feeding in India.
(Under the direction of DR. ELIZABETH RACINE).

Appropriate timing of complementary feeding is demonstrably beneficial and important for children's physical and mental health. In developing countries, delayed complementary feeding is one of the risk factors for underweight and malnutrition among children under five years old. The purpose of this retrospective cross-sectional study was to determine the factors that predict delayed introduction of complementary feeding after 7 months of age in India. Data from the Indian Human Development Survey (IHDS) II was used for this study. Logistic regression and multivariate logistic regression were used to investigate the associations between delayed complementary feeding and mother's year of education, annual household income, age, residence, work status, religion, breastfeed duration, size of the baby, number of child, place of birth of the child, and mother-in-law's residence status. The results show that among the sample of 11,218 women, approximately 61% delayed complementary feeding. In the adjusted multivariate logistic regression, women's annual household income, age, year of education, breastfeeding duration, residence, and work status were found significantly association with delayed complementary feeding. The findings from this study can be implemented in planning and conducting educational intervention programs to promote appropriate timing of complementary feeding.

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CHAPTER 1 INTRODUCTION

Childhood malnutrition is a significant public health problem, especially in the developing countries. According to the World Health Organization (WHO), two out of five children under five years are stunted (low height-for-age) in developing countries and a large proportion of children lack one or more micronutrient (UNICEF, 2017)). Micronutrients are essential for proper growth and proper functioning of every system in the body (Guy, 2017). During infancy and early childhood, balanced nutrition is essential for the physical and mental development of each child. WHO states that the first two years is the most crucial time for the promotion of optimal growth, health, and development (WHO,2016). In 2004, the Food and Nutrition Board of India published a report named National Guidelines on Infant and Young Child Feeding. The report stated that most of the body organs of infants develop structurally and functionally during the first two years and introduction of complementary feeding at six months of age is essential to meet the growing needs of infants (Singh, 2004).

Appropriate complementary feeding refers to 1) starting complementary feeding at the age of 6 months along with breastmilk; 2) providing adequate foods in terms of amount, frequency, and consistency; and 3) using a variety of foods to meet the nutritional needs of the growing child (WHO, 2016). The World Health Organization developed a report guiding the principles for complementary feeding and summarizing

the current scientific evidence for complementary feeding (WHO,2003). According to the report, the appropriate age to initiate the complementary feeding along with breastmilk is 6 months because at this

age breastmilk alone is no longer sufficient to meet the nutritional requirements of children. Furthermore, UNICEF also stated that from six months onwards appropriate complementary feeding should be started along with breastmilk to provide the growing needs of nutrients including energy, protein, fat, vitamins, and mineral.

The South Asia Infant Feeding Research Network (SAIFRN) published a report after analyzing the complementary feeding practices of five South Asian countries: Bangladesh, India, Sri Lanka, Pakistan, and Nepal. The report stated that approximately half of the world's malnourished children live in South Asia where 41% children are stunted (impaired growth and development), 16% are wasted, and 33% are underweight. Moreover, among the South Asian countries, India has the highest number of stunted children (UNICEF, 2012). The SAIFRN report suggested implementing necessary interventions to improve the complementary feeding practices in this region to reduce the burden of malnutrition (Senerath & Dibley, 2010). In India only 21% children aged between 6 to 24 months receive appropriate complementary feeding (UNICEF, 2016); this contributes to high numbers of stunted children.

As mentioned above, appropriate complementary feeding includes proper timing of initiation, frequency of feedings, amount of feeding, nutrition composition of feeding and the consistency of the feeding. In this research, among the three components of complementary feeding, I will study only one component: the timing of complementary feeding. The purpose of this thesis is to examine the factors that predict delayed

introduction of complementary feeding among mothers of infants in India. For the study, introduction of complementary feeding after 7 months will be considered as delayed complementary feeding, with a maximum grace of one month. Results from the study can be used to develop interventions to target educational efforts and interventions to address this public health issue.

CHAPTER 2 LITERATURE REVIEW

This section is a review of the existing literature exploring complementary feeding practices in India. Specifically, this review examines the timing of complementary feeding, the types of foods and beverages that typically comprise complementary feeding and the consequences of delayed complementary feeding in India.

The National Family Health Survey (NFHS) is a large-scale and multi-round survey conducted throughout India to gather extensive information on population, health, and nutrition, with an emphasis on women and children. NFHS administered three surveys from 1992 to 2006. The first survey, NFHS-1, was conducted in 1992-93 among 88,562 households to gather data on fertility, family planning, mortality, and maternal and child health. The second National Family Health Survey (NFHS-2) was conducted in 1998-99 among 91,000 women from 26 states in India with a focus on studying the health status of women and children. The last published NFHS-3 data were collected in 2005-06 among 15,028 mothers and provided information on several topics including maternal and child health. The pattern of complementary feeding was one of the foci of all three NFHS surveys (National Family Health Survey, 2009).

The first NFHS survey found that only 17% of children were introduced to solid food at the recommended age of 6 months. From age 4-5 months, 8% children were introduced by complementary feeding; from the age of 7-15 months, the percentage

increased from 30 % to 79% (National Family Health Survey, 2009). The NFHS 2 indicates that approximately, 40% started complementary feeding within 4 to 6 months and 60% started within 7 to 9 months. The types of complementary foods reported included green and leafy vegetables, fruits, and powdered milk (National Family Health Survey, 2009).

The participants of NHFS-3 are more diverse in terms of income, religion, and literacy status compared to the previous two NHFS surveys and the study sample included women from across the country. For example, among the study sample, 25% belongs to very low income, 22% belongs to low-middle income, 18% belongs to middle-higher income, and 16% belongs to high income. Among the participants, 78% were Hindu, 17% were Muslim, and 2% were Christian, and 47% of women were illiterate. The data showed that 55% of children were introduced with complementary feeding at the recommended age of 6 months and 78% were introduced to complementary feeding by 11 months (National Family Health Survey, 2009).

There is some other research conducted on a small number of participants in different states of India that examined the complementary feeding practices.

Philips et al. (2000) conducted a cross-sectional study among 386 mothers of children ages 6-24 months old in Maharashtra, India to determine the association between complementary feeding and its impacts on child nutritional status. The researchers found that among 386 participants, only 18% initiated complementary feeding at 6 months. These researchers did not find any significant association between timing of complementary feeding and improved nutritional status, but the study found that

increased maternal interaction was associated with delayed complementary feeding (Philips, 2000).

Aggarwal et al. (2008) studied 200 children ages 6 months to 2 years in a tertiary care hospital to assess complementary feeding practices, mother's knowledge regarding complementary feeding, and the causes of inappropriate complementary feeding practices. Among the study population, 165 of the children were from urban areas and 35 were from rural areas; 139 were Hindu and 61 were Muslim. Moreover, the study was comprised of 119 boys and 81 girls. The researchers found that only 18% of mothers started complementary feeding at 6 months, 77% delayed complementary feeding, 6% started earlier than the recommended age, and 16% did not introduce complementary feeding at the age of 2 years. The researchers also found that only 54% of mothers were aware of the recommended age for the introduction of complementary feeding. The most common reason reported for delaying complementary feeding was the unwillingness of children to accept any food other than breastmilk (Aggarwal et al, 2008).

In another study, researchers conducted a clinically based cross-sectional study among 342 mothers of children aged 0-23 months in a rural area of West Bengal, India (Das et al., 2013). The main objective was to determine the infant and young child feeding perceptions and practices among the mothers. The researchers found that the perceived appropriate age to initiate complementary feedings varied. Among 342 mothers, 27% stated that complementary feeding should start before 6 months, 28% and 45% mothers stated that complementary feeding should start at 6 months and within 7 months to 1 year, respectively (Das et al., 2013).

Rao et al. (2010) studied 200 children aged 6 months to 2 years at two private and one public hospital in the coastal south of India. The researchers found that almost 78% of the women started complementary feeding at the recommended age of 6 months. Among the participants, almost 96% of the mothers were literate. The researchers also analyzed the social economic status of the mothers and found that almost 42% were upper lower and lower middle class while 58% were upper middle and upper class. The researchers found that appropriate timing of the introduction of complementary feeding was associated with mother's literacy ($p=0.038$), place of delivery ($p=0.033$), and socio-economic status ($p=0.036$) (Rao et al., 2011).

Collectively, the results of the studies just reviewed suggest that in India, the timing of complementary feeding varies. For instance, early complementary feeding starts within 3-5 months. Based on the literature review, on average, approximately 20% of women initiate early complementary feeding. While on average approximately, 60% of women delay the introduction of complementary feeding until after 6 months. The month of introducing complementary feeding varied from 7 months to 15 months.

The literature also highlighted some of the factors associated with delayed initiation and appropriate initiation at 6 months. One of the studies suggests that increased maternal interaction was associated with delayed complementary feeding (Philips, 2000). In addition, perception and knowledge about appropriate complementary feeding among mothers were associated with the timing of complementary feeding (Aggarwal et al, 2008). Finally, another study found that mother's literacy, place of delivery, and socio-economic status are some of the influential factors significantly associated with the timing of complementary feeding (Rao et al., 2011).

The initiation of complementary feeding has changed over time. The NFHS conducted on 1993 shows that only 17% started complementary feeding by the recommended age of 6 months. The latest NFHS data conducted on 2006 shows the percentage increases from 17% to 55% (National Family Health Survey, 2005-06).

2.1 Recommendations for complementary foods and beverages fed in India

According to WHO, the complementary feeding should include meat, poultry, fish, and egg as often as possible and exclude liquid milk product i.e. cow's milk especially in the environment with poor sanitation (WHO, 2003). Additionally, complementary feeding should include micronutrients which include vitamins and minerals to develop healthy brains, bones, and bodies (UNICEF, 2016).

The Food and Nutrition Board of India recommend's that staple cereal is the first complementary food fed to infants. Suggested semi-solid food includes semolina, wheat flour, and ground rice using little water or milk. To increase the energy value of the food, it is recommended to add sugar, ghee or oil. Some of the recommended fruits are banana, papaya, and mango in a mashed form. Green leafy vegetables, carrots, pumpkin, pulses, egg, meat, and fish are also recommended complementary foods (Singh, 2004).

Using data from the NFHS-3, approximately 52% of complementary foods fed to young children in India are made from grains, roots, and tuber that include cereal, potatoes, bread, and noodles which are high in carbohydrates. Forty-two percent of introductory foods include cow's milk and milk products such as cheese, yogurt, and powdered milk. Only 8% of diets consisted of fruits and vegetables rich in Vitamin A, 5% other fruits and vegetables and 4% legumes and nuts. Only 1% of children were given eggs and meats. (National Family Health Survey, 2009). Moreover, according to

UNICEF, in India, only 35% of children are getting a minimum number of food groups which is inadequate to meet the nutritional need of a growing child (UNICEF, 2016).

Based on the result just described many young children in India are not receiving the recommended complementary feedings. Therefore, while the age of complementary feeding is important, the quality of the foods and beverages provided to the infants is also important for child health.

2.2 The consequences of delayed complementary feeding

Several studies conducted in a number of countries highlighted the short-term and long-term consequences of delayed introduction of complementary feedings.

Jones et al. did a systematic review of more than 9 million children from 42 countries to identify how many under-five child deaths could have been prevented by appropriate infant feeding. The researchers found that 587,000 children aged below 5 died due to delayed introduction of complementary feeding. The results suggest that an additional 6% of child deaths could have been prevented with appropriate complementary feeding (Jones et al., 2003).

During 2003-04, Kumar et al. conducted a cross-sectional study among 217 mothers with children of under-five years old. The participants were selected from four urban areas of Allahabad, India. The main objective was to determine the nutritional status of the children and to assess the association between infant feeding practices and undernutrition. Only 39% of the children were introduced to complementary feeding at 6 months. The researchers also found that improper complementary feeding i.e. timing and frequency of complementary feeding was one of the significant ($P < 0.05$) risk factors for

underweight and malnutrition among the children below five years old (Kumar et al., 2006).

Coulthard, Harris, and Emmette (2009) conducted a longitudinal study among 7,821 mothers to assess how the introduction of complementary feeding at different ages affected the dietary intake and feeding difficulties of children aged seven years old. The researchers found that children who were introduced to complementary feeding after 9 months reported reduced consumption of important food groups including fruits and vegetables at seven years as compared to children who initiated complementary feeding between 6 to 9 months. Moreover, delayed complementary feeding was significantly related to feeding problems such as being choosy with food and refusal to eat. At the age of seven years, those children refused to eat foods like fruits and vegetables (Coulthard, Harris & Emmette, 2009).

The reports of WHO and UNICEF suggest that the timing of complementary feeding has significant short term and long term health effects i.e. malnutrition, underweight, stunting among the children. However, more research is needed to be done to understand the long-term health consequences of delayed complementary feeding and to determine the associated factors of delayed complementary feeding i.e. mother's literacy, place of delivery, socioeconomic status, the gender of the child, urban and rural residence, and religion. Previous studies conducted on complementary feeding had small sample size. Whereas, this thesis will be conducted on 11,218 women.

CHAPTER 3 METHODS

3.1 Study Design

This study was a retrospective cross-sectional analysis using publicly available secondary data from the Indian Human Development Survey (IHDS). IHDS is a large-scale, multi-topic survey conducted in both rural and urban households in India to gather information on various topics i.e. health, education, economic status, marriage, gender relations, employment, fertility, women's health, and birth history. Researchers from the University of Maryland and the National Council of Applied Economic Research (NCAER) jointly facilitated the IHDS survey. The National Institutes of Health and the Ford Foundation provided the funding for the survey.

3.2 Sample Size

IHDS conducted the survey in two different periods. The first survey, IHDS-I was conducted in 2004-05 among 41,554 households from 1,503 villages and 971 urban neighborhoods across India. IHDS-II was conducted in 2011-12 and the researchers re-interviewed 83% of the original households with an additional replacement sample of 2,134 households, resulting in 42,151 households. Both surveys included participants from all states and union territories of India except Andaman and Lakshadweep. The rural sample was drawn using stratified random sampling and the urban sample was a

stratified sample of towns and cities within states selected by probability proportional to population (PPP) (Desai, Dubey, & Venneman, 2010).

3.3 Recruitment and Data Collection

Data were collected by conducting face-to-face interviews with the members of the family. The head of the household was interviewed to gather information on socio-economic status. The survey questions were translated into 13 languages. Interviewers visited households in teams of two: one male and one female interviewer, who were locally knowledgeable and linguistically fluent. It was an one hour face-to-face interview and the participants self-reported their responses (Desai, Dubey, & Venneman, 2010).

3.4 Study Sample

The present analysis included the women who had at least one birth since January 2005, had ever breastfed the child and had provided information on the complementary feeding of the child.

3.5 Outcome Variable

The outcome of this study is delayed introduction of complementary feeding; defined as initiation of complementary feeding after 7 months. As the recommended age of initiating complementary feeding is 6 months, I determined delayed complementary feeding after 7 months with a maximum grace of one month.

3.6 Control Variables

To determine the factors associated with delayed complementary feeding, the following covariates found in the literature have been explored: mother's years of education (none, 1-5 years, 6-11 years, 12 or more), place of delivery (public clinic, private clinic, home, and others), and socio-economic status (determined by annual

household income in Rupees 44,7000 to 4,392,620) (Rao et al., 2011). Moreover, I analyzed the gender of the child (male and female). Existing literature suggests that in India, girls are more likely to be neglected than a boy in respect of receiving nutritious diet and proper care (Borooah, 2004). I also analyzed whether the mother-in-law was living in the household (same household and another household) or not because existing literature found that the children feeding decision is reserved for the elders, especially for the mother-in-law (Mosley & Chen, 1984). I also analyzed residence (urban and rural) because it is also a potential determinant for infant and young child feeding (Patel et al., 2010). I also assessed religion (Hindu, Muslim, and others) because religious practices may inform the timing of complementary feeding (Kumar et al., 2006). Additionally, I analyzed mother's age (17-26, 27-30, 31 and more), work status, breastfed duration (0-6 months, 7-12 months, 13-24 months, more than 24 months), number of child (1, 2-3, 4 or more), and size of the child (large, average, and small) because these could be potential factors to delay complementary feeding.

3.7 Data analysis plan

Descriptive statistics was used to examine the frequencies of the outcome and independent variables. Multivariate logistic regression was used to examine the factors associated with delayed complementary feeding and to calculate the adjusted odds ratios and 95% confidence intervals. Only the variables statistically significant in bivariate analysis were included in the multivariate logistic regression. Statistical significance was determined at $p < 0.05$ and all analyses were conducted using SAS 9.4 (Cary, NC).

For any variable, if the number of missing participants were more than 2% of the sample size then a separate category was generated to maintain those participants in the analysis.

3.8 Power and effect size determination

The sample size for this analysis was 11,218 women. The steps used to determine the analytic sample from the IHDS II are shown in figure 1. Using the power of 0.80 and alpha set at 0.05%, the effect size determination by an online calculator showed a minimum deductible odd ratio of 1.15 (Demidenko, 2012).

3.9 IRB Exemption

The study was approved for exemption from IRB review under federal regulations [45 CFR 46.102 (d or f) and 21 CFR 56.102(c)(e)(1)] because this study used the publically available secondary data and did not constitute human subjects research. Documentation is included in Appendix C.

CHAPTER 4 RESULTS

The analysis used a sample of 11,218 women who had at least one birth since January 2005, had ever breastfed the child, and had provided information on complementary feeding of the child. Among the total population of IHDS II, 102,062 were male, 102,506 were female and 1 was missing. Among the 102,506 women, 22,962 women had no birth since 2005 and 65,290 women were missing information on last birth which results in 14,254 women who had at least one birth since 2005. Among these 14,254 women, 275 women never breastfed and 427 were missing information on the history of breastfeeding. After excluding these women, the population sample was 13,552 women. Among these 13,552 women, 586 did not provide any information on complementary feeding and 134 never started complementary feeding. After excluding these women, the sample size was 12,832. Among the remaining sample, 1,614 women were eliminated because they did not yet initiate complementary feeding when the survey was conducted. After eliminating these women, the final sample size of the study was 11,218. The detailed steps to determine the sample size will be found in figure 1 (Appendix A).

Out of 11,218 women, approximately 61% delayed complementary feeding initiation (Table-1). Approximately 36% (n=4065) of women were between 17-26 years, 31% (n=3478) were between 27-30 years, and 33% were more than 31 years of age. The

lowest income women (bottom 25th percentile) had an income less than 41 100 Rupees or \$594 per year; the highest income families (75th percentile or higher) had an income of more than 146000 Rupees or \$2115 per year. The majority of women lived in rural area (69%, n=7724). Approximately, 80% (n=8923) of participants were Hindu, 15% (n=1697) were Muslim and rest belonged to another religion (Christian, Sikh, Buddhist, Jain, and Tribal). Over 30% (n=3428) of women did not have any education; 17% (n=1870) went to school for 12 years and more. More than half of the women (61%, n=6896) worked and 39% of women did not work.

Table 1 also provides information on factors associated with delayed complementary feeding. Of the 12 factors analyzed, nine were significantly associated with delayed initiation of complementary feeding. All the demographic variables such as mother's age, education, household income, residence, and work status were significantly associated with the timing of complementary feeding. In terms of mother's age, women aged 30 years or more were more likely to delay complementary feeding compared to women aged 27 to 30 years (OR 1.22, CI: 1.06,1.39). Women without education were at greater odds of delaying complementary feeding compared to women who had 12 or more years of education (OR 1.37, 95% CI: 1.17,1.61). Additionally, women who never worked were more likely to delay complementary feeding compared to women who worked (OR 1.15, CI: 1.03,1.28). Women with a household income of less than 41000 Rupees are more likely to delay the introduction of complementary feeding compared to women with household income of more than 146000 Rupees (OR 1.32, 95% CI: 1.14,1.53). Women living in rural areas had higher odds of delaying complementary feeding compared to women living in urban areas (OR 1.19 CI: 1.07,1.32). Women who breastfed for 13 to 24

months had greater odds of delaying complementary feeding compared to mothers who breastfed for more than 24 months (OR 1.43 CI: 1.16,1.75). Mothers who had 4 or more children were also at greater odds of delaying complementary feeding compared to women who had 2 or 3 children (OR 1.24 CI: 1.07,1.44). Women who gave birth at home were more likely to delay initiation of complementary feeding compared to women who gave birth in public clinic (OR 1.15 CI: 1.01,1.31).

In the multivariate logistic regression, of the nine factors analyzed, six remained significantly associated with delayed complementary feeding. Women who breastfed for 13 to 24 months had greater odds of delaying complementary feeding (OR 1.50; CI: 1.22,1.85) compared to women who breastfed for more than 24 months. Each of the demographic variables including woman's age, work status, annual household income, woman's residence and year of education remained significant in the adjusted model. Women aged 30 years or more were more likely to delay complementary feeding compared to women 27 to 30 years of age (OR 1.18 CI: 1.02, 1.37). Women living in rural areas had 1.18 times the odds (CI: 1.05,1.32) of delaying complementary feeding. Lower income was associated with delaying initiation of complementary feeding; annual household income <41100 Rupees (OR 1.28 CI: 1.08-1.52) and annual income 74976 to 146000 Rupees (OR 1.18 CI: 1.01,1.37) compared to women whose house income is 146001 and more Rupees. Women with no education had greater odds of delaying (OR 1.28 CI: 1.06,1.55) complementary feeding compared to mother who had 12 years' education. Finally, women who never worked were more likely to delay complementary feeding initiation compared to mother who ever worked (OR 1.31, CI: 1.16,1.46).

CHAPTER 5 DISCUSSION

Balanced nutrition is important for the physical and mental growth of a child. Appropriate timing of complementary feeding helps to meet children's growing needs. The existing literature conducted in different states and diverse population in India suggests that on average, approximately 60% of women initiate delayed complementary feeding. Moreover, the existing literature suggests that there are several influencing factors associated with delayed complementary feeding. The purpose of my thesis was to examine the factors that predict delayed initiation of complementary feeding among women in India.

The study was completed using data collected from 11,218 women who participated in Indian Human Development Survey II. The results of this study confirm the results of previous studies which were highlighted in the literature review, but with a larger sample size than the previous studies. The majority of women in the current study (61%) initiated delayed complementary feeding. The result was relatively consistent with the findings of existing literature. Collectively, the existing research showed that on average, about 60% initiated delayed complementary feeding and the month of initiating complementary feeding varied from 7 months to 15 months.

My results indicate that women's year of education, place of birth, and annual household income were statistically associated with delaying complementary feeding.

Moreover, the magnitude of delayed complementary feeding association was more pronounced for women living in rural areas than the women living in urban areas. Some of the findings from the present study are consistent with previous studies conducted on complementary feeding practices. For instance, a study conducted on 200 women also found a similar significant association between delayed complementary feeding and mother's literacy, place of birth, and socioeconomic status (Rao et al., 2010).

The associations of delayed complementary feeding and woman's age, work status, annual household income, woman's residence, year of education, and breastfeed duration remained statistically significant after the multivariate logistic regression. However, some odds ratios were attenuated. The multivariate logistic regression results show that demographic characteristics of women are an important determining factor to delayed complementary feeding.

The overall results found some strong determining factors of delayed complementary feeding such as women's work status and education. These variables strongly predict delayed complementary feeding because the significance level stayed the same in the multivariate logistic regression. None of the previous studies found a strong relation between delayed complementary feeding and women's work status and education. It was important to determine whether religion, size of the baby, and gender of the baby were associated with delayed complementary feeding or not because none of the previous studies focused on these variables. Interestingly, none of these variables were found significantly associated with delayed complementary feeding.

The associations of delayed complementary feeding and woman's age, work status, annual household income, woman's residence, year of education, place of

delivery, number of children, and breastfeed duration remained statistically significant after the multivariate logistic regression. However, some odds ratios were attenuated and some got stronger. For instance, mother's age, year of education, annual household income, residence status, place of birth, and number of children get strengthened and breastfeed duration and mother's work status get attenuated after the multivariate logistic regression (Table 2).

The initiation of complementary feeding by 6 months has changed over time. In India, in 1993 only 17% of women initiated complementary feeding by 6 months (National Family Health Survey, 1992-93). The current study found that the rate has been increased from 17% to 39%. This change suggests that women are developing awareness about the importance of initiating complementary feeding within the recommended age. However, this trend is not consistent across all groups of women. More research is needed to understand the factors that have led some women in India to follow WHO complementary feeding recommendations and the factors that have led to many women to continue to delay the initiation of complementary feeding. That research would be helpful to plan a strategy to increase the rate of appropriate timing of complementary feeding.

If the proper intervention program can be implemented among the women with low annual household income, we expect the rate of delayed complementary feeding will decrease because most of the influencing factors are related to annual household income and socioeconomic statuses related factors such as residence, work status, and year of education. The results indicate that women with low-income are at risk of delaying complementary feeding. We expect this is due to lack of proper knowledge. Especially in

developing countries, women with low-income do not have access to opportunities i.e. education, resident, job to improve their quality of life. Due to lack of knowledge and lack of access to opportunities, they often are ignorant of the latest information. As a result, they cannot imply the appropriate knowledge to nurture their children.

An educational intervention targeting one of the rural communities in India identified a significant effect in improving complementary feeding practices (Bhandari et al., 2004). The significant component of this intervention program includes counseling on appropriate complementary feeding. These types of educational interventions should be implemented to increase the rate of appropriate timing of complementary feeding. The results of this study shows that approximately, 61% of women delayed complementary feeding whose mother-in-law stays in the same household.

The result of this current study shows that approximately 61% of women's mother-in-law stays in the same household as the women. Targeting mother-in-law in the intervention may be beneficial. In India, elders are more likely to decide children feeding practices. Moreover, anti-poverty and education programs, especially those which target current and future mother, can also impact health practices that affect their children.

5.1 Strengths

This study has a few key strengths that were not present in existing research conducted on complementary feeding. The prospective design of IHDS II with a diverse and large sample size is one of the significant strengths of this study. None of the previous studies have a large sample size of 11,218 women. As the sample size is considerably larger than prior research, the results of this study are more generalizable. Moreover, the IHDS II collected intensive information on women's demographic

characteristics which helped to determine the factors predicting delayed complementary feeding

5.2 Limitations

There are several limitations in this study. There was the possibility of recall bias if the women could not remember detailed information of the child who was born 4 to 5 years prior the survey. Moreover, as the survey was a self-reported face-to-face interview, participants were prone to bias and non-differential misclassification because participants may have reported the socially desirable answer. Lastly, the data were missing a significant number of observations (65,290 women) and information on complementary feeding (586 women) which affected the sample size. As the study is a cross-sectional study, it is difficult to predict the causal inferences. Additionally, this study only gave us a one-time snapshot on the factors related to delayed complementary feeding. However, the situation may provide different results if the study conducted in another period.

CHAPTER 6 CONCLUSION

The appropriate timing of complementary feeding is an important public health issue, especially in developing countries. This study helped to identify some factors that are significantly associated with delayed complementary feeding. A better understanding of influencing factors to delayed complementary feeding can help to develop and plan intervention program to improve the quality of life of infants. However, more research is needed to identify more factors behind delayed complementary feeding. The more influencing factors are identified, the more intervention can be planned to increase the rate of appropriate timing of complementary feeding. To improve this serious public health issue, more intervention program needs to be implemented to educate women about the benefits of initiation of complementary feeding within the recommended age. Promoting appropriate timing of complementary feeding can help improve the physical and mental growth of children.

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APPENDIX A: FIGURE

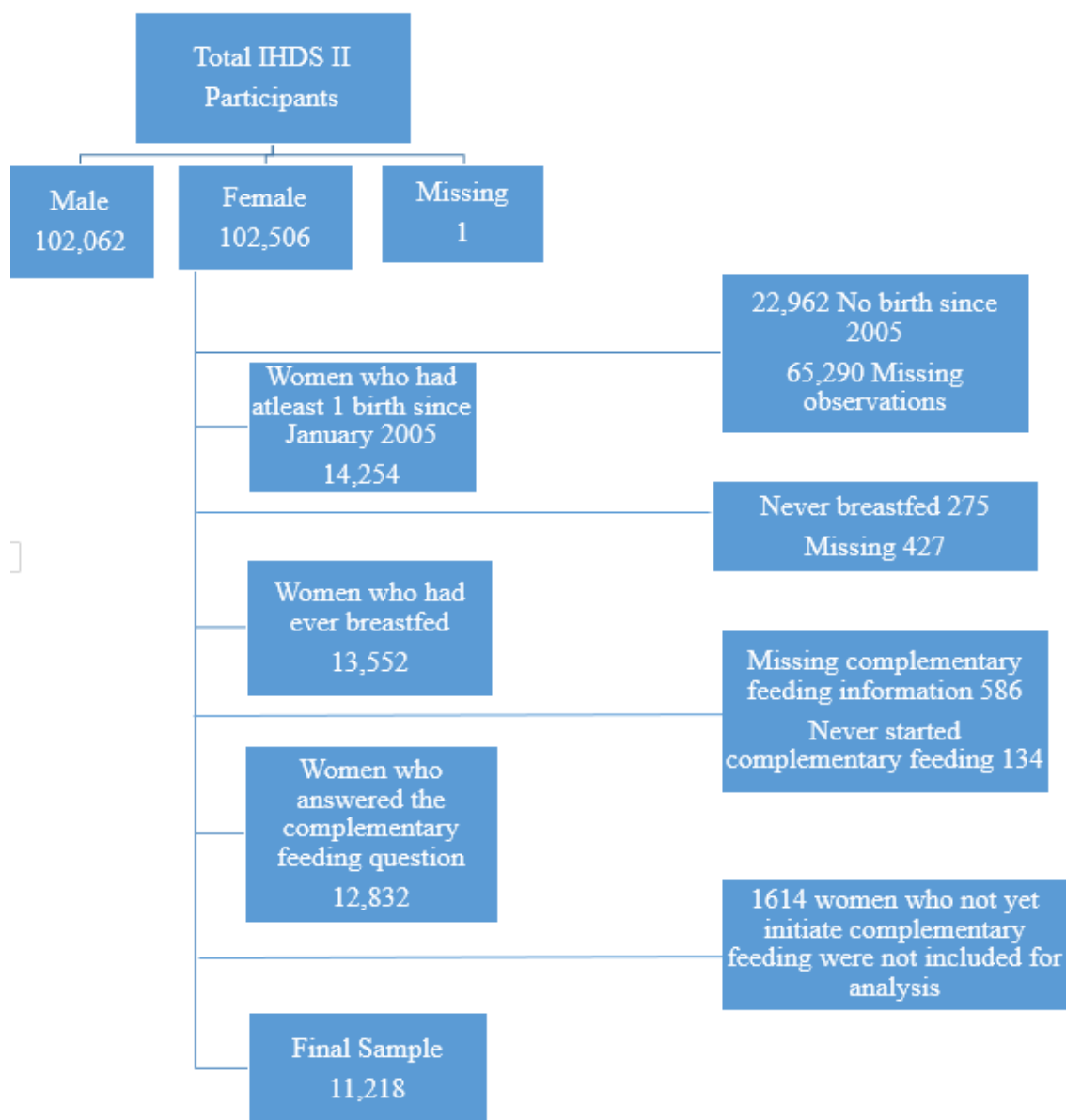


FIGURE 1: The steps used to determine the analytic sample, Indian Human Development Survey II (2011-2012).

APPENDIX B: TABLES

TABLE 1: Characteristics of participants and odds of delayed initiation of complementary feeding.

Characteristics	n (%)	OR	95% CI
Delayed complementary feeding >7 months			
Yes	6825 (60.8)	-----	-----
No	4393 (39.2)	-----	-----
Gender of the baby			
Male	5823(51.9)	0.99	[0.89- 1.11]
Female	5395 (48.1)	Reference	Reference
Annual household income in Rupees			
<41100	2805 (25)	1.32	[1.14-1.53]
41101 to 74975	2804 (25)	1.15	[0.99-1.34]
74976 to 146000	2811 (25.1)	1.17	[1.01-1.35]
146001 and more	2798 (24.9)	Reference	Reference
Mother's age			
17-26	4065 (36.2)	0.93	[0.82-1.07]
27-30	3478 (31.0)	Reference	Reference
31 and more	3675 (32.8)	1.22	[1.06-1.39]
Mother's years of education			
None	3428 (30.6)	1.37	[1.17-1.61]
1-5	1670 (14.9)	1.0	[0.83-1.19]
6-11	4248 (37.9)	1.01	[0.87-1.17]
12 or more	1870 (16.7)	Reference	Reference
Place of delivery			
Public clinic	4616 (41.4)	Reference	Reference
Private clinic	3092 (27.7)	0.84	[0.74-0.95]
Home	3390 (30.4)	1.15	[1.01-1.31]
Others	50 (0.5)	0.84	[0.39-1.78]
Mother-in-law lives in household			
Same household	5496(61.4)	Reference	Reference
Another household	3462 (38.6)	1.03	[0.91-1.16]
Missing n=2260			
Residence			
Urban	3494 (31.2)	Reference	Reference
Rural	7724 (68.9)	1.19	[1.07-1.32]
Breastfeeding duration			
0-6 months	2601 (34.6)	1.02	[0.83-1.25]

Table 1 continued			
7-12 months	1598 (21.3)	1.70	[1.37-2.12]
13-24 months	2323 (30.9)	1.43	[1.16-1.75]
More than 24	998 (13.3)	Reference	Reference
Missing n=3698			
Number of children			
1	2927 (26.1)	0.89	[0.78-1.00]
2-3	6260 (55.8)	Reference	Reference
4 or more	2031 (18.1)	1.24	[1.07-1.44]
Mother ever worked			
Yes	6896 (61.5)	Reference	Reference
No	4309 (38.5)	1.15	[1.03-1.28]
Size of the child			
Large	974 (8.8)	1.10	[0.92-1.33]
Average	8464 (76.3)	Reference	Reference
Small	1654 (14.2)	1.16	[0.99-1.35]
Religion			
Hindu	8923 (79.5)	Reference	Reference
Muslim	1697(15.1)	1.02	[0.89-1.18]
Others	598 (5.3)	0.88	[0.70-1.12]

TABLE 2: Adjusted model examining the relationship between characteristics and delayed initiation of complementary feeding.

Characteristics	OR	95% CI
Annual household income in Rupees		
<41100	1.28	[1.08-1.52]
41101 to 74975	1.11	[0.95-1.31]
74976 to 146000	1.18	[1.01-1.37]
146001 and more	Reference	Reference
Mother's age		
17-26	1.04	[0.91- 1.19]
27-30	Reference	Reference
31 and more	1.18	[1.02 -1.37]
Mother's years of education		
None	1.28	[1.06 - 1.55]
1-5	0.93	[0.76 - 1.14]
6-11	0.95	[0.81 -1.11]
12 or more	Reference	Reference
Breastfeeding duration		
0-6 months	1.02	[0.83-1.26]
7-12 months	1.81	[1.45-2.26]
13-24 months	1.50	[1.22-1.85]
More than 24	Reference	Reference
Missing n=3698		
Residence		
Urban	Reference	Reference
Rural	1.18	[1.05-1.32]
Mother ever worked		
Yes	Reference	Reference
No	1.31	[1.16-1.46]
Number of children		
1	0.96	[0.84 -1.09]
2-3	Reference	Reference
4 or more	1.06	[0.89 -1.26]
Place of delivery		
Public clinic	Reference	Reference
Private clinic	0.86	[0.75 - 0.98]
Home	1.05	[0.91 - 1.21]
Others	0.78	[0.37 -1.67]

APPENDIX C: IRB EXEMPTION



Bably, Morium <mbably@uncc.edu>

IRB Notice - 17-0026

1 message

IRB <uncc-irb@uncc.edu>

Mon, Feb 6, 2017 at 9:22 AM

To: mbably@uncc.edu

Cc: uncc-irbis@uncc.edu, skulkar4@uncc.edu, sladitka@uncc.edu, efracine@uncc.edu

To: Morium Bably
Deans Office College of Health and Human Services

From: Office of Research Compliance

Date: 2/06/2017

RE: Determination that Research or Research-Like Activity does not require IRB Approval

Study #: 17-0026

Study Title: Factors associated with delayed complementary feeding in India.

This submission was reviewed by the Office of Research Compliance, which has determined that this submission does not constitute human subjects research as defined under federal regulations [45 CFR 46.102 (d or f) and 21 CFR 56.102(c)(e)(l)] and does not require IRB approval.

Study Description:

This study is a secondary analysis of the Indian Human Development Survey and aims to investigate the factors associated with delayed complementary feeding practices in India. Childhood malnutrition is a significant public health problem, especially in the developing countries like India and in India, a significant number of children suffers from malnutrition and various infectious diseases due to delayed initiation of complementary feeding. Studying the factors associated with delayed complementary feeding can guide the government and non-profit organizations to design interventions to raise awareness about the appropriate timing of complementary feeding which will help to eliminate childhood malnutrition in India.

Please be aware that approval may still be required from other relevant authorities or "gatekeepers" (e.g., school principals, facility directors, custodians of records), even though IRB approval is not required.

If your study protocol changes in such a way that this determination will no longer apply, you should contact the above IRB before making the changes.

CC:

Shanti Kulkarni, School of Social Work
Sarah Laditka, Public Health Sciences
Elizabeth Racine, Public Health Sciences