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**Infant and young children's nutritional health  
and feeding practices in relation to flooding  
in Bangladesh**

By

Sophie Goudet

A Doctoral Thesis

Submitted in partial fulfilment of the  
requirements for the award of

Doctor of Philosophy of Loughborough University

31<sup>st</sup> July 2010

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## Abstract

Bangladesh is one of the poorest developing countries in the world where infant and young children (IYC) suffer from extremely high levels of malnutrition resulting in high morbidity and mortality rates. IYC are defined here as birth to 3 years old. Due to the double burden of climate variability and urbanisation, longer and more severe floods affect people living in urban slums, with IYC being highly vulnerable. Insufficient research exists into understanding the mechanisms leading to poor nutritional child health related to flooding in urban slums. Maternal nutritional status associated with infant and child health has been established previously, but rarely in the aftermath of a flood.

This study explores, 1) whether maternal nutritional status measured soon after a flood can predict the current nutritional status and the risk for future deterioration of nutritional status of their children, 2) the impact of flooding on IYC feeding practices during flooding compared to non-flooding and the coping strategies developed by caretakers in urban slums, 3) the perceptions of root causes of malnutrition including flooding for IYC living in urban slums and 4) develops a pilot study for an intervention to tackle malnutrition in IYC living in urban slums.

The research uses 1) quantitative data ( $n=143$ , secondary analysis of data collected after the 1998 flood in Bangladesh) to answer the first research question, and 2) a mixed method approach of qualitative data (participant observation  $n=24$ , semi-structured interviews  $n=23$  (18 mothers, 5 community health workers), and focus group discussions  $n=10$ ) and quantitative data (household questionnaire  $n=23$  and anthropometric measurements  $n=55$  for IYC and  $n=23$  for mothers and community health workers) collected in slums in Dhaka to answer the second and third research questions. A new technique is used to answer question three. This technique is based on existing methods for the building of a causal model combined with a pile sorting of photographs to understand the root causes and processes leading to malnutrition. The participants of the mixed method were mothers, pregnant women and Bangladesh Rural Advancement Committee (BRAC) community health workers living and working in the slums.

The key findings are: 1) maternal nutritional status measured soon after a flood can predict the current nutritional status and the risk for future deterioration of nutritional status of their children, 2) feeding practices for IYC deteriorate during flooding in Dhaka slums, 3) the coping strategies of IYC caretakers are limited and

their resilience capacity to floods is low, 4) there is a good perception of the root causes of malnutrition by participants living in Dhaka slums but feeding practices are not meeting the WHO guidelines due to barriers, limitations and poor knowledge, and 5) there is a need for a pilot project to test the feasibility of an intervention aiming at improving IYC nutritional health and feeding practices.

This research deepens the understanding of coping strategies for feeding practices and perceived roots of malnutrition for IYC living in urban slums exposed to flooding. It brings evidence of the interactions between coping strategies and nutritional health in relation to flooding. It also casts new anthropological light onto the series of existing studies and previous research essentially focused on the flood event itself. As a result, the research leads to recommendations for risk reduction strategies and nutrition promotion for flood exposed populations with infants and young children.

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- Goudet, S., Griffiths, P. L., Bogin, B., Selim, N., (2010). 'Infant and young children in Dhaka slums in normal time versus flooding time: what are the coping strategies (Bangladesh)'. *Maternal Child and Nutrition Journal*. *In press*.
- Goudet, S., Griffiths, P. L., Bogin, B., (2009). 'Mother's BMI as a predictor of children nutritional status in the post emergency of a flood (Bangladesh)'. *Disasters: The Journal of Disaster Studies, Policy and Management*. *In press*
- Goudet, S., Faiz, S., Bogin, B., Griffiths, P. L., (2010). 'How do pregnant women and community health workers perceive the roots of malnutrition in the slums (Bangladesh)?' submitted for consideration for publication to *American Journal of Public Health* and received comments from reviewers on June 28<sup>th</sup> 2010.

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### **Conferences contributions**

- A paper on 'Mother's BMI as a predictor of children nutritional status in the post emergency phase of a flood' was presented at the 2008 BSPS conference.
- A poster entitled "Living with a constant fear of flooding: what are the coping strategies for young children's feeding practices and their impacts?" was presented at the 2007 SSHB meeting and at the 2007 BSPS Annual conference.



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## **Abbreviations, acronyms and glossary (Chapter 1)**

BMI	Body Mass Index
BRAC	Bangladesh Rural Advancement Committee
GDI	Gender-related Development Index
GDP	Gross Domestic Product
GEM	Gender Empowerment Measure
GNP	Gross National Product
HDI	Human Development Index
HPI	Human Poverty Index
MFI	Micro-finance institution
NGO	Non-Governmental Organization
IYC	Infant and Young Children
TFR	Total Fertility Rate
UNDP	United Nations Development Programme
UNICEF	United Nations Children Fund
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization

# **Chapter 1 – Introduction**



## **1.1 Introduction**

Bangladesh is one of the poorest developing countries in the world where infant and young children (IYC) suffer from extremely high levels of malnutrition resulting in high morbidity and mortality rates (World Bank 2010, UNDP 2009, Deolalikar 2005, Bloem, Moench-Pfanner, and Panagides 2003, NIPORT and MITRA 2007). IYC are defined here as birth to 3 years old. The terminology 'infant and young children' is defined in the literature under the 'early years' of life, from birth to 3 years (Bricker 1994). Deficits or delays in physical growth and undernutrition during these early years are likely to have long-lasting effects on later health, including reduced cognitive development and productivity in adult life (Cole 2003, Bogin 2001, Stoch and Smythe 1996, ACC 1999, Victora et al. 2008, Osmani and Sen 2003). Due to the double burden of climate variability and urbanisation, longer and more severe floods are affecting people living in Bangladeshi urban slums, with IYC being highly vulnerable. Insufficient research exists into understanding the mechanisms leading to poor nutritional child health related to flooding in urban slums. Previous research has established that maternal nutritional status is one of the determinants of infant and child health. Rarely, however, has this relationship been studied in the aftermath of a flood. The first aim of this dissertation is to assess whether maternal nutritional status measured soon after a flood can predict the current nutritional status and the risk for future deterioration of nutritional status of their children in Bangladesh. The second aim is to explore the impact of flooding on IYC feeding practices and the coping strategies developed in Dhaka slums. The third aim is to investigate the perceptions of root causes of malnutrition for IYC living in Dhaka slums exposed to flooding. The final aim is to develop a pilot study for an intervention to tackle malnutrition in IYC living in urban slums.

## **1.2 Structure of the dissertation**

The dissertation consists of seven chapters including this one which introduces the Bangladeshi context in terms of geography, history, culture, economy, poverty, population, health and gender as well as the situation in Dhaka slums, Bangladesh. Chapter Two presents a general literature review relevant to the specific aims of this research and the scientific evidence under which the hypotheses were built. It covers flooding, infant and young children nutritional health in Bangladesh and the

health outcomes of flooding. The next three chapters (Chapters Three, Four and Five), present a literature review, research design, results, and discussion specific to each of the aims addressed. Chapter Three tackles the first research aim and presents evidence based on the analysis of secondary quantitative data to assess whether maternal nutritional status can be used as a predictor of infant and child health in the aftermath of a flood. Chapter Four addresses the second aim with a mixed-method approach and describes the impact of flooding on IYC feeding practices and the coping strategies developed by caregivers. Chapter Five, using a similar approach shows how pregnant women and community health workers perceive the root causes of malnutrition of IYC living in the slums. Chapter Six provides programmatic recommendations for a nutritional intervention drawn from the three studies. Finally, Chapter 7 presents the key findings and an overall discussion. The chapter also discusses the strengths and limitations of the research and brings forward the main conclusions from the combined findings.

### **1.3 The Bangladesh context**

#### **1.3.1 History, geography and culture**

Bangladesh was a part of India during British rule of the region from 1858 and 1947. In 1947 the independent states of Pakistan and India were created. The present territory of Bangladesh was part of Pakistan and was known as East Pakistan. Bangladesh became a sovereign state in 1971 after fighting a nine-month war of liberation with Pakistan. A military regime ruled Bangladesh until 1990, when a very unstable democracy began to govern (Gilmartin 1998, Kumar 1997). Bangladesh, the country (*Desh*) of *bangla* speaking people, is proud of its language, which is also spoken in the Indian Bengal state. Bangladeshis fought for preservation of their language during Pakistan rule and started a worldwide movement for the recognition of mother languages called the Language Movement. As a tribute, UNESCO in 2000 declared 21 February International Mother Language Day for the whole world to celebrate the ethno-linguistic rights of people around the world (Imam 2005).



**Figure 1-1: Map of Bangladesh (source: Wellesley 2010)**

Bangladesh is located in the north-eastern part of South Asia and covers an area of 147,570 square kilometres bordered by India, Burma and a southern coastline on the Bay of Bengal (Figure 1-1). Rivers are the most important geographical characteristic in Bangladesh. Three large rivers, Padma (called Ganges in India), Jamuna (called Brahmaputra in India) and Meghna create a river delta that comprises nearly 90% of the country (FAO 1999). Bangladesh is a subtropical country with three main seasons, 1) the hot season from March to May, 2) the monsoon season from June to September, and 3) a cool season from October to February.

Bangladesh is a country characterised by its rich cultural heritage in art, music, theatre, poetry and literature from the blend of religions and cultural traditions. Elements of Islam (89% Muslim), Hinduism (10% Hindu), Christianity and Buddhism (1% Christians and Buddhists) are present in the daily lives of Bangladeshis (BBS 2010a). The country, traditionally peaceful and tolerant towards other religions, has seen a recent rise in Islamic extremism.

### **1.3.2 Economic situation**

Since its independence, Bangladesh has faced political instability, natural disasters and famine and has remained among the poorest countries in the world. Corruption, poor infrastructure, insufficient power supplies and slow implementation of economic reforms have been limiting factors for economic growth (CIA 2010).

The long term corruption has contributed to poor governance and limited development of the country by diverting resources to pockets of dishonest officials (Transparency International 2003). It also deprived the population access to good public services with key institutions being downgraded (Transparency International 2003). However, in the past decade, Bangladesh has recorded considerable success in economic and social sectors (General Economics Division Planning Commission Government of the People's Republic of Bangladesh, 2009.). The Human Development Index (HDI)<sup>1</sup> of Bangladesh has shown significant improvement rising from 0.309 in 1992 to 0.543 in 2007 (Table 1-1) (UNDP 2009). Despite this progress, with a current GDP per capita of \$US 497 and a HDI rank of 146<sup>th</sup> out of 182 countries, Bangladesh is still one of the poorest countries in the world (World Bank 2010, UNDP 2009). At the end of 2008 the newly elected governing party, the Awami League, came to power. Bangladesh faces today the challenge of overcoming its structural constraints (corruption, poor infrastructure, insufficient power supplies and poor services by key institutions) of economic growth.

Large-scale industry, construction, transportation, textile and garment manufacture have supported this economic growth (FAO 1999). Major exports include garments, leather goods, jute products, frozen foods and tea (BBS 2010a). Merchandise trade represents the largest share in economic growth with 49.3% of the Gross Domestic Product (GDP) followed by agriculture with 19% (World Bank 2010, NIPORT and MITRA 2007, BBS 2010a). Tea, rice, wheat, jute, sugarcane, tobacco, oilseeds, and potatoes are the principal crops and agriculture contributes to 48% of the total labour force (BBS 2010a). The 2008-09 global financial crisis and recession did not hamper Bangladesh's growth (CIA 2010).

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<sup>1</sup> 'The HDI provides a composite measure of three dimensions of human development: living a long and healthy life (measured by life expectancy), being educated (measured by adult literacy and gross enrolment in education) and having a decent standard of living (measured by purchasing power parity, PPP, income). The index is not in any sense a comprehensive measure of human development. It does not, for example, include important indicators such as gender or income inequality nor more difficult to measure concepts like respect for human rights and political freedoms. What it does provide is a broadened prism for viewing human progress and the complex relationship between income and well-being' (UNDP 2009).

**Table 1-1: Bangladesh data sheet selected indicators (source: Human development report 2009, UNICEF State of the World's Children 2009, World Bank 2010 and WHO 2007)**

<b>Human development index 2007 and its components</b>	
Human development index value, 2007	0.543
HDI rank, 2007 (out of 182 countries)	146
Life expectancy at birth (years), 2009	64
Adult literacy rate (% aged 15 and above), 2007	53.5
GDP per capita (US\$), 2008	497
<b>Human and income poverty</b>	
Human poverty index (HPI-1) rank, 2007 (out of 135 countries)	112
Probability at birth of not surviving to age 40 (% of cohort), 2005-2010	11.6
Population not using an improved water source (%), 2006	20
Children underweight for age (% under age 5), 2000-2006	48
Population living below \$1.25 a day (%), 2000-2007	49.6
Population living below \$2 a day (%), 2000-2007	81.3
<b>Gender-related development index and its components</b>	
GDI rank, 2007 (out of 155 countries)	123
GDI value, 2007	0.536
Female life expectancy at birth (years), 2007	66.7
Male life expectancy at birth (years), 2007	64.7
Female adult literacy rate (% aged 15 and above), 1997-2007	48
Male adult literacy rate (% aged 15 and above), 1997-2007	58.7
<b>Gender empowerment measure</b>	
Gender empowerment measure (GEM) rank, 2007 (out of 109 countries)	108
<b>Demographic trends</b>	
Population density per sq km	1063
Total population (millions), 1990	115.6
Total population (millions), 2007	157.8
Total population (millions), 2020	185.6
Total urban population (millions), 2007	41.0
Annual rate of natural increase of the population (%), 2005-2010	1.5
Total fertility rate (births per woman), 2005-2010	2.4
<b>Economy and inequality</b>	
Total GDP (US\$ billions), 2007	68.4
Annual growth rate of GDP per capita (%), 1990-2007	3.1
GDP per capita (PPP US\$), year of highest value, 1980-2007	1,241
GDP per capita (PPP US\$), year of highest value	2007
<b>Health and education</b>	
Percentage of adults with low educational attainment levels (% aged 25 and above)	82.9
Percentage of adults with medium educational attainment levels (% aged 25 and above)	12.9
Percentage of adults with high educational attainment levels (% aged 25 and above)	4.2
Under 5 mortality rate (per 1,000 live births), 2009	61
Rank under 5 mortality rate (rank 1: worst), 2009	58
Under 5 mortality rate in the lowest quintile of wealth (per 1,000 live births)	121
Under 5 mortality rate in the highest quintile of wealth (per 1,000 live births)	72

### 1.3.3 Population and health

Bangladesh is a country of 160 million people and is the most densely populated country in the world with a population density of more than 1063 persons per square kilometre, excluding city-states such as Hong Kong and Singapore (UNDP 2009). Nearly a third of the population lives in urban settlements with 30% of the urban residents being slum-dwellers (UNDP 2009). Bangladesh has undergone an extremely rapid demographic transition with a sharp decrease in fertility rate and a

high increase in contraceptive use among women of reproductive age (Rahman et al 2001, MITRA et al. 1997, Bairagi and Datta 2001). Despite a reduction in fertility rate to a Total Fertility Rate (TFR) of 2.4 births per woman and better family planning through social and health interventions, Bangladesh is still likely to face decades of continued population growth and to continue to be constituted by a young population (World Bank 2010, WHO 2007, BBS 2010a). Thirty two percent of the population is aged between 0 to 14 years old (World Bank 2010). The United Nations estimates that the population could rise to 243 million by 2050 (UNITED NATIONS 1999).

Even though Bangladesh has improved the health of its population over the last few decades, health indicators remain poor. Twelve percent of the population faces the risk of not reaching the age of 40 and the life expectancy is short; 67 for women and 65 for men (Table 1-1) (UNDP 2009). Thirty percent of women are undernourished or thin (Body Mass Index (BMI) less than 18.5) with women aged 15-19 and aged 45-49 being more likely to be thin or undernourished compared to women in other age cohorts (35% and 34%, respectively) (NIPORT and MITRA 2007). Extremely limited research shows overall that the same nutritional situation exists for men with 30% being undernourished (Sudo et al. 2004). Urban women are less likely to be undernourished than rural women (20% and 33%, respectively) probably due to their empowerment through income generation (NIPORT and MITRA 2007). However women living in the slums suffer from higher levels of undernutrition (54%) compared to women living in rural areas and the rest of the country (Pryer 2003).

The malnutrition prevalences for IYC are among the highest in the world (Deolalikar, 2005; Bloem, Moench-Pfanner, and Panagides, 2003; NIPORT and MITRA, 2007). Forty three percent of the under five year old children are stunted (% of children with Height-for-Age <-2SD), 41% are underweight (% of children with Weight-for-Age <-2SD) and 17% are wasted (% of children with Weight-for-Height <-2SD) (UNDP 2009, WHO 2007, NIPORT and MITRA 2007). Infant (under 1 year old) and under-five child mortality are high with respectively 45 and 61 deaths per 1000 live births (BBS 2010b, UNDP 2009). The under five mortality rate ranks Bangladesh in the top 60 countries out of 189 with the highest score (UNICEF 2009). Seventy six per cent of births are not delivered by skilled health personnel which decreases the chances for prevention, detection and management of birth complications (BBS 2010b). Twenty percent of the population does not use an

improved water source and 64% does not have access to improved sanitation<sup>2</sup> entailing the risks of transmission of diarrhoeal diseases (WHO 2007). Health indicators are even worse for the urban poor than the rural poor (BBS 2010b).

While much of the Bangladeshi population is critically undernourished, the country is undergoing a nutritional transition and is also experiencing an increase in overweight people. The prevalence of underweight women decreased from 2000 to 2004 (prevalence of chronic energy deficiency CED for urban poor: 33.8–29.3%; rural: 42.6–36.6%). During the same period, the prevalence of overweight women increased (urban poor: 6.8–9.1%; rural: 2.8–5.5%) (Shafique et al. 2007). The risk of being overweight was higher among women who were older and of higher socioeconomic status (Shafique et al. 2007). Bangladesh is also facing the consequences of industrialization and is classified in the early stage of epidemiologic transition; the poor suffer from a heavy communicable disease burden while the rich are experiencing an increase in noncommunicable diseases (Chen et al. 2006). The prevalence of hypertension has increased from more than 3% in 1976 to 9% in 1999 (Zaman et al. 1999). As for other countries in South Asia, Bangladesh health systems have been mainly designed to address communicable diseases and now face the challenge to prevent and control the development of chronic diseases (Goyal and Yusuf 2006).

#### **1.3.4 Poverty situation**

Despite a decrease of the poverty incidence in both rural and urban areas with a stronger decrease in urban areas, half of the population still live under the poverty line and 82% live with less than USD\$2 a day (UNDP 2009, General Economics Division Planning Commission Government of the People's Republic of Bangladesh 2009). Due to population growth, the absolute number of poor persons has increased over time. Although all indicators of human poverty (life expectancy at birth, infant mortality rate, population having access to drinking water, and adult literacy rate) have improved, the absolute values of many of these indicators are still poor and rank Bangladesh among the countries with the worst absolute values (UNDP 2009, General Economics Division Planning Commission Government of the People's Republic of Bangladesh 2009, FAO 1999). The Human Poverty Index (HPI-1)<sup>3</sup> ranks Bangladesh 112 out of 135 countries (Table 1-1). Income inequity has

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<sup>2</sup> Using an improved water source and having access to improved sanitation are now part of the health indicators to assess the access to health of a population (WHO 2007).

<sup>3</sup> The Human Poverty Index (HPI-1) focuses on the proportion of people below certain threshold levels in each of the dimensions of the human development index - living a long and healthy life, having access to

increased nationally, but is significantly more in urban than rural areas (General Economics Division Planning Commission Government of the People's Republic of Bangladesh 2009, UNITED NATIONS 1999). The upper 10% of the population receives 27% of the national income whereas the lower 10% of the population receives only 4% of the national income (UNDP 2009). However when the income distribution is assessed with the Gini<sup>4</sup> index, Bangladesh has a value of 33.2 (in 2005), which is relatively good, ranking 40 of 134 countries (CIA 2010).

Five main determinants were identified which induce and perpetuate poverty in Bangladesh: 1) natural disasters (floods, cyclone and river bank erosion), 2) illness-related expenditure, 3) insecurity (theft, policy harassment, etc...), 4) dowry (expenses for a daughter's marriage), and 5) death of the main income earner in a household (UNITED NATIONS 1999). The poor frequently have unstable, inadequate employment, and low levels of formal education. They have little or no savings and frequently are unable to develop coping strategies to face crises (FAO 1999). Women are significantly more vulnerable to poverty than men, resulting in a total number of poor women higher than that of poor men (UNITED NATIONS 1999). Although wage rates are increasing for both women and men, female wage rates remain significantly lower than male rates (UNITED NATIONS 1999). The elderly people in Bangladesh are also becoming critically vulnerable to extreme poverty<sup>5</sup> because of the changing social conditions in a country where traditionally sons look after their parents by hosting them in their house or providing financial support (UNITED NATIONS 1999).

Poverty alleviation in Bangladesh has been tackled through Micro Finance Institutions (MFIs) and an extensive network of national and international Non-Governmental Organization (NGOs). Bangladesh has the most important transactions in currency of MFIs in the world and has used it successfully to reach the poor people, especially women and their children to reduce poverty and improve welfare (Mahjabeen 2008, Khandker 2005, Hashemi et al. 1996; Cheston and Kuhn 2002, Wydick 1999, Afrane 2003). At first, microfinance programmes

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education, and a decent standard of living. By looking beyond income deprivation, the HPI-1 represents a multi-dimensional alternative to the \$1.25 a day (PPP US\$) poverty measure' (UNDP 2009).

<sup>4</sup> 'GINI index measures the degree of inequality in the distribution of family income in a country' (CIA 2010).

<sup>5</sup> 'Extreme poverty is taken as a situation where people persist in deep poverty that is at the bottom of the poverty ladder. On the other hand, chronic poverty is defined as a situation in which people live in poverty for a prolonged period of time, often spanning generations. These people have low consumption, and suffer from hunger and under-nutrition, lack of access to basic health services, illiteracy, and other deprivations' (General Economics Division Planning Commission Government of the People's Republic of Bangladesh, 2009 pp10:15 chapter 2).



were designed to reach the poor who are left out of the formal financial system to raise their income and consumption with small scale credit transactions and savings. However with time, MFIs have also developed to provide information related to education, health, and hygiene and skill-based training to improve productivity and organizational needs (Mahjabeen 2008, Khandker 2005). The 2006 Nobel Peace Prize was awarded to Muhammad Yunus (and Grameen Bank) for pioneering the idea of microcredit and setting up the Grameen Bank, a microfinance institution (MFI) in Bangladesh (Mahjabeen 2008). National and international NGOs supported by international donors have been implementing interventions throughout the country towards poverty alleviation. Among them, Building Resources Across Communities (BRAC) employing 100,000 people works to combat poverty in rural areas and in urban areas (BRAC 2010). BRAC is the largest NGO in Bangladesh and serves a population of 110 million (BRAC 2010). BRAC is also the first NGO from a developing country working in other developing countries (Afghanistan, Pakistan, Sri Lanka, Sudan, Sierra Leone, etc...) and claims to be the largest INGO in the world in terms of budget (BRAC 2010).

### **1.3.5 Gender**

A combination of factors, including poverty and cultural values for a strong son preference in family formation, creates a situation of considerable inequality between the sexes (Rhaman and DaVanzo 1993, General Economics Division Planning Commission Government of the People's Republic of Bangladesh 2009). The gender-related development index (GDI)<sup>6</sup> value of 98.7% ranks Bangladesh as one of the worst countries for gender equity; out of the 155 countries, 100 countries have a better ratio than Bangladesh (Table 1-1). The gender empowerment measure (GEM)<sup>7</sup> reflective of inequality in opportunities in economy and politics, ranks Bangladesh 108<sup>th</sup> out of 109 countries, (Table 1-1) representative of the lack of an active role of women in economic and political life. Life expectancy in Bangladesh along with only two other countries in the world (Pakistan and India), was until 1967 longer for men than women reflective of gender inequality, and extremely difficult living conditions throughout life (World

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<sup>6</sup> 'GDI introduced in Human Development Report 1995, measures achievements in the same dimensions using the same indicators as the HDI but captures inequalities in achievement between women and men. It is simply the HDI adjusted downward for gender inequality. The greater the gender disparity in basic human development, the lower is a country's GDI relative to its HDI' (UNDP 2009).

<sup>7</sup> 'GEM reveals whether women take an active part in economic and political life. It tracks the share of seats in parliament held by women; of female legislators, senior officials and managers; and of female professional and technical workers- and the gender disparity in earned income, reflecting economic independence' (UNDP 2009).

Bank 2010). The recent increase in women's life expectancy relative to men provides a glimpse of hope towards improved gender equality and better access to health care for women.

Despite improvement in life expectancy, female children and women are still discriminated against in the provision of food and in health care-seeking behaviours (Chen et al. 1981, Hossain and Glass 1988, Sudo et al. 2004). Women in Bangladesh are likely to be undernourished, less educated, frequently professionally exploited, and suffer from domestic violence, and from work related violence (NIPORT and MITRA 2007, UNDP 2009, BBS 2010a). The percentage of girls married as teenagers classifies Bangladesh as one of the worst countries in the world for early arranged and forced marriage practices (NIPORT and MITRA 2007). The 'hard-core'<sup>8</sup> poor are largely women with 30% of divorced/widowed women living below the lower poverty line (General Economics Division Planning Commission Government of the People's Republic of Bangladesh 2009). However microfinance has been successful in reducing poverty for women by empowering them in terms of decision making, asset ownership and political and legal awareness (Hashemi et al. 1996; Cheston and Kuhn 2002). Children of women benefiting from microfinance are in better health and more educated setting them on a trajectory for a path out of poverty (Wydick 1999, Afrane 2003).

Despite economic growth and progress in health and poverty reduction, Bangladesh remains one of the poorest countries in the world where adults and IYC suffer from high level of poverty, poor health and a high level of malnutrition. Women are the most vulnerable to poverty with gender inequity increasing their burden. Poverty alleviation in Bangladesh has been tackled through NGOs and micro finance institutions which have been successful in empowering women, improving their health and the health and education of their children. Today, Bangladesh faces the challenges of its epidemiologic and nutritional transition resulting in a double burden of malnutrition and both infectious and chronic diseases.

In the next section, the situation in Dhaka slums is presented. It covers the living conditions, the household food insecurity, the nutritional health of adults, school attendance and participation in income generating activities for children living in the Dhaka slums.

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<sup>8</sup> Hard core poor are people earning less than USD\$ 1 a day.

## 1.4 The situation in Dhaka slums, Bangladesh

Urbanisation is one of the most important demographic trends of the past century. The latest UN estimates state that by 2030, 55% of the population in Asia will live in cities (UN HABITAT 2003). Bangladesh (160 million inhabitants) with Afghanistan (22.4 million inhabitants) and Nepal (23.5 million inhabitants) are the three most highly populated least developed countries (LDCs) in the world. In 2001, these three countries along with Bhutan (2 million inhabitants), had an urban population accounting for 23.3% of the total world population, with 86.6% living in slums (UN HABITAT 2003).

Dhaka, the capital of Bangladesh is among the fastest growing mega-cities in the world (UN HABITAT 2003). Every year an estimated 300,000 to 400,000 new migrants, mostly of low socio-economic status, arrive in the city increasing the demand for very inexpensive living infrastructure (Vosika 2004). In 2000, approximately 28% of Dhaka's population were classified as poor, and 12% as extremely poor (World Bank 2007). Poor households tend to have more people, particularly children, be younger, less educated and have lower school attendance than non-poor households (World Bank 2007). There are approximately 5000 slums scattered throughout the city with an estimated 10 million inhabitants (Podymow et al. 2002). The operational definition of slums by UN-HABITAT is an area that to various extents combines the following characteristics: 1) inadequate access to safe water, 2) inadequate access to sanitation and other infrastructure, 3) poor structural quality of housing, 4) overcrowding, 5) and insecure residential status (UN-HABITAT 2003). Prior to this definition, the Centre for Urban Studies (CUS) and the Government of Bangladesh (GOB) defined a slum or '*bostis*' as: '*bostis*' are authorised or unauthorised areas of very high area of density; as well as very high room crowding, and poor housing fabrics. The areas have inadequate water supply, poor sewage and drainage facilities, little paved streets and lanes and irregular clearance of garbage. '*Bostis*' are inhabited by very poor and poor people who are mostly engaged in various types of '*informal activities*' (Islam, Nazem and Mahbub 1996). The differences in the two definitions lie in the recognition by CUS and the GOB that some slums may be on authorised land and that the slum-dwellers are involved in informal activities.

Bangladesh does not have a comprehensive policy for improving living conditions of slum-dwellers (World Bank 2007). Slum settlements are often demolished and slum-dwellers are forced to leave their homes. Even though some strategies by non

governmental organizations (NGOs) exist to ensure better access to water and health, the situation in the slums remains difficult (Rashid 2009). Only 9% of households of the poorest quintile have a sewage line, and 27% obtain water through piped supplies. Most of the slum households have a shared toilet more than 100 meters from the housing area (World Bank 2007). Households living in the slum areas are characterised by poor food security levels which are an underlying cause of malnutrition. In 2006, the Bangladesh Bureau of Statistics (BBS) conducted a study in slum areas in Dhaka, Chittagong, Khulna, and Rajshahi to develop a food security profile of households and to permit a better understanding of the nature of and trends in the food security of these households for The World Food Programme (WFP) (Benson 2006). In Dhaka slums, 24% of households fell below 80% of the recommended calorie consumption level. The results showed that urban slum households consumed relatively diverse diets, having consumed foods from an average of 9.6 food groups in the past week. Meat & poultry, milk & milk products, and sugar are the three food groups that are the least regularly consumed. Sixty two percent of households in the study population were categorized as 'severely food insecure'. It was highlighted that the prevalence was higher than seen in similar studies of food insecure populations, including those in Bangladesh. Larger households were more likely to be found in the lowest calorie consumption sufficiency tertile (calorie consumption was split in 3 equal groups, each representing a tertile). There was a significant relationship between literacy and food security; food secure households living in the urban slums of Bangladesh were more likely to be headed by literate heads (Benson 2006). According to the latest World Health Organisation (WHO) study (2007), the urban poor living in the slums spend the majority of their budget on food (62%). Other major expenditures are rent (14%), and other non-food items (14%) (WHO 2007). Podymow et al. (2002) collected data from 100 households using a food frequency questionnaire in 3 slums of Dhaka, Mohammedpur, Danmondi, and Lalbag (Table 1-2). They found that meals were consumed three times per day in 89% of families and that rice and vegetables were consumed daily. It can be hypothesised that the fact that the survey was conducted during the dry season (before the rainy season) explains such a high level of families eating 3 times days a day. When asked: "Do you feel that your family eats a balanced diet and receives proper nutrition?" 94% responded negatively. Participants were asked if they or their family ever go hungry; 90% responded "sometimes" and 10% said "never."

**Table 1-2: Food frequency questionnaire in % (Podymow et al. 2002)**

<b>Food consumed</b>	<b>Daily</b>	<b>Weekly</b>	<b>Monthly</b>	<b>Special occasions</b>	<b>Never</b>
<b>Rice</b>	99	1	-	-	-
<b>Vegetables</b>	97	3	-	-	-
<b>Fish</b>	17	70	12	1	-
<b>Bread</b>	5	28	18	35	14
<b>Egg</b>	4	45	16	34	1
<b>Milk</b>	3	6	30	36	25
<b>Meat</b>	-	14	51	28	7

Pulses have not been included on the food frequency questionnaire which makes it difficult to analyse as pulses *dal* are an excellent source of protein when eaten with rice. Nevertheless, the authors concluded that slum-dwellers protein intake was low. Hassan and Ahmad (1991) carried out a nutrition survey in 1985-86 covering about 1000 people in 4 selected urban slums of Dhaka. The data were compared to data collected in the rural setting. The results showed an alarming situation for the urban poor, it being worse than the rural poor. Intake of almost all foods and nutrients was lower among the slum dwellers compared to the rural poor. Consumption of cereals, fish, milk and milk products was found to be very low. Eighty eight percent of the slum households did not meet their energy requirement, and 80% of families had protein intakes below estimated requirements while in poor rural households the proportion was only 59%. The severest deficiencies for micronutrients were in respect of riboflavin and vitamin A (Hassan and Ahmad 1991).

Parents' nutritional status, and health are key to the well-being of the household. If the parents are undernourished, they are more likely to be sick, and therefore will not be able to provide resources to the household. Women will also be less likely to take good care of their children which is an underlying cause of malnutrition. Fifty four percent of the women were underweight (body mass index (BMI) less than 18.5) in the slums in Mohammadpur, Dhaka (Pryer 2003). Some of the determinants for better nutritional health of women resulting from Pryer's study of women were, household income, her own savings, household food expenditure per capital above 559 taka per month (approximately 5 GBP), household break in financial situation, female-headed household, her working situation and her capacity of managing the household budget. BMI was worse during the rainy

season; mainly due to the impossibility of income generating activities and the increase in morbidity related to water-borne diseases. In the study, 80% of the households reported at least one adult sick in the past 14 days. In a latter study, Pryer and Roger (2006) showed that there was a difference by age for female subjects, with women aged 30–39 and 40–49 years having the worst BMI. The results demonstrated that the *beri bahd* (embankment) area of residence in Mohammedpur had the worst BMI. Other determinants of malnutrition were a financial deficit situation, being casual wage workers, unskilled and dependent self-employed individuals, not being involved in credit organizations and NGO credit organizations. In addition those households that had a monthly income of 2000–2499 Taka (approximately 19 – 23 GBP), living with no electricity, and using tube well water had the worst BMI. Better nutritional status was associated with a living space floor area of 5 m<sup>2</sup> or more per person. Those two studies showed that adult under nutrition was related to demographic, economic, social and environmental factors (Pryer and Rogers 2006, Pryer, Rogers et al. 2006). The coping strategies developed include taking loans, reducing expenditure, diversifying income sources, working women, use of savings, selling assets, merging households and migration to the rural home (Pryer 2003). When reducing expenditures, households tended to do it by reducing their food expenditure and when the household exhausted their resources, women and children were forced to start working.

Children living in the slums tend to be engaged in income generating activities at an early age and this often results in them not attending school. According to Delap (2001), around 30% children were engaged in income-generating work; and approximately 7% more boys were involved in this type of work than girls. For both boys and girls, workforce participation rates increase dramatically with age. Pryer et al. (2003) confirm these findings; for the children aged 5-9 years, 7% of the boys and 4% of the girls were working to earn money. For the children aged 10-14 years old, almost half of the children were involved in income generating work. The most common professions for boys were shop work, street selling and garment work. For girls, the majority were involved in income-generating work in garments factories. Some girls were also involved in domestic service and brick breaking. Boys and girls worked long hours; for boys 7.7 hours per day, for girls 9 hours per day. Girls were also involved in domestic chores. Girls in the 8–12-year age range completed a wide range of housework tasks, including child care and firewood collection. Girls in the oldest age range not involved in income-generating work completed a large proportion of the households' housework load. They were often given sole responsibility for cooking and food preparation (Delap 2001). For

children aged 16 years and under who were not currently attending school, the first reason for not attending given by mothers was working, followed by 'schooling too expensive' (Pryer et al. 2003).

According to Benson (2006) in Bangladeshi slums, poor, uneducated parents are more likely to raise children who end their schooling too soon and begin work at a young age. The quality and level of health and nutritional care provided to these children is likely to be insufficient. The children living in the slums partially because of an early drop off from school are likely to be both physically and cognitively delayed. When compared to urban non-slum and rural areas, the children (5 to 10 years old) from the slum area were significantly more likely to have serious behavioural problems, and marginally more likely to have post-traumatic stress disorder (Mullick and Goodman 2005). Research in other countries (India and Turkey) has shown that children living in slums suffer from a cognitive development delay. Nair and Radhakrishnan (2004) conducted research on early childhood development in deprived urban settlements in India. Children under 2 years old had a higher development delay compared to the state prevalence (2.5% vs 1.5%). The poor urban preschool children suffered from a delayed skill development and concept development. A study in Turkey has also shown that preschool children from deprived urban settlements lag behind their high socioeconomic status counterparts in performance on The Denver Development Screening Test<sup>9</sup> indicating the influence of socio economic status on children's development (Epir and Yalaz 2008). It is suggested that lack of caring practices because of a heavy workload, at home or for income generation, and non-attendance at school have negative consequences on the cognitive development and the health of children, trapping the children in a vicious circle of poverty (Nair and Radhakrishnan, 2004).

In the capital of Bangladesh, Dhaka slum-dwellers live in appalling conditions and suffer from poor health and high food insecurity level. The IYC living in slums are often involved at an early age in income generating work and do not have the opportunity to attend school trapping them in poverty.

In the next Chapter, a general literature review on flooding, and infant and young children's nutritional health in Bangladesh and the health outcomes of flooding is presented.

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<sup>9</sup> The Denver Developmental Screening Test (DDST) is a test for screening cognitive and behavioral problems in preschool children. It was developed by William K. Frankenburg and first introduced by him and J.B. Dobbs in 1967.

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## **Abbreviations, acronyms and glossary (Chapter 2)**

BDHS	Bangladesh Demographic and Health Study
BRAC	Building Resources Across Communities
HFA	Height-For-Age
HKI	Helen Keller International
ICDDR,B	the International Centre for Diarrhoeal Disease Research, Bangladesh
IFPRI	International Food Policy Research Institute
IYC	Infants and young children
NCHS	National Centre for Health Statistics
NGO	Non governmental organization
UNEP	United Nations Environment Programme
WFA	Weight-For-Age
WFH	Weight-For-Height
WHO	World Health Organisation

## **Chapter 2 – Flooding and nutritional health of IYC in Bangladesh**

This chapter provides a background to the existing literature relevant to the research conducted within this thesis. Section 1.1, first gives a detailed introduction of flooding, its characteristics and its impacts in both rural and urban areas. It then presents urbanisation and global warming as two major risks factors for floods. Later, the vulnerability, perception of risks and coping strategies developed by the affected population are described. The nutritional situation of infants and young children (IYC) in Bangladesh is presented in Section 1.2 to provide baseline data for later discussion in the thesis on malnutrition in the slums and on malnutrition in relation to flooding. Section 1.3 explores the health and nutritional outcomes of flooding and highlights the research and knowledge gaps. While the geographic coverage of the literature review for the sections on flooding, health and nutritional outcomes of flooding was kept wide, references to Bangladesh were made to stress its high exposure to the combined effects of flooding and urbanisation and to set the context for the later research presented in the thesis. Finally, in the last section, the project aims and the study design for this research are presented.

Using key words specific to each chapter (ie malnutrition\_Bangladesh, mother\_food insecurity, malnutrition\_urban slums, etc...), the major electronic bibliographic databases were searched: ScienceDirect, PubMed, Medline, Google Scholar, Grey literature. Refworks web based bibliographic management software was used to save references and the final database contained 948 references. Due to personal environmental considerations, I took the decision to keep only soft copies of the articles read and used for my research instead of having hardcopy version of articles. For this purpose, an excel spreadsheet 'ref review list.xls' was developed to keep track of the literature reviewed. It contained 800 references with the following information; date, author(s), year, title, hyperlink to the electronic document (a comment if the electronic version was not available), key words used, if the reference was registered in Refworks (Y/N), personal qualitative rating (from 0 to 10), and personal comments on the paper. The hyperlink enabled a quick access to all the electronic papers saved on my computer. When the electronic version of the paper was not available, the abstract was copied into the general comment field. Ninety-five percent of the references were in electronic version with the rest being old papers not available electronically or books. The reference list contained fewer references than Refworks because of the references that were registered in Refworks but not used in the dissertation.

The electronic papers were saved on the computer using a folder classification either by authors, by source or by topic. The authors' folder contained the

publications of 27 authors who have had important contribution to this research. The source folder contains two subfolders; 1) flood and 2) general nutrition. Each of these subfolders were constituted of publications by research institutes, NGOs, United Nations agencies, and specific journals that have been predominantly used. The topic folder classified publication by topics (49 in total); ie malnutrition\_Bangladesh, mother\_food insecurity, malnutrition\_urban slums, etc...). These topics corresponded to the key words used for the search in bibliographic databases. For the literature review on flooding and health outcomes, presented in this chapter, a matrix of keywords was developed around the words: flood, floods, flooding, Bangladesh, health, malnutrition, impact, global warming, urbanisation, complementary feeding practices, nutritional health, diarrhoea, coping strategies, mitigation, management, adaptation, infant, young children, children. For example, one of the bibliographic database searches was flood + impact + infant + young children + health. The literature review resulting from the use of these keywords is presented in this chapter.

## **2.1 Flooding**

### **2.1.1 Characteristics of floods**

Handmer et al. (1999) presented a typology of flooding which comprises, overflow of rivers produced by prolonged seasonal rainfall, rainstorms, snowmelt, dam-breaks, accumulation of rainwater in low-lying areas with high water tables, inadequate storm drainage and intrusion of seawater on to land during cyclonic/tidal surges. Heavy rainfall is usually considered as the most common cause. However some factors can influence the magnitude, speed of onset and duration of the flood. The topography, vegetation and soils, river alteration, land use and urbanisation are major influencing factors. According to Zillman (1999), floods in the low-lying floodplains adjacent to major rivers are usually widespread and long in duration. For example, this is the case of the Ganges–Brahmaputra–Megna river system in Bangladesh and approximately 110 million people live on the floodplain of southern Asia’s most flood-prone river system (Oliver-Smith 1996).

A major growing awareness first stated by Maskrey, Bull-Kamanga et al. (2003) and then advocated by Wisner et al. (2004) is that riverine floods are caused not just by natural processes but by human activities. This is mainly because people live in flood-prone areas and alter the natural flow regime of the river. For thousands of years, people have chosen to live in floodplains for agricultural

benefits, and enhanced fishing or trade opportunities. This development has been followed by a commercial and industrial growth (Wisner et al. 2004). Landowners and governments have attempted through construction of flood-protection infrastructure (e.g. dams, levees, embankment, etc) to 'manage' floods, the aim being to keep the flood as a beneficial event rather than a disaster. These engineering solutions have very often failed to protect people during disaster floods and have caused flooding in areas historically never flooded before (Wisner et al. 2004). As a result of this understanding, restoring rivers to their natural state instead of engineering solutions is increasingly advocated as part of a 'living with floods' approach (Wisner et al. 2004, Winchester 2000).

From 1992 to 2001, there were over 2000 reported disasters globally, with flooding being the most frequent natural weather disaster (43%), killing almost 100 000 people and affecting over 1.2 billion people (McMichael et al. 2006). Asia from 1993 to 2002 is the continent which has suffered the highest burden in terms of disasters: more than a million people have been affected versus less than 40,000 people in the other continents combined (EM database 2007). United Nations Environment Programme (UNEP) ranks Bangladesh highest on the list of disaster prone areas in Asia and the Pacific region including floods, earthquake and tsunami-related disasters (UNEP 2004). Bangladesh experiences flash floods, river floods, and tidal floods along with serious river erosion that causes thousands of families to become homeless and landless every year. River floods in rural areas are due mainly to the hydro-geographical setting of the country being formed by the confluence of great river systems of the Ganges, the Brahmaputra and the Meghna. The water of these 3 rivers goes through Bangladesh to reach the Bay of Bengal carrying the excessive rainfalls from outside its territory and inundating an important part of the flat areas close to the rivers (Akter 2004). In Dhaka and other main cities, floods are the result of heavy rainfall during the rainy season and poor drainage. Bangladesh has attracted much attention in the past two decades having experienced a 100-year flood in 1987, this being followed by a more severe flood in 1988. A decade later, the 1998 flood was considered as the worst flood ever recorded and called 'The Flood'. Like the 1988 flood, it covered more than 50% of the country but lasted 2 months longer which prevented any recovery solutions in terms of agriculture (Mirza 2003, del Ninno 2001). Excepting these disaster floods, flooding in Bangladesh is a normal event and every year some part of the country is flooded with more or less severity (Ahmed et al. 1999, Khalil 1990, Karim 1995). Table 2-1 shows the major floods (more than 20% of affected area) since 1954. The other years, the country was affected to a lesser extent.



**Table 2-1: Major Flood Affected Area in Bangladesh (Ahmed et al. 1999)**

<b>Year of flooding</b>	<b>Flood-affected area (sq. km.)</b>	<b>% of total area</b>
<b>1954</b>	36,780	24.8
<b>1955</b>	38,850	26.2
<b>1974</b>	52,520	35.4
<b>1987</b>	57,270	38.6
<b>1988</b>	77,700	52.4
<b>1998</b>	100,000	67.4
<b>2004</b>	30,582	20.6

### 2.1.2 Flood impacts

In many areas of the world, floods for centuries have had positive and beneficial impacts on the sustainability of agriculture in rural areas. When the waters recede, people living in the area can practice flood-retreat agriculture which consists of planting seeds in wet soil. Floods can irrigate and fertilize fields, flush out salts and toxins from soils and watercourses, and recharge reservoirs. Flooding also provides habitat for fish, wildlife and plays a key role in maintaining high levels of plant and animal diversity (Wisner et al. 2004). In Bangladesh, Alam (1989) denounced the myths around the purely negative images of floods, as they are considered beneficial by people living in rural areas. For example, *Aus* and *Amon* types of rice are grown in fields flooded during times of high water. He advocates that the flood is not a hazard but a resource as well. In fact the terminology used by Bangladeshi people to describe floods varies according to the type of flood. *Barsha* or *Shababik bonna* is a normal, beneficial and anticipated flood. *Bonna* or *Ashabakik bonna* is on the contrary considered as a undesirable and damaging hazard (Alam 1989). The dual nature between normal and disaster floods often makes it difficult to address flood mitigation for people living with floods. For instance they may not be in favour of embankments, levees or dams which will prevent the flood-agriculture in normal years.

While recurrent floods can have positive impacts in rural areas, disaster floods have been considered to affect more people and cause higher economic losses than any other natural disasters in both rural and urban settings (Wisner et al. 2004). The damage from 1900– 2007 has been estimated globally to more than \$380 millions (OFDA/CRED.EM-DAT 2007). It is not only major flooding disasters that impact peoples' lives, as serious damage and disruption can also be caused by lower magnitude floods causing food scarcities, disrupting access to services, suspending

business activities, and exacerbating health risks in the home and local environment (Blaikie 1994, Oliver-Smith 1996, Parker 2000). When floods have a long duration, difficulties for people living with floods can be aggravated further. At the household level, injured or sick people will not be able to generate income. This will prolong the difficulties for many months (Wisner et al. 2004). Households may sell land, or other assets under a distress situation worsening the state of poverty. The other common problems faced by flood victims include difficulty finding wood for cooking, difficulties in using latrines and the risk of drowning for young infants and children (Akter 2004).

Floods tend to have more harmful consequences in urban settings than in rural areas. This is mainly due to the vulnerability of people exposed (Main 2001, Few et al. 2004, Wisner et al. 2004). In fact, the consequences of urban floods have gained more attention because of the growing accumulation of human vulnerability to hazards among low-income city dwellers (Sanderson 2000). In Dhaka, slums tend to be in low-lying areas subject to flooding (26.5% fully flooded, 27.4% partly flooded, 46.1% flood-free), with over half of the area being poorly drained (Streatfield and Karar 2008).

The next sections will cover global warming and urbanisation as two risks factors to flooding and will present how Bangladesh is one of the countries at high risk towards flooding because of the combined effect of global warming and urbanisation.

### **2.1.3 Global warming – a risk factor**

Average global temperatures will rise by 2 - 3°C within the next fifty years if the existing trend holds. Global warming will have many severe impacts in terms of flood risk (IPCC 2007, Stern et al. 2006). Melting glaciers will at first increase flood risk and then strongly reduce water supplies in some parts of the planet, subsequently causing drought. Tens to hundreds of millions more people will be flooded each year because of sea level rises. The countries at risk will be low lying coastal ones such as Bangladesh. Several recent studies on South Asian climate suggest some increments have occurred in the surface temperature and rainfall patterns in the region during the past three decades (Mirza and Dixit 1997, Mirza et al. 2001, Pant and Kumar 1997, Warrick and Ahmad 1996). Two hundred million people may become permanently displaced due to rising sea levels, heavier floods, and more intense droughts by the mid-century (Stern et al. 2006).

In monsoonal regions there will be increases in precipitation along with changes in the frequency and intensity of extreme events (Cubasch et al. 2001, Handmer et al. 1999, Parry et al. 2001, Parry et al. 2007). Sea-level rises combined with increased rainfall and extreme wind events along coasts could increase flood magnitude and frequency in many parts of Asia (IPCC 2007, IPCC. 2001b). In Asia, there is a high confidence that the large deltas and low-lying coastal areas would be inundated by sea-level rises (IPCC 2007, IPCC. 2001a). This will result in major loss of agricultural land as a consequence of the rise in sea level and salinization of soil.

The burden of flooding is likely to fall most heavily on the poor and already vulnerable populations (McMichael 1996, McMichael et al. 2006, Woodward et al. 2000, IPCC, 2001b). According to a study conducted by Tearfund (an international Non Governmental Organization, NGO) 'Giving voices to developing countries on climate change', poor communities already are extremely vulnerable to changes in climate and this will be even more exacerbated by future climate variability (Roach 2005). Tearfund advocates that climate change should be considered as a major impediment to achieving some of the Millennium Development Goals (MDGs) for poverty reduction (Roach 2005).

In Asia, Bangladesh stands as one of the most vulnerable countries in relation to global warming risks and global warming is likely to contribute to more frequent flooding in Bangladesh. Bangladesh being already a country with a long history of floods will suffer from more damage as a result of river floods and excessive rainfall (Alam and Rabbani 2007). A rise in sea level of 45cm would displace 5.5 million people and submerge 10.9% of the country (IPCC 2007). As monsoon rainfall intensifies and the Himalayan glaciers melt because of temperature increase, a greater flow of river water encounters rising sea levels (IPCC 2007, IPCC 2001). Massive population movements should then be expected towards urban slums. This unplanned urbanisation will increase the vulnerability of people towards flooding, poverty and health related diseases.

### **2.1.4 Urbanisation – a risk factor**

Urbanisation is one of the most important demographic trends of the century. By 2025, approximately 95% of global urban growth will take place in the developing world and Asia will represent 63% of the world's urban population or 3.3 billion people (UN-Habitat 2009). In Bangladesh, population growth and land scarcity has

encouraged the migration of more than ten million people during the past two decades (IPCC 2001). This migration has been exacerbated by floods, droughts, sea-level rises by damaging crops, houses, and infrastructure. These disasters have affected the livelihoods of landless and poor farmers (Roach 2005). As a result, the poor rush towards the cities considered as a safer ground in search of jobs (Roach 2005).

Most of this urbanisation is unplanned and takes place in mega-slums and very often in flood-prone areas in Bangladesh. Since these settlements are not recognized by most governments, nothing is done in terms of flood mitigation and urban infrastructure. *'Many poor urban dwellers live on the worst quality land on the edges of ravines, on flood-prone embankments, on slopes liable to mudslide or collapse, in densely packed areas where fires easily start, on roundabouts at busy intersections'* (Sanderson 2000:93-94). In Bangladesh, the number of slum settlements has grown rapidly in recent years. The urban poor are estimated at approximately 37% of the urban population in Bangladesh (Islam 2006, GTZ 2010). These slums provide shelter for poor people and are the trade-off to live close to the city. Urbanisation also aggravates flooding by limiting where the floodwater flows because of construction, drainage and roads, pavements. The vulnerability towards floods may increase with a high rate of urbanisation. The consequence is that quite moderate storms could produce high flows in rivers because there are more impermeable surfaces (Parkinson and Mark 2005, ActionAid 2006).

People living in the slums are at risk from flooding due to their location and their inability to develop effective coping strategies because of very low social and financial resources. Few et al. (2004) compared the level of vulnerability towards flooding between rural and urban populations. At first it may seem that people living in urban areas are less vulnerable because access to health care facilities, pharmacies, and alternative water supplies are better. In addition, relief efforts are slower to reach rural areas than urban areas because of logistical and political reasons after the flood (Few et al. 2004). But Few and colleagues (2004) strongly advocate that there are other factors to take into account which prove that urban people could be more vulnerable than rural populations. In low-income urban areas, higher disease vulnerability may be expected than in rural areas due to the high population density and faecal-waste water contamination. The other factor is that urban populations may have become dependant on social protection and therefore do not know anymore how to protect themselves using households or

community coping strategies. They may also have lost social support mechanisms that exist in rural areas.

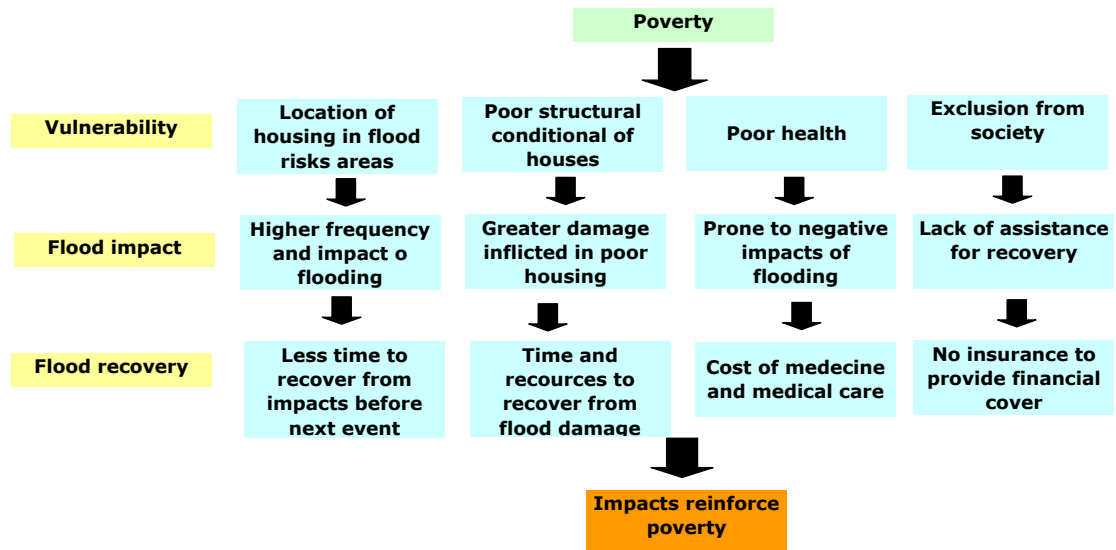
## **2.1.5 Vulnerability and flood mitigation**

### **2.1.5.1 Vulnerability**

According to Wisner et al. (2004:238), *'flood hazards have a variable impact on people according to vulnerability patterns generated by the socio-economic system in which they live'*. Winchester (2000) adds that people with resources affected by floods can effectively protect themselves economically and physically and recover more rapidly than the ones without resources. It is for this reason that Khan (1994) advocates that in Bangladesh large-scale flooding puts the affected population that has marginal food security and a poor nutritional status at a very high risk of food shortage and severe malnutrition.

People living in flood-prone areas may be unable to move to a safer area and often do not have the resources for the construction of stronger, safer housing. The squatters feel that the danger of eviction from authorities is lower in flood-prone areas which are not deemed constructible (Hardoy et al. 1992). The flooding levels could be accentuated by these unsustainable settlements due to encroachment of flood plains, increased run off and restricted drainage. This results in an increase of the hazard exposure (Main 2001).

Chan and Parker (1996), Few (2003) and Maskrey (1999) agree that it would be incorrect to associate poverty and vulnerability even if generally the poor suffer more from hazards than the wealthy. Vulnerability is multidimensional and is associated with various factors such as socio-economic status, gender, age, ethnicity, geography, political and religious affiliation. Stephens et al. (1994) explain that social and economic risks of flooding are not evenly distributed across communities. The poorer households are the ones who are less adapted to flooding and therefore the ones to suffer the most. The downward spiral effect that repeated impact reinforces poverty is well shown in Figure 2-1. Chambers (1995) adds that after each flood, the same families tend to lose their homes, possessions and livelihoods, increasing their vulnerability to the next disaster event.



**Figure 2-1: Livelihood impacts of flooding reinforce conditions of poverty (reproduced from Parkinson, J. Mark, O. 2005)**

Gender has been noted by Wisner and colleagues (2004) as an important factor that influences the impact of the flood on individuals. For instance women may carry a heavier burden than men during recovery because of their pre-flood lower nutritional status and their lower socio-economic status. According to Del Ninno (2001) women of all ages in Bangladesh are more calorie-deficient than men, and the prevalence of chronic energy deficiency among women is the highest in the world. In addition, women also receive less and poorer quality healthcare in comparison with men. The research showed however, that the 1998 floods did not lead to an increase in intra-household food discrimination against females when food resources were decreased.

At the same time as starting out to be more vulnerable, women perform heavy tasks such as protecting their houses, children, livestock and belongings. In Bangladesh, men do not help women when tasks are gender specific (e.g. carrying water, cooking, caring for children and animals). In some cases, women could put their lives in danger to carry on their duties without any help (Nasreen 2004).

According to a study from BRAC regarding the 1998 and 2004 floods in Bangladesh, women and children are often the most vulnerable groups suffering from both personal hygiene and domestic violence problems (Akter 2004). The lack of work for men and the future uncertainties were observed to lead to increased tensions within the family resulting in women being the ones to suffer from their husband’s violence. Rashid (2000) showed that during floods women face extreme difficulties to take care of their personal hygiene because of a lack of clean water and privacy.

Akter (2004) highlighted that girls and particularly unmarried ones are an important part of this vulnerable group. They may suffer from shame and a loss of self-respect during a flood because they will not be able to conform to the socio-cultural norms and become the target for sexual harassment. For instance, they may have to sleep under the eyes of unknown men without having a cover to protect themselves or even having to carry out their domestic tasks wearing a wet sari exposing themselves to men's harassment (Rashid and Michaud 2000).

#### **2.1.5.2 Flood mitigation**

In urban areas, flood mitigation interventions are extremely limited and mainly consist in cleaning up, improving existing drainage, creating new drainage, retention ponds and deepening lakes and rivers. In rural areas, most flood mitigation intervention tends to focus on limiting the effect of the flood hazard with a 'technical-fix' engineering approach<sup>10</sup> such as the Bangladesh Flood Action Plan (BFAP). These 'man-made' interventions which attempt to change or regulate the flow of rivers are perceived to disturb the natural patterns and reduce the ability of communities to predict floods (Stephens et al. 1994). Eighty-six per cent of households in rural areas of Bangladesh were satisfied with the way that they adjusted to normal inundation, and did not want any change to that situation (Leaf 1997). In addition to the negative perception of technical-fix approaches by affected populations, Wisner and his colleagues (2004) advocate that the focus should be in understanding the vulnerabilities of people living in flood-prone areas and designing interventions which use vulnerabilities as the core building blocks of disaster mitigation. Understanding local-level and indigenous coping and adapting strategies would help in that regard. They also raised the importance of accurate early warning systems to give opportunities for people living in flood-prone areas to prepare themselves, and move to safer ground.

Hutton and Haque (2003) in their study entitled 'Patterns of Coping and Adaptation Among Erosion-Induced Displacees in Bangladesh' highlight the need to integrate into mitigation interventions a social, cultural and psychological approach. For example in Bangladesh, the poor seem to cope with natural disaster by relying on religion. Thirty percent of the displacees answered that the causes of erosion was the will or punishment of Allah. These strong beliefs help them to go through disasters providing them with reasons for their suffering and sacrifice. They argued

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<sup>10</sup> A technical-fix engineering approach consists into constructing levees, dams, embankment and other forms of civil engineering infrastructure.

that the capacity of people to respond to flooding is dependent on indigenous social and cultural belief systems even more than physical or economic resources because these social and cultural beliefs are the determinants of how people perceive, react, and cope with disasters. The physical and economic resources are mainly used as reparative means after the flood if these resources have not yet been already exhausted to cope with the daily normal survival needs.

In Bangladesh, the World Bank in 1990 produced the Bangladesh Flood Action Plan (BFAP) in collaboration with the Government of Bangladesh (GoB). It combined different studies exploring living with the floods and engineering solutions. The problem of the BFAP was that it was more a series of studies rather than a holistic approach to the flood problem (Wisner et al. 2004). There was a strong consensus to end the flood problem. However, a top down approach was taken which ignored vulnerabilities of the affected population. A good example of flood mitigation programmes inspired by existing community initiatives is the programme led by CARE and the Bangladesh Urban Disaster Mitigation Programme (BUDMP) (ADPC 2004). This programme makes use of minor structural mitigation and flood proofing through successful and effective existing coping mechanisms. This community based disaster management (CBDM) programme relied on indigenous knowledge, local materials and labour and limited financial resources. The project was expanded in several communities and has shown how effective community interventions can be when encouraged to participate and to take responsibilities. In one of the municipalities selected by CARE and BUDMP, the community organized itself to collect 218,142 cubic feet of soil, 3,429 labourers, and a small budget of over US\$ 4,000. These resources along with 22 local people and in addition to an additional budget from CARE were mobilised to implement a series of minor structural flood proofing activities.

### **2.1.6 Perceptions of risks and coping strategies**

#### **2.1.6.1 Perceptions of risks**

Carolyn Stephens et al. (1994) investigated in India the individual and group perceptions of and adaptations to flooding as an environmental risk. In the communities studied, flood was perceived as a natural event which is beneficial for agriculture. In comparison to other risks in relation to jobs, housing and mosquitoes, flooding was ranked low. In addition the communities considered flooding as a 'trade-off' of both social and economic risks and benefits of living close



to the city and of accessing sources of employment. Winchester (2000) in South India concluded after two decades of research that people live in flood exposed areas because they can easily work in the city and make money there. The risks they choose to take are offset by the gains they hope to make. In terms of health risks, it appears that communities do perceive differences in the quality of water (Stephens 1994). They will use the water differently according to their own water classification (faeces contaminated water, dirty water without excreta, rainwater, clear water, drinking water). They also feel that the after-effects of flood (standing water, contaminated mud) are worse than the immediate ones.

#### **2.1.6.2 Adaptation and coping strategies**

Guarnizo (1992) studied in developing countries the different categories of mechanisms that people use to adapt during a disaster (technical, gender-based, social and economic). In terms of technical adaptation and coping strategies, the communities studied by Guarnizo (1992), made improvement in their homes both permanent and temporary (raising plinth levels and paving the courtyard, etc). They also adapted technically against flood damage by building portable housing materials and schemes for food storage (Guarnizo 1992). Other examples of adaptations to flood situations are platform and elevated food stores. The platform is used as a market ground during normal times and a temporary refuge in the case of a flood where the most important valuables of the community households can be stored. The elevated food stores made in trees or in elevated separate huts are used by households to keep the food dry and out of reach of animals. The use of flood shelters is also common in Bangladesh. Most of these shelters were built in higher ground after the 1998 flood. In the slums, it was reported that flooded houses whose residents did not want to leave would raise the level of their beds and stove with bricks and bamboos (Rashid and Michaud 2000). Some also made temporary wooden platforms to store their most important belongings.

In urban slums, women developed their own gender-based coping strategies (Rashid and Michaud 2000). They ate at different times and also ate less to avoid having to use the latrine during the day time when they can not maintain their privacy. In the flood context, most latrines are flooded or have been destroyed. The few newly built ones are often in flood-shelters with no distinction between genders. Therefore women tend to control themselves until night to access public latrines or to urinate directly in the flood water (Akter 2004, Rashid 2002, 2000). Other reported coping strategies developed by women resulting from BRAC studies

are to use specially made clay stoves in order to cook when flood-water has not receded yet from their homes (Akter 2004). Women use these clay stoves because the way to the kitchen or the kitchen is under water.

Social coping mechanisms at the community level include contingency plans for evacuating persons and possessions (Guarzino 1992). Finally economic adjustments include livelihood diversification and community credit groups (Guarzino 1992). After the 1998 flood in Bangladesh, del Ninno et al. (2001) studied the coping strategies developed by households. The results showed that private borrowing, used mainly for buying food, was the most widely used coping mechanism relied on by Bangladeshi households. According to Haque (1997) the poor will usually survive after a flood-disaster by selling their few belongings, assets such as livestock, housing material and personal belongings.

McCluskey (2001) stresses the need to better understand coping mechanisms of the affected populations being non-displaced, the way they adapt and their perceptions of risks. In addition Wisner et al. (2004) advocate that the past decade has seen a shift in considering floods. Part of the reasons is that major devastating floods have occurred in developed and wealthy countries, and that the frequency and the magnitude of floods in developing countries have been higher. This was linked rightly or wrongly to global warming. As a result, a shift happened in flood preparedness as it became difficult to advocate for engineering solutions but rather to try to understand how people live with floods. In Bangladesh, a country recurrently affected by floods with an urban population highly vulnerable to flooding, it is important to explore further how people cope with flooding.

The next section presents the nutritional situation and feeding practices of IYC in Bangladesh. Appropriate complementary feeding and breastfeeding practices are key for the good health of IYC. Assessing them is important to understand the root causes of the IYC nutritional health.

## **2.2 Nutritional situation and feeding practices of IYC in Bangladesh**

In Bangladesh, the level of malnutrition in infants and young children is among the highest in the world (Deolalikar, 2005; Bloem, Moench-Pfanner, and Panagides, 2003). In 2007, 43% of children under 5 years old were stunted (% of children <-

2SD for height-for-age), 17% wasted (% of children <-2SD for weight-for-weight) and 41% underweight (% of children <-2SD for weight-for-age) (NIPORT and MITRA 2007). This suggests that children in Bangladesh suffer from both short-term malnutrition as well as from longer term, chronic undernutrition. Table 2-2 gives an explanation of the different malnutrition indicators. Each year approximately 250,000 deaths among IYC under 5 are due to malnutrition (Perry 2000). Despite progress in reducing malnutrition among children under 5 between 1996 and 2004, the large-scale flooding in 1998 and 2004 and other disasters have slowed these trends (Deolalikar, 2005; Bloem, Moench-Pfanner, and Panagides, 2003). Bangladesh also has the second highest percentage of infants with low birth weight (less than 2500 grams) in the world (after India) (UNDP, 2001). Girls suffer from higher levels of malnutrition compared to boys and this difference is most pronounced at young ages (Deolalikar 2005). Boys aged 6–11 months are significantly less likely than girls to be underweight and stunted (27% of boys are underweight compared to 34% girls and 19% boys are stunted compared to 25% girls). Boys between one and two year old are still less likely to be stunted than girls but this is no longer the case for underweight (52% of boys are stunted compared to 55% for girls and 56% of boys and girls are underweight).

**Table 2-2: Explanation of malnutrition indicators, Height-for-age, Weight-for-age, and Weight-for-Height (NIPORT and MITRA 2007, 181:381)**

Height-for-age measures linear growth. A child who is below two standard deviations (-2 SD) from the median of the WHO reference population in terms of height-for-age is considered short for his/her age, or stunted. This condition reflects the cumulative effect of chronic malnutrition. If a child is below minus three standard deviations (-3 SD) from the reference median, then he/she is considered to be severely stunted. Stunting reflects a failure to receive adequate nutrition over a long period of time and is worsened by recurrent and chronic illness. Height-for-age, therefore, reflects the long-term effects of malnutrition in a population and does not vary appreciably according to recent dietary intake.

Weight-for-height describes current nutritional status. A child who is below two standard deviations (-2 SD) from the reference median for weight-for-height is considered to be too thin for his/her height, or wasted. This condition reflects acute or recent nutritional deficit. As with stunting, wasting is considered severe if the child is more than three standard deviations below the reference median. Severe wasting is closely linked to mortality risk.

Weight-for-age is a composite index of weight-for-height and height-for-age. Thus, it does not distinguish between acute malnutrition (wasting) and chronic malnutrition (stunting). A child can be underweight for his age because he/she is stunted, because he/she is wasted, or both. Children whose weight-for-age is below two standard deviations (-2 SD) from the median of the reference population are classified as underweight. Children whose weight-for-age is below three standard deviations (-3 SD) from the median of the reference population are considered severely underweight. Weight-for-age is a good overall indicator of a population's nutritional health'.

The prevalence of underweight among preschool children is almost double in Bangladesh compared to Somalia or Mozambique and equal to that of Ethiopia (Bloem et al. 2003). As a consequence, the poor nutritional status takes a devastating toll on life with an under-five mortality rate of 61 deaths per 1000 live births (BBS 2010b, UNDP 2009). During 1996 to 2004, there were steady reducing trends in the prevalence of underweight, wasting and stunting among under five children in Bangladesh (Table 2-3). During this period, prevalence of underweight was reduced by 8.8 percentage points (from 56.3% to 47.5%) and stunting by 11.6

percentage points (from 54.6% to 43.0%). The overall reduction in stunting and underweight rates is attributable mostly to the reduction of severe undernutrition while the prevalence of moderate undernutrition ( $<-2$  to  $>-3$  Z-score) remained virtually stagnant over the entire period (Bloem et al. 2003). Over the period from 1990 to 2005, trends in wasting showed a steady increase. The periodical slowdowns were explained by the large-scale flooding in 1998 and 2004 and other disasters or crises. Similar patterns were seen in the trends of mean height-for-age (HFA) over the same period.

The malnutrition prevalences resulting from the 2007 Bangladesh Demographic and Health Survey (BDHS) are integrated in Table 2-3 using the 2006 World Health Organization (WHO) growth standards. Only the 2004 prevalences were recalculated using the same WHO child growth standards to enable the comparison with the 2007 prevalences. The previous ones for the years 1996-1997 and 1999-2000 are based on the 1977 National Centre for Health Statistics (NCHS) references. Because of the limitations of the NCHS references, the WHO 2006 growth standards were developed to provide information on how children should grow, rather than on how children are growing (Butte et al. 2007, Hamil et al. 1979, Hediger et al. 2000, de Onis et al. 2007a; de Onis et al. 2007b). Due to the difference in malnutrition classification resulting from using NCHS references or WHO growth standards, the 2004 prevalences were recalculated to have a comparison baseline for the 2007 ones (de Onis et al. 2007, Norris et al. 2009). When comparing 2007 to 2004 data with the WHO growth standards, stunting (HFA) among children from 2004 to 2007, has declined by eight percentage points from 51% to 43%. There is some indication of an increase in wasting (WFH), from 15% to 17% and the percentage of children underweight (WFA), which combines both of these measures, has decreased slightly from 43 to 41%.

**Table 2-3: Percentage of children under five years of age considered malnourished according to three anthropometric indices of nutritional status (Bangladesh Bureau of Statistics 2007 and FAO 2004 Final Report) (Vosika 2005, FAO 2004, NIPORT and MITRA 2007)**

Nutritional Status of Children		96-97	99-	2004	2004	2004	2007
		(BDHS-NCHS)	(BDHS-NCHS)	(BDHS-NCHS)	(FAO-NCHS)	(BDHS-WHO)	(BDHS-WHO)
<b>Height for Age (stunting)</b>							
	Severe	28	18.3	16.9	12.6		
	Severe or Moderate	54.6	44.7	43.0	40.2	51	43
<b>Weight for Height (wasting)</b>							
	Severe	3.7	1.1	1.3	0.7		
	Severe or Moderate	17.7	10.3	12.8	11.5	15	18
<b>Weight for Age (underweight)</b>							
	Severe	20.6	12.9	12.8	10.3		
	Severe or Moderate	56.3	47.7	47.5	45.9	43	41

Based on an extensive review of scientific evidence, WHO recommends the following for mothers: 1) to breastfeed their IYC, 2) to exclusively breastfeed<sup>11</sup> for the first 6 months of the infant's life, and 3) to introduce complementary feeding starting at 6 months of age.

The scientific evidence for these recommended feeding practices is presented in Table 2-4. The evidence based on a WHO systematic review of scientific research, demonstrates that breastmilk is the optimal food for the growth and development of infants until 6 months in developing countries. After 6 months of age, breast milk becoming insufficient, complementary food in addition to breast milk until 2 years of age should fill in the energy and nutrient gap.

<sup>11</sup> Exclusive breastfeeding: the infant only receives breastmilk without any additional food or drink, not even water (WHO 2009)

**Table 2-4: WHO systematic review of scientific evidence for breastfeeding, exclusive breastfeeding and complementary feeding (WHO 2009 pp4:6)****Breastfeeding**

Breastfeeding confers short-term and long-term benefits on both child and mother (Leon-cava 2002), including helping to protect children against a variety of acute and chronic disorders. The long-term disadvantages of not breastfeeding are increasingly recognized as important (Fewtrell 2004, WHO 2007). Reviews of studies from developing countries show that infants who are not breastfed are 6 (WHO 2000) to 10 times (Bahl et al. 2005) more likely to die in the first months of life than infants who are breastfed. Diarrhoea (De Zoysa et al. 1991) and pneumonia (Bachrach et al. 2003) are more common and more severe in children who are artificially fed, and are responsible for many of these deaths. Diarrhoeal illness is also more common in artificially-fed infants even in situations with adequate hygiene, as in Belarus (Kramer 2001) and Scotland (Howie et al. 1990). Other acute infections, including otitis media (Duncan et al. 1993), Haemophilus influenzae meningitis (Silfverdal et al. 1999), and urinary tract infection (Marild et al. 2004), are less common and less severe in breastfed infants. Artificially-fed children have an increased risk of longterm diseases with an immunological basis, including asthma and other atopic conditions (Gdalevich et al. 2001, Oddy et al. 2004), type 1 diabetes (Sadavskatte et al. 2004), celiac disease (Akubeng et al. 2006), ulcerative colitis and Crohn disease (Klement et al. 2004). Artificial feeding is also associated with a greater risk of childhood leukaemia (Kwan et al. 2004). Several studies suggest that obesity in later childhood and adolescence is less common among breastfed children, and that there is a dose response effect, with a longer duration of breastfeeding associated with a lower risk (Harder et al. 2005, Burke et al. 2005). The effect may be less clear in populations where some children are undernourished (Grummer-Strawn and Mei 2004). A growing body of evidence links artificial feeding with risks to cardiovascular health, including increased blood pressure (Martin et al. 2005), altered blood cholesterol levels (Owen et al. 2002) and atherosclerosis in later adulthood (Martin et al. 2005). Regarding intelligence, a meta-analysis of 20 studies (Anderson et al. 1999) showed scores of cognitive function on average 3.2 points higher among children who were breastfed compared with those who were formula fed. The difference was greater (by 5.18 points) among those children who were born with low birth weight. Increased duration of breastfeeding has been associated with greater intelligence in late childhood (Daniels and Adair 2005) and adulthood (Mortensen et al. 1999), which may affect the individual's ability to contribute to society. For the mother, breastfeeding also has both short- and long-term benefits. The risk of postpartum haemorrhage may be reduced by breastfeeding immediately after delivery (Chua et

al. 1994), and there is increasing evidence that the risk of breast (Collaborative Group 2002) and ovarian (Robenblatt and Thomas 1993) cancer is less among women who breastfed.

### **Exclusive breastfeeding for 6 months**

The advantages of exclusive breastfeeding compared to partial breastfeeding were recognised in 1984, when a review of available studies found that the risk of death from diarrhoea of partially breastfed infants 0–6 months of age was 8.6 times the risk for exclusively breastfed children. For those who received no breast milk the risk was 25 times that of those who were exclusively breastfed (Feachem and Koblinsky 1984). A study in Brazil in 1987 found that compared with exclusive breastfeeding, partial breastfeeding was associated with 4.2 times the risk of death, while no breastfeeding had 14.2 times the risk (Victora et al. 1987). More recently, a study in Dhaka, Bangladesh found that deaths from diarrhoea and pneumonia could be reduced by one third if infants were exclusively instead of partially breastfed for the first 4 months of life (Arifeen et al. 2001). Exclusive breastfeeding for 6 months has been found to reduce the risk of diarrhoea (Kraner et al. 2003) and respiratory illness (Chantry et al. 2006) compared with exclusive breastfeeding for 3 and 4 months respectively. If the breastfeeding technique is satisfactory, exclusive breastfeeding for the first 6 months of life meets the energy and nutrient needs of the vast majority of infants (Butte et al. 2002). No other foods or fluids are necessary. Several studies have shown that healthy infants do not need additional water during the first 6 months if they are exclusively breastfed, even in a hot climate. Breast milk itself is 88% water, and is enough to satisfy a baby's thirst (Linkages 2002). Extra fluids displace breast milk, and do not increase overall intake (Sachden et al. 1991). However, water and teas are commonly given to infants, often starting in the first week of life. This practice has been associated with a two-fold increased risk of diarrhoea (Brown et al. 1989). For the mother, exclusive breastfeeding can delay the return of fertility (WHO 1999), and accelerate recovery of pre-pregnancy weight (Dewey et al. 2001). Mothers who breastfeed exclusively and frequently have less than a 2% risk of becoming pregnant in the first 6 months postpartum, provided that they still have amenorrhoea.

### **Complementary feeding from 6 months**

From the age of 6 months, an infant's need for energy and nutrients starts to exceed what is provided by breast milk, and complementary feeding becomes necessary to fill the energy and nutrient gap (Dewey and Brown 2003). If complementary foods are not introduced at this age or if they are given



inappropriately, an infant's growth may falter. In many countries, the period of complementary feeding from 6–23 months is the time of peak incidence of growth faltering, micronutrient deficiencies and infectious illnesses (Dewey and Adu-Afarwuah 2008). Even after complementary foods have been introduced, breastfeeding remains a critical source of nutrients for the young infant and child. It provides about one half of an infant's energy needs up to the age of one year, and up to one third during the second year of life. Breast milk continues to supply higher quality nutrients than complementary foods, and also protective factors. It is therefore recommended that breastfeeding on demand continues with adequate complementary feeding up to 2 years or beyond (WHO 2002). Complementary foods need to be nutritionally adequate, safe, and appropriately fed in order to meet the young child's energy and nutrient needs. However, complementary feeding is often fraught with problems, with foods being too dilute, not fed often enough or in too small amounts, or replacing breast milk while being of an inferior quality. Both food and feeding practices influence the quality of complementary feeding, and mothers and families need support to practise good complementary feeding (WHO 2002).

Research on breastfeeding and its impact on IYC health has been conducted in Bangladesh and is presented in addition to the WHO systematic review to expand on Arifeen et al.'s work and to present other research specifically done in Bangladesh. Mitra and Rabbani (1995) demonstrated the beneficial impact of breastfeeding on infant health and showed the importance of breastfeeding in minimizing mortality and morbidity from diarrhoeal diseases. Arifeen et al. (2000) looked at the effect of morbidity and feeding on infant's growth for their first year of life in Dhaka slums. They conducted a prospective observational study of a newborn cohort over 12 months in Dhaka slums. Mean differences in body weight by birth weight and length, SGA and prematurity categories remained relatively constant throughout infancy after adjusting for other variables. A positive impact of exclusive breastfeeding during the first 3 months was identified at 12 months of age; infants exclusively breastfed in the first 3 months were likely to be about 95 g heavier and 0.5 cm taller at 12 months than those partially or not breastfed. However the results also showed a very low exclusive breastfeeding rate decreasing the chance for most of these children of catch-up growth (Arifeen et al. 2001). Another study added to the importance of exclusive breastfeeding through postnatal interventions for SGA children as they found that there was a greater plasticity of growth in the first 3 months of life than later in the first year (Shams et al. 2000).

Infant and young child-feeding practices presented in the dissertation are compared with WHO guidelines for breastfeeding and complementary feeding (Table 2-5) and the 10 guiding principles for complementary feeding of the breastfed child (Table 2-6) from 0-23 months of age in developing countries.

Throughout the dissertation, the terminology insufficient breast milk is used and covers either perceived or real low breast-milk production. The symptom presented by WHO is 'the commonest difficulty that mothers describe is a feeling that they do not have enough milk' (WHO 2009 pp 68). An infant may not receive enough breast milk because of a problem in the breastfeeding pattern or technique but also because the mother has a physiological or pathological low breast-milk production (Woolridge 2003). A mother's psychological factors such as depression, a lack in confidence, and stress can interfere with the way in which she breastfeeds her infant. This can result in the baby taking less milk and consequently failing to stimulate milk production. A mother's physical condition such as whether she takes hormone-containing contraceptive pills, pregnancy, severe malnutrition, smoking and alcohol consumption can temporarily reduce milk production. In a few cases, mothers have low milk production because of a pathological reason including endocrine problems or poor breast development (WHO 2009). The volume and composition of human milk in poorly nourished women living in countries like Bangladesh is frequently suboptimal in quantity and in quality with less fat content, vitamins, calcium and protein, than in well-nourished women (Jelliffe and Jelliffe 1979). In Bangladesh, severe malnutrition in a breastfeeding mother is likely to be the main physical factor for insufficient maternal milk production. Brown et al. (1986) research in peri-urban communities in Bangladesh demonstrated that milk production declined significantly just before the major harvest period and that the mothers' milk production was limited to some extent by their nutritional status.

**Table 2-5: WHO guidelines for breastfeeding and complementary feeding (WHO 2010)**

<p><b>Breastfeeding</b></p> <p>To enable mothers to establish and sustain exclusive breastfeeding for 6 months, WHO and UNICEF recommend:</p> <p>Initiation of breastfeeding within the first hour of life</p> <p>Exclusive breastfeeding – that is the infant only receives breast milk without any additional food or drink, not even water</p> <p>Breastfeeding on demand – that is as often as the child wants, day and night</p> <p>No use of bottles, teats or pacifiers</p>
--

### **Complementary feeding**

Complementary feeding should be timely, meaning that all infants should start receiving foods in addition to breastmilk from 6 months onwards. It should be adequate, meaning that the nutritional value of complementary foods should parallel at least that of breastmilk. Foods should be prepared and given in a safe manner, meaning that measures are taken to minimize the risk of contamination with pathogens. And they should be given in a way that is appropriate, meaning that foods are of appropriate texture and given in sufficient quantity. The adequacy of complementary feeding (adequacy in short for timely, adequate, safe and appropriate) not only depends on the availability of a variety of foods in the household, but also on the feeding practices of caregivers. Feeding young infants requires active care and stimulation, where the caregiver is responsive to the child clues for hunger and also encourages the child to eat. This is also referred to as active or responsive feeding. WHO recommends that infants start receiving complementary foods at 6 months of age in addition to breastmilk, initially 2-3 times a day between 6-8 months, increasing to 3-4 times daily between 9-11 months and 12-24 months with additional nutritious snacks offered 1-2 times per day, as desired.

### **Table 2-6: 10 Guiding principles for complementary feeding of the breastfed child (WHO 2003 pp 36-37)**

1. DURATION OF EXCLUSIVE BREASTFEEDING AND AGE OF INTRODUCTION OF COMPLEMENTARY FOODS. Practice exclusive breastfeeding from birth to 6 months of age, and introduce complementary foods at 6 months of age (180 days) while continuing to breastfeed.
2. MAINTENANCE OF BREASTFEEDING. Continue frequent, on-demand breastfeeding until 2 years of age or beyond.
3. RESPONSIVE FEEDING. Practice responsive feeding, applying the principles of psychosocial care. Specifically: a) feed infants directly and assist older children when they feed themselves, being sensitive to their hunger and satiety cues; b) feed slowly and patiently, and encourage children to eat, but do not force them; c) if children refuse many foods, experiment with different food combinations, tastes, textures and methods of encouragement; e) minimize distractions during meals if the child loses interest easily; f) remember that feeding times are periods of learning and love - talk to children during feeding, with eye to eye contact.
4. SAFE PREPARATION AND STORAGE OF COMPLEMENTARY FOODS. Practice good hygiene and proper food handling by a) washing caregivers' and children's hands before food preparation and eating, b) storing foods safely and serving foods

immediately after preparation, c) using clean utensils to prepare and serve food, d) using clean cups and bowls when feeding children, and e) avoiding the use of feeding bottles, which are difficult to keep clean.

5. AMOUNT OF COMPLEMENTARY FOOD NEEDED. Start at 6 months of age with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding. The energy needs from complementary foods for infants with "average" breast milk intake in developing countries are approximately 200 kcal per day at 6-8 months of age, 300 kcal per day at 9-11 months of age, and 550 kcal per day at 12-23 months of age. In industrialized countries these estimates differ somewhat (130, 310 and 580 kcal/d at 6-8, 9-11 and 12-23 months, respectively) because of differences in average breast milk intake.

6. FOOD CONSISTENCY. Gradually increase food consistency and variety as the infant gets older, adapting to the infant's requirements and abilities. Infants can eat pureed, mashed and semi-solid foods beginning at six months. By 8 months most infants can also eat "finger foods" (snacks that can be eaten by children alone). By 12 months, most children can eat the same types of foods as consumed by the rest of the family (keeping in mind the need for nutrient-dense foods, as explained in #8 below). Avoid foods that may cause choking (i.e., items that have a shape and/or consistency that may cause them to become lodged in the trachea, such as nuts, grapes, raw carrots).

7. MEAL FREQUENCY AND ENERGY DENSITY. Increase the number of times that the child is fed complementary foods as he/she gets older. The appropriate number of feedings depends on the energy density of the local foods and the usual amounts consumed at each feeding. For the average healthy breastfed infant, meals of complementary foods should be provided 2-3 times per day at 6-8 months of age and 3-4 times per day at 9-11 and 12-24 months of age, with additional nutritious snacks (such as a piece of fruit or bread or chapatti with nut paste) offered 1-2 times per day, as desired. Snacks are defined as foods eaten between meals—usually self-fed, convenient and easy to prepare. If energy density or amount of food per meal is low, or the child is no longer breastfed, more frequent meals may be required.

8. NUTRIENT CONTENT OF COMPLEMENTARY FOODS. Feed a variety of foods to ensure that nutrient needs are met. Meat, poultry, fish or eggs should be eaten daily, or as often as possible. Vegetarian diets cannot meet nutrient needs at this age unless nutrient supplements or fortified products are used (see #9 below). Vitamin A-rich fruits and vegetables should be eaten daily. Provide diets with adequate fat content. Avoid giving drinks with low nutrient value, such as tea,

coffee and sugary drinks such as soda. Limit the amount of juice offered so as to avoid displacing more nutrient-rich foods.

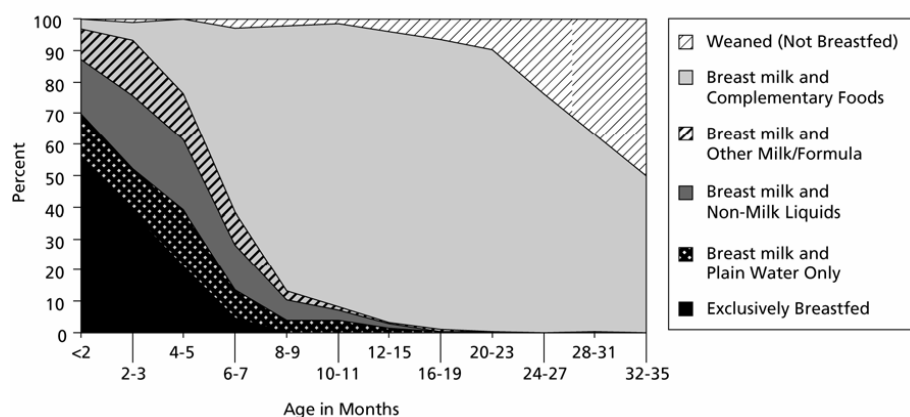
9. USE OF VITAMIN-MINERAL SUPPLEMENTS OR FORTIFIED PRODUCTS FOR INFANT AND MOTHER. Use fortified complementary foods or vitamin-mineral supplements for the infant, as needed. In some populations, breastfeeding mothers may also need vitamin mineral supplements or fortified products, both for their own health and to ensure normal concentrations of certain nutrients (particularly vitamins) in their breast milk. [Such products may also be beneficial for pre-pregnant and pregnant women].

10. FEEDING DURING AND AFTER ILLNESS. Increase fluid intake during illness, including more frequent breastfeeding, and encourage the child to eat soft, varied, appetizing, favourite foods. After illness, give food more often than usual and encourage the child to eat more.

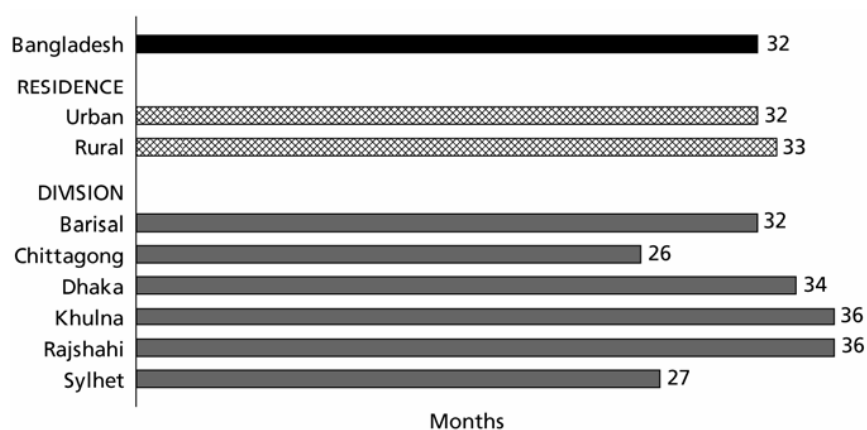
In Bangladesh, even though the median duration of breastfeeding of 32 months is higher than the WHO recommendation of 24 months (Figure 2-3), exclusive breastfeeding practice is low. The percentage of children under 6 months exclusively breastfed decreased over the period 1993 to 2007 (Table 2-7). In 2007, 43% of children meet the WHO's guideline for infant feeding practices as they are exclusively breastfed under 6 months of age (indicating no improvement in exclusive breastfeeding practices over the years) (WHO 2003, NIPORT and MITRA 2007). The percentage decreased because of mothers giving other liquids in addition to their milk (Figure 2-2). A positive trend is the important increase in children being breastfed and receiving complementary food between 6-9 months (Table 2-7).

**Table 2-7: Exclusive Breastfeeding and Complementary Feeding (BDHS 2004 and 2007 Final Report) (Vosika 2005, NIPORT and MITRA 2007)**

Breastfeeding	99-				
	93-94	96-97	2000	2004	2007
Percent of children under 6 months who are exclusively breastfed (based on 24 hour recall)	45.9	45.1	46.1	42.2	43.0
Percent of children under 6 months who are exclusively breastfed (based on 7 days recall)	--	--	--	36.4	
Percent of children age 6-9 months receiving breast milk and complementary food (based on 24 hour recall)	28.5	28.4	58.9	62.3	74.0



**Figure 2-2: Infant Feeding Practices by Age (source: BDHS 2004 Final Report) (Vosika 2005)**



**Figure 2-3: Median Duration (months) of Breastfeeding (BDHS 2004 Final Report) (Vosika 2005)**

Despite high rate of breastfeeding, IYC feeding practices in Bangladesh are not meeting the WHO guidelines (NIPORT and MITRA 2007). Colostrum is often not given at birth and initial breastfeeding is delayed for several hours or even more than a day after the baby's birth. These practices are detrimental to the nutritional well-being of the child. The delay in breastfeeding is often related to an incorrect perception that colostrum is considered to be an inferior food (Deolalikar 2005). In addition, early introduction of foods other than breast milk, which is a common practice, greatly increases the risk of infection leading to malnutrition (Deolalikar 2005). Among infants less than 2 months old, only 64% are exclusively breastfed and the others are given water, other milk, and other liquids in addition to breast milk, with 6% even receiving complementary foods (NIPORT and MITRA 2007). Early termination of exclusive breastfeeding with a premature introduction of inadequate complementary food before 6 months has disastrous consequences on the health of IYC mainly because of the risk of morbidity transmission (Table 2-4). Weaning foods have poor nutritional value and lead to growth faltering because the daily energy intake is not meeting the WHO guidelines (Table 2-4) (NIPORT and MITRA 2007, Deolalikar 2005). Complementary food is introduced within the first four months of life for 36% of children and within the first six months for 91% of children while WHO and UNICEF recommends exclusive breastfeeding for the first six months of a child's life (Deolalikar 2005). In the case of breastfed children, complementary food is often introduced too late, about three in ten children even at age 6-7 months are not given any solid or semisolid food (NIPORT and MITRA 2007).

The following section presents flooding and health outcomes using epidemiological and nutritional evidence. It also investigates how flooding impacts the nutritional health of IYC in Bangladesh.

## 2.3 Flooding and Health Outcomes

### 2.3.1 Epidemiological Evidence

The theoretical risk of acquiring communicable diseases by type of disaster is higher for floods and hurricanes (which usually cause major floods). They both have either high or medium risks for person to person, water borne, food borne and vector borne transmissions because the floodwaters can become contaminated with human or animal waste and become a transmission vector of diarrhoeal diseases. (Table 2-8) (Hales et al. 2006).

**Table 2-8: Theoretical risk of acquiring communicable diseases, by type of disaster (reproduced from Hales et al. 2006)**

Type	Person to person	Water borne	Food borne	Vector borne
<b>Earthquake</b>	M	M	M	L
<b>Volcano</b>	M	M	M	L
<b>Hurricane</b>	M	H	M	H
<b>Tornado</b>	L	L	L	L
<b>Heatwave</b>	L	L	L	L
<b>Coldwave</b>	L	L	L	L
<b>Flood</b>	M	H	M	H
<b>Famine</b>	H	H	M	M
<b>Fire</b>	L	L	L	L

**H: High**

**M: Medium**

**L: Low**

According to Kolsky and Shaw (1998), the effect of flooding on health is one of the most significant but difficult impacts to evaluate. Mc Cluskey (2001) highlights that the public health consequences of floods depend upon the nature of the floods and the effects upon a given population. According to the author, the risks of epidemic disease are higher when floods take place in highly-populated areas and where the standards of water and sanitation are not maintained. Kondo et al. (2002), based on a study in Mozambique after the 2000 flood, highlighted the risk factors for infectious diseases such as an increase in population, the deterioration of physical strength, the temporary living conditions and the poor quality of drinking water.



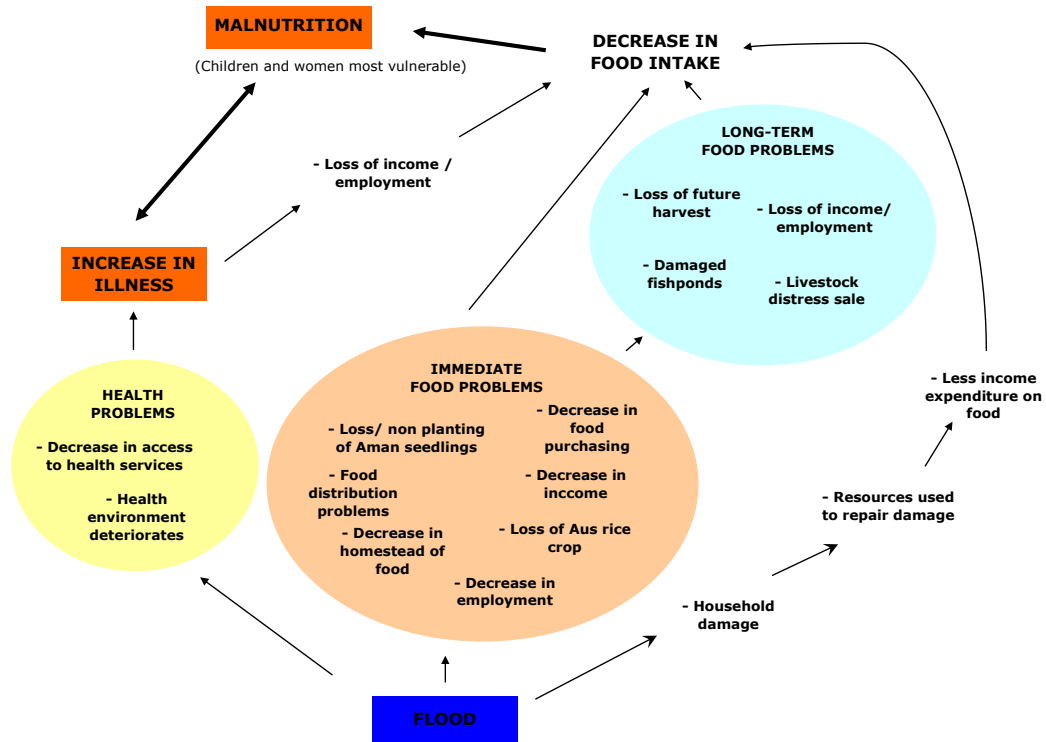
Ahern and colleagues have reviewed global epidemiological, social and institutional research that has addressed health impacts, adaptation processes and policies relating to flood risk (Ahern et al. 2005). The search was based on academic and non-academic sources to assemble worldwide information on health outcomes and health related responses to flooding. The health impacts were grouped under the following categories: mortality, injuries, diarrhoeal disease, other faecal-oral, infection from soil-transmitted helminths<sup>12</sup>, vector-borne disease, rodent-borne disease, mental health, and other health outcomes. The main conclusion points of the review were that Asia supports the highest mortality burden. In less developed countries, infectious disease transmission which is already an endemic health problem becomes a major flood-related health problem. In the aftermath of flooding in developing countries, infectious disease outbreaks of various magnitude and mortality burden have been reported (Ahern et al. 2005, Ahern et al. 2004). The risk of disease transmission through poor water and sanitation is higher in highly populated places such as slums (Cairncross et al. 1996, Kolsky 1994, Kolsky and Blumenthal 1995). In Bangladesh during the 1998 floods, people complained of diarrhoea, fever, coughs, colds, skin and fungal infection on their legs and feet (Ahmed et al. 1999, Rashid 2000, Shahaduzzaman 1999). It is important to stress that in addition to the increased risk of disease, the disruption to medical facilities and the increased demand on their resources can reduce the access for the exposed population to necessary treatment and medicine (Rashid 2000). During flood induced epidemics, children have an increased risk of suffering from diseases compared to adults since they have not yet developed an acquired immune system.

### **2.3.2 Nutritional Evidence**

Floods have both short term and long term negative consequences on food security which trigger famine and malnutrition (Figure 2-4). Floods wash away crops, limit food transport within the country and destroy food storage. Income generation becomes harder because of the inundated areas and the impossibility for people to get to their job location. The timeline of important factors influencing child nutrition in Bangladesh (Figure 2-5) comparing a normal to a disaster-flood year shows that the typical 2 months pre-harvest food insecurity in Bangladesh was extended by 6 months during the 1998 disaster-flood.

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<sup>12</sup> Parasitic worms or helminths are a division of parasites which live inside their host. They can be free-living as well. They are worm-like organisms that live and feed off living hosts receiving nourishment and protection while disrupting their hosts' nutrient absorption, causing weakness and disease.



**Figure 2-4: Conceptual framework of flooding and malnutrition (Source: HKI 1999)**

The Bangladesh government, after experiencing famines due to disaster floods developed planned actions to maintain market prices. After the 1998 flood, the combined action of the government and NGOs in maintaining market prices and distributing food aid was successful and a famine was prevented (del Ninno et al. 2002).

Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
<b>NORMAL YEAR</b>												
Monsoon season				Typical pre-harvest food insecurity	Aman harvest		Wheat harvest					Boro harvest
Increase in child illness												
<b>FLOOD AFFECTED AREAS 1998</b>												
Extended severe flooding, decrease in Aus harvest, Increase in child illness, increase in food prices, decrease in employment opportunities, increase in food insecurity, decrease in food stores				Severe pre-harvest food insecurity: extended due to low aman rice harvest. Child nutrition situation show little or no improvement during this period								
					Low/ late aman harvest		Wheat harvest					Boro harvest

**Figure 2-5: Timeline of important factors influencing child nutrition in Bangladesh, normal year versus 1998-99 (Source: HKI 1999)**

The main nutritional studies relating to floods have been conducted in Bangladesh since it is a country recurrently affected by severe floods as well as high levels of malnutrition. Other studies have been conducted in Sudan after the 1988 and 2000 floods. In both rural Bangladesh and Khartoum, Sudan, the proportion of severely

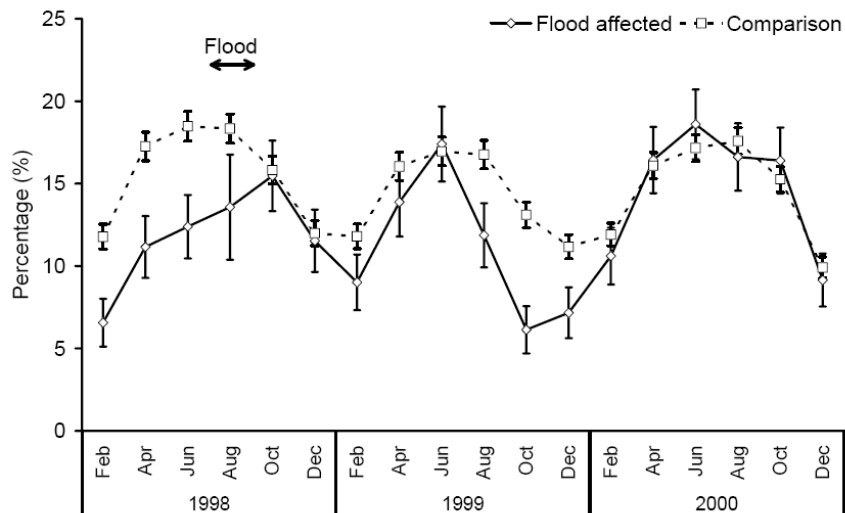
malnourished children increased after flooding (Chowdhury et al. 1990, Woodruff et al. 1988, CDC 1989).

Stewart et al. (1990) in a study conducted in Matlab with the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) concluded that factors unrelated to flooding (e.g. maternal education, socio-economic status, possession of land) were more significant in explaining differences in nutritional status of children. In term of biosocial factors, Choudhury and Bhuiya (1993) using data collected before, during and after the 1987 flood in Bangladesh, showed that there was an adverse effect of flood on nutrition. The effect was dependent on sex of a child and intake of vitamin A supplements. After the flood the proportion of severely malnourished children was significantly greater among those who had not taken vitamin A. The proportion of severely malnourished boys increased after the flood. It is hypothesized that girls were affected to a much lesser extent because they were already more undernourished than the boys before the flood.

Based on the International Food Policy Research Institute (IFPRI) dataset collected after the 1998 flood, Del Ninno and Lundberg (2005) showed that the children exposed to the flood were systematically smaller than those who were not exposed, and that this pattern holds during the one year timeframe of the survey. They also concluded that there was no catch up growth since flood-exposed children were not growing more rapidly than their unexposed counterparts after the flood withdrew. The authors concluded that these children did not recover from the calamity and were likely to become shorter adults. Finally they observed that programmes of assistance designed to intervene after the crisis were ineffective, especially when compared to programmes designed to maintain children's health over the long run (del Ninno and Lundberg 2005). Deolalikar (2005) argued further that flooding has lasting consequences on IYC health as the rates of underweight children in villages that experienced a flood in the five years after the study are 7 percentage points greater than in villages that experienced no flood (Deolalikar 2005).

The NGO, Save the Children UK (2003), using the same data from the 1998 Bangladesh flood demonstrated that there was a crossover phenomenon: some children improved from malnourished to normal while others deteriorated from normal to malnourished during the crisis to rehabilitation phase (Hossain and Kolsteren 2003). The NGO Helen Keller International, in their countrywide longitudinal study, showed that the percentage of wasted children aged 6-59 months (z-score weight-for-height  $< -2$  SD) in the sub-districts severely affected by

the flood increased during and in the aftermath of the flood (Figure 2-6) (Bloem et al. 2003). They however stress that the prevalence of wasted children in October 1998 was lower than the peak prevalence in the two subsequent years when no disaster was reported. Their conclusions were based on longitudinal data that the 1998 flood did not have a notable impact on child nutritional status, even though the prevalence of diarrhoea increased. They propose two confounding factors as clues to understand this surprising result: the death of severely wasted children and the food and medical interventions that targeted children. An interesting finding from the same study was that mothers tend to give priority to feeding other family members when access to food is poor. As a result, the mother's BMI was negatively impacted by the flood (Bloem et al. 2003). Finally the study highlighted an increase in cases of night blindness of children and mothers which is a sign of vitamin A deficiency.



**Figure 2-6: Percentage of wasted children aged 6-59 months (z-score weight-for-height <-2 SD) in the sub-districts severely affected by the 1998 flood (n=20,055) and in the less affected comparison sub-districts (n=136,367). Bars show 95% confidence intervals (Bloem et al. 2003)**

So far the limited epidemiological research has resulted in inadequate evidence on the health outcomes of floods (Ahern et al. 2005, Few et al. 2004, Morgan et al. 2005). Likewise insufficient systematic research has been undertaken to explore the nutritional impact of floods on communities and especially in urban settings. The literature review completed on studies exploring relationships between floods and the nutritional status of affected populations in Bangladesh identified only ten previous studies on this topic. These studies used economic (Del Ninno et al. 2001), nutritional (Deolalikar 2005, O'Donnell et al. 2002, Shafique et al. 2007, Stewart et al. 1990) and epidemiological (Bloem et al. 2003) analytical frameworks. Only one

has previously used an anthropological approach (Rashid 2000) to explore the struggles and coping strategies of urban poor in Dhaka during the floods of 1998. This study was also the only one conducted in slum settings. The study highlighted that women and children were the most vulnerable groups during the floods. The study discussed increased food prices resulting in decreased food intakes, and changes in women's diet. However no reference was made to alteration in diet and feeding practices for infants and young children.

Most previous studies were NGO sponsored and were carried out in the aftermath of major flood disasters. Their focus was generally to evaluate a nutritional situation in regards to an on-going intervention or to justify future interventions. As a consequence, they present malnutrition prevalence and some brief hypotheses on the root causes. They do not provide any qualitative information on alterations in young children's feeding practices in response to floods and understanding of the roots of malnutrition. In the next section, the rationale for the study is presented based on the literature gaps identified.

## **2.4 Project Aims**

### **2.4.1 Rationale for the Study**

The evidence gathered in the literature review suggests that climate variability as well as urbanisation in addition to other drivers of change (e.g. global economy, world trade, demography, etc) will result in increased intensity of flooding and vulnerability of populations. The already poor and vulnerable populations will be the groups who are most likely to suffer the most. Even though one cannot predict how flood patterns will evolve on a country basis, there is a strong likelihood that Bangladesh is one of the countries which will support the double burden of climate variability and urbanisation resulting in longer and more severe floods. Bangladesh is one of the poorest developing countries in the world; more than three-fifths of its population is living below the poverty line with a per capita energy supply and total protein supply that are the lowest figures in the South Asian region (UNICEF 1997). Infants and young children (IYC) in Bangladesh already suffer from extremely high levels of malnutrition resulting in high morbidity and mortality rates.

The background research has shown that people living in urban slums and especially women and children are extremely vulnerable to flooding. Yet insufficient research exists into understanding the mechanisms leading to poor nutritional child

health related to flooding in urban slums. While earlier research also provided evidence of a wide range of non flood related risk factors affecting nutritional status, the long-term predictive risk factors have not yet been explored (Choudhury and Bhuiya 1993, Stewart et al. 1990). Maternal nutritional status associated with infant and child health has been established previously, but rarely in the aftermath of a crisis (Rahman et al. 1993, Rahman and Chowdhury 2007, Lima, Figueira, and Ebrahim 1990, Faber, Swanevelde, and Benade 2005, Sanghvi et al. 2001, Mock et al. 1994). Given these gaps in the literature, this study will explore the following research questions:

1. Can maternal nutritional status measured soon after a flood predict the current nutritional status and the risk for future deterioration of nutritional status of their children?
2. What is the impact of flooding on IYC feeding practices and the coping strategies developed in urban slums?
3. What are the perceptions of roots of malnutrition for IYC living in urban slums exposed to flooding?
4. What would be a feasible pilot project to tackle IYC malnutrition based on best practices?

#### **2.4.2 Research design**

The three related research questions are answered by using a mixture of quantitative and qualitative approaches, including the analysis of existing data and the collection of new data via questionnaire, interviews, and ethnography. In particular, the research undertaken in Dhaka slums justified a mixed-method approach to slowly allow the researcher to immerse in the slums and understand how people live, take care and feed their children. Time is key to understanding the dynamics involved and to gain the trust of the respondents in an hostile environment such as the slums where crime and violence prevail. The innovative integration of ethnography with the other methods blends the benefits of robust systematic nutritional quantitative analysis and the interpretative and descriptive qualitative strengths of ethnographical techniques. The combination of quantitative nutritional analysis and qualitative interpretation creates a balanced approach to understanding processes leading to flood related malnutrition in infants and young children.

To answer the first question, the research uses secondary analysis of data collected by the International Food Policy Research Institute where the same infants were followed for one year after the 1998 flood in Bangladesh ( $n=143$ ). Logistic regression models are used to investigate the predictive strength of maternal BMI on infant's nutritional status after controlling for a range of child and maternal factors. Details of the research design are presented in Chapter 3.

The second and third questions are answered using a mixed method approach. To explore the impact of flooding on IYC feeding practices and the coping strategies developed, qualitative ethnographic data (participant observation and semi-structured interviews) and quantitative data (household questionnaire and anthropometric measurements) collected in slums in Dhaka ( $n=18$  mothers,  $n=5$  community health workers, and  $n=55$  children) are analysed. The subjects of the interviews were mothers and Bangladesh Rural Advancement Committee (BRAC) community health workers living and working in the slums. Details of the research design for the second question are presented in Chapter 4.

To explore the perception of root causes of malnutrition, the research uses analysis of focus group discussions (FGDs) conducted in Dhaka slums, Bangladesh. The participants were pregnant women (50% of them had children), experienced and novice community health workers for Bangladesh Rural Advancement Committee<sup>13</sup> (BRAC). Ten FGDs with an average of 10 participants each were organized. A new technique is created for this research project. This technique is based on existing methods for the building of a causal model combined with a pile sorting of photographs to understand the root causes of malnutrition and the processes leading to malnutrition. The transcripts of the FGDs were coded by extracting concepts and using a constant comparison of the data to draw out themes. Further details of this new technique and the research findings are presented in Chapter 5.

The design of a pilot project to tackle IYC malnutrition in relation to flooding in Dhaka slums is based on a systematic review of best practices and on the existing capacity of the organisation which will be conducting it.

Flooding and its impact on IYC nutritional health are the foundations for this research and the link throughout Chapter 3, 4 and 5. Unfortunately at the time of this research, there was no existing data set collected in Dhaka slums in relation to flooding. Thus Chapter 3 uses secondary data set collected in flood affected rural

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<sup>13</sup> Bangladeshi Non Governmental Organisation

areas in Bangladesh. Chapter 4 and 5 explore the impact of flooding on IYC feeding practices as well as the perception of the root causes of malnutrition in urban settings (Dhaka slums), Bangladesh. All of the data used for the research was collected after a flood or the rainy season; the IFPRI data set in Chapter 3 was collected during the one year timeframe after the 1998 flood and the data used in Chapter 4 and 5 were collected in between the rainy seasons.



## **2.5 Summary**

This literature review highlights research and knowledge gaps in understanding people living with floods. It stresses the lack of nutritional studies exploring the root causes of malnutrition during floods. It shows that the most vulnerable groups are the target population of our study being mothers and infants and young children living in urban slums. Based on these findings, this research project will deepen the understanding of coping strategies for feeding practices and perceived roots of malnutrition for infants and young children. It will provide evidence for the interactions connecting coping strategies and nutritional health between seasonal floods. This will cast new ethnological light onto the series of existing studies and previous research essentially focused on the flood itself. As a result, the study should lead to recommendations for risk preparedness interventions, risk reduction strategies, and nutrition promotion for flood exposed populations with infants and young children.

The next chapter investigates whether maternal nutritional status can be used to predict children's nutritional health in the aftermath of a disaster such as a flood.

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### **Abbreviations, acronyms and glossary (Chapter 3)**

ADB	Asian Development Bank
ARI	Acute Respiratory Infection
BFAP	Bangladesh Flood Action Plan
CED	Chronic Energy Deficiency
FFWC	Flood Forecasting and Warning Centre
GoB	Government of Bangladesh
HKI	Helen Keller International
IFPRI	International Food Policy Research Institute
NGO	Non-Governmental Organization
VGF	Vulnerable Group Feeding
WSH	Water purification, sanitation and hygiene

*Aman:* Rice crop harvested in November-December (see B. Aman and T. Aman).

*Aus:* Summer rice planted in March-April and harvested in July-August.

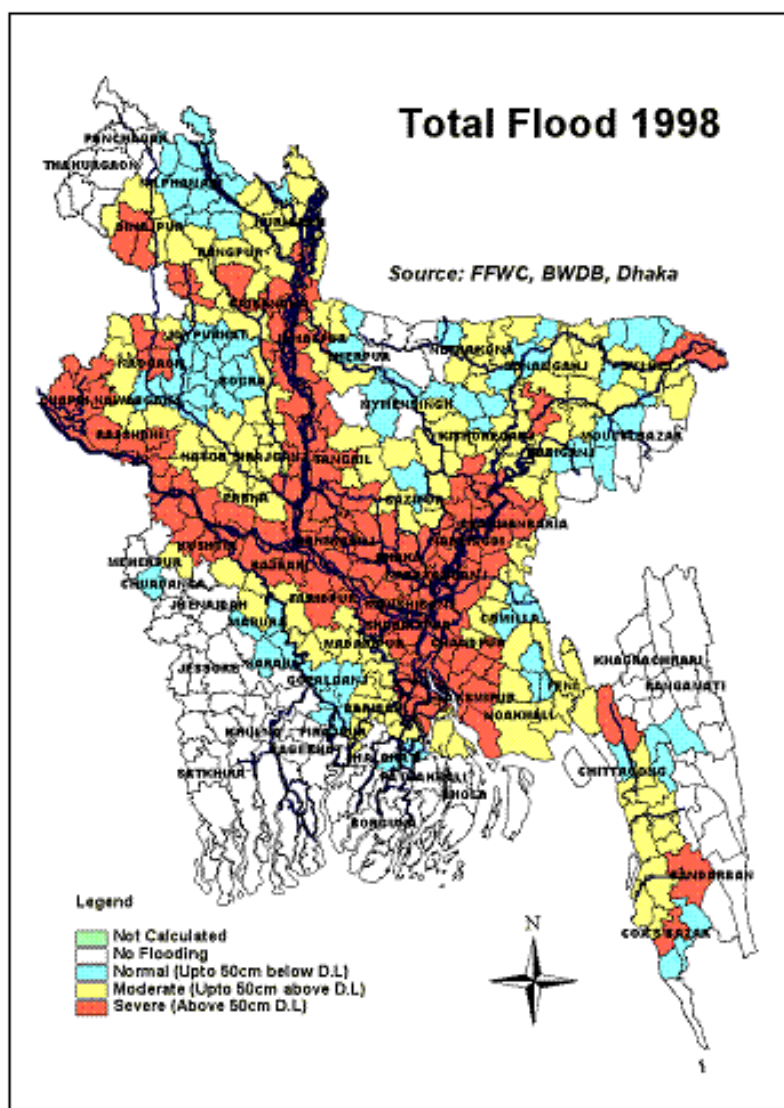
*Boro:* Rice crop planted in December-February, and harvested in April-June; mostly HYV with higher yield potential than the local varieties.

**Chapter 3 - Mother's BMI as a predictor of infant and young children's nutritional status in the post-emergency phase of a flood**

### 3.1 Background

In Bangladesh, the level of malnutrition in infants and young children is among the highest in the world (Deolalikar 2005, Bloem, Moench-Pfanner, and Panagides 2003, NIPORT and MITRA 2007). Despite progress in reducing malnutrition among children under 5 between 1996 and 2007, the large-scale flooding in 1998 and 2004 and other disasters have slowed these trends (Deolalikar 2005, Bloem, Moench-Pfanner, and Panagides 2003).

The 1998 flood in Bangladesh was called ‘The Flood’ because of its disastrous consequences on agriculture, livelihoods, food security and health. Fifty-five of the 64 districts of Bangladesh representing 33 million people were affected (Figure 3-1). Eighteen million people were assessed to be in need of emergency food and health services (Ahmed et al. 1999). The flood caused severe damage to the *aus* rice crop which was about to harvest and to the *aman* rice seedlings in July and August 1998. It destroyed an estimated 2.2 million tons of rice, an amount equal to 10.45% of target rice production in 1998-99 (del Ninno et al. 2002). The Asian Development Bank estimated total losses at US\$3.5 billion (Shehabuddin 1999). The flood had a devastating impact on households because of the reduction in income due to agricultural losses in rural areas, the lack of jobs in urban areas and the expenditure rise in health care and food prices (Del Ninno et al. 2004). Del Ninno and colleagues in the IFPRI study on coping strategies developed during the 1998 flood showed that households managed to smooth consumption and avoid starvation by mainly borrowing money from the private sector and/or from micro-credit organizations. The level of caloric consumption of poor flood-exposed households was 1,602 per day (estimated using a 7 days food consumption recall) which was 73% of the amount consumed the previous year (Del Ninno and Lundberg 2005). With government and non-government interventions, the worst in terms of food insecurity was avoided.



**Figure 3-1: Extent of 1998 flooding in Bangladesh (Source: FFWC, BWDB 2007)**

The Government of Bangladesh (GoB) decided on a one-year suspension of loan repayments by farmers and planned a post-flood agricultural credit programme valued at 400 million Euros. The Vulnerable Group Feeding (VGF) programme<sup>14</sup> extended its coverage to 4 million cards with the help of UN World Food Programme. Later the number of cards and the ration quantity per card increased because of the ongoing disastrous situation and the food insecurity level. The GoB decided also to intervene on the rice markets to avoid an increase in prices. The zero tariffs on rice imports and the encouragement from the GoB to import rice mainly from India through private channels prevented a drastic rise in prices. The GoB and 163 participating NGOs initiated immediate relief and rehabilitation

<sup>14</sup> VGF is designed to provide one or more months of food rations to a selected number of household in a period of distress.

interventions to remedy the extensive damage (Choudury 1998). Through the combination of these interventions especially the stabilization of the rice market, the 1998 flood did not lead to the disastrous consequences of the 1974 flood. There was no massive migration to cities and famine did not spread. Paul (1999) compared the emergency aid distribution efforts undertaken by the government and NGOs and examined their performance based on opinions of the flood victims in the study area. He showed that, unlike in the past, government relief reached the victims who really needed it. According to respondents, programmes of both the government and NGOs were efficient and successful compared to precedent programmes following the 1974 flood which suffered from misuse of relief aid and corruption.

The impact of flooding emergencies on the nutritional status of infants and young children has been explored in various studies conducted in Bangladesh (Bloem, Moench-Pfanner, and Panagides 2003, Choudhury and Bhuiya 1993, del Ninno and Lundberg 2005, Buitendijk 2006). Overall, a negative impact of the flood on nutritional status has been demonstrated as presented in Chapter 2 (eg. Chapter 2 – Section 2.3.2 Nutritional Evidence). The lack of pre-flood anthropometric measurements and the presence of many confounding factors (medical assistance targeted to children, death of severely malnourished children, etc) cast doubt on results demonstrating an association between children’s nutritional status and flood exposure (del Ninno and Lundberg 2005, Hossain and Kolsteren 2003). While earlier research also provided evidence of a wide range of non-flood related risk factors affecting nutritional status (biological, socio-economic and environmental factors), the long-term predictive risk factors have not yet been fully explored (Choudhury and Bhuiya 1993, Stewart et al. 1990). Although these studies have offered some indication of associations between risk factors and children’s nutritional status, their focus was on the emergency itself rather than the long-term impact of the disaster. The aim often has been to provide arguments for immediate action rather than preventive ones on a longer term timescale.

An exception is the work of Hossain and Kolsteren (2003) who report the rapid nutritional deterioration of children from emergency to post-emergency (normal to malnourished) using evidence collected during the 1998 flood in Bangladesh. Data were collected in seven rural *thanas* mainly consisted of *charlands*<sup>15</sup> in two separate surveys (August at the peak of the flood and in December at the post-flood harvesting period). The sample was 180 children aged 6 to 59 months.

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<sup>15</sup> *Charlands* are piece of land surrounded by water.



Anthropometric measurements were done using standard guidelines and materials. The study observed that repeated attacks of diarrhoea were associated with the infant and child's nutritional deterioration from normal to malnourished during the post-emergency phase. In addition, taking loans with low interests and long repayment schedules were positively associated with recovery of the infant and young child while taking loans from money lenders was negatively associated. The authors suggested, as a preventive method for young children's nutritional deterioration, that flood exposed households are able to borrow money from other sources than money lenders in the post-emergency phase. Del Ninno and Lundberg (2005) also suggested that programmes of assistance designed to intervene after the 1998 flood emergency were ineffective in preventing IYC nutritional deterioration, especially when compared to programmes designed to maintain children's health over the long run. The Bangladesh Integrated Nutrition Programme (BINP) was the only long term intervention towards improved nutritional health of children providing child growth monitoring and food supplementation. BINP was established in 1995 across Bangladesh and had reached by the end of 2001 more than 3 million households in over 13,000 villages across Bangladesh, providing child growth monitoring and supplementation of vulnerable groups. Compared to the emergency interventions, only the BINP had a beneficial impact on the health of children exposed to the floods. The mean standardized heights and weights of children included in the BINP were statistically higher than those not included. The targeting criteria used for the BINP were children under the age of two and severely malnourished, breastfeeding women and pregnant women, while emergency relief interventions targeted vulnerable households mainly based on their flood exposure. The study also concluded that targeting children nutritionally at risk before the crisis rather than after would give them a better chance of survival and growth with more focused intervention (Del Ninno and Lundberg 2005).

Maternal nutritional status associated with infant and child health has been established previously, but rarely in the aftermath of a crisis (Rahman et al. 1993, Rahman and Chowdhury 2006, Lima, Figueira, and Ebrahim 1990, Faber, Swanevelde, and Benade 2005, Sanghvi et al. 2001, Mock et al. 1994). Mock et al. (1994) examined in a non emergency situation whether anthropometric indicators for the mother can be used to make inferences or predict the nutritional status of her child in rural Guinea. Using a cross-sectional survey in rural Guinea, they collected sociodemographic, economic, health and nutritional information (anthropometric measurements of women and children) of 780 women and 1118

children under 5 years old. They demonstrated that a significant association in nutritional status among mothers and children does exist within the household. However, because of the low sensitivity of anthropometric indicators they concluded that using the nutritional status of the mothers and/or child to screen households for maternal-child nutritional risk into the future would not be efficient based on these indicators alone. They discussed the existence of some factors that may partially explain the absence of stronger intra-household mother-infant nutritional association. In addition to breastfeeding, which is well known to be a successful buffering against food deprivation, an appropriate composition of the weaning diet was also observed to act as a safeguard. In rural Guinea, the weaning diet is fairly homogeneous across families because it is culturally driven. While mothers are exposed and suffer from lack of food availability, children are protected through breastfeeding and an appropriate weaning diet.

Rationing of food consumption and becoming undernourished is one of the first household responses to a crisis such as a flood in order to avoid having to dispose of key productive assets (Corbett 1988). However, it is unclear how the burden of food decrease is shared out through intra-household food allocation. This is a very complex issue which is mostly culturally driven and has not yet been systematically investigated (Haaga and Mason 1987, Corbett et al. 1988). For instance, Wasito et al. (2002) demonstrated the reverse relationship and reported that the nutritional status of the mother remained stable while the nutritional status of the children deteriorated during the crisis in Indonesia in 1997-1998. One possible explanation lies with the idea of ‘maternal equity’ and how the mother is nutritionally favoured among household members who contribute the most to household living. In the case of a flood-crisis, it has been demonstrated that mothers are the ones who typically take on the burden of food insecurity in a household by giving food to other family members first (Rashid 2000, Rashid and Michaud 2000, Maxwell 1996). This coping strategy called by Maxwell ‘maternal buffering’ has been shown to result in lower maternal BMI after the flood and is intended to protect infants and young children (Bloem, Moench-Pfanner, and Panagides 2003).

The fact that mothers are undernourished at the end of the emergency phase<sup>16</sup> may predict that their children’s nutritional status will soon deteriorate if no relief assistance is provided. It is important to establish a relationship between maternal and IYC nutritional health in order to identify potential criterion to be used to

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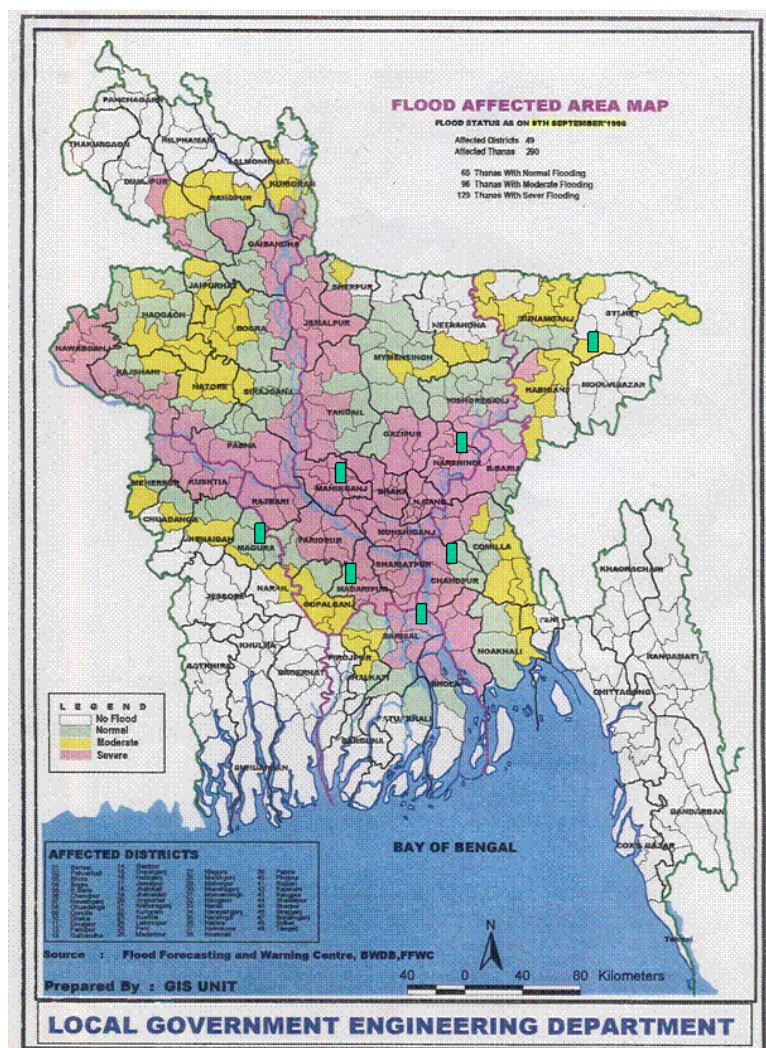
<sup>16</sup> The emergency phase is defined here as the time of the flood (June to September) plus 1 month after floods have received (October). Post-emergency is defined as the phase starting in October.

identify IYC at risk. The objective of this analysis is to establish whether maternal nutritional status measured soon after a flood can predict the current nutritional status and the risk for future deterioration of nutritional status of their children.

## **3.2 Methods**

### **3.2.1 Data**

In the study presented here, we conduct a secondary analysis of data collected by the International Food Policy Research Institute (IFPRI) (Del Ninno 2001). The data were collected from 757 households in seven rural areas of Bangladesh affected by the flood of 1998 using multiple stage probability sampling techniques (4433 individuals in 117 villages). Figure 3-2 shows the 7 selected areas (green rectangle - Madaripur, Muladi, Shahrasti, Derai, Saturia, Shibpur and Mohammadpur thanas) and their location on the map of Bangladesh. The map also shows the level of exposure to the flood for Bangladesh.



**Figure 3-2: Map of Flood Affected Areas of Bangladesh as of September 9, 1998 (reproduced: Del Ninno 2001, survey documentation Coping Strategies)**

The households were not uniformly affected by floods; some were not exposed whereas other households were severely affected. Three rounds to the survey were carried out over a one year timeframe between November 1998 and December 1999. The aims of the survey were to capture the difference in labour participation and food security in the period following the flood and to understand the capacities of people to recover from the shock of the flood. A detailed household questionnaire was used to collect information. Some parts of the questionnaire contained retrospective questions on the situation during and before the flood. Anthropometric measurements were collected for all children below 10 years of age (957 children) and all females between the ages of 13 and 45 (1148 women). Morbidity questions were answered by mothers or caregivers based on a 2 week and 4 month recall period of illnesses. For the purpose of our analysis, the post-emergency phase is limited to 2 to 15 months after the flood. The most commonly

used definition for post emergency phase is based on the crude mortality rate; an emergency phase is defined as  $>1$  death/10,000 persons/day and a post-emergency phase is defined as  $<1$  death/10,000 persons/day (Burkholder 1995, Spiegel 2001a, Spiegel 2001b). In case of the 1998 flood, the mortality rate is unknown. It was therefore decided to use a timeframe which corresponds to the survey timeframe.

The analysis is restricted to infants and young children (IYC), defined here as birth to 2.99 years old. The terminology 'infant and young children' is defined in the literature under the 'early years' of life, from birth to 3 years (Bricker 1994). The infantile stage of life is characterized by the most rapid postnatal growth, and also rapid deceleration of growth rate. Deficits or delays in physical growth and undernutrition during these early years are likely to have long-lasting effects on later health, including reduced cognitive development and productivity in adult life (Cole 2003, Bogin 2001, Stoch and Smythe 1996, ACC 1999, Victora et al. 2008, Osmani and Sen 2003). From the IFPRI database, a sample size of 220 IYC were extracted with repeated measures taken at 2 separate points (baseline data collection completed 2 months after the flood, and a year after baseline or 15 months after the flood). The 220 IYC are all the IYC under 3 years old with repeated measures taken at the 2 separate points. The IYC selected were aged less than three years old a year after baseline. Exclusion of IYC with a pregnant mother (26 cases) and those with missing data for weight and height at baseline and a year after (51 cases) resulted in a final sample of 143 cases in total. The excluded cases were similar to the final samples in terms of sex ratio and age distribution based on analyses using the Pearson chi-square and Mann-Whitney U test, respectively ( $P$ -value  $> 0.05$ ).

### **3.2.2 Measures**

The variables included in the analysis were selected for their potential association with the nutritional status of IYC based on the findings of previous studies. These factors are related to the IYC, mother and household characteristics, and to the household Water Sanitation Hygiene (WSH) practices. As well as maternal nutritional status, for which this analysis tests the association, literature shows that there are a number of other variables which are associated with IYC nutritional health during flooding. These include household characteristics reflective of socio-economic status (household monthly expenditure, household monthly expenditure for food, and food share) and exposure to the flood (Bloem, Moench-Pfanner, and

Panagides 2003, del Ninno and Lundberg 2005, Choudhury and Bhuiya 1993, Stewart and Fauveau et al. 1990, Buttenheim 2006, Hossain and Kolsteren 2003). Infants and young children own characteristics such as age, gender, and nutritional status during the flood are also factors associated with their future nutritional health (Choudhury and Bhuiya 1993, del Ninno and Lundberg 2005, Buttenheim 2006). Mother’s education (literacy level and years at school), was selected into the analysis as this variable is associated with IYC nutritional health in relation to flooding (Stewart and Fauveau et al. 1990). Mother’s age and mother’s age at menarche have not been yet been identified as significant factors associated with IYC malnutrition in the case of flooding but have been in normal time (not during rainy season) (Rah et al. 2008, Chowdhury et al. 2000, Bogin 1997, Bogin and Smith 1996). IYC morbidity episodes for diarrhoea were shown to be associated with IYC nutritional deterioration in a flood context (Hossain and Kolsteren 2003). Acute respiratory infections (ARI) and WSH practices (type of latrine, type of water, purification or garbage disposal) are important factors well known to be associated with the health of IYC but the statistical association has not been yet demonstrated in a flood context (Parker 2004, Rahman and Rahman 1997, Hoque et al. 1999, Blum and Feachmen 1983). However, studies showed the deterioration of WSH practices and the importance of ARI during flooding suggesting them as potential influencing factors impacting IYC nutritional health (Rashid 2000, Rashid and Michaud 2000, Akter 2004, Parker 1987, Zaman et al. 1997).

The anthropometric measures were taken following standard procedures (Cameron, 1984; Cogill, 2003). The data collection was carried out with the support of DATA<sup>17</sup>. A total of four survey teams (each team included a field supervisor, three male interviewers, three female interviewers) carried out the data collection. No information about inter-observer error was provided. Food share was calculated as the percentage of total expenditure dedicated to food. The index of household flood exposure created by Del Ninno and Lundberg (2005) (not exposed, moderate, severe, very severely exposed) was entered as an ordinal variable. Water purification, sanitation (type of latrine) and hygiene (garbage disposal), abbreviated as WSH were considered as ordinal, and reflects practices assumed to be from worse to better. No latrine (open defecation) was considered the worst practice for sanitation. ‘Katcha’ (temporary latrine) was considered a poor practice. ‘Pucca’ (a standard pit latrine) was considered the best practice. Mother’s BMI was used to assess maternal nutritional status in our analysis. As the anthropometric measurements were taken 2 months and 15 months after the flood, mother’s BMI

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<sup>17</sup> DATA is a Bangladeshi organisation specialised in data collection.

was reflective of pre-flood vulnerability and emergent vulnerability related to the flood. BMI is considered a good index of body fat and protein stores and reflect the stores needed to cope with reduced calorie intake, increased activity, pregnancy or diseases (Cogill 2003). Mother’s BMI ( $WT(kg)/HT(m)^2$ ) was dichotomised into normal and underweight ordinal categories (BMI <18.5 = underweight, BMI  $\geq$ 18.5 = normal). Chronic Energy Deficiency (CED) status was characterised by being underweight defined as having a low BMI (BMI < 18.5 kg/m<sup>2</sup>) (Ferro-Luzzi et al. 1992).

The two age groups of IYC at a year after baseline were group 1 from 12 to 23 months, and group 2, from 24 to 36 months. The decision to group IYC in two groups is driven by the feeding practices involved as weaning happens during the second year of the IYC’s life in Bangladesh (Vosika 2005). Appropriate complementary feeding practices increase with the age of children in Bangladesh; only 16% of children age 6-8 months are fed adequately according to the IYC complementary guidelines compared with 55% of children age 18-23 months (MITRA and NIPORT 2007).

### **3.2.3 Statistical Analysis**

Data were first analysed using the bivariate Pearson chi-square test and Mann-Whitney U test. Repeated measures statistics comparing means of IYC’s nutritional status and the effect of the time (after the flood and a year after) were performed using Pillai’s Trace Multivariate tests. Pillai’s Trace test was chosen compared to other statistics because of its robustness to violations of model assumptions (Olson 1974). Hypothesis and error degrees of freedom of the F distribution were 1 and 113. Subsequently multivariate analysis was undertaken using a binary logistic regression (SPSS, version 14, Inc., Chicago, IL). A *P*-value of <0.05 was considered statistically significant.

Logistic regression was used after dichotomizing the dependent variables (weight-for-height [WFH], height-for-age [HFA], weight-for-age [WFA] z-score at a year after baseline) into two groups; malnourished and normal IYC in order to study the clinical outcomes. Stunting, wasting and underweight were defined respectively as a HFA, WFH and WFA status of less than - 2 z-score SD, from the National Centre for Health Statistics (NCHS) references using the Epi-Nut programme of Epi Info(TM) (version released 07/09/2004) (Hamill et al. 1979). NCHS references were preferred to the 2006 WHO growth standards in order to make the results

comparable to other studies also using NCHS references (del Ninno and Lundberg 2005, Hossain and Kolsteren 2003, Bloem, Moench-Pfanner, and Panagides 2003, Stewart et al. 1990). These studies used NCHS references because the data analysis was done before 2006 and the release of the 2006 WHO growth standards. There are differences between the WHO standards and the NCHS reference especially during infancy because only breast-fed infants are included in the WHO sample whereas there is a predominance of formula-fed infants in the NCHS reference (de Onis et al. 2007). The malnutrition prevalences calculated using WHO standards compared to NCHS references are likely overall to be different, with variation by age group, specific percentile or z-score curve (de Onis et al. 2007, Norris et al. 2009).

The Epi-Nut programme flagged 2 cases as outliers by default and further investigation of data did not show any additional outliers. These outliers were deleted from the database. The three nutritional indicators have been purposely used in order to determine associations between different types of malnutrition (chronic, acute and combined) and their predictors. The logistic regression was repeated for each nutritional indicator: WFA, HFA, and WFH at a year after baseline. It was decided to enter the independent variables in 5 nested models (Table 3-1). Since this work was interested in testing hierarchical models, the ‘*Enter*’ method was used to include variables for each of the 5 nested models. This modelling strategy enabled associations to be tested between mother’s BMI and infant’s nutritional status after controlling for a range of other factors and to observe the effects of controlling for the potentially confounding factors.



**Table 3-1: Grouping of the independent variables for the modelling strategy**

	<b>Variables</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
<b>Group 1 - Mother’s BMI</b>	Dichotomized mother’s BMI	✓	✓	✓	✓	✓
	Household monthly expenditures in the Bangladeshi currency taka		✓	✓	✓	✓
<b>Group 2 - Household</b>	Household monthly expenditures for food in the Bangladeshi currency taka		✓	✓	✓	✓
	Food share		✓	✓	✓	✓
	Index of flood exposure		✓	✓	✓	✓
<b>Group 3 - WSH</b>	Distance to source of drinking water in meters			✓	✓	✓
	Type of latrine			✓	✓	✓
	Type of water purification			✓	✓	✓
	Type of garbage disposal			✓	✓	✓
<b>Group 4 - Mother</b>	Age in year				✓	✓
	Age at first menstruation in year				✓	✓
	Years at school				✓	✓
	Literacy level				✓	✓
<b>Group 5 - Infant</b>	Sex					✓
	Age group a year after baseline					✓
	Number of days of diarrhoea during flood					✓
	Number of days of acute respiratory infection during flood					✓
	Dichotomized nutritional status for the relevant indicator at baseline: WFA or HFA or WFH					✓

A case with a standardized residual larger than 3.0 or smaller than -3.0 was considered an outlier. Influential cases were identified if its Cook’s distance was greater than 1.0. Outliers and influential cases were then evaluated for their impact on the accuracy rate of the model. Based on a 2% improvement threshold, none were excluded.

### 3.2.4 Ethical approval

Ethical approval to use secondary data collected from a vulnerable group (ie children under the age of 18 years) was obtained from Loughborough University Ethical Committee.

## 3.3 Results

More IYC were significantly more stunted and underweight a year after baseline than at baseline (Table 3-2). There was no significant change in the percentage classified as wasted between baseline and a year after.

**Table 3-2: Comparison of percentage of HFA, WFA, WFH in malnourished IYC immediately after the flood and a year after (Results of multivariate test of significance – sample size n=143)**

	Malnourished %	P-value <sup>a</sup>
<b>Height-for-age</b>		
Baseline <sup>b</sup>	50.3	<0.001
A year after <sup>c</sup>	60.6	
<b>Weight-for-age</b>		
Baseline <sup>b</sup>	58.7	<0.01
A year after <sup>c</sup>	66.7	
<b>Weight-for-height</b>		
Baseline <sup>b</sup>	24.6	0.925
A year after <sup>c</sup>	18.8	

<sup>a</sup> based on repeated measures statistics comparing the means of malnourished and normal children with the round effect based on Pillai's Trace multivariate test of significance. Hypothesis and error degrees of freedom of the F distribution are 1 and 113.

<sup>b</sup> Baseline: 2 months after the end of the flood (Nov- Dec 1998)

<sup>c</sup> A year after baseline: 15 months after the end of the flood (Oct – Nov 1999)

There was 14.0% of IYC with underweight mothers (mean BMI=16.9) at baseline who were wasted a year later while there was 6.1% of IYC with normal weight mothers (mean BMI=19.72) at baseline who were wasted a year later (Table 3-3). Of the IYC of mothers who were underweight at baseline, 39.5% were stunted and 46.5% were underweight a year later. Although underweight mothers were more likely to have malnourished children on any index of malnutrition, for stunting and underweight, there is deterioration between baseline and a year later in the proportion of children malnourished among the normal weight mothers and the underweight mothers. The mean z-scores for stunted and underweight IYC were significantly lower a year later reflecting a deterioration of their nutritional status (HFA: -2.1 to -2.6; WFA: -2.3 to -2.7). IYC with underweight mothers at baseline were on average two months older and suffered from fewer days of either reported diarrhoea or acute respiratory infection during the flood compared to IYC with normal weight mothers.

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**Table 3-3: Comparison of means and percentages of grouped variables between normal and underweight mothers (descriptive results Mother’s BMI baseline and grouped variables)**

		Mother's BMI - Baseline			
		Underweight (BMI<18.5) (n=79)	Normal (BMI ≥18.5, <=24.99) (n=56)	P-value	
Household variables	Flood - Not exposed (%)	23,70	22,50		
	Flood - Moderately exposed (%)	17,50	22,50		
	Flood - Severely exposed (%)	38,60	29,60	0.542 <sup>##</sup>	
	Flood - Very severely exposed (%)	20,20	25,40		
	Household monthly expenditure per member in taka (mean, sd)	630.87 (376.66)	694.01 (434.74)	0.148 <sup>###</sup>	
	Household monthly food expenditure per member in taka (mean, sd)	439.69 (282.19)	479.49 (260.47)	0.148 <sup>###</sup>	
	Food share (mean, sd)	70.55 (14.25)	71.93 (434.74)	0.961 <sup>###</sup>	
Water, Sanitation and Hygiene variables	Distance to source of water in meter (mean, sd)	103.47 (154.14)	88.22 (135.31)	0.952 <sup>###</sup>	
	Purification - none (%)	95,60	97,10		
	Purification - boil (%)	0,90	0,00	0.697 <sup>##</sup>	
	Purification - chemicals (%)	3,50	2,90		
	Garbage - fixed place (%)	95,60	97,10		
	Garbage - own place (%)	0,90	0,00		
	Garbage - anywhere (%)	0,90	0,00	0.221 <sup>##</sup>	
	Garbage - other (%)	3,50	2,90		
	Latrine - none (%)	29,80	33,80		
	Latrine - katcha (%)	49,10	45,10		
	Latrine - Pacca (%)	9,60	12,70	0.594 <sup>##</sup>	
	Latrine - Pacca water sealed (%)	7,00	5,60		
	Latrine - others (%)	4,40	2,80		
Mother variables	Age in year (mean, sd)	27.02 (5.88)	27.06 (5.55)	0.764 <sup>###</sup>	
	BMI (mean, sd)	16.93 (0.89)	19.72 (0.93)	<0.001 <sup>###</sup>	
	Age at menarche in year (mean, sd)	13.18 (0.94)	13.07 (0.97)	0.913 <sup>###</sup>	
	Illiterate (%)	38,00	33,90	0.630 <sup>##</sup>	
	Education - No education (%)	60,00	66,10		
	Education - 1 to 5 years (%)	24,50	19,60	0.728 <sup>##</sup>	
	Education - More than 6 years (%)	15,70	14,30		
Infant variables	Wasted (% of children <-2SD WFH) (n=25 baseline, n=23 a year after)	14,00	7,90	0.548 <sup>##</sup>	
		A year after	14,00	6,10	0.239 <sup>##</sup>
	Underweight (% of children <-2SD WFA) (n=61 baseline, n=78 a year after)	36,80	16,70	<0.01 <sup>##</sup>	
		A year after	46,50	21,90	<0.01 <sup>##</sup>
	Stunted (% of children <-2SD HFA) (n=54 Baseline, n=66 a year after)	32,50	14,90	<0.05 <sup>##</sup>	
		A year after	39,50	18,40	<0.05 <sup>##</sup>
	Age in months (mean, sd)	12.5 (7.3)	10.5 (9.0)	0.284 <sup>###</sup>	
	Age group 12-23 months (%)	58,67	41,33		
	Age group 24-36 months (%)	58,33	41,67	0.969 <sup>##</sup>	
	Girl (%)	54,40	52,10	0.762 <sup>##</sup>	
	Days of diarrhoea during the flood (mean, sd)	1.34 (4.29)	2.11 (4.98)	0.426 <sup>###</sup>	
	Days of ARI during the flood (mean, sd)	2.13 (7.79)	3.51 (10.83)	0.585 <sup>###</sup>	

<sup>##</sup> Based on Pearson X square test

<sup>###</sup> Based on Mann-Whitney U test

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The results of the binary logistic regression analysis are presented in Table 3-4. The 5 models compare the odds ratio for the significant predictors of IYC being either underweight, or stunted or wasted versus being normal at a year after baseline. The results are only presented for those that showed a significant association with the outcome. The insignificant factors were removed at the final step. This explains why the odds ratio may slightly change from one model to another because there are more parameters in the regression than are shown in the table. There is a difference in sample size from the descriptive statistics (n=143) to the logistic regression (n=114) because of the missing data for some of the variables included in the model.

**Table 3-4: Results of the binary logistic regression analysis (Odds ratio and 95% confidence intervals for the significant predictors of infant being underweight/stunted/wasted versus normal at a year after baseline).**

Significant predictors (baseline)	n	Underweight (WFA z-score <-2SD)				
		Model 1	Model 2	Model 3	Model 4	Model 5
M1 - Normal (Ref)	47	1	1	1	1	1
Mother's BMI Underweight	67	3.301** (1.407-7.744)	3.894** (1.551-9.775)	3.845** (1.429-10.344)	3.968** (1.401-11.240)	3.509* (1.022-12.048)
M2- Household variables	114		0.960* (0.924-0.997)	0.959 (0.919-1.001)	0.961 (0.917-1.007)	0.924* (0.865-0.987)
M5- Infant variables	61					15.305** (3.048-76.840)
Nagelkerke R Square		0.101	0.183	0.293	0.335	0.532
Classification accuracy		67.3 (Model constant only 67.3)	76.9	76.0	76.0	78.8

\* significant at alpha=5%

\*\* significant at alpha=1%

-: not significant when variable is never significant from model 1 to 5

## Chapter 3 – Mother’s BMI as a predictor of infant and young children’s nutritional status in the post-emergency of a flood

Significant predictors (baseline)			Stunted (HFA z-score <-2SD)				
			Model 1	Model 2	Model 3	Model 4	Model 5
<b>M1 - Mother's BMI</b>	Normal (Ref)	47	1	1	1	1	1
	Underweight	67	2.444* (1.100-5.429)	2.405* (1.037-5.578)	2.431 (0.988-5.983)	2.923* (1.104-7.743)	4.447* (1.044-18.943)
<b>M2- Household variables</b>	Flood impact - not exposed (Ref)	22	1	1	1	1	
	Flood impact - moderately exposed	20	2.178 (0.591-8.025)	2.489 (0.621-9.977)	2.411 (0.542-10.721)	7.828 (0.663-92.402)	
	Flood impact - severely exposed	42	4.099* (1.268-13.249)	4.049* (1.147-14.293)	4.134* (1.065-16.042)	8.210* (1.194-56.464)	
	Flood impact - very severely exposed	30	3.784* (1.071-13.367)	3.951* (1.022-15.271)	3.986 (0.957-16.598)	4.024 (0.512-31.199)	
<b>M3- Water, Sanitation and Hygiene variables</b>	Garbage disposal - fixed place (Ref)	67	1	1	1	1	
	Garbage disposal - own place	11	0.297 (0.057-1.560)	0.220 (0.033-1.452)	0.016* (0.001-0.501)		
	Garbage disposal - anywhere	27	0.542 (0.161-1.826)	0.564 (0.150-2.126)	0.101 (0.035-1.044)		
<b>M4 - Mother variables</b>	Garbage disposal - other	9	0.605 (0.107-3.415)	1.175 (0.168-8.225)	0.262 (0.018-3.837)		
	Mother's age	114	0.871** (0.789-0.962)	0.807** (0.688-0.946)			
<b>M5- Infant variables</b>	Infant's age - 12 to 23 months (Ref)	54	1	1	1		
	Infant's age - 24 to 36 months	60	0.069** (0.011-0.441)				
<b>M5- Infant variables</b>	Number of days of diarrhea during the flood	114	1.249* (1.010-1.545)				
	Number of days of ARI during the flood	114	0.893* (0.807-0.989)				
	Normal (Ref)	60	1				
	Stunted	54	58.356** (7.602-447.973)				
<b>Nagelkerke R Square</b>			0.062	0.157	0.221	0.319	0.619
<b>Classification accuracy</b>			61.5 (Model constant only 55.8)	68.3	68.3	70.2	86.5

\* significant at alpha=5%

\*\* significant at alpha=1%

- : not significant when variable is never significant from model 1 to 5

Significant predictors (baseline)			Wasted (WFH z-score <-2SD)				
			Model 1	Model 2	Model 3	Model 4	Model 5
<b>M1 - Mother's BMI</b>	Normal (Ref)	60	1	1	1	1	
	Underweight	60	1.609 (0.589-4.396)	1.741 (0.598-5.069)	1.799 (0.554-5.847)	1.895 (0.525-6.843)	2.097 (0.507-8.671)
<b>M2- Household variables</b>	Flood impact - not exposed (Ref)	22	1	1	1	1	
	Flood impact - moderately exposed	20	4.915 (0.830-29.103)	5.595 (0.830-37.695)	10.028* (1.216-82.738)	25.062* (1.808-347.445)	
	Flood impact - severely exposed	38	1.846 (0.327-10.410)	1.820 (0.277-11.978)	2.908 (0.330-25.620)	6.371 (0.408-99.532)	
	Flood impact - very severely exposed	24	2.504 (0.419-14.982)	3.014 (0.447-20.309)	4.611 (0.550-38.684)	10.433 (0.750-145.055)	
<b>M4 - Mother variables</b>	Mother's age	143	1.161* (1.017-1.325)	1.176 (0.997-1.387)			
	Infant's age - 12 to 23 months (Ref)	77	1	1	1		
<b>M5- Infant variables</b>	Infant's age - 24 to 36 months	66	0.161* (0.033-0.789)				
	Normal (Ref)	80	1				
	Wasted	24	0.787 (0.132-4.691)				
<b>Nagelkerke R Square</b>			0.013	0.130	0.229	0.318	0.429
<b>Classification accuracy</b>			79.8 (Model constant only 79.8)	78.8	83.7	83.7	84.6

\* significant at alpha=5%

\*\* significant at alpha=1%

- : not significant when variable is never significant from model 1 to 5

The most important predictors for identifying IYC who were underweight a year after baseline were their own underweight status (OR 15.31, 95% CI 3.05 – 76.84), their mother’s CED status (OR 3.51, 95% CI 1.02 – 12.05) and the food share (OR 0.92, 95% CI 0.86 – 0.98) after controlling for factors related to the household, WSH, mother and infant (model 5). The probability of the Wald statistic for the variable WAZ, mother’s CED status and food share at baseline was less than the

level of significance of 0.05 (model 5 - Table 3-4). Underweight IYC in the post emergency phase were more likely to have been underweight and have an underweight mother immediately after the flood. They were also more likely to live in a household where fewer resources were allocated to food. The classification accuracy (78.8%) is higher than the proportional by chance accuracy criteria and supports the utility of the model. Despite the fact that introducing IYC’s variables decreases the odds for mother’s CED status as a predictor, mother’s CED status remained a significant predictor of underweight.

The most important predictors for IYC who were stunted were, again, the IYC own stunted status (OR 58.35, 95% CI 7.60 – 447.97) and their mother’s CED status (OR 4.45, 95% CI 1.04 – 18.94). In addition, the IYC’s age group, their mother’s age, morbidity, flood exposure and garbage disposal were also significant predictors in model 5. Stunted IYC with underweight mother after the flood were likely to be stunted a year later. They were also more likely to be in the age group of 12 to 23 months and have younger mothers. Compared to normal IYC, they were significantly suffering from more days of diarrhea and fewer days of acute respiratory infection (ARI) during the flood. Finally they were more likely to be living in severely exposed households where garbage disposal was kept in the household location. In addition, the classification accuracy (86.5%) surpassed the proportional by chance accuracy criteria, thus supporting the utility of the model. While mother’s CED status was a significant predictor in models 1,2 and 4, the odds increased by 1.5 in model 5 when the IYC variables were introduced.

In model 5, the only significant predictors for identifying IYC who were wasted a year later were the flood exposure (OR 25.06, 95% CI 1.81 – 347.45) and being in a younger age group (OR 0.16, 95% CI 0.03-0.78). IYC living in moderately exposed households were more likely to be wasted than those not exposed. Inconsistent with the findings for underweight and stunting, neither the IYC’s own nutritional status nor its mother’s nutritional status after the flood were significant predictors for wasting a year later, respectively (OR 0.78, 95% CI 0.13-4.69) and (OR 2.09, 95% CI 0.51-8.67). Again the classification accuracy (84.6%) supports the utility of the model (Table 3-4).

### **3.4 Discussion**

Our analysis finds that mother’s CED status was associated with an IYC’s underweight and stunted status a year after a flood-emergency, even after controlling for household, WSH, mother and IYC variables. However, in the case of wasting, mother’s CED status does not play a predictive role. The discrepancy between WFH and the other two nutritional indicators could be explained by the nature of the indicators themselves: HFA reflects long-term nutritional history, while WFH reflects short-term nutritional impact, such as acute malnutrition. WFA incorporates both short-term and long-term history, a child can be underweight for age because of stunting, wasting or a combination of both.

#### **3.4.1 Comparison with other work**

Previous studies on maternal and child nutritional association investigated whether maternal nutritional status is a risk factor for IYC nutritional health but not whether maternal nutritional status could predict IYC nutritional health. However similar to our results, these studies concluded an association between maternal nutrition and children underweight and stunted status but not between maternal nutrition and a child’s wasted status. Sanghvi et al. (2001) in India and Rahman (1993) in Bangladesh found that maternal BMI is a potential risk factor for child underweight and in the case of Rahman’s study, the relationship was statistically significant in the lower and middle socio economic groups (the sample was 339 children aged 3-36 months and their mothers in two urban hospitals and a community out-patient clinic). Rahman (1993) explains that undernourished mothers tend to have little or no education and mostly come from poor families. Rahman suggested poverty as a direct cause of maternal undernutrition and explained that mothers from poor families were nutritionally deprived during childhood and adolescence, and continued to be after marriage. Maternal undernutrition is often aggravated due to an early marriage, frequent childbirth with lack of proper birth spacing, and discrimination of intrahousehold food distribution in a male dominated family. Due to their own poor nutritional health, undernourished mothers are less likely to sufficiently breast-feed their children, contributing to the poor nutrition of their children. They also tend to give birth to low birth weight babies entailing long term malnutrition (Rahman 1993, Sanghvi et al. 2001).. Sanghvi and colleagues (2001) add to the argument and explain that undernourished mothers are not able to take good care of their children. These children usually have a slower growth than similar children from stimulating environments (Sanghvi et al. 2001).

In the case of stunting, Rahman and Chowdhury's findings (2006) in Bangladesh confirmed our results of an association between maternal nutrition and stunted status of IYC. The study used data from the Bangladesh Demographic and Health Study 1999-2000 (BDHS) of a total sample of 5333 Bangladeshi children aged 0–59 months for whom anthropometric measurements were provided. Multinomial logistic regression analysis showed that mother's BMI and mother's height were significantly associated with severe as well as moderate stunting. The risk of severe and moderate stunting in children decreases with increases in maternal nutrition (Rahman and Chowdhury 2006). In their recommendations they suggest tackling maternal undernutrition in order to improve IYC nutritional outcomes and present poverty and its underlying social causes as a direct cause of maternal undernutrition. Gender discrimination and in particular intra-household inequity in food distribution in male-dominated families are common practices in Bangladesh. These practices are likely to aggravate the already poor state of maternal nutrition due to early marriage and frequent births (Rahman and Chowdhury 2006). Improving the quantity of diet for mothers through better intra-household food equity will not only benefit the mothers but most likely her children as well. The same holds for improving the quality of the mothers' diet as a mother-child association for iron status exists; mothers deficient in iron tend to have children also deficient in iron probably because of an inadequate dietary intake and low bioavailability of dietary iron (Faber et al. 2005).

Similar to previous studies, this analysis found that the flood affected IYC suffered from nutritional deterioration overtime (Buttenheim 2006, del Ninno and Lundberg 2005, Hossain and Kolsteren 2003). There was an increase in underweight and stunted IYC a year after baseline (respectively 8% and 10% more). However there are less wasted IYC a year later (6% less). Similar to previous studies, the analysis found that variables not related to flood exposure were significant predictors of the infant's nutritional status (the infant's own nutritional status, food share, infant's age, and mother's age) (Choudhury and Bhuiya 1993, Stewart et al. 1990). It can be observed that some variables related to flood exposure (level of exposure, morbidity, garbage disposal) were found to be significant predictors. Stunted and wasted IYC a year later were more likely to have been affected by the flood and other flood-related variables while underweight children were more likely to have been affected by the household environment (food share, mother's nutritional status and their own nutritional status). While variables often associated with wasting such as morbidity (diarrhea, acute respiratory infection), WSH did not play



a statistically significant role in the regression model for wasting, they were significant predictors for stunting. The disposal of garbage in the household location rather than in a fixed place was a risk factor for stunting. In addition IYC suffering from more days of diarrhea and fewer days of ARI are more likely to be stunted a year later. This discrepancy may well be explained by the fact that mothers could over-report recent illness episodes and under-report earlier episodes (Goldman, Vaughan, and Pebley 1998, Byass and Hanlon 1994, Boerma et al. 1991). It can be hypothesized that the latest episodes of diarrhea were reported while the previous episodes of ARI were not.

### **3.4.2 Limitations of study**

A major limitation of this study is the absence of a control group. This limitation results in it being impossible to state whether the nutritional deterioration observed in the flood affected IYC due to the flood only or to the combined effect of the flood and the changing age of the IYC. In low-income nations such as Bangladesh, as IYC grow older, their nutritional health is more likely to deteriorate due to additional exposure to nutritional insults. This typically results in a pattern of higher underweight and stunting prevalences for older children, regardless of flood conditions (Vosika 2005).

Using secondary data is a limitation because all of the measures that are susceptible to be associated with IYC nutritional status during flooding based on previous studies, are not available in the IFPRI data set. For example, intake of vitamin A, land tenure and having loans are factors that could not be included in the model despite the fact that previous research has shown a significant association with IYC malnutrition (Choudhury and Bhuiya 1993, Stewart and Fauveau et al. 1990, Hossain and Kolsteren 2003). Biological and socioeconomic measures of nutritional status and food security, such as Mid-Upper-Arm-Circumference (MUAC), triceps skinfolds or Household Economic Assessment (HEA) are recommended to assess the impact of disasters (Dorlencourt and Legros, 2000, Ferro-Luzzi and James 2007, SMART 2006, FANTA 2002, Ulijaszek and Kerr 2007, James et al. 1994). However these measures were not available in the IFPRI database. For this reason, BMI was used to assess maternal nutritional status. Triceps skinfolds and arm circumferences are more precise indicators of the peripheral wasting of muscle and subcutaneous adipose tissue but require more training and are subject to different degrees of errors (Ulijaszek and Kerr 2007, James et al. 1994). Only in cases of severely undernourished adults has arm

circumference been assessed to be easier to carry out compared with height and weight (Collins 1996). In comparison to skinfolds and circumferences, height and weight have the advantage of being fairly quick, simple and require only limited training (Slaughter et al. 1988, Ferro-Luzzi et al. 1992, James et al. 1994). They are also the most precisely measured making them the favourable choice in most nutritional studies (Ulijaszek and Kerr 2007). As a result, BMI has been the most established indicator for nutritional assessment of adult populations.

The data related to morbidity based on a 4 month recall period is a limitation in this analysis as these data may not be fully reliable due to memory lapses, and under- and overestimation (Goldman, Vaughan, and Pebley 1998, Martorell et al. 1976). Another limitation of this study is the small sample size. Even though the sample remains the same over time, the small size limits the predictive strength of the regression models and increases confidence intervals to very wide estimates in some cases. The fact that the analysis was restricted to IYC under 3 years old, resulted in a small sample. In this analysis, the effect sizes, measured with R square values, are medium to large. It is likely that if the sample size increases, the statistical significance of the finding will be stronger as medium to large effect sizes are unlikely to disappear with a larger sample size.

Finally we have been unable to exploit data on breastfeeding as they were not collected in a way that would allow the calculation of any standard breastfeeding rates. Data on WSH are also difficult to analyse as the body of evidence on good and bad practices during floods is extremely limited (Ahern et al. 2005, Few 2003). During flooding, latrines typically overflow and faecal matter mixes with flood water. A 'good' latrine in normal time (not during flooding) may be a hazard during floods as large quantities of pathogens are released into the environment near to dwellings and water supplies. Where flooding makes latrines unusable, open defecation becomes common practice often bringing excreta into even closer proximity with the living environment (Hales et al. 2006, Rashid 2000, Rashid and Michaud 2000, Akter 2004). The quality of drinking water typically deteriorates as water supplies become contaminated or inaccessible (Stanton and Clemens 1987, Rashid 2000, Rashid and Michaud 2000, Akter 2004). Families who used to boil drinking water cannot anymore due to unavailability of fuel. Problems associated with solid waste management also increase as waste floats out of garbage disposal points and families are more likely to throw their garbage into the flood waters as the 'usual' disposal point is inaccessible (Stanton and Clemens 1987, Rashid 2000, Rashid and Michaud 2000, Akter 2004).

### **3.4.3 Policy implications**

Our results add strength to previous reports of a long term link between maternal and IYC’s nutritional health after an emergency such as a flood. The results of the analysis also demonstrate the value of considering mother’s BMI as another measure of chronic energy deficiency and measure of risk to households after a flood. Humanitarian interventions in flood-emergencies typically use the nutritional status of infants and children (especially wasting) as a criterion for vulnerability. This is also the case in other types of emergency situations. The detection of a malnourished infant or child (WFH z-score < -2 SD) in a household results in the distribution of relief aid (food, hygiene items, etc). Additionally, the selected households often become eligible for low interest/long-term loans in countries such as Bangladesh where micro-credit has been used by NGOs to alleviate poverty (Gehlich-Shillabeer 2008, Ahmad 2003, Meyer 2002, Zaman 2000). After the emergency phase, relief assistance and funds tend to decrease dramatically, but the need for assistance is still great. Households which were not eligible for assistance during the emergency phase, could become more vulnerable than those that received assistance as resources have often been exhausted to survive the peak of the crisis (Hossain and Kolsteren 2003). They may be forced to borrow money from high-rate money lenders and enter a non-recovery vicious poverty trap (Chambers 1995, Parkinson 2005). Often this leads to a deterioration of infant and child health (Khan 1999). Maternal nutritional status and IYC stunting and underweight status compared to wasting status are all measures likely to reflect not only the flood effect but also any pre-flood nutritional vulnerability. In our analysis, the malnutrition prevalences were demonstrative of an alarming situation resulting from the combined effect of endemic poverty in Bangladesh and flood impact. These exceed most thresholds usually used to define a humanitarian crisis and highlight the need for policies to target these normally nutritionally vulnerable groups in crisis situations. Using simple indicators of maternal nutritional status such as BMI as an additional tool along with other vulnerability assessment measures during emergencies to allocate resources would further help to identify potentially vulnerable households and to more effectively allocate resources.

As the household would become eligible for relief, it would prevent IYC from becoming at greater risk of undernutrition even though their nutritional status may also be due to pre-flood causes. This finding suggests that preventive long-term interventions, based on well-targeted households, could be beneficial both immediately after a crisis and over the years of growth and development of children. For these interventions, both IYC’s and mother’s nutritional status could

be used to screen households, for example a severely undernourished mother with a moderately malnourished child will become eligible for relief (food supplementation for herself and her child) whereas in traditional humanitarian response only the child will receive food supplementation. Mothers with improved nutritional health will be able to provide better care for their children, thus alleviating malnutrition and enhancing better infant survival chances in the household (Bouis and Hunt 1999, Sen 1999). The targeted households may be able to develop stronger and more successful coping strategies for the next crisis.

Mother's BMI could be considered as an additional measure to traditional household food insecurity measures used to identify food insecure households in post-emergency situations. Sarlio-Lahteenkorva and Lahelma (2001) in a study conducted in Finland showed that food insecurity was associated with past and present economic disadvantage and lower BMI. The association was very strong between underweight and food insecurity. Bhattacharya et al. (2004) find evidence that food insecurity is a predictor of adult BMI. James et al. (1999) analysed anthropometric data collected in India and Zimbabwe. They suggested that mother's BMI may serve as an index of food adequacy/availability, and put forward policy implications based on anthropometric measurements. The work of Ferro-Luzzi et al. (1990, 1992) highlighted the value of monitoring adult BMI as an indicator of food adequacy during seasonal changes. Household food procurement data and 24h recall of food consumption are two quantitative methods widely used, respectively, by economists and nutritionists to estimate household food insecurity. However both methods are subject to measurement errors, recall bias, and are extremely time consuming (Maxwell 1996, Bouis and Hunt 1999). Taking the BMI of mothers may be more practical to implement compared to these other methods. Recently more qualitative approaches have been developed to measure household food insecurity by asking a set of questions. One of them is the 'coping strategies index' which included 'maternal buffering' as a coping strategy for household food insecurity (Maxwell 1996). It has also been argued that food insecurity cannot be estimated by a single indicator given its multidimensional aspect (Haddad, Kennedy, and Sullivan 1994, Riely et al. 1995). In this context, mother's BMI could be used as an additional indicator to complement other measures. Furthermore, previous research showed that maternal BMI could be associated with other aspects of households, e.g. maternal long term mortality risk, socio-economic status, education, sex bias, and intra-household food equity (Hosegood and Campbell 2003, Chen, Huq, and D'Souza 1981, Delpeuch et al. 2000, Campbell 1991).

### 3.5 Conclusions

In conclusion, our findings reveal the importance of promoting the nutritional health of both the mother and her IYC in the post-emergency context such as flooding disasters. Maternal BMI combined with IYC nutritional status could be potentially useful indicators for indentifying households requiring support after a flood, although, more research should be conducted to confirm this finding in developing countries.

#### **Key Messages**

- Mother’s CED status is associated with an IYC’s underweight and stunted status a year after a flood-emergency, even after controlling for household, WSH, mother and IYC variables.
- The flood affected IYC suffer from a nutritional deterioration overtime; there is an increase of underweight and stunted IYC a year after baseline (respectively 8% and 10% more).
- Variables related to flooding (level of exposure, morbidity, garbage disposal) and unrelated to flooding (the infant’s own nutritional status, food share, infant’s age, and mother’s age) are significant predictors of IYC nutritional status.
- The results of the analysis demonstrate the value of considering mother’s BMI as another measure of chronic energy deficiency and measure of risk to households after a flood.
- Mother’s BMI could be considered as an additional measure to traditional household food insecurity measures used to identify food insecure households in post-emergency situations.
- It is important to design interventions to promote the nutritional health of both the mother and her IYC in the post-emergency context such as flooding disasters.

In the next chapter, the impact of flooding on IYC feeding practices and the coping strategies developed by caretakers are explored based on the findings from participant observations and in-depth interviews carried out in Dhaka slums, Bangladesh. The results lead to further policy recommendations for interventions in relation to IYC malnutrition and flooding.

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## Abbreviations, acronyms and glossary (Chapter 4)

ACF	Action Contre la Faim or Action Against Hunger
BRAC	Bangladesh Rural Advancement Committee
CF	Complementary Food
CHS	Community Health Solutions
FAST	Food Access Survey Tool
SES	Socio-economic status
IFPRI	International Food Policy Research Institute
IYC	Infant and Young Children
NGO	Non-Governmental Organization
ORS	Oral Rehydration Solution
RUSF	Ready to Use Supplementary Food
RUTF	Ready to Use Therapeutic Food
UNICEF	The United Nations Children's Fund
WASA	Water and Sewerage Authority

<i>Bosti:</i>	Slum
<i>Chira:</i>	Flattened rice
<i>Choki:</i>	Wooden bed
<i>Gur:</i>	Traditional unrefined sugar
<i>Kitchouri:</i>	Meal prepared with rice, dhal and vegetable cooked together. It's often given as complementary food to IYC.
<i>Kolchi:</i>	Water container either in clay or aluminium.
<i>Muri:</i>	Puffed rice.
<i>Matir chula:</i>	Clay stove
<i>Pataton:</i>	Elevated structure made of bamboo and wood.
<i>Shasto shebika:</i>	BRAC community health worker
<i>Suji:</i>	Complementary feeding food prepared with rice powder, sugar, water or milk.

**Chapter 4 - Impact of flooding on  
Feeding Practices of Infants and Young  
Children in Dhaka, Bangladesh Slums:  
What are the coping strategies?**

## **4.1 Introduction**

Flooding has a downward spiralling impact on vulnerable populations and increases vulnerability to outcomes like malnutrition in affected households (Chambers 1995, Khan 1994). Bangladesh, one of the most disaster prone countries in the world is frequently affected by floods with the last two severe floods occurring in 1998 and 2004. Infants and young children's (IYC's) nutritional health is negatively impacted by floods as previous research conducted in Bangladesh has shown (Bloem, Moench-Pfanner, and Panagides 2003, Choudhury and Bhuiya 1993, del Ninno and Lundberg 2005, Bутtenheim 2006). Indeed, women and IYCs are the most vulnerable groups to flood impacts (Akter 2004, Wisner et al. 2004, Rashid 2000, Rashid and Michaud 2000).

This research uses quantitative and qualitative data collected in slums in Dhaka, Bangladesh to explore feeding practices for IYC in slums during the flood time and compares this to a non flood (normal) time. The research does not focus on one specific flood but rather on experience developed by caregivers over years of living with floods as Bangladesh is a country recurrently affected by floods on a yearly cycle. Flooding in the slums of Dhaka is not an exceptional disaster and this research is not about response to disaster. Rather, the focus of this study is about the kinds of adaptations that families routinely make over the course of a year. In this context, it is hypothesized that caregivers develop coping strategies in relation to feeding practices during flooding. This study aims to establish whether flooding is perceived to have a negative impact on the nutritional health of IYCs living in the slums. The related objectives are: 1) to identify the impact of flooding on IYC's feeding practices, 2) to explore the coping strategies developed by caregivers.

## **4.2 Background**

The urban poor in Dhaka, the capital of Bangladesh were estimated at around 12 million in 2007, or 37% of the total Dhaka population (World Bank 2007). Dhaka is the fastest growing mega-city in the world attracting an estimated 300,000 to 400,000 new migrants per year (Vosika 2005). There are approximately 5000 slums scattered throughout the city with an estimated 10 million inhabitants (Podymow et al. 2002). These slums, often located in flood-prone areas, provide appalling living conditions.

Slums are known to be extremely hostile environments for the growth of IYC, resulting in high prevalences of malnutrition and mortality (Pryer 2003, Hussain et al. 1999). Many children in the slums are born with a low birth weight (46.4% are born with a weight less than 2500g), an important risk factor for later malnutrition and developmental delays (Arifeen et al. 2000). Poor women often cannot afford to buy and prepare special food, resulting in growth faltering and malnutrition of their IYCs aged between 6 to 24 months old (Pryer 2003, Baqui et al. 1993). A study by Baqui et al. (1993), conducted in old slum settlements in Dhaka, showed that the prevalence of breastfeeding was high (82.4% of children 0-23 months), however the prevalence of exclusive breastfeeding was low (36% of infants 0-2 months, and 10% of infants 3-5 months). Moreover, about 30% of the infants did not receive colostrum within 3 days of birth. More than half of the 3-5 month old infants received semi-solid foods. Arifeen et al. (2001) confirmed these results. A little more than half of the infants in their sample were exclusively breastfed at 1 month of age, declining to about a quarter at 3 months. Widespread use of pre-lacteal feeds explained the low prevalence of exclusive breastfeeding at enrolment (Arifeen et al. 2001a).

Previous research in Dhaka shows that food insecurity levels for slum-dwellers were high. About 61.8% of households were categorized as 'severely food insecure'. This prevalence was higher than the level found in similar studies among food insecure populations in other areas of Bangladesh (Benson 2006, Hassan & Ahmad 1991).

### **4.3 Materials and Methods**

#### **4.3.1 Research methodology**

The present analysis uses qualitative data (participant observation and semi-structured interviews) and quantitative data (a household profile determination questionnaire, a food security assessment and anthropometric measurements of height/length and weight) collected from mothers and their IYCs in ten *bostis* (slums) in Dhaka, Bangladesh. The purpose of collecting quantitative data was to support the qualitative data by defining a detailed profile of the participants' household. The data were collected for seven months during the period from November 2008 to May 2009. The semi-structured interviews took place in 4 *bostis* (Begunbari, Kunibara, Mohammedpur and Kamrangir Char). These *bostis* were all recurrently affected by floods. The participant observations took place in these as

#### Chapter 4 - Impact of flooding on Feeding Practices of Infants and Young Children in Dhaka, Bangladesh Slums: What are the coping strategies?

well as another 6 additional *bostis* (Korai, Shadinata Sorony Bada, Arichpur, Railwaystaff, Sabujbag and Arjur). The participant observations were conducted in more *bostis* in order to obtain an overall view of the various slum situations in Dhaka.

The nature of the slums justifies a qualitative approach. Slums are very complex and difficult places to work. A researcher needs time to understand the dynamics involved and to gain the trust of the respondents. A short and quick evaluation would bring only false and inaccurate data because slum-dwellers live under a constant state of fear and mistrust. As Rashid (2007) reported in relation to her work on accessing adolescent women in Dhaka slums, violence, fear and insecurity, are part of everyday life in the slums. Slum-dwellers live under the fear of gang warfare, police raids, and oppression by local leaders and the state. A straight forward nutritional quantitative study would provide malnutrition prevalences, and various breastfeeding and complementary feeding rates based on recall. However it would not provide any in-depth understanding of the IYC feeding practices. For this research, a mixed-method approach was undertaken to slowly immerse myself in the slums and to help to understand how people live in the slums, as well as take care and feed their children. The qualitative component of this study permitted myself to gain insight of indigenous knowledge and practices. Prior to the collection of data in the slums, I learnt intensively Bangla during three months and learnt specifically vocabulary on the following topics: slums, IYC, health, nutrition, food, cooking and flooding. My research assistant was an anthropologist and she helped me to improve my knowledge of the language and the culture. We conducted the interviews together and both asked questions. When I asked a question in Bangla which the participant did not understand, the research assistant would ask the question again to get an answer. As much as possible, we avoided speaking in English during interviews to make the interview transparent to the participant.

The participant-observations (in total 24 observations) were key to comprehending the lives of the slum-dwellers and the resilience mechanisms adopted (Pelto and Pelto 1996, Cresswell 1975, Cresswell and Godelier 1976, Sanjek 1990, Albarello, Digneffe, and Hiernaux 1995, Denzin and Lincoln 1994, Copans and Singly 1996). During the first 2 months of the research, only participant observations were conducted and after both participant observations and semi-structured interviews were conducted (12 in 6 slums where only participants observations took place, 12 in 4 slums where both participants observations and in-depth interviews took place). The initial observations were facilitated by BRAC staff who guided me in the



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slums, gave me insight information and advice. Later when I was also conducting interviews, I organized myself to have plenty of time before or after the interview to interact with the community and become, as much as possible, an unseen observer. This was achieved by slowly immersing myself in the day-to-day activities of the people living in slums. Field notes were used to develop an understanding of constraints, strengths, weaknesses and forces driving the community.

The semi-structured interviews were conducted using a question guide and took place at the households. Most were conducted around lunch time in order to observe meal preparation, food intake and leftovers. The question guide was designed with the help of qualitative researchers and anthropologists in Bangladesh, and was pre-tested and modified before being used. As the work progressed, the guide was revised and expanded since new areas of interest emerged. It consisted of 3 parts: 1) IYC feeding practices and care in normal time, 2) experience with floods, and 3) IYC feeding practices and care in flooding time (Appendix I). It was important to understand the baseline feeding practices and care of IYCs in 'normal time' before exploring the impact that flooding may have on these. The approach undertaken was to define what 'normal time' was and to discuss feeding practices and care during this timeframe. Then 'flooding time' was defined and discussed. Topics were not discussed for one specific flood. Rather an overall experience developed over years of exposure to flooding was investigated. Finally IYC feeding practices for the two periods were compared. Each interview lasted approximately 1 to 2 hours and participants were interviewed four times on average depending on their availability.

### **4.3.2 Selection of the slums**

#### **4.3.2.1 Inclusion criteria**

The fieldwork took place in urban and peri-urban slums in Dhaka, Bangladesh (Figure 4-1). The exact slum locations were defined after visiting 10 major slums (Korai, Shadinata Sorony Bada, Arichpur (bow bazaar), Begunbari, Kunibara, Mohammedpur, Kamrangir char, Railwaystaff, Sabujbag, Arjur). The inclusion criterion for selection was to be flood-prone. The fieldwork was conducted in two types of slums, 1) heterogeneous and 2) homogeneous in terms of housing structure, infrastructure services and socio-economic status (Figure 4-2). The justification of choosing these types was to compare the behaviours, coping strategies, and feeding practices for IYC in relation to the surrounding context.

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The first type of slums (Kunibara and Begunbari slums) are very homogeneous in terms of housing structure (built on bamboo stilts), infrastructure services (water supply, gas in the community kitchen), and socio-economic status (1 or 2 resident members working in a garment factory). As these slums are constructed on government land, they are more prone to eviction risks compared to the second type built on private land. The rent varies between 6 to 20 GBP<sup>18</sup> per month with electricity; water and gas provided inclusively. These slums are situated in the industrial zone where garment factories are located. The majority of slum dwellers work in these factories; 8 to 10 hours per day for 40 GBP per month. One characteristic of these slums is the 4 to 6 meters high elevation above water or garbage and waste water. Part of the slum was destroyed a few days after the researcher first visited. The government had announced massive evictions 3 days earlier as a road was to be built along the lakeside. Most of the evicted people moved to other slums in Dhaka.

The second type of slums (Mohammedpur and Kamrangir *char*) are very heterogeneous in terms of housing structure (concrete building, tin-shed houses on bamboo stilts, bamboo huts built on ground), infrastructure services (sometimes no water supply or gas supply) and socio-economic status (resident members working in different factories, garment factory, plastic factory...). These slums are built on private land bought by businessmen. They typically buy it at a very cheap price because the land is not deemed constructible. In some cases there is no land at all and the slums are built on bamboo stilts over water bodies. After a couple of years of making money from the rents, landlords will evict the slum and turn the land into constructible land by importing huge amounts of sand. At this point the land is generally sold to developers. The rent varies between 3 to 20 GBP a month. The high rent includes gas, electricity and water. These slums are 'pocket slums' within one area compared to one big slum area such as in Begunbari and Kunipara *bosti*. Mohammedpur *bosti* is next to the flood embankment and thus faces high flood exposure during the rainy season. Kamrangir *Char bosti* is close to the Buriganga River and is one of the oldest slums in Dhaka, although it is not part of Dhaka City Corporation. This means that Dhaka Water and Sewerage Authority (WASA) does not work there so water supply is very poor and there is no centralised sewage network. In both Mohammedpur and Kamrangir *Char*, most slum-dwellers work in plastic factories (the city plastic garbage is sorted and recycled there), tanneries or factories making pots and pans.

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<sup>18</sup> GBP: United Kingdom Pounds

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**Figure 4-1: Dhaka map with location of slums used in this study (source: Yogsutra)**

Figure 4-2 gives examples of the type of environment found in each of the selected slums.



**Figure 4-2: Pictures of the slums selected**

**Picture 1:** Begunbari. Two and three level buildings made of CGI sheet and bamboo on bamboo stilts over seasonally flooded land.

**Picture 2:** Kunibara. Single level building with cement pillars over garbage and waste water.

**Picture 3:** Mohammedpur. Single level buildings made of CGI sheet with bamboo stilts over polluted water with floating solid waste. In the foreground there is a rubbish dump.

**Picture 4:** Kamrangir char. A three level building made of CGI sheet with few windows next to a garbage recycling factory.

### 4.3.3 Participants' identification and selection

The participants of the interviews were mothers and Bangladesh Rural Advancement Committee<sup>19</sup> (BRAC) community health workers living and working in the slums with children ( $n=18$  mothers, and  $n=5$  BRAC community health workers, Table 4-1). The total number of children born to these participants was 61 but anthropometric measurements were available for only 55 of them. There are missing data for 6 of them because the children were not present when the anthropometric measurements were taken on any visit to the household.

<sup>19</sup> Bangladeshi Non Governmental Organisation, the largest NGO in Bangladesh

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**Table 4-1: Number of interviews per location and per group of participants**

	Kunibara	Begunbari	Mohammedpur	Kamrangirchar	Total
<b>In-depth interviews</b>					<b>23</b>
Community health worker	2	2	1	0	5
Mothers	1	5	7	5	18

The first inclusion criterion was previous exposure to floods which means that participants had lived in a flooded area, but had not necessarily had their house flooded. Then mothers were selected based on the number of children (2 or more children versus only one child), age of the children (having at least one child under 3 years old), mother's age (from 19 to 45 years old), and household socio-economic status SES, which was assessed based on possession of assets. The classification based on possession of assets was discussed and defined beforehand with BRAC managers and researchers. Household SES was classified into high, medium and low. The classification was developed using an asset score. Household SES was classified as low when the household did not have a bed. A Household was classified to have medium SES when the household had a bed but no fan nor TV set nor DVD player. A household was classified to have high SES when the household had a bed and either a fan or a TV or a DVD player.

The participants' selection was done in order to obtain a wide range of profiles. An exception was made for the profile of 'old mothers'; where none of them had children under 3 years old. It was important to change this criterion to include older mothers in the study in order to explore how feeding practices and coping strategies used to be developed by older mothers to establish whether differences have occurred. The case list in Appendix II details the profile for the participants' age of the participant, the number of children and household SES.

BRAC community health workers were selected based on two criteria: 1) having children, and 2) previous exposure to flooding. BRAC community health workers or *Shastho Shebikas* are women living in the slum who have been chosen as volunteers and trained by BRAC to take part in the Manoshi<sup>20</sup> programme. They refer pregnant women to the BRAC delivery centre and provide antenatal and postnatal advice to pregnant and breastfeeding mothers.

<sup>20</sup> The Manoshi project was developed by BRAC to establish a community- based health programme targeted at reducing maternal and child mortality in the urban slums of Bangladesh. The programme is funded by the Bill and Melinda Gates Foundation under the Community Health Solutions (CHS) initiative aiming at strengthening and leveraging community organizations and participants to scale up proven interventions in community settings (BRAC 2009, Khan & Ahmed 2006).

#### **4.3.4 Household profile determination**

A structured questionnaire was completed to determine the profile of the households (Appendix III). The questionnaire was designed and customised based on questionnaires previously used in Bangladesh. The questionnaire was administered after having gained the trust of the respondent, usually after 2 – 3 visits. It consisted of questions on: 1) Household composition, migration and education, 2) Housing, 3) Household assets, 4) Environment water and sanitation, 5) Diarrhoea and other illnesses, 6) Household food insecurity: Food Access Survey Tool (FAST) (Coates et al. 2003) and 7) measurements of height/length and weight. Anthropometric measurements of the mother or community health worker and all her child(ren) were taken based on standard procedures and guidelines (Cameron 1984, Cogill 2003).

Sections 1 to 5 of the questionnaire are standard as they were used previously by other surveys, CARE Bangladesh SHAHAR Survey on Livelihood Security Analysis of Vulnerable Urban Households, Food Management & Research Support Project Ministry of Food, Government of the People’s Republic of Bangladesh and IFPRI survey on Household Coping Strategies in Bangladesh (IFPRI 2002, IFPRI 2003). The sections on FAST and anthropometric measurements are detailed further.

##### **4.3.4.1 Food Access Survey Tool (FAST)**

The Food Access Survey Tool (FAST) is the result of research conducted between 2000 and 2003 by the Tufts University Friedman School of Nutrition Science and Policy (FSNSP) to test the extent to which qualitative questionnaire approaches devised for use in the United States during the 1990s (with Tufts and Cornell involvement) can be adapted and enhanced for applications in diverse developing country settings. Bangladesh was chosen to be the country where FAST would be developed and tested.

In a first phase, the research focused on the development of the prototype Food Access Survey Tool (FAST) using the United States “food security core module” as a model<sup>21</sup> adapted to the Bangladesh context. Then the FAST module was administered for 3 rounds of data collection to a sample of households randomly selected from among villages. As a result of this research, the module of nine

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<sup>21</sup> The US ‘food security core module’ is a validated set of 18 questions that collectively distinguishes individuals and households experiencing food insecurity related to insufficient quantity and quality of food, food procured through personally and societally unacceptable means, and a feeling of vulnerability to downturns in supply (Nord and Andrews 2002, Frongillo 1999, Frongillo et al, 1997).

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questions (Appendix III) constructed for use in Bangladesh 'passes' validation tests that were applied to the US module, and it is transparent in both its underlying concepts and the meaning of the questions used. The set of nine questions together have strong statistical properties that measure not only the prevalence of food insecurity, but also give an indication of its severity and how that may change over time.

Based on the answers to these 9 questions, households were classified by levels of food insecurity; food secure, food insecure with hunger and food insecure without hunger. The classification was done resulting from a discussion between me and the researcher assistant after the interview. As suggested by the FAST methodology, our assessment was done based on the totality of information gained (verbal, visual, and measured by the questionnaire) during our time with the participants (Coates et al. 2003).

### **4.3.4.2 Anthropometric measurements**

The research assistant was trained to take good and consistent anthropometric measurements based on the standard procedures and guidelines (Cameron 1984, Cogill 2003). Because I took all measurements with the research assistant and I could ensure the appropriateness of the measurements taken, no technical error was calculated. The mother was present for all child measurements and was encouraged to hold the child in the correct position for measurement. Length for children up to 2 years was measured in a lying position. Height for children aged 2 years or more was measured standing. These measurements were carried out using the UNICEF Model measuring board for children and adults (Model No. PE-AIM-101) which was lent by ACF (Cogill 2003). Weight of child was measured using the double measurement method (the first measurement is taken for the mother only and the second is taken for the mother carrying the child. The child's weight is the difference between the two) (Cogill 2003). A SECA electronic scale (1-150kg x 100g - Item No. 0141015 Scale mother/child, electronic) was used and calibrated daily. Mother's weight was done as the first measurement as described previously. Mother's height was measured using the UNICEF Model children and adult measuring board (Cogill 2003).

### **4.3.5 Data analysis**

All interviews were recorded with an MP3 player. They were then transcribed into Bangla, and translated into English by the research assistant. The researcher could

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ensure the quality of the translation as she was present during the interview and she understood Bangla. The transcripts of interviews were coded by extracting concepts and using a constant comparison of the data to draw out themes (Denzin and Lincoln 2003). The coding book was developed through the process (Appendix IV). The concepts and themes were validated in discussions with the translator and participants in the field to ensure that misconceptions and important concepts were not missed. The software ATLAS.ti (release 5.2.0 ATLAS.ti Muhr, T. 1993-2009) was used to code and manage the data and compare themes/codes across the different profiles. Open coding included selection of phrases, sentences, and paragraphs of common as well as unique themes. In addition, the automatic coding function in Atlas Ti was used to identify words and phrases and to confirm and tabulate these throughout all transcripts. To ensure objectivity of coding, two transcripts (one coded by the researcher, one coded by the translator) were compared and any differences were discussed and corrected until they reached a consensus.

The quantitative data were coded in SPSS v14 and analysed using descriptive statistics; frequencies, mean and standard errors. As the sample was not randomly selected, none of the statistics produced can be used to infer findings to the general population. Rather these statistics describe only the types of participants included into the qualitative studies to further help understand the context in which they reside. Anthropometric measurements were analysed in Epi Info (TM) version 2004 to calculate the various malnutrition indicators (stunting, wasting, and underweight) in z-score. Stunting, wasting and underweight were defined respectively as a HFA, WFH and WFA status of less than 2 z-score SD, from the National Centre for Health Statistics (NCHS) references (Hamill et al. 1979). NCHS references were preferred to the 2006 WHO growth standards in order to make the results comparable to other studies conducted in urban slums in Bangladesh also using NCHS references (Pryer 2003, Hassan and Ahmad 1991, Kiess 1996). The limitations of the NCHS references compared to the WHO standards have been discussed previously in Chapters 2 and 3.

### **4.3.6 Ethical approval and consideration**

Prior to starting the study, ethical approval was obtained by the Loughborough University Ethical Committee, UK. A successful criminal record check (CRB) was done for the researcher as young children were involved in the study. Before conducting the interview, the research aims of the study were explained to the



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participant. An informed consent statement emphasizing the voluntary nature of the participation and the right to withdraw from the study was also read to them (Appendix V).

A gift valued 3 GBP was given to each participant after a visit to thank them for their time. The gift consisted of one kilo of oranges or apples as fruits are eaten only on special occasions or offered when visiting relatives in Bangladesh. Pictures taken during the interview of the family were given as well. Health costs (doctor consultation and medicines) were supported by the researcher when the household had exhausted all their resources and could not borrow money to pay for these. Therapeutic feeding (plumpynut provided by ACF) and specific nutritional advice were given to severely wasted children (Weight-For-Height < -3SD).

In this dissertation, the names of women have been changed to preserve anonymity.

The next section presents BRAC support for the project, provides some context to the urban slums included in the study, as well as identifying important gender issues and participants' time constraints as contextual influences on the methods used.

### **4.4 Contextual influences**

#### **4.4.1 BRAC support**

The first visits in the various slums in Dhaka were facilitated by The BRAC Manoshi programme. At each visit, one or two of their staff working in the slum took time to walk around with me. They helped with translation since at the time of my first visits in the slum I was learning Bangla and getting a first insight of the area. This was vital to the success of my project since slums are extremely difficult places to enter without having the support of an organisation or somebody well-known in the slum. Throughout the research, BRAC staff were very supportive. They helped me to find a mother if she moved to another location. They helped to identify certified doctors to provide good health care for some of the children.

The Manoshi project was developed by BRAC to establish a community based health programme targeted at reducing maternal and child mortality in the urban slums of Bangladesh. The programme is funded by the Bill and Melinda Gates Foundation

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under the Community Health Solutions (CHS) initiative aimed at strengthening and leveraging community organizations and participants to scale up proven interventions in community settings. Manoshi should be implemented in the urban slums of six major cities of Bangladesh (Dhaka, Chittagong, Sylhet, Rajshahi, Barisal and Khulna). By the end of 2007, the Manoshi programme had been rapidly expanded to all urban slums in Dhaka and around 1.5 million slum dwellers covered. By 2007, approximately 44% of the pregnant women under the programme used the BRAC Delivery Centres to give birth to their babies.

### 4.4.2 Urban Slums

The research was conducted in urban slums where slum-dwellers have hardly ever seen foreigners walking around and talking to people in their living place. The access to the communities was facilitated by BRAC staff working in the slums where the research took place. As a white European researcher in the field, I at first attracted lots of attention and interest. Most of the people just wanted to talk and know the reason for my visit. After explaining to them, and spending some time talking to them, they would leave satisfied. The fact that I spoke Bangla helped greatly to reduce this attraction. After several times being in the same area, women used to call me and my research assistant *apa* (sisters). The research assistant is a female anthropologist familiar with the local community. She was responsible for translation during the interview, transcription and translation of the recording.

In the slums built over water, bamboo stilts support 1 to 3 story buildings made of tin, bamboo and wood. These buildings have 10 to 15 rooms per floor with one household per room (Figure 4-2). A participant's house is typically a small room of approximately 6m<sup>2</sup>. During some of the first interviews, women would gather in the participant's house, or outside the doorway to listen. This situation was very difficult because I was worried that the basement would collapse and also that this might infringe on the privacy of the interview. Other women tended to interrupt during the interview and to answer some of the questions. This made it difficult at a later stage when the interviews needed to be transcribed as the recording was not clear. As the interview lasted 1 - 1.5 hours, women slowly left one after another to return to their occupation. After some time only the interviewed mother and her children were in the room. Sometimes after the interview, women would come again and ask me some questions. My food habits were one major area of interest for most of these women. As they were very similar to them, their curiosity was filled. The fact that I had a small baby at that time, made the link with mothers

much easier. Although I never took my daughter to the slums, I had photographs of her which I showed when I was asked about my family.

Some of the interviews were conducted in total darkness or by the light of a candle as there was no electricity at the time (even during day time). This made it difficult to see the facial reactions of the mother during interviews. This may have hindered some of the interviews. Participants facial reactions are reflective of happiness, sadness, anger, shyness, doubt, fear or tiredness as a natural response to a specific question. I consider these facial reactions meaningful and used them as a clue for what to ask next. In some cases, I had to change topic if for example a participant felt too much anger or sadness in response to a specific question. Not being able to observe these reactions, was challenging for the course of the interview. I may have asked a question when the interview was conducted in total darkness which I would not have done or would have asked differently or later during the course of the interview if in the light I would have seen the participant strongly reacting.

Slums are well known to be violent and stressful places where crime and drug businesses take place (Rashid 2007). Domestic abuse, fights between household members, neighbours, and among gamblers and drug addicts are common (Rashid 2010). Conducting fieldwork is extremely challenging and access to the communities need to be constantly negotiated through gatekeepers and local dealers. Thanks to BRAC support, I and the research assistant were free and felt free to move around. We never felt insecure or in danger and never faced hostile behaviours.

#### **4.4.3 Gender issues**

The topics tackled in the interviews were gender sensitive. The scope of the interview covered topics such as breastfeeding, birth, women's health and personal hygiene. The mothers interviewed seemed always comfortable to answer. In some cases their husbands were present but they did not feel shy to answer those questions in front of them. The results did not show differences between women with and without their husband.

#### **4.4.4 Time pressure and constraints of the participants**

The working mothers living in the slums have a very tight agenda. They usually work from 8 am till between 8 to 10 pm. The interview had to take place during

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their one hour lunch break if they had come back home. In the other cases, the interview was conducted either early in the morning (6-7 am) before they left to work or during their day off (Sunday or Monday depending on the type of work).

For the non-working mothers, it was easy to conduct the interview at any time. They were always busy with various tasks but took the time to talk or would tell the researcher to come back at another time if busy, for example after the mother finished the cooking.

### **4.5 Results**

#### **4.5.1 Participant profile**

The children were on average 67 months old and 50.9% were girls (Table 4-2). The mean age is higher than 3 years old because it takes into account the age of all the children for one mother. Even though one of the criteria for mother selection was to have at least one child under 3 years old, some mothers had elder children which increased the age mean. The malnutrition prevalence for the IYCs of the participants was high. Stunting (% of children z-score Height-For-Age<-2SD) was 48.9% of children of all ages ( $n=55$ ), and 56.3% of children <5 years old ( $n=23$ ). Underweight (% of children z-score Weight-For-Age<-2SD) was 50.0% and 60.9% of these same age groups. The prevalence of wasting (% of children z-score Weight-For-Height<-2SD) was 35.1% and 43.8% (Table 4-2).

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**Table 4-2: Comparison of Percentage of HAZ, WAZ, WHZ in the Children of the Selected Sample per Age Group and Breastfeeding Rates in the study slums (Dhaka, Bangladesh)**

		Selected sample	
		All (n=51)	Children <5 years old (n=23)
<b>HAZ</b>	Severely malnourished <sup>1</sup> (%)	17.8	18.8
	Moderate malnourished <sup>2</sup> (%)	31.1	37.5
	<b>Global chronic malnutrition (%)</b>	<b>48.9</b>	<b>56.3</b>
	<b>Mean (SE)</b>	<b>-1.92 (0.21)</b>	<b>-2.41 (0.35)</b>
<b>WAZ</b>	Severely malnourished <sup>1</sup> (%)	19.2	21.7
	Moderate malnourished <sup>2</sup> (%)	30.8	39.1
	<b>Global underweight malnutrition (%)</b>	<b>50.0</b>	<b>60.9</b>
	<b>Mean (SE)</b>	<b>-2.34 (0.20)</b>	<b>-2.55 (0.34)</b>
<b>WHZ</b>	Severely malnourished <sup>1</sup> (%)	13.5	18.8
	Moderate malnourished <sup>2</sup> (%)	21.6	25.0
	<b>Global acute malnutrition (%)</b>	<b>35.1</b>	<b>43.8</b>
	<b>Mean (SE)</b>	<b>-1.70 (0.17)</b>	<b>-1.90 (0.31)</b>
<b>Children age in months, mean (SE)</b>		67.1 (50.3)	
<b>Girls (%)</b>		50.9	
<b>Breastfeeding children &lt;1 year (%)<sup>3</sup></b>		100.0	
<b>Breastfeeding children &lt;2 year (%)<sup>3</sup></b>		92.3	
<b>Breastfeeding children &lt;3 year (%)<sup>3</sup></b>		66.7	
<b>Breastfeeding children &lt;4 year (%)<sup>3</sup></b>		60.9	
<b>Breastfeeding children &lt;5 year (%)<sup>3</sup></b>		53.8	

<sup>1</sup> percentage of children <-3SD from the median of the 2000 CDC International Reference Population.

<sup>2</sup> percentage of children <-2SD and >= -3SD from the median of the 2000 CDC International Reference Population.

<sup>3</sup> nb of children breastfed under 1,2,3,4,5 year old / total nb of children under 1,2,3,4,5 years old

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**Table 4-3: Household Descriptive Data of the Selected Sample (age, employment status, mobility, house structure, health, water, sanitation and hygiene)**

	<u>Selected sample</u> All households ( <i>n</i> = 23, household members <i>n</i> = 115)
<b>Mother age, mean (SE)</b>	28.4 (6.7)
<b>Mother literacy (%)</b>	
Can read only	4.3
Can sign name only	<b>39.1</b>
Can read and write	34.8
Can neither read nor write	21.7
<b>Mother employment (%)</b>	
Garment worker	13.0
Plastic factory worker	5.0
Beggar	5.0
Community health worker	13.0
Housekeeper	9.0
At home	<b>55.0</b>
<b>Father employment (%)</b>	
Garment worker	10.5
Rickshaw puller	<b>31.6</b>
Beggar	5.3
Construction labor	15.8
Seller	15.8
Farm worker	10.5
Other	10.5
<b>Move to a new house during study (%)</b>	17.4
<b>Rain water leaking into the house (%)</b>	57.1
<b>Feeling safe inside the house during storm (%)</b>	33.3
<b>Garbage disposal (%)</b>	
Dispose in a designated area	<b>36.4</b>
Under bamboo basement 'pataton'	<b>36.4</b>
In front of bamboo basement 'pataton'	9.1
Next to the river	18.2
<b>Purification process for drinking water (%)</b>	
None	<b>66.7</b>
Boil	28.6
Chemical	4.8
<b>Food security level (%)</b>	
Food secure	18.2
Food insecure without hunger	<b>45.5</b>
Food insecure with hunger	36.4

The reported breastfeeding practices at the time of the study were very good; 100% and 92.3% of the children under, respectively, 1 and 2 years old were

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breastfed. However the exclusive breastfeeding rate for the under 6 months old (28.5%) was low. Only 44% of the children aged over 5 years old were going to school (Table 4-3). The mothers of the selected sample were on average 28 years old with only 34.8% of them being literate and 55% of the mothers staying at home. Seventeen percent of households had relatively high SES, 47% medium SES and 39% relatively low SES based on the SES classification developed. The husbands' occupation was most commonly recorded as being a *rickshaw*-puller (31.6%). During the time of the study, less than 20% of the families moved to another house in the same slum or another slum.

The food insecurity level according to the analysis of FAST was very high for the household participants (Table 4-3) (Coates et al. 2003). A total of 81.9% of the households were food insecure, with 36.4% being food insecure with hunger. Participant families also suffered from poor health status (Table 4-3). In 100% of the households, one member was reported to be sick in the past 30 days of the study. 86.4% of households, failed to get proper medical care because of lack of money. Living conditions were poor; 57.1% had rain coming into their house during the rainy season, 77.3% did not feel safe during storms, and 36.4% of the households consistently disposed their garbage directly under their house (Table 4-3). Only 28.6% boiled water before drinking. On average, 6 families shared one latrine which was commonly a sanitary water sealed pit latrine for the households living on the ground, and a hanging latrine for the households living on the *pataton* (elevated structure of several meters high, Figure 4-3).



**Figure 4-3: *Pataton* structure in Dhaka slums (bamboo, elevated structure 3-6 meters high over wasteland/water)**

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In the following sections, the feeding practices for IYC during 'normal time' are presented and their severe deterioration during flooding can be observed. 'Normal time' was defined as the period in between the usual rainy season, which occurs July to September. It is during the yearly rainy season that flooding takes place. A 'flood' and its severity were defined by participants by the length of time water stayed inside the house and the depth of the water in the house. A flood was considered a 'big' flood when water remained inside the home for two months at minimum knee height. A 'small' flood was defined when water remained inside the house for less than two months and less than knee height. For example, one mother living in Mohammedpur described the 2008 flood as a small flood, 'last year the flood was not big, the room was only inundated under 2 feet of water and water stayed only 2-3 days in the room'. Another woman reported on last year's flood, 'it was not a big flood... our room was 2 feet under water and water stayed for only 1 month!' The classification of a flood and its severity was necessary for the research because I used them as a reference during the interviews to assess the exposure towards flooding for the participant's household.

### 4.5.2 IYC feeding practices in 'normal time'

#### 4.5.2.1 Breastfeeding practices: 'If I eat more...I would have more breast milk!'

The breastfeeding practices for infants were not meeting the WHO guidelines (Chapter 2 - Table 2-4); colostrum was not commonly given to infants and exclusive breastfeeding was not a widespread practice. A community health worker reported 'They [the mothers] give colostrum. But very often they do not understand, they feed *suji*<sup>22</sup>, or water of rice to the baby. They feed milk vita (pasteurized cow's milk) when the baby is only 2 to 3 days old.' Mothers reported insufficient maternal milk and believed it was due to their underweight status. One mother stated '*Apa*<sup>23</sup> (sister), my husband is sick. He can not go for work! That's why we don't have sufficient food in our house now. I can not eat enough food... That's why I have less breast milk. If I eat more, I would have more breast milk.' As a replacement for maternal milk, they had to feed their infants other milk-based drinks at an early age. These preparations were either extremely diluted and/or

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<sup>22</sup> *Suji* is prepared with rice flour or wheat flour (more expensive), sugar, water or milk. It's usually 2 spoons of flour, 2 spoons of water or milk and 1 table spoon of sugar. It's introduced from 1 month of age. For a less than 6 month old child, half a glass is fed. It's very quick (5 to 10 minutes) and easy to prepare. The older the child gets, the more solid *suji* is prepared.

<sup>23</sup> *Apa*, meaning sister is commonly used by Bangladeshi women when talking to each other in a courteous way.



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based on cow's milk with sugar. One mother explained 'I have started to give her *suji* when she was one and a half months old because I had no breast milk. What else could I do? She cried. When I gave her *suji* she stopped her crying...I made it with packet milk, sugar (*tal misri*), rice powder and water'.

Working mothers had to stop breastfeeding during the day but did not have the financial means to provide appropriate infant formula milk to their infant (<6 months old). As a result, improper milk-based drinks (cow's milk, full cream powdered milk) or liquid *suji* were fed to the infant by the alternate caregiver<sup>24</sup>. One mother working in a garment factory for the entire day reported, 'I breastfed only at night. So I provided packet milk during the day... How else could I manage? I had no other way'. Alternate caregivers did not have the skills nor the knowledge to feed infants correctly; instead they often fed them biscuits or sweets. One caregiver (7 years old) used to feed her little brother (4 months old) biscuit mixed with water. She would also from time to time buy some processed fruit juice (intake high in sugar and water) when the child cried too much.

Eight out of the ten working mothers had an alternate caregiver for their children; of whom six were considered inadequate because they were under 12 years<sup>25</sup>. The mean age of these underage caregivers was 8 years. Four caregivers were the mother's daughters and three were their own mothers. In addition to child care, young girls were also involved in domestic chores (firewood collection, food preparation and cooking, clothes washing) when their mother was at work. They are not given the choice of going to school. When working mothers do not have a young daughter, they frequently ask their own mother to come and live with them in the slums. Typically these grand-mothers are not happy in the slums and miss their village life. Eventually many will go back to their village with their grandchild. Mothers will then see their child once to twice a year. Romella, the grandmother of a 6 months old boy explained, 'My daughter works in a garment factory... She needs money... So she can not look after her son properly... I also can not stay here forever because in my village I have some land, some cattle and cows. We grow crops and look after cattle. That's why I cannot stay here. That's why I will take him'. The grand-mother recognised the need for her daughter to make money by working in a garment factory which she would not be able to do in the village. But she also considers the slum environment as a hostile place for a child to grow

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<sup>24</sup> Throughout this paper, the term 'alternate caregiver' is used for a sibling, a relative, or a grand-mother who provide of care for the child.

<sup>25</sup> According to LaMontagne *et al.* (1998), an alternate caregiver is considered inadequate when the care is provided by a child under 12 years old.

up in compared to the village where it is less risky and peaceful and where the child can be fed better food (fresh milk, eggs, fruits and vegetables from the garden).

Breastfeeding duration was good as most of the mothers breastfed until 2 to 4 years. Predominant breastfeeding often lasted too long compared to the WHO recommendations as some children were fed predominantly maternal milk in addition to other drinks until two years of age; children are getting their main source of nourishment from maternal milk which is not enough for their growth and survival from the age of 6 months old (when complementary food should be introduced) (Dewey 2003, Bogin 1999). In a small number of cases, weaning from breastfeeding happened too quickly (at one year of age) with no appropriate weaning food available; the child's diet was reported to go from maternal milk directly to the family meal.

**4.5.2.2 Complementary feeding practices: 'I gave *suji* at one year; then a little bit of rice at one and half years and at 2 years what we eat'.**

Complementary feeding practices for infants and young children did not meet the WHO recommendations (Chapter 2 - Table 2-4). Complementary feeding was often introduced too early (before the child is 6 months old) posing the risk of morbidity transmission, and reasonable quality complementary feeding was introduced at a late age (1 to 3 years old) posing the risk of insufficient energy intake. IYCs were fed empty calorie snacks (sweets, ice creams made of water and sugar) as a replacement of appropriate complementary foods. One mother explained that she could feed her 2 year old 'only breast milk and biscuits'. She said she could not prepare *suji* or *khichuri*<sup>26</sup> 'because I don't have time'. Non-working mothers did not have the means to cook a separate meal for their children as the cooking time was limited in the community kitchen. A good quality complementary food, called *khichuri* which is prepared with rice, *dal* (lentils), vegetable oil and salt, was mentioned to be prepared by some mothers but was never seen prepared, cooked or fed to IYCs during the participant observations. While some mothers reported buying fruits, such as apples, oranges and grapes once a month for their IYCs, fruits were never seen to be consumed during participant observations.

Working mothers (ten out of the twenty three of the participants) did not have time to cook appropriate complementary food for their children, as they left early and came back late from work. One mother had to leave her 3 children by themselves

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<sup>26</sup> *Khichuri* is prepared with rice mixed with double proportion of lentils and vegetables.

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while she worked as a housekeeper. The mother could eat at her working place while the children had to manage with the food left in the house: 'If there is rice they can eat... otherwise they remain hungry!' The eldest daughter confirmed not eating anything during the day 'My mother brings rice for us at night from work'. Alternate caregivers were either too young (elder brother or sister) or too old (grand-mother) to cook appropriate complementary food. The youngest child (11 months old) of one working mother was severely wasted (z-score Weight-For-Height < -3SD) because he was fed only biscuits in addition to breastmilk at night. His caregiver, the eldest sister (11 years old), bought with the 10 BDT<sup>27</sup> (0.1 GBP) given by her mother in the morning, some candies and ice cream for him as 'he did not eat much' of the family meal.

### 4.5.2.3 Food insecurity: 'We eat what we earn!'

IYC feeding practices were affected when the household became 'food insecure with hunger'. While the majority of the households were assessed to be food insecure, they became 'food insecure with hunger' when one of the income generators became sick, or handicapped and could no longer work (Table 4-4). As their initial health status was poor and the exposure to diseases was high, this happened frequently.

#### Table 4-4: Examples of household food insecurity

Kobita stopped working because she felt weak and sick. Three of her four children were sleeping at the time of the household visit. They had not eaten since last night because she had no money to buy food. She was waiting for her husband to come back with money later in that afternoon. Then she would be able to go to the market and buy food. Her husband then would rest after an exhausting day of pulling *rickshaw* to earn money.

Aforoza said that she did not have any food at home. Her daughter cried and she said that she would buy biscuits for her from the nearest shop on credit. Biscuits are considered as special treats for children. They are often bought for IYCs because they are available for a low cost in all local shops, are packaged in a small packet and are "ready to eat".

To cope with food insecurity, some of the participants borrowed money and relied on neighbours' solidarity for their children. A mother explained 'Apa, today I will not eat (*Na khye thaki*)! There is no rice in my house now... but my neighbours will give my daughter food'.

<sup>27</sup> BDT: Bangladesh Taka

### **4.5.3 IYC feeding practices during flooding and impact of flooding**

#### **4.5.3.1 Flooding experience: 'Then four people eat one person's food!'**

The difficulties encountered by slum-dwellers illustrate the living conditions during flooding. The major reported problems were related to the lack of environmental cleanliness (smell of bad water, dirty water with human waste floating everywhere, spread of cockroaches, rats and snakes). Further problems resulted from the restriction of movement, in particular for women and IYCs, such as difficulty to use latrines and to travel to work. Finally participants faced issues due to a decrease in food security and an increase in domestic burden (e.g., food collection and preparation, washing clothes, and child care). All usual domestic tasks became extremely difficult to carry out and took 2 to 3 times longer compared to the normal time because of the restriction of movement and the non-availability of cooking gas.

During flooding, the decrease in food security resulted from the combined effect of lack of access to food and limited availability of food in the market. The household resources also declined and limited the purchasing power. This was essentially due to the inability of the income generators to work; especially the *rickshaw*-pullers who could not work due to the roads being inundated with flood waters. One mother reported on her husband who is a *rickshaw*-puller, 'He works half day. Sometimes he cannot work because of water.' Food quantity and quality were affected too. Slum-dwellers reported eating 50% less food than usual, and a limited diet (potatoes, rice, and dry food). They suffered from hunger and ate once a day. A mother narrated, '*Apa*, the cooked *dal* was so transparent (diluted)! We could wash our hands in it.' Another mother recounted, 'People could not bring food to the market. So the price was high. We bought half KG of rice instead of one.'

#### **4.5.3.2 Breastfeeding practices during flooding: 'I had no breastmilk!'**

Breastfeeding mothers reported a decrease and cessation of maternal milk supply as they ate less in quantity and a limited variety of food. A mother recounted, 'During flood I ate less fish and vegetables. That's why I had less breast milk'. The options for replacement of maternal milk were limited or non-existent. Liquid *suji* or diluted powdered milk was given as replacement when the mother could afford it. A mother explained, 'When the baby could not suck I understood then [that I had no more milk]'. She added further that she could not afford providing any replacement food for her baby.

#### 4.5.3.3 Complementary feeding practices during flooding: 'We cannot afford special food...children eat what we eat'

A deterioration in complementary feeding occurred during flooding. Mothers and alternate caregivers did not have the money nor the time due to an increase in domestic burden to cook complementary foods for their children (Table 4-5). Mothers had difficulties in food preparation, as cooking stoves were either under water or gas lines were disconnected. They often had to cook with a *matir chula* (clay stove) on top of their bed which was time consuming and costly due to the price of wood. A mother reported, 'Apa, if we cook one day then we couldn't cook another day. There was no wood (*lakri*). We tried to find leaves and branches (*lata pata*) on the road and cooked with those. Most of time we ate dry food. Kitchen was a bit far away. It was difficult. I felt disgusted to go over dirty water. There were small animals (rats) and insects in the water.' Dry foods such as puffed rice (*muri*), flattened rice (*chira*) and unrefined sugar (*gur*) were provided by relief organisations to vulnerable households. Most participants reported eating dry food once or twice a day.

As a result, IYCs ate the same meal as the rest of the family; this was either too spicy or did not have the appropriate nutritional density and value. One mother narrated, 'We provide the baby what we eat.' When asked how it affected the baby's health, she answered, 'The baby becomes thin (*sukae jae*).' Participants perceived that during flooding the IYCs lost weight, became thin and suffered from poor health (*sastho kharap hoe jeto*). They also reported more morbidity episodes, e.g., diarrhoea, scabies, acute respiratory infection, fever and cold (*patla pai kanna, chulkani, shash tontrer prodaho, jor, tanda laga*). Recovery from such episodes usually took 1 to 4 months after the flood as reported by the mothers.

**Table 4-5: Everyday life of Sumi, a garment factory woman during normal time versus flooding time<sup>28</sup>**

<u>Normal time</u>
5:00 - Wake up
5:00 - 7:00 - Hygiene, preparation of family food for breakfast and lunch, breakfast
7:30 - Travel to work
8:00 - 13:00 - Work at the factory
13:00 - Lunch time (at the factory or at home if close by)
14:00 - 20:00 - Work at the factory (until 22:00 if overtime)
20:00 - Stop at the market to buy one day supply of food

<sup>28</sup> See Appendix VI for coping strategies

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20:30 – Return home and start cooking

21:30 - 22:00 – Dinner

22:00 – 24:00 – Visit neighbours or watch TV at a neighbours' home.

Flooding time compared to normal time

5:00 - Wake up

5:00 – 7:00 – Difficult to go to the latrine (the path and the latrine are under flood water; the alternative is to defecate into flood water within the home), impossible to cook (gas lines are disconnected), eat dry food for breakfast (mother eats last - whatever is left after her husband and children eat)

7:00 – 13:00 – Stay at home (impossible to go to work because of flood water), cook on a *matir chula* for several hours (cooking is done on the bed as flood water is in the house), watch that children don't fall in the water, search for clean water (the usual water supply is polluted), wood for cooking and food (usual market often does not exist anymore due to flood water; the household relies mainly on food distribution by relief organizations)

13:00 - Lunch time (eat rice and *dal*, or dry food, or nothing)

14:00 – 20:00 – Stay at home, wash clothes on the bed, search for water, wood, food

21:30 - 22:00 – Dinner (eat remaining food from lunch time, or dry food, or nothing)

#### **4.5.4 Coping strategies**

##### **4.5.4.1 Food insecure households: 'Sometimes I had to beg money with my sons'.**

The usual coping strategies developed by food insecure households with adequately nourished or malnourished children during flooding were; 1) finding 'cash' by various means (borrowing money, buying on credit, depositing for loan their jewellery as collateral, selling their assets, begging on the roads), 2) spending less by decreasing their food intake and by decreasing their resources allocated to other expenditures, 3) dealing with the flood environment by buying a raised bed and a *matir chula* and 4) migrating to higher ground (a school or a relative's house). These coping strategies were developed by the household to survive in extremely hard living conditions. Although they were not meant specifically to deal with IYC's feeding practices during flooding, their indirect impact on children's survival is hard to evaluate and in some cases may have negative consequences.

The coping strategy developed by mothers to purposely protect their children's nutritional health was to reduce their own food intake. Priority and intra-household food allocation between members favoured the fathers as they were the main income generators, and then the children in the households. Mothers always ate last even when food was remaining but frequently skipped meals. A mother narrated that 'Mothers often pass the day by drinking a glass of water.'

##### **4.5.4.2 Comparison between food insecure household with adequately nourished or malnourished children and food secure household with adequately nourished children: 'I had some savings...I used all of them!'**

The coping strategies for food secure households (FSHs) with adequately nourished children and food insecure households (FIHs) with adequately nourished or malnourished children were compared to understand the differences in vulnerability and resilience capacity (Appendix VI). The coping strategies developed and their experiences during flooding were different. FSHs with adequately nourished children had more resilience capacity consisting of savings, food stock and assets. They were also able to develop successful strategies to prepare for the flood such as having a raised bed, a *matir chula*, a stock of combustible fuel (cow dung) or moving back to their home village before the flood. On the contrary, FIHs with adequately nourished or malnourished children were forced to develop negative

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coping strategies during the flood; thus increasing their vulnerability and poverty level.

FSHs were more likely to have savings, or to have borrowed money before the flood while FIHs had to borrow money (if they were able to find someone to lend them money), or were forced to beg for money or even sell valuable assets during flooding (which were often bought by the FSH group). FSHs were more likely to have food available during flooding however they faced the same difficulties in cooking as the FIHs. The decrease in food security was important for the FIHs as they reported not eating *dal* during flooding. However the reduction in rice intake (50% less) was reported to be the same between the two groups. There was also a difference in intra-household food allocation; for the FSHs, the fathers were eating less while in the second group it was the mothers or the children. In food insecure families, 71% of men worked as rickshaw-puller, construction or farm labourers. In food secure families, only 25% of them were involved in such physically demanding jobs. It is likely that the calories needed for physical work led to a larger share of food for men in food insecure families.

The complementary feeding practices were different; the FSH group managed to cook complementary foods for their IYCs during flooding as in normal time, whereas the FIH group had to feed IYCs the same food as the rest of the household. The FSHs were more prepared for flooding than the FIHs as all of the FSHs already had a raised bed and a *matir chula* before the flood. Some of the FSHs had also prepared cow dung as combustible fuels to be used during flooding. Finally some participants of the FSHs were able to move back to their hometown to avoid the difficult living conditions imposed by the floods whereas the members of the FIHs did not have the financial capacity to do this and were limited to move to a school or a relative's house in Dhaka.

All of the BRAC community health workers were part of the FSH with adequately nourished children. They also managed to develop successful coping strategies before the flood which were either living on higher ground or going back to their home village.



## 4.6 Discussion and Policy Implications

There is hardly any evidence from previous research of flood impact on feeding practices for IYCs in the slums. Data from the interviews with caregivers about their practices in the flood compared to non-flood conditions reveals that flooding causes deterioration in feeding practices for IYCs. These deteriorate from poor and inappropriate during normal times to worse and even non-existent during floods. The findings also confirm results of a few previous studies showing that inappropriate feeding practices based on WHO guidelines for IYCs living in Dhaka slums are typical in normal times (BDHS 2004, Baqui et al. 1993, Arifeen et al. 2001). These new findings provide sharper focus on the limiting factors for appropriate feeding in the slum environment, namely perceived insufficiency of maternal milk, food insecurity with hunger, difficulty in IYCs food preparation, the demands of the working mother and the inabilities of alternate caregivers in this environment. During flooding, the same limiting factors were found to be more escalated and grave resulting in a deterioration of IYC feeding practices.

Findings suggest that participants perceived the deterioration in the IYC's nutritional health through weight loss and morbidity episodes. These results corroborate the quantitative findings which revealed a negative impact of flooding on the nutritional health of IYCs and an increase in malnutrition (Bloem et al. 2003, Choudhury & Bhuiya 1993, del Ninno & Lundberg 2005). In Chapter 3, the prevalence of underweight and stunting was significantly higher a year after baseline. However all these studies were carried out in rural settings. The fact that household food security and health of IYC living in the slums based on existing literature, are worse compared to those living in rural areas could result in a higher vulnerability to the impact of flood. Mothers were however constrained to starve themselves to prevent the IYC's nutritional deterioration. By decreasing their food intake, mothers allowed the main income generator to continue working and prevented their children from total nutritional deterioration. During flooding, it has been demonstrated that mothers are the ones who typically take on the burden of food insecurity in a household by giving food to other family members first (Rashid 2000, Rashid & Michaud 2000, Maxwell 1996). This coping strategy called by Maxwell 'maternal buffering' results in lower maternal Body Mass Index (BMI) after the flood and is intended to protect infants and young children (Bloem et al. 2003). However, it exposes mothers to undernutrition and could also have potentially negative impacts on a mother's ability to breastfeed. This has the counter

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productive effect of weakening their child's health when maternal milk is likely to be essential for the child's survival. The fact that mothers in this study were undernourished, may also influence negatively the level of care they were able to provide to their children. Previous research has shown evidence of an association between maternal deficiencies and maternal caregiving capacities resulting in malnourished mothers being less active and responsive to the children's needs (Rahmanifar et al. 1992, McCullough et al. 1990). In Kenya, one study demonstrated that mothers cared significantly less for their children during a time of famine (McDonald et al. 1994). Findings in Chapter 3 suggest that maternal nutritional status should be considered during flooding as a key criterion to assess the level of vulnerability of households in future interventions.

The influencing factors, maternal work and the inabilities of the alternate caregiver are interlinked. Previous research has found negative associations of maternal work with child nutritional status (Abbi et al. 1991, Rabiee and Geissler 1992). In India, Abbi et al' collected data on 1990 rural children to determine the effect of mother's work status on their children's nutrition and health with comparable socioeconomic status, sanitary and drinking water conditions, and average family size between working and non-working mothers. Analysis of covariance showed that the risk of a low weight for age for children less than 3 years old was significantly higher by 1.7 times for working mothers and low height for age was significantly higher for children of working mothers independent of the child's age. The authors hypothesised that maternal work has a negative association on child nutritional status due to the lack of access to money by the working mother combined with inadequate care by alternate caregivers such as siblings or grandparents. The authors suggested as policy recommendations creches for children under 3 years old of working mothers, training in simple child care for siblings and grandparents, and income-generating activities for women staying at home. Using data collected in rural Iran of working mothers with children under 5 years old, Rabiee and Geissler (1992) also showed a negative effect on the nutritional status of young children through mechanisms affecting food consumption and health that are not directly financial. They also suggested provision of child care as a policy recommendation.

However maternal work may result in increasing the household buying power and food security level, eventually resulting in benefits for IYC's growth and health status. More money, however, does not automatically translate into improved IYC health. Maternal education, the type of work, the age of the IYC and the ability of the alternate caregiver are key determinants to increased food security and

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improved IYC health (Ruel 2000). Poor working mothers with inflexible and intensive work schedules, due to poor maternal education and qualifications may put their young children at greater risk when the alternate caregiver is not adequate. This was the common scenario for most of this study's participants. The outcomes on the child's nutritional status could depend on his/her age; before one year old the impact may be negative as the preparation for complementary food requires more skills and knowledge for infants less than 1 year old, while after two years of age it could be neutral or positive (Leslie 1988). So far the capacity of alternate caregivers and their impact on the nutritional status of IYCs have been only examined based on the age of the alternate caregiver without integrating the child's age as a potential confounding factor. Caregivers under the age of 12 years are associated with lower nutritional status of IYCs under two years, even after controlling for mother's education and socioeconomic status (Engle 1991, LaMontagne et al. 1998). No study has assessed the quality of care by old caregivers. One study compared feeding practices carried out by mothers and alternate caregivers, although it failed to make distinction between adequate and inadequate caregiving. Engle & Zeitlin (1996) showed that mothers were more likely to encourage eating than were alternate caregivers across all meal types rather than giving snacks. These authors report, however, that the nutritional status of the children (WFH, HFA and WFA) fed by the mother did not differ from children fed by alternate caregivers.

The research reported here highlights the increased difficulties encountered by women during flooding to complete their daily domestic tasks (Table 4-5). Gender has been noted by Wisner et al. (2004) as an important factor that influences the impact of the flood on individuals. Women often carry a heavier burden than men during recovery because of their pre-flood lower nutritional status and their lower socio-economic status. According to Del Ninno (2001), women of all ages in Bangladesh are more calorie-deficient than men, and the prevalence of chronic energy deficiency among women is the highest in the world. In addition, women also receive less and poorer quality healthcare in comparison with men. In addition to starting out more vulnerable, flooding requires women to perform heavy tasks, such as protecting their houses, children, livestock and belongings. In Bangladesh, men will not help women where tasks are gender specific (e.g. carrying water, cooking, caring for children and animals). In some cases, women could put their lives in danger to carry on their duties without any help (Nasreen 2004). According to a study by BRAC regarding the 1998 and 2004 floods in Bangladesh, 'women and children are often the most vulnerable groups during floods suffering from personal

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hygiene and domestic violence problems' (Akter 2004:p12). The lack of work for men and the future uncertainties led usually to increased tensions within the family resulting in women being the ones to suffer from their husband's violence. Further research should be conducted on how to positively change the position of women in a gender discriminated environment and how to promote a fairer task sharing with their husbands during flooding.

A limitation of this study occurs because neither observations nor interviews were able to be conducted during the last rainy season. Because I was not able to observe the flooding and its impact on the households directly during the rainy season, the research findings are based on the information from the in-depth interviews on the impact of flooding on IYC feeding practices. Additional research is planned to be conducted during and after the next rainy season to be able to directly observe lives of slum-dwellers and their coping strategies during flooding.

The research demonstrated that numerous limiting factors and barriers to appropriate feeding practices for IYCs exist in normal times which are escalated during flooding resulting in extremely poor IYC nutritional health in Dhaka slums. The coping strategies developed by food insecure households during flooding are limited and their resilience capacity is low to external shocks such as floods. Women face extreme difficulties because of gender discrimination during flooding and the working mothers have to cope with inabilities of the alternate caregiver to care for their IYC. This findings leads to the following policy recommendations (Table 4-6); 1) provision of relief for nutritionally vulnerable groups during flooding, 2) support to mothers in their working role, 3) breastfeeding counselling and support to mothers with difficulties and 4) preventing malnutrition in under 2 years old IYCs. While these recommendations aim to improving the living conditions and the nutritional health of IYC living in the slums, the government could in parallel develop strategies to reduce the rural-to-urban migration by encouraging people to stay in rural areas. This could eventually be facilitated through delocalisation of garment factories in rural areas and developing poverty and disaster relief programmes in rural areas and in affected areas by disaster.

**Table 4-6: Policy recommendations**

1. Provision of relief for nutritionally vulnerable groups during the rainy season
  - a. Distribution of oral rehydration solutions (ORS) and dry food
  - b. Distribution of Ready to Use Supplementary Food (RUSF)
  - c. Distribution of cooking fuels
2. Support to mothers in their working role
  - a. Child care policy
  - b. Factory day care centres
3. Breastfeeding counselling and support to lactating mothers with difficulties
  - a. Mothers and peer counselling
  - b. Supply of micro-fortified food
  - c. Improving the household food security level
  - d. Conditional cash transfer programme
4. Preventing malnutrition in under 2 years old IYC
  - a. Educational programme to promote appropriate complementary food before 2 years old
  - b. Supply of appropriate complementary food, micro-fortified food or Sprinkles
  - c. Research on improved complementary food recipes based on locally available food

**4.6.1 Provision of relief for nutritionally vulnerable groups during the rainy season**

Interventions during flooding typically consist of distribution of dry food, oral rehydration solutions (ORS) and eventually water to households living in flooded areas (Rashid 2000, Akter 2004, O'Donnell et al. 2002). Our research suggests that there is a need to plan for further provisions during the rainy season for nutritionally vulnerable groups. The focus should be on the commonly-defined nutritionally vulnerable group, e.g. IYC, breastfeeding mothers and pregnant women. However as this research demonstrated, undernourished mothers with children under 2 years old should also be considered as vulnerable. As part of an intervention, Ready to Use Supplementary Food (RUSF) such as fortified biscuits are suggested to be distributed to vulnerable families as they do not require cooking facilities. Distribution of zinc and Vitamin A tablets would be particularly appropriate for IYC in order to reduce the prevalence of persistent diarrhoea and dysentery (Brooks et al. 2005, Salgueiro et al. 2002, Osendarp et al. 2002, Rahman

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et al. 2002). Finally distribution of combustible fuels could help mothers to cook with a *matir chula* as mothers reported difficulties in finding and buying wood during flooding.

Flooding only intensifies existing problems that should be addressed on a long term basis. The recommendations during flooding are significant only if the root causes of poor IYC feeding practices are tackled through a holistic approach combining improvement in mothers working conditions, promotion of appropriate breastfeeding and prevention of malnutrition in normal times as well as during the floods.

### **4.6.2 Support to mothers in their working role**

Factory day care centres for infants of working mothers are a legal requirement under the Bangladeshi Factories act of 1965. In practice these have been largely ignored by many industries. Some NGOS such as Phulki<sup>29</sup> have made a difference in changing the childcare policy in garment factories (Barrientos & Kabeer 2004, Kabeer 2004, Thomas et al. 2003). Factory day care centres for IYCs have been created to keep breastfeeding mothers close to their infants during working hours. Employers and employees were involved in making the day care centres sustainable resulting in a win-win situation; healthier children due to better care and feeding practices and increased productivity for the factory.

### **4.6.3 Breastfeeding counselling and support for lactating mothers with difficulties**

Educational programmes through home-based peer counselling have a significant impact in increasing the initiation and duration of exclusive breastfeeding (Haider et al. 2000, Morrow et al. 1999). Haider et al.'s study included 363 women living in Dhaka in the control and in the intervention group having peer counselling sessions. The prevalence of exclusive breastfeeding at 5 months was significantly higher for the intervention group compared to the control group (70% and 6% respectively). Mothers in the intervention group also initiated breastfeeding earlier than control mothers and were less likely to give prelacteal and postlacteal foods. Morrow et al. 1999 confirmed these findings based on a sample of 130 women living in peri-urban Mexico City. At 3 months post partum, the prevalence of exclusive breastfeeding was significantly higher in the intervention group versus the control group.

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<sup>29</sup> A Bangladeshi organization

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Duration of breast-feeding was also significantly longer in intervention groups than in the control group. Incorporating traditional beliefs and practices as well as including elders and husbands into the counselling session on optimal breastfeeding are recommended and have proved to be successful in other developing countries (Semega-Janneh et al. 2001). Providing mothers with micro-fortified food supplementation during flooding while working on improving the household food security level on a longer term are likely to improve maternal health status. Conditional cash transfer programmes would be particularly appropriate in these circumstances and effective in raising household food security levels. The poorest households are targeted by these programmes and the cash transfer is conditioned on attendance for example at school or health clinics (Behrman & Hoddinott 2001, Maluccio 2005).

### **4.6.4 Preventing malnutrition in under 2 years old IYCs**

Promotion through educational programmes is effective to change feeding practices when the household is food secure (Caufield et al. 1999, Guldan et al. 2000, Penny et al. 2005, Santos et al. 2001). For food insecure households, supply of appropriate complementary food or of micronutrient-fortified food in addition to promotion is necessary to be of benefit to the child's nutritional status (Oelofse et al. 2003, Adu-Afarwuah et al. 2007, Lartey et al. 1999, Schroeder et al. 2002, Lutter et al. 2008, Bhandari et al. 2001, Obatolu 2003). A suitable intervention in the case of inadequate caregivers, caregivers with limited resources and/or food insecure households, is the supply of appropriate pre-prepared CF, either at a low cost or without cost. In Haiti, research has shown the success of integrating the distribution of micronutrient Sprinkles through an overall behavioural change communication intervention to achieve appropriate utilization by the caregiver for the targeted child (Loechl et al. 2009).

## **4.7 Conclusion**

These findings reveal the problem of malnutrition and many barriers that mothers face in providing adequate nutrition to their IYC in both normal and flood conditions. Local and international policy makers may use these findings to plan more effective nutrition interventions in the slums of Dhaka. A holistic approach to intervention is suggested combining 1) provision of relief for nutritionally vulnerable groups during flooding, 2) support to mothers in their working role, 3)

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breastfeeding counseling and support to breastfeeding mothers with difficulties, and  
4) preventing malnutrition in under 2 year old children. Further research is required  
so that study findings can be generalized.



**Key Messages**

- Numerous limiting factors and barriers to appropriate feeding practices for infants and young children (IYCs) exist in normal times which are escalated during flooding resulting in extremely poor IYC nutritional health in Dhaka slums.
- There are extremely limited coping strategies developed by food insecure households during flooding and their resilience capacity is low to external shocks such as floods.
- Gender discrimination increases difficulties encountered by women during flooding.
- A particular focus should be placed upon working mothers and the inabilities of the alternate caregiver in order to improve IYC's nutritional health in Dhaka slums.
- It is important for policy makers to consider a holistic and creative approach to interventions that combine preventive actions during normal times and emergency response during floods.

In the next chapter, the root causes of malnutrition in IYC are explored based on the findings from the focus group discussions carried out in the same slums as this study. The perceptions of the root causes by pregnant women and BRAC community health workers are presented and compared to existing conceptual frameworks for the determinants of IYC malnutrition. The results lead to further policy recommendations.

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**Abbreviations, acronyms and glossary (Chapter 5)**

BCC	Behavioural Change and Communication
BBS	Bangladesh Bureau of Statistics
BMI	Body Mass Index
CUS	Centre for Urban Studies
DDST	The Denver Developmental Screening Test
DSK	Dushata Shastya Kendra
GOB	Government of Bangladesh
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
IYC	Infant and Young Children
LDC	Least developed country
SGA	Small for Gestational Age
UNICEF	United Nations Children Funds
WASA	Water and Sewerage Authority
WFP	World Food Programme
WHO	World Health Organisation

<i>Beri bahd:</i>	Embankment
<i>Bosti:</i>	Slum
<i>Chira:</i>	Flattened rice
<i>Choki:</i>	Wooden bed
<i>Dal:</i>	Pulses and also a dish prepared with pulses
<i>Kitchouri:</i>	Meal prepared with rice, dhal and vegetable cooked together. It's often given as CF to IYC.
<i>Kolchi:</i>	Water container either in clay or aluminium.
<i>Muri:</i>	Puffed rice.
<i>Mutir chula:</i>	Clay stove
<i>Pataton:</i>	Elevated structure made of bamboo and wood.
<i>Shasto shebika:</i>	BRAC community health worker
<i>Suji:</i>	Complementary feeding food prepared with rice powder, sugar, water or milk.



**Chapter 5 - How do pregnant women and community health workers perceive the root causes of malnutrition in infants and young children in Dhaka slums, Bangladesh?**

## **5.1 Introduction**

In Bangladesh, research shows that infants and young children (IYC) suffer from higher levels of malnutrition in the urban slums of Dhaka compared to the rest of the country including rural settings (Pryer 2003, Hassan and Ahmad 1991, Kiess 1996, HKI 1997, BBS 1997). IYC are frequently born with a low weight and are exposed to high morbidity and mortality risks. The high food insecurity level in the households combined with poor adult' nutritional health and an early engagement with income generation activities mean that IYC chances for catch up growth are extremely low and that the risks of becoming or remaining malnourished are high. Malnutrition has long term negative consequences on the growth and cognitive development of IYC. This chapter explores the perception by pregnant women and community health workers of the root causes of malnutrition of IYC living in the slums.

## **5.2 Background**

Few nutritional studies have been conducted in the slums most likely because of the difficulty of conducting research in such a complex environment, where crime and insecurity prevail and basic services remain scarce (Rashid 2000). However the limited data that do exist show a high prevalence of malnutrition and that the nutritional status of IYC in urban slums is worse than that of the rural poor or the urban non-slum populations (Izutsu et al 2000, Pryer 2003, Hassan and Ahmad 1991, Kiess 1996, HKI 1997, BBS 1997). For instance in Mohammedpur (old slum settlement), Dhaka, the prevalence of malnutrition in IYC was higher than the rest of the country (the prevalences of malnutrition in Mohammedpur are from Pryer's study and the nationwide prevalences are from the Bangladesh Demographic Health Study conducted by the National Institute of Population Research and Training): 68% were stunted (% of children under 5 years old <-2SD of median reference body length/height) compared to 49% stunting nationwide; 31% were wasted (% of children under 5 years old <-2SD of median reference body weight-for-height) compared to 17% wasted nationwide; and 73.2% were underweight (% of children under 5 years old <-2SD of median reference for body weight) compared to 56% underweight nationwide (National Institute of Population Research and Training (NIPORT) et al. 1997, Pryer 2003). The prevalence of stunting, wasting and underweight children is highest in August to October (end of rainy season and post

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rainy season) and lowest in November to January (relatively cold and dry season) (Pryer 2003).

**Table 5-1: Percentage distribution of malnourished children classified by z-score and age group (Pryer 2003)**

Category of malnutrition	Age group	(n)	Severe (%)	Moderate (%)	Overall (%)
<b>Stunted</b>	<b>3-24 months</b>	163	30.7	28.2	58.9
	<b>24-59 months</b>	274	42.0	32.1	74.1
	<b>P value</b>		<0.01	0.40	<0.001
<b>Wasted</b>	<b>3-24 months</b>	163	9.8	28.8	38.6
	<b>24-59 months</b>	277	3.3	23.5	26.8
	<b>P value</b>		<0.004	0.21	<0.01
<b>Underweight</b>	<b>3-24 months</b>	178	40.5	31.5	72.0
	<b>24-59 months</b>	281	38.1	36.0	74.1
	<b>P value</b>		0.61	0.32	0.62

The nutritional status of IYC in urban slums is worse than that of the rural poor or the urban non-slum populations (Hassan and Ahmad 1991, Kiess 1996). The prevalence of stunting is highest in urban slums, followed by the rural and urban non-slum areas (respectively 66.2%, 61.1%, and 52.5%). Underweight prevalence is extremely high in urban slums when the nutritional status among children from vulnerable households (landless and/or where the main earner is a casual worker) is compared: 71.0% in urban slums vs. 61.9% in the urban non-slums and vs. 64.8% in the rural areas. The same holds for adolescents with slum adolescents having a significantly lower weight compared to non-slum adolescents (Izutsu et al. 2006).

Malnutrition for these IYC born in the slums frequently starts at birth. IYC are born with a low weight, entailing a risk of remaining lighter and smaller throughout life; 46% of them with a low weight (birth weight less than 2500g), 70% of them being SGA (small for gestational age) and 17% premature (Arifeen et al. 2000). While Arifeen et al. (2000) demonstrated the positive impact of exclusive breastfeeding on infant's growth and the possibility of catch-up growth for these infants born with a low weight, the literature review in Chapter 4 and the findings from the same chapter revealed that the breastfeeding practices for IYC in the slums did not meet WHO guidelines and thus could result in decreasing the chances for any catch up growth for these IYC born with a low weight.

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Malnourished IYC who have developed very little acquired specific immunity to infectious agents, are particularly vulnerable to morbidity due to the poor living conditions in the slums and are at high risk of mortality. The rates of morbidity are high among children under 5 years, the diarrhoea and respiratory illness prevalence is 25% and 40% respectively (Pryer 2003). In the Dhaka slums of Agargoan, Kamalapur and Mohammedpur, the reported death rates in the households per 1000 children (0–107 months) are 20.5 for boys and 27.0 for girls from a 1500 household cross-sectional survey. Malnutrition is not reported as a cause of death while diarrhoea is (Hussain et al. 1999). For infants less than 1 year old, the reported mortality rate is 50% in a sample of 100 households (Podymow et al. 2002). While in some cases, diarrhoea, respiratory disease, trauma and stillbirth are cited as known causes of mortality, in most cases the cause is unknown and malnutrition is not cited. Despite high reported mortality rates, children's health is reported by household heads to be good to very good (76%) and only 19% noted it to be poor (Podymow et al. 2002). These findings are demonstrative of a lack of perception of malnutrition and poor health of the children. It could be hypothesized that this is the 'normal' expectation of parents because the majority of children are sick and malnourished. Malnutrition has long term negative consequences on the physical growth and cognitive development of children and ultimately severe malnutrition could lead to the child's death. It is therefore necessary to understand the perceptions of slum dwellers regarding the root causes of malnutrition in order to design interventions to promote better health of IYC living in the slums.

Previous research shows an alarming situation for the health of IYC with high malnutrition, mortality and morbidity rates in Dhaka slums. Frequently born with low weight, the inappropriate feeding practices do not allow for IYC any chance for catch up growth and they will remain shorter and lighter for their age. These children are often trapped in a vicious circle of poverty that spans across generations. The lack of caring practices, a heavy workload, and non-attendance at school have negative consequences on their development and health and do not leave any chance for better perspective.

This research goes beyond simple statements of the quality of health status. Using participant-driven classification systems during focus group discussions (FGDs), the research presented in this chapter attempts to extract the perceptions of the root causes of malnutrition by pregnant women and community health workers in Dhaka slums.

### 5.3 Contextual influences<sup>30</sup>

#### 5.3.1 BRAC birth centre

The FGDs took place in seven Bangladesh Rural Advancement Committee<sup>31</sup> (BRAC) birth delivery centres<sup>32</sup> located in the four selected *bostis* (slums) for the research (1 in Begunbari , 1 in Kunibara, 3 in Mohammedpur and 2 in Kamrangir *Char*<sup>33</sup>). Mohammedpur and Kamrangir *Char bostis* as described in Chapter 4 in the section on selection of slums, are heterogeneous slums compared to Begunbari and Kunibara. This explains why in these areas several birth centres were chosen to reach a good geographic coverage of the participants. Birth centres are well-known to most pregnant women and community health workers and are a familiar and safe location for these women to meet.

A birth centre is typically located on the ground floor of a concrete building and is divided in two rooms, one for women to give birth and one for welcoming women. The FGDs took place in the 'welcoming room' on the floor which made it easy to spread, use and sort out the photographs used during FGDs. Pictures of healthy children and posters with key health messages were on the walls prior to the FGD session. The birth centre is a clean place with a fan, toilet and light which made it very comfortable to conduct FGDs. People respect the privacy of the birth centre, thus only participants attending the FGD were present. FGDs took place on the condition that no woman was giving birth at the time. However it never happened that a FGD had to be rescheduled.

#### 5.3.2 BRAC support

FGDs were organised with the help of BRAC staff working in the slums. They provided support to invite participants to the FGDs and ensured the 'welcoming room' was free to be used for the FGDs.

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<sup>30</sup> Further details regarding the slum context, research funding and slum selection can be found in Chapter 4.

<sup>31</sup> Bangladeshi Non Governmental Organisation

<sup>32</sup> Birth centres are places for pregnant women living in urban slums to give birth in clean and safe environment assisted by trained traditional birth attendant.

<sup>33</sup> A char is a piece of land surrounded by water

### 5.3.3 Time pressure and constraints of the participants

The time pressure and constraints of the participants are the same as described in Chapter 4. For these reasons, it was agreed that the FGD would not last more than one hour and a half. Even though the time was short, some of the participants wanted to leave before the end. In some cases, the process of the causal tree building had to be sped up to avoid losing participants before the completion of the session. Time limitation was a constraint I had to constantly keep in mind during FGDs sessions to ensure that the different phases in FGDs were completed appropriately. The FGDs phases were 1) the pile sorting of photographs and 2) the building of the causal model of the determinants of malnutrition. In order to minimise the disturbance for participants to have to come several times to the birth centre, the FGDs were conducted before or after an event already planned by BRAC in the birth centre. For example BRAC frequently organises initial training for newly trained community health workers, refreshment training for experienced community health workers and information sessions on pregnancy and birth for pregnant women.

## 5.4 Methods

### 5.4.1 Research methodology

The research uses analysis of focus group discussions (FGDs) conducted in Dhaka, Bangladesh in four *bostis*, from November 2008 to May 2009. The slum selection inclusion criteria are explained in Chapter 4. All of the participants were living in the slums (12% in Begunbari, 36% in Kunibara, 18% in Mohammedpur and 35% in Kamrangir *char*). The participants were pregnant women, experienced community health workers, and newly trained community health workers for BRAC (Table 5-2) with 12% of them living in Begunbari, 35% in Kamrangir char, 36% in Kunipara and 18% in Mohammedpur.

**Table 5-2: FGD participants' profile**

<b>Participants profile</b>	<b>All (n=104)</b>	<b>Pregnant women (n=20)</b>	<b>Experienced community health workers (n=72)</b>	<b>Newly trained community health workers (n=12)</b>
Age (average, range)	28 (17 - 50)	23 (17 - 32)	29 (19 - 50)	29 (21 - 45)
Number of children (average, range)	2 (1 - 6)	1 (1 - 4)	2 (1 - 6)	2 (1 - 5)

BRAC community health workers or *Shasto Shebikas* are women who are volunteers and trained by BRAC to take part in the Manoshi<sup>34</sup> programme. Experienced community health workers have at least 1 year experience in addition to the training received by BRAC. The criteria used (being pregnant, or experienced or newly trained community health workers) were chosen to compare views between groups who are exposed to the issue of malnutrition; for community health workers because it is part of their job and for pregnant women because of the impending birth of their child. Ten FGDs with an average of 10 participants were organized lasting 60-90 minutes. Three FGDs were organized for new community health workers, 5 for experienced community health workers and 2 for pregnant women). The number of FGDs conducted for community health workers was driven by reaching a saturation of concepts from participants. The number of FGDs for pregnant women was limited to two because of the difficulty of finding participants.

A technique based on the building of a causal model combined with pile sorting of photographs, was used to understand the root causes of malnutrition. The causal model building technique has previously been used to understand the root causes of malnutrition (Lefèvre et al. 2004). This is the first time, however, that it is combined with photographs and pile sorting. The combination of the two techniques was designed specifically to facilitate the construction of the causal model by using familiar verbal representations of the participants' understanding of the causes of malnutrition with photographs of the environment, places and activities that are common to the participants.

#### **5.4.1.1 Causal model**

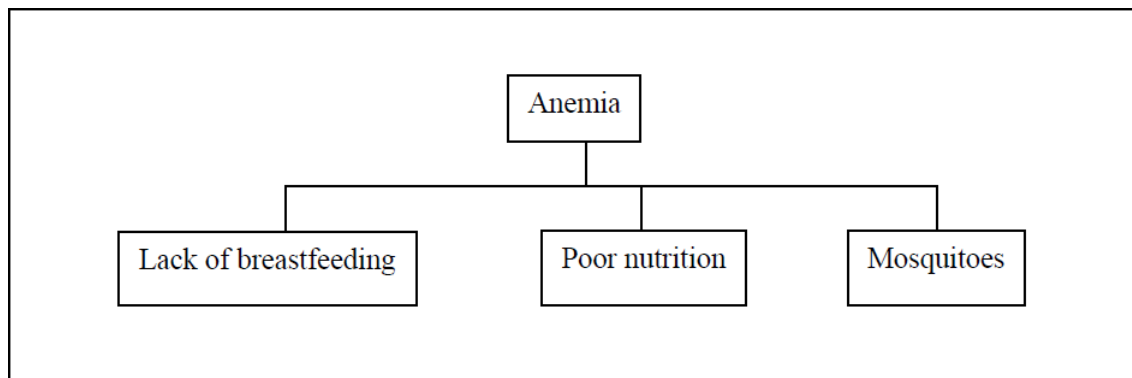
The construction of a causal model is used to better understand the perception of the underlying contributory factors of a phenomenon: '*a causal model is an organized and hierarchical set of hypotheses linking together the potential factors that play a role in a given situation,*' (pp 4-5:17 Lefèvre and de Suremain 2004). Causal models have been used previously in qualitative nutrition research (Lefèvre et al. 2004, Beghin et al. 1988, Beghin 2002, Tonglet et al. 1992, Lefèvre and

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<sup>34</sup> The Manoshi project was developed by BRAC to establish a community- based health programme targeted at reducing maternal and child mortality in the urban slums of Bangladesh. The programme is funded by the Bill and Melinda Gates Foundation under the Community Health Solutions (CHS) initiative aiming at strengthening and leveraging community organizations and participants to scale up proven interventions in community settings.



Beghin 1991). Figure 5-1 shows an extract of a causal model built by health promoters in Peru to explore the uneasiness and well being of children. The specific objective of the research was to study the various determinants of child's health and illness as experienced by different groups of actors (health promoters, mothers and fathers). Figure 5-1 shows that health promoters believe that anaemia can be transmitted by mosquitoes. The causal models were compared to distinguish between the health professionals and the population's perceptions on the perceived causes of infantile illnesses.



**Figure 5-1: Extract of a causal model built by the health promoters (source: Lefèvre et al. 2004)**

For this research, the participants collaborated to explore their perception of malnutrition and to define the determinants of malnutrition in IYC. Because of the limited time available, only a short version of the full causal model technique was used. The participants were limited in the construction to a maximum of 9 determinants compared to an open construction with an unlimited number of determinants in the full model.

#### **5.4.1.2 Use of photographs and pile sorting**

The photographs used were taken in previous research in the slums during participant observations for 80% of them, and were found on internet for the rest of them. The photographs that had to be searched for on internet, were mostly the ones representing flood. I, however, ensured that the photographs found on internet were taken in Bangladesh or India. For the ones taken in India, I verified that they were no cultural differences that would have made them not familiar to the participants. I did so by showing them to various Bangladeshi people. Participants were asked for permission beforehand to use their photographs for the research. Seventy-two photographs were selected to be representative of food,

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environment, socio-economic status, care, health, nutrition, education, water-sanitation and hygiene (list in Appendix VII, photographs in Appendix VIII). Figure 5-2 gives an example of some of the photographs used. I selected these photographs for their representation of a topic, for example a photograph showing girls studying represents the topic education. In a first phase, participants were asked to group photographs with the same characteristics into different piles. The purpose was mainly for the participants to become familiar with the photographs and to explore their perceptions associated with the representation in the picture. The results of this initial sorting are not presented here.



**Figure 5-2: Example of photographs used for the building of conceptual framework**

In a second phase, participants selected one photograph representing the most malnourished child and subsequently 9 other photographs explaining potential reasons as to why this child was malnourished thus indicating participants' perceptions of the root causes of malnutrition. The participants had to choose 9 photographs and were not allowed to choose less than 9. Practically, the photographs were organized and ranked in a tree shape; the top picture (1<sup>st</sup> picture selected) representing a malnourished child and underneath 9 photographs representing the roots of malnutrition ranked into major and minor roots. Major roots had a direct causal link to malnutrition while minor roots were underlying causes. The causal model findings were compared for the different groups (pregnant women, new and experienced health workers) to identify similarities

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between determinants. Figure 5-3 and 5-4 show participants working on the construction of a causal tree using photographs and a completed causal tree.



**Figure 5-3: Pregnant women building a causal tree using photographs**



**Figure 5-4: A completed causal tree using photographs**

#### **5.4.2 Data analysis**

All FGDs were recorded with an MP3 player. They were then transcribed into Bangla, and translated into English by the research assistant. I could ensure the quality of the translation as I was present during the interview and I understood Bangla. The technique of back translating some randomly selected transcripts was not used because of the quality of the translation done by the research assistant. This technique was used previously (for the translation of the semi-structured questionnaire-guide presented in Chapter 4) and the quality of the translation done by the research assistant was very good. For this reason, I did not deem it

necessary to use the technique again. The transcripts of FGDs were coded by extracting concepts and using a constant comparison of the data to draw out themes to enable a thematic analysis. Each conceptual framework made in photographs during FGDs was translated into a formal conceptual framework using the theme associated with the picture. Three main frameworks were developed, one for pregnant women, one for newly trained community health workers and one for experienced community health workers based on the emerging themes, the overall conceptual framework being the combination of these 3 models. Since the overall conceptual framework is the synthesis of the 3 separate models built for each group of participants, all the roots are represented in the overall model. For example, if one root was in the model for pregnant women but not for the other participants' groups, it was still included in the overall model. The software ATLAS.ti® (Release 5.2.0 Muhr, T. (1993–2009) was used to identify emerging themes and to compare themes across the different groups.

### **5.4.3 Ethical approval**

Approval for the study was obtained from the Loughborough University Ethical Committee. Before starting the discussion, the research aims of the study were explained to the participants. An informed consent statement emphasizing the voluntary nature of the participation was also read to them (Appendix V).

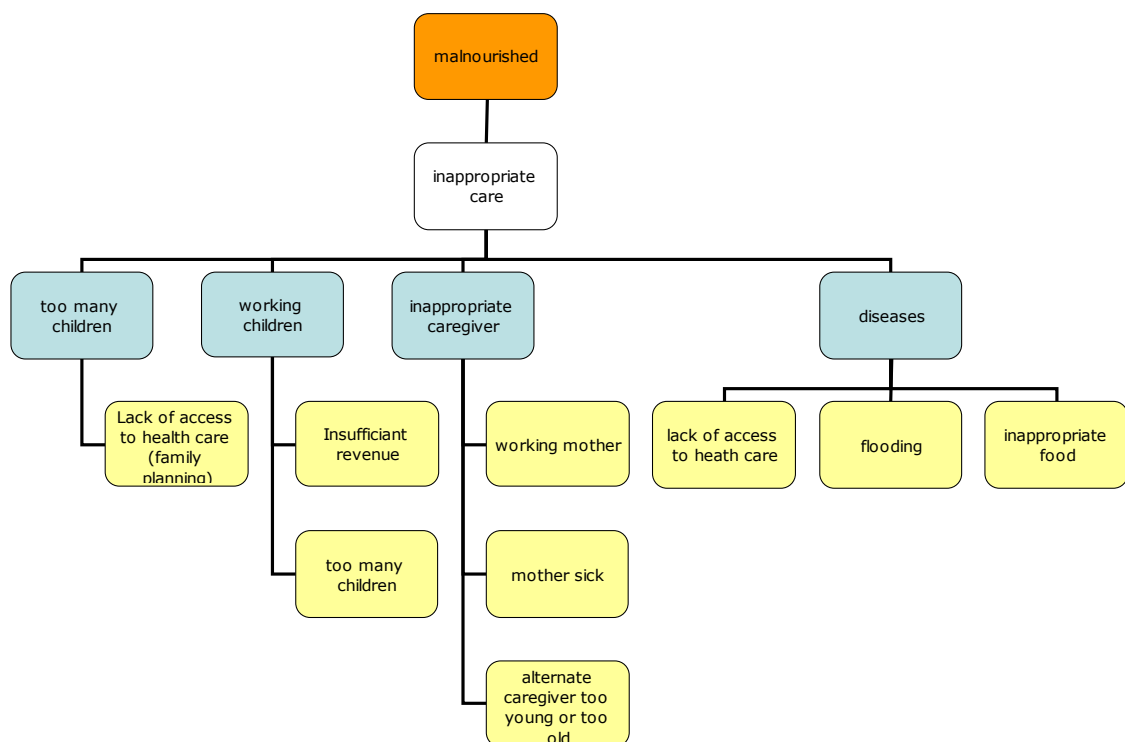
## **5.5 Results**

### **5.5.1 Conceptual framework of roots of malnutrition: 'This child is malnourished BECAUSE...'**

The participants, based on their perceptions, explain why a child is malnourished. They tell a story which begins by, '*this child is malnourished because...*' The overall conceptual framework shows four main groups of root causes of malnutrition resulting from the analysis of the FGDs' transcripts of community health workers and pregnant women, these include; 1) inappropriate care, 2) inappropriate environment, 3) inappropriate food and 4) flooding. These roots are perceived by community health workers and pregnant women to be related to malnutrition. Each dominant root cause is further detailed in minor root causes. The closer to the top of the tree the determinant is, the more 'dominant' it is.

### 5.5.1.1 Inappropriate care

The first group of determinants are identified under the theme of inappropriate care which includes as minor roots having too many children, working children, an inappropriate caregiver and having diseases (Figure 5-5). Working children are children who have to go out and earn money for the household. An inappropriate caregiver is defined by participants as a young child, an old grand-mother, a working mother or a sick mother.



**Figure 5-5: Conceptual framework for inappropriate care**

#### 5.5.1.1.1 Too many children

A popular understanding among pregnant women and community health workers is that a child becomes malnourished because he has too many brothers and sisters. Most of the participants believe that having two children, one boy and one girl is 'good'. While the average number of children for the participants is 2, some of them had up to 6 children probably taking into account the high risk of mortality that they are exposed to. In fact, this policy has been promoted by the Bangladeshi government as 'the happy family' in order to advocate for family planning and

gender balance. Participants refer to families with many children as 'not happy family'. Because of the number of children, they suggest that parents cannot provide proper care and let them grow without attention, guidance and rules. They are also unable to provide adequate physical comfort, *'they all sleep together on the floor'* or *'they sleep in a dirty place'*. Not having a bed and sleeping on the floor is a characteristic identified as symbolising the poorest of the poor in the slums.

Pregnant women believe large families to happen because of a lack of access to health care and family planning. In contrast, community health workers report that family planning is available for women who desire it through various organizations but that some women are not willing to take contraception because they don't like the effect that it has on their body or simply because they want a son if they already have daughters. In Bangladesh, having a son compared to a daughter is often preferred because of the dowry that the bride's parents have to pay to the groom's family before and often after a marriage (Amin and Mariam 2008, Chowdhury and Bairagis 1990, Edlund 1999). Sons are also most likely later on to bring income to the household and therefore to support aging parents because of a patrilineal family structure (Kabir et al. 2002, Rashid 2006).

#### **5.5.1.1.2 Working children**

Most of the participants perceive that a child who works becomes malnourished because there is no money for him/her to go to school. The value of education is perceived mainly by community health workers, who are generally literate themselves, to be the key for obtaining a good job and getting out of poverty. These school age children (5 years old and older) are pushed in poor families to bring income to the households. *'The poor children can't go to the school...they collect paper to make money'*. These children become malnourished because their jobs are physically demanding, such as collecting paper, begging on the street, or selling items to car drivers on the road. They stay outside the whole day in the heat and sun and frequently have to skip meals or eat only *roti* (flat bread).

Some mothers report not being able to afford to pay the small monthly school fees (approximately less than 1 GBP) and struggling to buy a school uniform. In families with many children, it is common that only one child goes to school while the others work. Children are also reported to start working when the mother definitively stops working in garment factories. Mothers report stopping work after

a few years because of the difficulty of the job, which results in her older children commencing work to compensate for the decrease in revenue.

#### **5.5.1.1.3 Inappropriate caregiver**

A common idea is that neglect by sick mothers or working mothers leads to the child becoming malnourished. As participants note, *'she [the mother] works and has to leave them alone all day long'*. If she has an infant, she keeps him suspended in a hammock made of a scarf while she works outside. They explain further that some mothers lock their children in their room while they are out or leave the youngest ones under the care of the eldest child. Alternate caregivers such as young children or old grand-mothers are common in the slums. These caregivers are typically inappropriate because they often lack the skills, the knowledge and/or the physical capacity to properly take care of IYCs.

Participants stress that mothers in the slums are often sick suffering from various diseases, anaemia, headache, stomach ache, respiratory infections. They feel weak and exhausted and therefore lack the physical energy and motivation to provide adequate care to their children leading to poor health and malnutrition. In female headed households, women who are mainly divorced, especially face difficulties in bringing income to the household while taking care of children. While the children's father, who frequently has remarried and may have more children with his second wife, may contribute a small part of the household income, the major burden of income generation and household tasks is carried by the mother. Men tend to play a limited role in caring for the children as caring tasks tend to be gender specific and remain the women's duties. However women report frequently finding support from neighbours and help in looking after children when needed.

#### **5.5.1.1.4 Diseases**

Participants report children to be malnourished because they suffer from various diseases including diarrhoea, scabies, "polio"<sup>35</sup>, pneumonia, asthma, anaemia, lack of iodine, and worms, with diarrhoea and scabies being the two most frequently cited diseases. "Polio" (disability) is associated with a lack of access to health care.

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<sup>35</sup> Polio has been eradicated in Bangladesh since 1990, Here participants meant physical malformation or handicap.



Children who do not use the latrines in the slums but defecate on the bamboo *pataton*<sup>36</sup> (Figure 4-3 in Chapter 4) path [outside the latrines] are assumed to be suffering from diarrhoea which is an indication of being malnourished. Participants explain that a child who suffers from diarrhoea, will lose weight quickly and will become weak because he cannot eat properly and the food eaten will '*go through its body too quickly*'. Alternatively, participants report that a child could have diarrhoea because he/she defecates outside the latrines, an indication of not having proper hygiene practices. Participants identify flooding as a cause of diarrhoea because of the polluted water used for bathing and drinking. Scabies and pneumonia are noted as being especially common in the slums during the rainy season. As one participant mentioned for scabies, '*this is during flooding...the child is malnourished, he has scabies (khajli hoy)... and cannot have proper bath*'. Finally respondents identify a child to be malnourished because he/she has worms. They explain this is because he/she eats too many *misti* (sweet), eats with dirty hands and walks bare foot. '*His stomach becomes big and he suffers from stomach ache...he needs to go often to toilets...if it's not treated, he will become skinny (sukna hobe)*'.

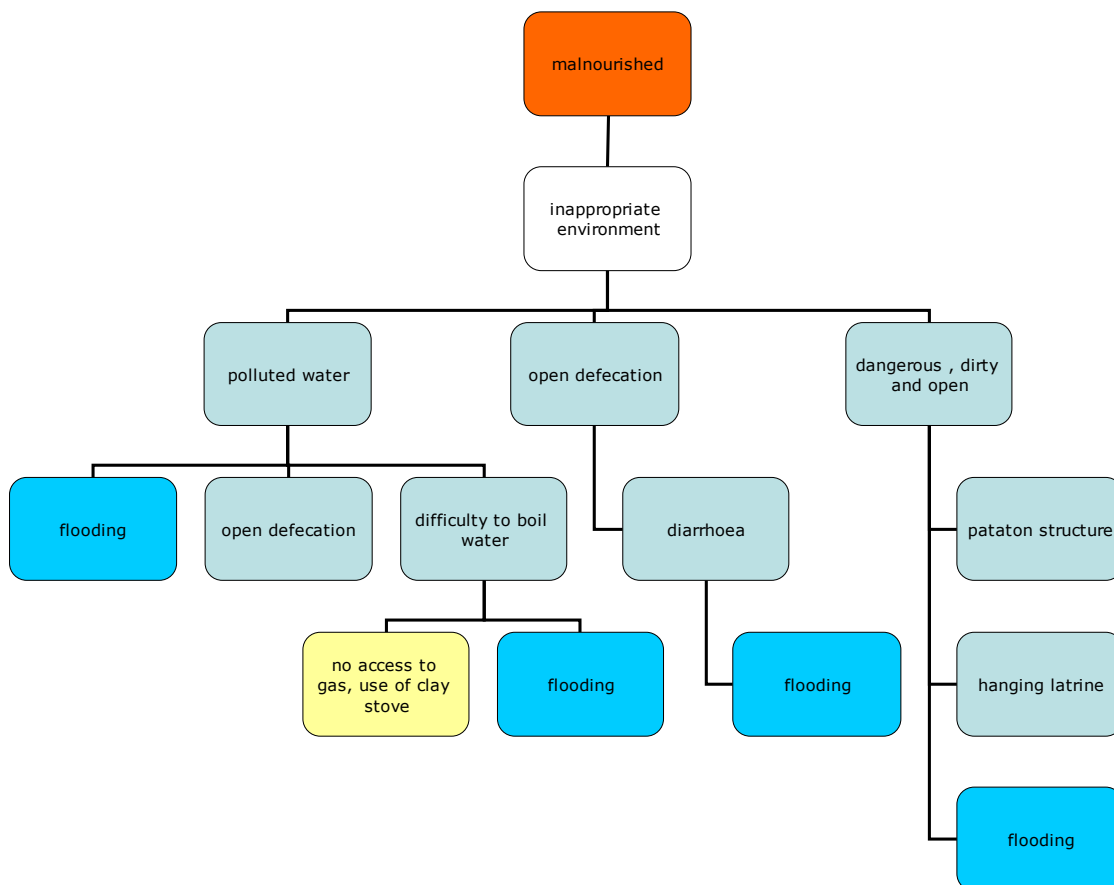
#### **5.5.1.2 Inappropriate environment**

The second group of determinants of IYC malnutrition are defined in relation to an inappropriate environment. The slum environments are 'not peaceful' (*shanto poribesh na*) and difficult to live in, contributing to increased risk of poor IYC nutrition outcomes. The minor roots related to inappropriate environment are polluted water, open defecation and a dirty, dangerous and 'open' environment (Figure 5-6).

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<sup>36</sup> *Pataton*, elevated habitat structure, several meters above ground level





**Figure 5-6: Conceptual framework for inappropriate environment**

### 5.5.1.2.1 Polluted water

Polluted waters can be stagnant water, flood water, uncovered water or waste water, and are everywhere in the slums. Most slums in Dhaka are built on top of polluted waters because these are the only areas not deemed suitable for construction. Polluted water in its various forms is highly present in the participants' minds and associated with malnutrition. Water supply in the slums is poor in quantity with water being not always available in sufficient quantity and quality.

Participants state that the child is malnourished because he/she drinks polluted water. The participants perceive that if the child drinks non-boiled water or water that is not kept covered, then he/she will become sick and malnourished. However they report that most of the slum-dwellers cannot boil their drinking water because of a limited access to the community kitchen<sup>37</sup>. Participants mention that regular water supply from hand pumps can become polluted during the rainy season because flood water can get into the water pipeline through the pipe joints. They

<sup>37</sup> Community kitchens are kitchens shared by all the households living together in the same building of one to three stories (there is one household per room and approximately 14 households per level).

report this water to taste and smell bad and deduce that if this water is not boiled, children will become sick and malnourished. Women have limited time to use a gas stove for cooking; which is usually a maximum of 30 minutes per day. They also mention that the mothers using clay stoves (*matir chula*) cannot boil water as it takes too much time and firewood.

Participants also consider water to be polluted when it is flood water. Flood water is perceived to be dirty as latrines frequently overflow and black water mixes with flood water, rubbish, dead cockroaches, snakes and rats. This water flows through the alleyways of the slums. A participant narrated, '*during flooding, the child is not given proper bath...he drinks polluted water...at this time, it's impossible to boil water!*'. During the rainy season participants report extra problems because slum-dwellers are not able to boil water as the gas connections are cut.

#### **5.5.1.2.2 Open Defecation**

Open defecation is associated with exacerbating the situation during floods as this dirty water stagnates or flows through the homes and leads to diarrhoea, '*the child defecates on a bamboo path above dirty water... this is flood water...he has diarrhoea*'. Participants explain '*when the dirty water (moyla pani) goes into the belly then he gets diarrhoea (pet kharap hoy)*.' Open defecation into flood water is frequent during flooding because either the latrines are not accessible (water blocks the way) or the latrines have overflowed. Children often walk through or swim in heavily flooded areas to access supplies and drink some of the dirty water.

#### **5.5.1.2.3 Open, dirty and risky**

The environment in their slum settlements is considered dirty (*nongra poribesh, oporishka*) by participants because '*there is lots of garbage underneath houses*'. Slum-dwellers directly throw their garbage underneath their door step or on top of a garbage pile at the entrance of the slums, given the lack of alternative options. Children play in and with the garbage and expose themselves to disease transmission (fever and diarrhoea). According to participants, *pataton* slums are dangerous and risky. The *pataton* bamboo path in the slums is built on stilts and can be uneven, frequently broken and unstable. This unsafe environment leads to malnutrition in IYC because participants feel that IYC don't have a suitable place to

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grow and play. Finally an 'open' place [not having a roof over their head] is identified as a determinant of malnutrition. Participants report that it is a negative thing for a young baby to stay outside because of fears of airborne disease transmission harming the baby. Participants stress that a mother should not have to work and should keep her baby at home 'under a roof' to protect him against diseases (Box 1).

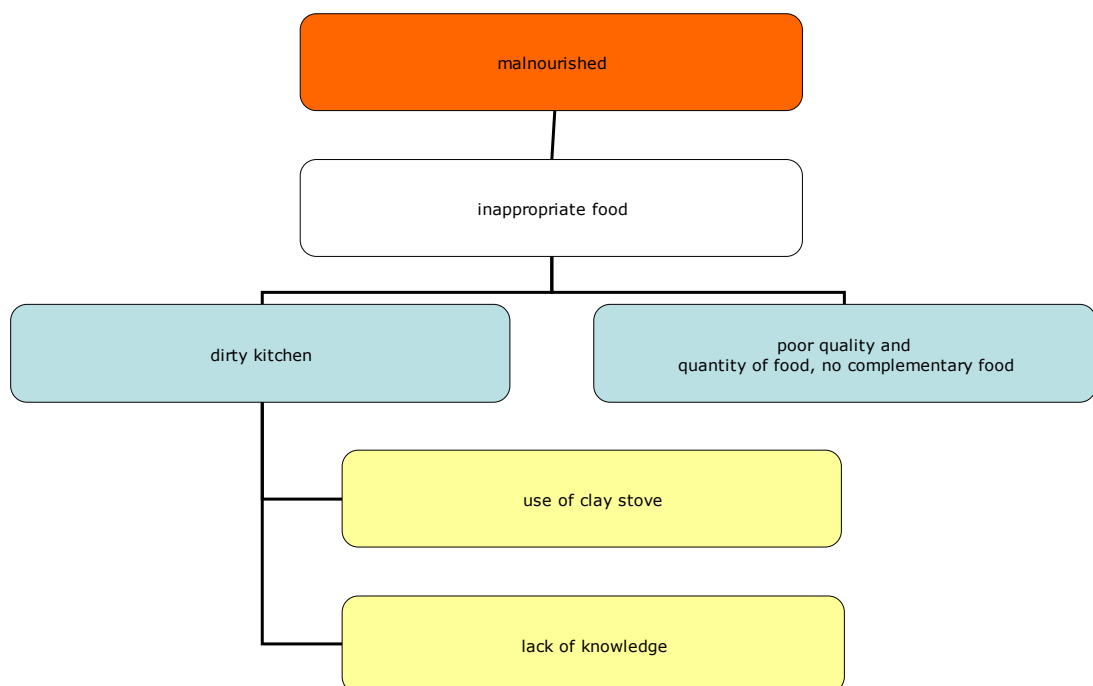
**Box 1: The use of the words 'open' and 'dirty'**

During focus group discussions, the word 'open' is used negatively by participants when related to food, latrine and environment. 'Open' food (meaning without cover *khola kabar*) is a bad practice because the food can become contaminated. An 'open' latrine and 'open' bathroom (meaning without a roof) are not good because of privacy, comfort and the risk of contamination from diseases. Participants mentioned that because of an open toilet, '*disease and germs (rog, jibanu) spread out and the air (abohwoa) becomes polluted*'. Hanging latrines, which are frequently used in the slums are considered not sanitary because they are 'open'.

'Dirty' (*moila, nomra*) is also used frequently in relation to malnutrition. Water is considered 'dirty' when it is flood water or waste water underneath the *pataton* structure. 'Dirty' food is contaminated food, or food cooked with polluted water. A 'dirty' place (*nomra, o shasto kor poribesh, moila jayga*) is defined to be a flooded area or a *pataton* slum.

**5.5.1.3 Inappropriate food**

The third group of determinants identified were inappropriate food including minor roots related to a dirty kitchen, and poor quality or quantity of food (Figure 5-7).



**Figure 5-7: Conceptual framework for inappropriate food**

#### **5.5.1.3.1 Dirty kitchen**

The participants explain that the child is malnourished because, '*his mother cook in a very dirty place...she does not have sufficient knowledge. She is careless (gusae rakhte parena) and doesn't arrange well the cooking environment*'. Here the community health workers stress the lack of knowledge of the mother. According to them, cooking equipment (pots and pans) should be kept neatly in a shelf and drinking water in a *kulchi* with a cover. They explain that a good community kitchen is a clean kitchen with high gas stoves, because cooking with low gas stoves, is more prone to contamination and is likely to be flooded during the rainy season. Clay stoves or *matir chulas* are considered to be the worse means of cooking and are associated with malnutrition because they are frequently used in households without access to gas. In the slums, rent for rooms without gas connection is the cheapest. The poorest of the poor cook with a *matir chula* and it is extremely time consuming, so mothers cook only once a day. It is also costly if combustible material is purchased, although typically mothers will look for wood in the streets. Because of this limitation, participants suggest that mothers will not be able to cook special meals for their children. The community health workers stress that mothers should prepare and feed their IYC special nutritious meals to cover the IYC nutritional needs, but raise the lack of facilities for doing this as a barrier to meeting this goal. During flooding, *matir chula* are used by more households because gas lines are cut. BRAC community health workers tend to be judgemental about poorer women. Because of the training they received, and their status as community health workers, they feel they have to endorse the role of advising mothers with regards to other topics in addition to pregnancy and breastfeeding.

#### **5.5.1.3.2 Poor quality and quantity of food**

Participants in the mothers group suggest that, '*the family eats kola khabar (not covered) food... that's why the child is in bad health*'. Open food is prone to getting spoiled (*nosto*) quickly and to being contaminated by flies. Participants in the community health workers group mentioned, '*the child doesn't get sufficient food because his parents cannot afford it*' or '*the mother does not breast feed her child*'.

*and cannot prepare nutritious food (birthy kabar) like 'khichuri'<sup>38</sup>. They explained 'the child is weak because he does not eat vegetable...'. 'Khichuri' has been promoted as the recommended IYC complementary food in Bangladesh by the Ministry of Health and various organisations including BRAC working in the slums. Khichuri has a high nutritional value, and is easy to prepare at a low cost. However the community health workers recognise that even they themselves are very rarely able to prepare it for their own children. The use of community kitchens makes it difficult to prepare several meals at a time as users are limited to 2 gas rings for a very short time. They frequently use one gas ring to cook rice and the other one for dal. Using dirty polluted water (dusoto pani) for food preparation is also associated with malnutrition because of the risk of disease transmission, 'the child is malnourished...his mother probably washes vegetables with dirty water [flood water]!' Mothers in the slums face the difficult choice of using flood water which is in front of their house but is dirty or having to walk through water to find a water supply on the road.*

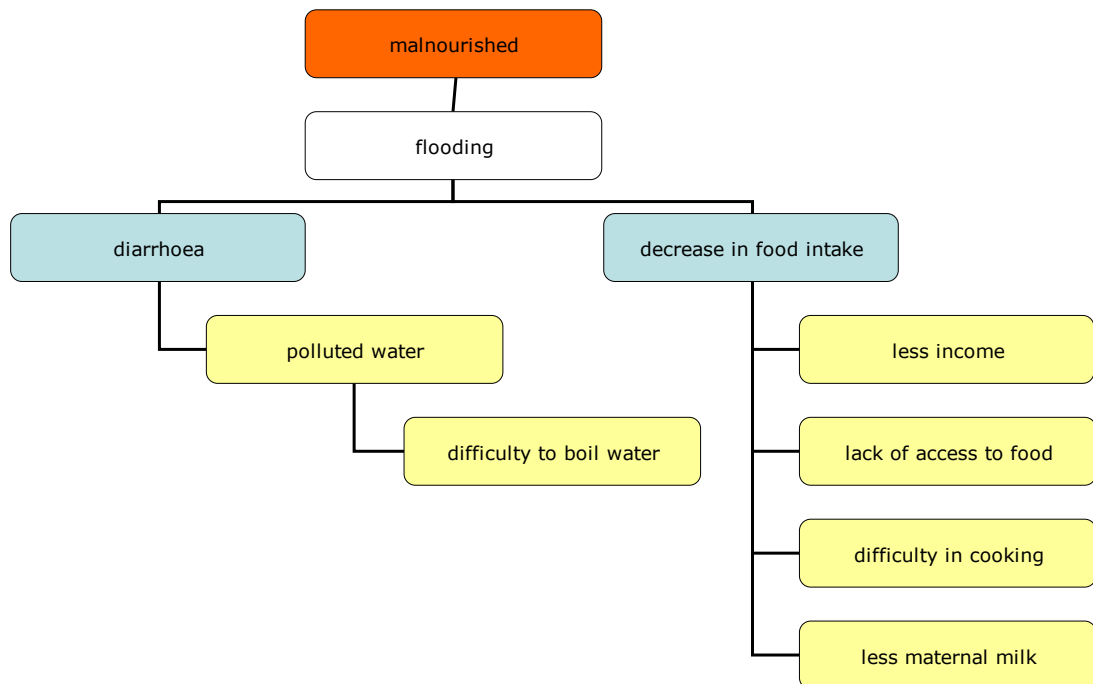
#### **5.5.1.4 Flooding**

During the rainy season, children become 'bony' and lose weight because there is a decrease in food intake and an increase in diarrhoeal episodes (Figure 5-8). At that time, everybody suffer, 'Apa<sup>39</sup>, in this unhealthy environment [flooded environment], a healthy man becomes unhealthy.

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<sup>38</sup> *Khichuri* is prepared with rice mixed with double proportion of lentils and vegetables.

<sup>39</sup> *Apa*, meaning sister is commonly used by Bangladeshi women when talking to each other in a courteous way.



**Figure 5-8: Conceptual framework for flooding**

#### **5.5.1.4.1 Decrease in food intake**

Participants explain, 'in the month of June, July and August (Assin kartik) it starts with storm and rain...then we can not work...we have less money to buy food...we eat less and breastfeeding mothers have less milk...life is then so painful (jibon kosto)!'. Most of the fathers work as rickshaw-puller and cannot work during the rainy season because the roads are inundated. Women cannot go to work at the garment factories because they fear going through the water and feel ashamed to show parts of their body. The decrease in revenue and availability of foods mean that most participants decrease their food intake by 50%. Mothers tend to skip meals to favour men and children. Consequently some mothers have to stop breastfeeding during the rainy season because of their own poor nutritional health.

#### **5.5.1.4.2 Diarrhoea**

Participants explain that children also become malnourished because they suffer from diarrhoea due to the surrounding dirty water, 'latrines go under water...stools float on the water...and children have then scabies and diarrhoea'. Community health workers mentioned, 'they [the slum-dwellers] bathe their children with dirty water... They don't understand... This is the flood water. They are passing urine and

*stool in this water and they bathe again*'. Few go to the street and get their drinking water in a *kulchi* (water container in clay or metal) from the road tube well because it is too difficult to reach the street.

### **5.5.2 Comparison of the causal models built by pregnant women, experienced and newly trained community health workers**

Pregnant women versus newly trained and experienced community health workers perceive differently some of the determinants of malnutrition. There are differences in the perception of determinants but also in the classification of the determinants (dominant versus minor). Community health worker participants, both novice and experienced, have very similar views whereas pregnant women participants have some different perceptions. The participants of the pregnant women FGDs stressed that 'environment and flooding' are dominant roots of malnutrition. In contrast, the community health workers do not perceive these as dominant causes. Rather, 'inappropriate food' was considered a more important factor of malnutrition by both the newly trained and experienced community health workers malnutrition.

The participants in the pregnant women's groups report a 'working mother' as a root to malnutrition whereas the community health workers groups did not. Lack of iodine and anaemia are mentioned only by community health workers but not by pregnant women. For community health workers, bottle feeding was described as a determinant of malnutrition when the mother cannot afford proper infant formula milk and therefore feeds '*suji*<sup>40</sup>'. They suggest that *suji* is often prepared in a very liquid manner and fed with unclean bottles. They perceive this to be a root to malnutrition because it does not provide adequate nutrition for the child, it is introduced at a too early age and exposes the infant to disease transmission. In contrast, the pregnant women participants state that it is good to use a bottle when the mother does not have sufficient milk.

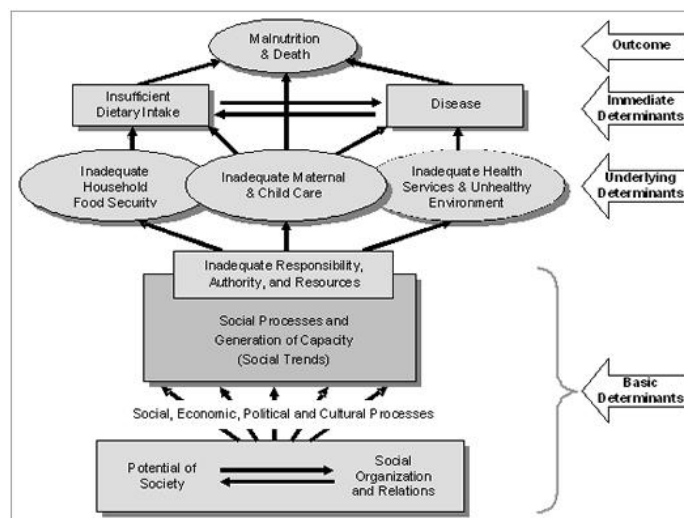
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<sup>40</sup> *Suji* is prepared with rice flour or wheat flour (more expensive), sugar, water or milk. It's usually 2 spoons of flour, 2 spoons of water or milk and 1 table spoon of sugar. It's introduced from 1 month of age. For a less than 6 month old child, half a glass is fed. It's very quick (5 to 10 minutes) and easy to prepare. The older the child gets, the more solid *suji* is prepared.



### 5.5.3 Comparison to the UNICEF conceptual framework

The conceptual framework developed by the participants in the FGDs is compared to the UNICEF framework for the root causes of malnutrition (UNICEF 1988) to identify similarities and discrepancies between the two. This conceptual framework was developed in 1988 as part of the UNICEF Nutrition Strategy (Figure 5-9). It shows that causes of malnutrition are multi-sectoral, embracing food, health and caring practices and are classified as immediate (individual level), underlying (household or family level) and basic (societal level).

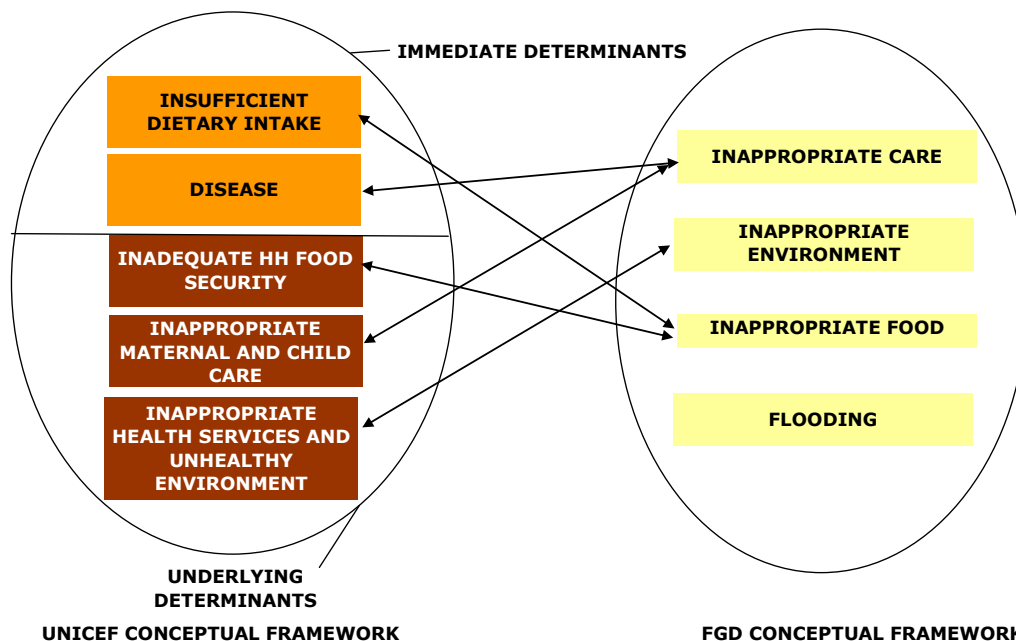


**Figure 5-9: UNICEF conceptual framework of the roots of malnutrition (source: UNICEF 1988)**

With one exception, all of the determinants of malnutrition resulting from the analysis of the FGDs can be successfully mapped onto the UNICEF ones (Figure 5-10). Flooding is the exception and appears to be a new root cause of malnutrition for these participants, which is not included in the UNICEF framework. Flooding is considered here as a disaster factor rather than an environmental factor because it is not a consistent presence in an already poor environment. Instead flooding is an exceptional event and appears to be a new root cause of malnutrition for these participants, which is not included in the UNICEF framework. Flooding takes the environment to an even harsher level than the poor conditions that already exist in the slum and is unpredictable in its nature.

Another discrepancy is that inappropriate health services are never mentioned in the FGDs as a determinant of malnutrition despite the fact that one photograph represents a hospital. In fact participants mention diseases but not the lack of access to health services or the fact that health services in the slums are

inappropriate. An exception to this is polio (disability) which is associated to a lack of access to health care and the fact that the child did not get vaccinated in time. Most slum-dwellers go to the nearest pharmacy for treatment. It is very often an unqualified store holder with no medical training who gives advice and treatment. Slum-dwellers call these persons 'doctor' even though they have never studied medicine. For serious diseases, they will go to Dhaka medical college (Government hospital). This hospital is far away and most are reluctant to have to pay the bus fair to go there. In addition people complain of the poor quality of services provided at this location. In cases of severe diarrhoea, most people will go to ICDDR,B<sup>41</sup> called the 'cholera hospital' where adequate treatment is free of charge. Despite observations of these complaints whilst working in the slum, participants do not identify a lack of access to health care services as a root cause of malnutrition. It could be hypothesized that slum dwellers do not identify the lack of access to health services as an issue because they have never had the opportunity to benefit from such services.



**Figure 5-10: Comparison between UNICEF and FGD conceptual framework**

<sup>41</sup> ICDDR,B is the International Centre for Diarrhoeal Disease Research, Bangladesh - an international health research institution located in Dhaka.

## 5.6 Discussion

The newly developed technique combining causal modelling and pile sorting of photographs enabled an in-depth understanding of the perceptions of root causes of malnutrition by mothers and community health workers living in the Dhaka slums. The strengths of this method were to make the exercise interesting to participants by turning FGD into a game play and to use photographs that are familiar to them.

The results show that pregnant women and community health workers living in the slums have an excellent perception of the root causes of malnutrition in IYC, which align with those developed by international experts. All of the determinants of malnutrition except for flooding were successfully mapped onto the UNICEF conceptual framework (UNICEF 1988). The fact that the majority of the participants are experienced community health workers explains their good understanding of the UNICEF determinants of malnutrition. However, results showed that even the newly trained community health workers and pregnant women who did not receive any training, have a similar level of understanding. Newly trained and experienced community workers strongly associate malnutrition to inappropriate food while pregnant mothers relate it more to environment and flooding. This difference is likely to be due to the training received, which emphasizes the traditional causes of malnutrition such as inappropriate food rather than other determinants of malnutrition such as environment, care and flooding. The pregnant women's perception of malnutrition is not biased by prior training and is demonstrative of their experiences of the importance of the slum environment and flooding as determinants of malnutrition. Lefèvre et al. (2004) also showed differences in perception when comparing a causal model built by health professionals and mothers; health professionals considered micro-biological factors, factors related to the caretakers' behaviours, and external factors as root causes of malnutrition while mothers emphasize factors related to child behaviour. These differences in perceptions should be taken into account in designing interventions in the slums as they influence the way nutrition interventions will be received by participants. If interventions are mapped onto knowledge they are more likely to be successful.

The difference in perception associated with bottle feeding shows the dilemma faced by mothers in the slums. Community health workers, because of their training, recognised the risk of using bottle feeding when the bottle is improperly

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prepared and used. Pregnant mothers, in contrast, complained of insufficient breast milk because of their own poor health and nutrition, especially during the flood and were afraid to expose their child to the malnutrition that may ensue from a perceived lack of breast milk. They therefore feel the need to compensate breast milk with bottle feeding. The problem is that most mothers do not have the financial means to afford appropriate infant formula milk. They will over dilute the formula thus exposing their child to a greater health risk because of insufficient nutritional value in addition to the morbidity risk due to the use of unclean water for dilution purposes. Baqui et al's (1993) findings confirmed this and stressed the risk of early supplementation of powdered milk. Chapter 4 has previously shown the importance of understanding mothers' limitations and constraints regarding breastfeeding due to insufficient milk supply or employment.

Similar to our own findings, Zeitlyn and Rowshan (1997) showed in Dhaka slums, Bangladesh how insufficient breast milk is regarded with ambivalence by mothers and health professionals. Mothers themselves blamed their poor nutrition while health professionals blamed the mothers' breastfeeding malpractices and the lack of care. Intervention in promoting of breastfeeding often fails to take into account other knowledge on which women rely. For instance, in Bolivia, anthropological research on breastfeeding showed that the biomedical and economic benefits of breastfeeding promoted through health intervention failed to take into account the ways culture comes to shape this practice (Tapias 2006). Mothers, because of strong peer pressure, considered their milk, insufficient and unhealthy and ceased to breastfeed their children.

Other differences in perception are likely to be due to difference in social status (family link with the landlord), education (literate versus illiterate) and occupation (working versus non working) between the community health workers group and the pregnant women. Lefevre and Beghin (1991) also showed differences in perception when comparing a causal model built by health professionals and mothers; health professionals considered micro-biological factors, factors related to the caretakers' behaviours, and external factors as roots of malnutrition while mothers emphasize factors related to child behaviour. These differences in perceptions should be taken into account in designing interventions in the slums as they influence the way nutrition interventions will be received by participants. If interventions are mapped onto knowledge they are more likely to be successful.

### **5.6.1 The nutritional risk posed by flooding in the slums**

Flooding as a new determinant of malnutrition reveals the need to understand the nutritional risk posed by flooding to children in the slums. A large number of households live in slums that are within 50 meters of the river and are at frequent risk of being flooded (World Bank 2007). Unregulated filling of water bodies for new construction has contributed to the increased frequency and duration of flood events in recent years. The embankments that were designed to prevent inflow of water from outside of the city slow the drainage of stagnant water from within. Residents feel that the danger of eviction from authorities is lower in flood-prone areas which are not deemed suitable for construction (Hardoy, Mitlin & Satterthwaite 1992). The vulnerability to flooding increases with the rainy season as often the bamboo basement structure of buildings is built lower than predictable flooding levels because of a lack of money (Wood and Salway 2000). Thus a large number of families live with flood waters in their homes for a significant portion of the rainy season. Flood affected IYC suffer from a nutritional deterioration overtime (Buttenheim, 2006; del Ninno and Lundberg, 2005; Hossain and Kolsteren, 2003, Chowdhury et al. 1990, Woodruff et al. 1988, Centers for Disease Control (CDC) 1989, del Ninno, Bloem, Moench-Pfanner & Panagides 2003).

### **5.6.2 The importance of sanitation as a determinant of malnutrition**

The findings presented in this chapter also show the importance of the environment and especially the sanitation as a determinant of malnutrition in the slums of Dhaka. Slums are referred as dirty places with no or poor sanitation. They are almost invariably poorly drained and next to, or over water bodies. Poor coverage and maintenance of the small existing sewage network means that sewage ends up in the remaining lakes and canals within the city, upon which many of the slums exist. Open defecation is still common practice in the form of hanging latrines. Solid waste management facilities are virtually non-existent in the slums and in many cases the slum itself is the refuse disposal point for richer areas of the city. The build-up of massive amounts of solid waste contributes to the blockage of drainage canals and increases problems further.

Open defecation threatens the quality of water resources and has serious consequences on people's health with IYC being the most vulnerable due to their low immune system (COHRE et al. 2008, WHO and UNICEF 2000). Excreta-related diseases and intestinal worm infections are a cause for millions of children to be

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stunted, mentally disabled and severely malnourished (WHO and UNICEF 2000). Poor sanitation not only can cause child deaths by diarrhoea but can also contribute to child deaths in combination with malnutrition and acute respiratory infection (WaterAid 2008, WHO and UNICEF 2000).

According to UN-HABITAT (pp 19:94, 2003), *'a household is considered to have adequate access to sanitation, if an excreta disposal system, either in the form of a private toilet or a public toilet shared with a reasonable number of people, is available to household members'*. Target 11 of the Millennium Development Goals and Targets adopted in 2000 by UN member states deal specifically with the issue of slums and the improvement of the lives of slum dwellers, *'by 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers'* (UN-HABITAT 2003). Significant improvement to reach this goal will require giving access to adequate sanitation to a million slum dwellers in Dhaka who do not currently have access to this basic service. Toilets and latrines are expensive for slum dwellers and emptying them remains a major issue. Also the challenges to poor environments are largely not in direct control of individuals and rely upon innovative community level solutions. For instance, the success story of DSK<sup>42</sup> and the Dhaka Water and Sewerage Authority (WASA) shows how change is possible to give slum-dwellers access to clean water supplies (Rashid 2007). Over the last eighteen years DSK and DWASA have worked together to provide slum communities with legal water connections benefiting more than 200,000 inhabitants who previously had no access to water and often had to collect water from far away or use polluted water. WaterAid, an international NGO working with Bangladeshi partners tested cost recovery interventions for latrine construction along with hygiene promotion and water supply interventions (Hanchett et al. 2003). Slum-dwellers contribute to the cost recovery by paying on a usage basis for water and latrines. They found these programmes successful in improving water and sanitation only for slum-dwellers who can afford it. For example, a very poor family can afford to pay for water but not for using the latrines. The study has found that cost-recovery is possible for poor households, but not for the very poorest who cannot afford it.

Interventions relying on latrine construction without cost recovery are expensive and have a low household coverage; a sanitation block construction can cost up to 500,000 BT (around 6,260 GBP) covering only 100 to 180 households (Hanchett et

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<sup>42</sup> Dushata Shastya Kendra, Bangladeshi Non Governmental Organization

al. 2003). In highly populated areas such as slums, low cost, small improvements to existing sanitation technologies implemented on a large scale may have larger health impacts than the provision of a few expensive latrines on a small scale. This is especially relevant in flooded areas such as Dhaka slums, where floodwaters can transport pathogens over large distances and cause illnesses such as diarrhoea, which have major negative effects on children's health. In these situations no matter how good an individual latrine is, levels of pathogens are still largely determined by the practices of the wider community; a few people practicing open defecation can have negative health impacts for the whole community (COHRE et al. 2008). Educational programmes through behavioural changes and communication (BCC) messages could be the key to impacting high numbers of people at a low cost as these programmes rely on community participation. Stanton et al. (1987) tested the impact in 25 slum communities of an educational intervention for altering water and sanitation behaviours to reduce childhood diarrhoea. The educational messages focused on three behaviours which appeared to influence the incidence of diarrhoea: 1) lack of hand washing before preparing food; 2) open defecation by children in the family compound; and 3) inattention to proper disposal of garbage and faeces which is increasing the danger to young children to put dirty objects in their mouths. The rate of diarrhoea (per 100 person-weeks) in children under six years was significantly lower in the intervention communities compared to the control communities. The intervention was also successful in improving hand washing practices before preparing food but no change was noted in the defecatory practices of young children and in the garbage disposal. The authors suggest explanations for these failures which should be taken into account in designing sanitation interventions in the slums. In a latter publication using the same data, Stanton et al. (1988) demonstrated that unfortunately the improvement in diarrhoea rates was not accompanied by a substantial overall improvement in nutritional status in the children of the intervention group. The weaknesses and failures of past and existing interventions stress the need to further explore low-cost sanitation solutions for adequate sanitation and reduced risks to IYC's health in the slums of Dhaka.

### **5.6.3 Limitations of the study**

The time constraints of participants is a limitation of the study. Only a limited version of the full causal model was used with a maximum of 9 determinants. This limitation forced participants to select the immediate causes of malnutrition, thus

underlying causes may have not been explored. They were also confined to only talk about the factors shown in the photographs which might have influenced the findings. Factors that they may have had in mind, but not represented among the photographs selected, were not discussed and are not part of the model. The representativeness of participants is another limitation since experienced community health workers represented more than half of the participants.

Despite the novelty of the causal model approach, the conceptual frameworks built during FGDs were linear, linking an effect to a cause. Frequently participants struggled to identify cause and effect. For example, participants would find it difficult to differentiate cause and effect between malnutrition and diarrhoea, and indeed there is in fact a bidirectional causal link between the two. During the FGDs, participants were forced to choose a direction as the model used was causal and linear. This limitation is reflective of the many vicious circles existing where malnutrition may not be only the effect but also the cause. There is a need to explore malnutrition through a systems approach that recognises that causes and effects are often dynamically interdependent. A “causal loop modelling” approach is suggested as a potential tool for future research (Richardson 1997). It would enable having negative and positive links between variables and allow for non-linear dynamics in the model.

#### **5.6.4 Policy recommendations**

In the Dhaka region, urban growth compounded by climate variability, as well as other drivers of change, could lead to increased intensity of flooding and vulnerability of slum populations. Flooding is clearly identified as a major determinant of malnutrition in the slums and is demonstrative of the need for emergency intervention in nutrition during the rainy season. This recommendation is also stressed by the research on coping strategies developed by mothers in the slums presented in Chapter 4. Security of the environment, care and food are determinants of health, which should be tackled on a long-term basis to prevent malnutrition with a focus on improving the sanitation situation for slum-dwellers. These research findings highlight the need to update the UNICEF conceptual framework (UNICEF 1988). It is an important first step to include natural disasters such as floods into the framework because this model is used by policy makers to drive intervention. Giving a place in the framework to natural disasters like floods as well as other potentially important natural disasters which could be equally



relevant in other settings (eg earthquakes, and tsunamis) could help to drive a policy agenda for initiating interventions to help those most vulnerable to malnutrition.

## 5.7 Conclusion

The findings from this study reveal an accurate perception of the root causes of malnutrition by mothers and community health workers. Inappropriate knowledge therefore does not appear to be a root cause of malnutrition. The fact that flooding is considered as a new root cause of malnutrition stresses the need to conduct further research to address the nutritional risk posed by flooding in the slums. Findings also highlight the need to design sanitation interventions to decrease the risks posed by poor sanitation environments to IYC's health. Finally, findings bring evidence to update the UNICEF conceptual framework with natural disasters as a determinant of malnutrition and to consider interventions that help communities to overcome the negative consequences of natural disasters like floods who tend to house infants who are the most vulnerable to malnutrition.

### **Key Messages**

- There is an accurate perception of the root causes of malnutrition by pregnant women and community health workers living in the slums.
- Flooding is considered as a new root cause of malnutrition. The risk posed by flooding on IYC's health should be addressed.
- Poor sanitation is highly stressed to cause malnutrition in IYCs. Solutions to improving poor sanitation through design of interventions should be explored.
- There is a need to update the UNICEF conceptual framework with natural disasters as a determinant of malnutrition.

In the next chapter, recommendations for interventions based on the combined findings presented in Chapter 3, 4 and 5 are proposed.

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## **Abbreviations, acronyms and glossary (Chapter 6)**

CF	Complementary food
CMAM	Community based Management Acute Malnutrition
CNC	Community Nutrition Centre
CSR	Corporate Social Responsibility
GAM	Global Acute Malnutrition
MAM	Moderate Acute Malnourished
MUAC	Mid-upper-arm-circumference
OTP	Outpatient Therapeutic Program
PM2A	Prevention of Malnutrition in under 2 years Age
PS	<i>Pouchti Shebikha</i> (Nutrition teacher)
RUSF	Ready to Use Supplementary Food
RUTF	Ready to Use Therapeutic Food
SAM	Severe Acute Malnourished
SFP	Supplementary Feeding Programme

## **Chapter 6 – Implications and pilot project**

This chapter's objective is to bring forward recommendations related to the highlighted problems and issues of IYC feeding practices and nutritional health in normal and flooding times resulting from the combined findings of the qualitative and quantitative approach. Our combined findings lead to recommendations for improving infant and young children (IYC) and maternal nutritional health in the long term through preventive actions. This research also suggests that nutritional health of IYC's living in the slums should be promoted in order to make them more 'resilient' to external shocks such as flooding. Flooding only intensifies existing problems in the slums that should be addressed on a long term basis. Inappropriate environments, care and food are perceived determinants of malnutrition which should be tackled through durable interventions to prevent malnutrition.

This chapter suggests ways of turning research into action and outlines a proposal for a pilot project to tackle IYC malnutrition in the slums of Dhaka, Bangladesh. The recommendations for intervention are grounded in the literature review for best practices presented in Chapter 4. In addition the recommendations are based on two proven designs presented in Chapter 6, 1) prevention of malnutrition in infants under 2 years old (PM2A) (FANTA 2009) and 2) community based management of acute malnutrition (CMAM) to treat acute malnourished children (Collins et al. 2006, Collins et al. 2005, Ashword 2006, FANTA 2009) .

In this chapter, a pilot project is presented in order to allow for testing on a small scale the feasibility of the intervention to allow for improvements in design before scaling up. The originality of the pilot project is to combine these two designs; prevention and treatment of malnutrition and to customize them for urban settings. Only part of the recommendations resulting from the quantitative and qualitative research are answered through the pilot project. The prioritisation on how to respond to highlighted issues is based on a feasible, simple and holistic approach that is focussed on preventive rather than curative interventions.

The proposal consists of a set of practical actions to be implemented by an operational organisation. The practical actions are divided into programmatic implications (proposal for a pilot project), scientific implications and further research. The proposal was kept extremely practical in order to stress the link to applied research and the importance for the researcher that these research findings translate into action. As ACF funded part of the qualitative research, the proposal for a pilot project has been submitted to them for consideration for action.

## **6.1 Programmatic implications**

In order to recognise the potential of the findings of this PhD research to be used to improve nutritional health in Bangladeshi slums, the practical implications of the research findings are presented in the form of a proposed pilot programme designed to target improving IYC nutritional health.

### **6.1.1 Cornerstones**

The idea driving the pilot project is to test a realistic approach to improve IYC nutrition, which should be scalable for use in a larger population. The scalability of the approach is critical as real success depends on large scale coverage as millions of IYC live in the slums. The pilot project, if assessed to be successful based on the results of the impact study, should be able to be easily replicable in order to reach a high coverage of IYC.

At this stage it is impossible to know what amount of future funding will be available for this project or what the future management capacity of the implementing organisation will be. The project is therefore designed to consist of three independent modules which will function simultaneously towards achieving the overall objective:

**“To improve the nutritional status of infants and young children in the slums of Dhaka, Bangladesh”**

The sub-objectives are:

1. To prevent malnutrition in IYC under 2 years old through increased knowledge of appropriate feeding practices
2. To treat global acute malnutrition (GAM) in IYC under 2 years old using cost effective locally produced ready to use therapeutic food (RUTF), ready to use supplementary food (RUSF) and optimal complementary food (CF).
3. To advocate quality day care services in garment factories for breastfed IYC of working mothers.

If sufficient resources are not available one or more modules can be excluded or postponed and it will still be possible to initiate a pilot project on a reduced scale with those that remain. However it is recommended that the prevention part will be



prioritised if a limited budget is available because preventive programmes are more effective for the reduction of childhood undernutrition than the traditional recuperative model (Ruel et al. 2008, Menon et al. 2007, IFPRI 2008).

It is also crucial that the pilot project should be implemented for 3 years as the main focus is prevention of malnutrition. Changes in malnutrition prevalences, especially for chronic malnutrition may be seen only after this duration of time. The implementation phase of the programme is likely to take up to a year so it is assumed that 2 years is the suitable timeframe to see changes in the nutritional health of IYC based on previous interventions (Rivera et al. 2004, Bhutta et al. 2008).

The 3 modules have been formulated to be realistic taking into account the capacity of ACF which is an NGO with strong experience in treatment and prevention of malnutrition but not so much in advocacy. In practice, ACF will have difficulty to implement the third module and address the non-compliance of factories in the pilot project. This pilot project has been designed with ACF as a specific funder and implementing organisation in mind which has expertise in the treatment and prevention of malnutrition in IYC.

The three proposed modules are briefly summarised below:

- 1. Community Nutrition Centre (CNC)**– Such a centre would allow for treatment and prevention of malnutrition in part of a slum in Dhaka using a Prevention of Malnutrition in IYC under 2 years old Approach (PM2A) alongside Community Based Management of Acute Malnutrition (CMAM). Given the flooding problems identified in Dhaka, special attention should be put on continuation of existing services (provision of Ready to Use Supplementary Food, of Ready to Use Therapeutic Food, referral of children severely malnourished with medical complications to hospital) and extra assistance to nutritionally vulnerable groups during the rainy season. IYC longitudinal nutritional data must be collected so that impact study reports can be prepared every year to assess the success of the intervention.
- 2. Factory day care strengthening** - Evaluation of existing IYC day care centres in factories and development of a support and monitoring network to facilitate appropriate functioning of such facilities. This will be supported by advocacy for improved care of children of employees at the national and international levels.

- 3. Local Manufacture of RUTF/RUSF and optimal CF** – Research into the feasibility of locally manufactured ready to use therapeutic and supplementary foods through partnership with the nutrition research institute in Bangladesh and abroad. This will be coupled with research on the improvement of CF with micronutrients and/or amylases.

Detailed explanations for CNC and factory day care strengthening are included in the following sections of the programmatic implications. Local manufacture of RUTF/RUSF and optimal CF are presented in the scientific implications section.

### **6.1.2 Community Nutrition Centre (CNC)**

The community nutrition centre (CNC) will focus on infants under the age of two years. This is the age during which long term impacts on malnutrition can happen (Ruel et al. 2008, Menon et al. 2007). It is therefore the key window for nutrition intervention. The centre will tackle malnutrition in the slum through two major approaches; PM2A and CMAM. It will be also the focal point for specific interventions during the rainy season.

#### **6.1.2.1 Prevention of Malnutrition in IYC under 2 years Approach (PM2A)**

Several studies show the importance of intervening by promoting appropriate complementary feeding before the age of 2 years old to have a long term impact on malnutrition (Ruel et al. 2008, Menon et al. 2007, IFPRI 2008, Caulfield et al. 1999). The period from birth to two years of age is a 'critical window' for the promotion of nutritional health in IYC as this is the peak age for growth faltering, deficiencies and morbidity such as diarrhoea (Dewey 2001). After 2 years of age, the chances for catch up growth for stunted children are reduced (Martorell et al. 1994). In addition, poor nutritional health during these early years is associated with lower intellectual performance, work capacity, reproductive outcomes and overall health during adolescence and adulthood compared to well nourished children. Children under two years of age are also likely to benefit more from nutrition interventions than older children (Schroeder et al. 1995). In terms of food supplementation, the benefits on growth are important the earlier and the longer food supplementation is provided before 2 years of age (Rivera and Habicht 1996, 2002, Martorell 1995). Traditionally nutrition interventions often focus on acute malnutrition however there is clear evidence from previous research that programmes that aim to **prevent** malnutrition can be much more effective than

those that target children already malnourished (Ruel et al. 2008, Menon et al. 2007, IFPRI 2008). Menon et al. (2007) highlight how the traditional recuperative approach frequently intervenes too late when children are already malnourished after months of growth faltering. On the other hand, the preventive approach target children before their growth falters, during their most vulnerable period from birth to 24 months (Schroeder et al. 1995, Lutter et al. 1990, Allen 1994, Rivera and Habicht 1996, 2002). The key finding of their study was, that the prevalence of stunting, underweight, and wasting was 4, 6, and 4% points lower after 3 years of operation in communities randomly allocated to receive a preventive approach compared to communities exposed to the recuperative program approach. Ruel et al. confirmed this finding in a cluster randomised trial to compare a preventive model for all children aged 6–23 months and a recuperative model for underweight (weight-for-age Z score  $<-2$ ) children aged 6–60 months. Two surveys were conducted at baseline and 3 years later. Three years later, the prevalences for stunting, underweight, and wasting were 4–6% points lower in preventive than in recuperative groups.

The pilot project therefore aims to place much greater emphasis on a “preventative approach” that targets children based upon their age rather than their nutritional status. The general term for this approach in the technical nutrition literature is “*Prevention of Malnutrition in under 2’s Approach*” - PM2A (Ruel et al. 2008, Menon et al. 2007).

Prevention of malnutrition will be based on promotion of appropriate breastfeeding and complementary feeding practices through beneficiaries’ home visit and Behavioural Change and Communication session at the CNC (Caulfield et al. 1999, Guldan et al. 2000, Penny et al. 2005, Santos et al. 2001). Supply of appropriate complementary food (CF) and or micronutrient-fortified food in addition to promotion will also be necessary to be of benefit to the child’s nutritional status (Oelofse et al. 2003, Adu-Afarwuah et al. 2007, Lartey et al. 1999, Schroeder et al. 2002, Lutter et al. 2008, Bhandari et al. 2001, Obatolu 2003). Finally growth follow up will be key for the prevention of malnutrition in IYC by the identification of IYC at risk and the degree to which physiological needs for growth and development are met (WHO 2006).

### **6.1.2.2 Community-based Management of Acute Malnutrition in IYC under 2 years (CMAM)**

The treatment activities proposed within this project are largely based upon tried and tested CMAM approaches (Collins et al. 2006, Collins et al. 2005, Ashworth et al. 2006, Ashworth 2001, Ahmed 2006, Ashworth and Khanum 1997). The CMAM model focuses on providing effective therapeutic care to the majority of acute malnourished children as outpatients by using techniques of community mobilisation. CMAM programmes attempt to build on local capacity, existing structures and systems. This is achieved through intensive community consultation and mobilisation to maximise understanding and participation of the communities.

A combination of three treatment modalities, 1) supplementary feeding, 2) outpatient therapeutic and 3) inpatient therapeutic are offered according to the clinical and anthropometric characteristics at presentation:

- 1) Supplementary feeding: Moderate Acute Malnourished (MAM) children (children with WFH  $< -2SD$  and  $\geq -3SD$ ) with no medical complications are supported through a Supplementary Feeding Programme (SFP) and will be given dry take-home rations.
- 2) Outpatient therapeutic feeding: Severe Acute Malnourished (SAM) children (children with WFH  $< -3SD$ ) with no medical complications are treated in an Outpatient Therapeutic Programme (OTP). The child receives Ready to Use Therapeutic Food (RUTF), a course of oral broad-spectrum antibiotics, anti-helminth treatment, folic acid, and if appropriate vitamin A, measles vaccination and anti-malarials.
- 3) Inpatient therapeutic feeding: Severe Acute Malnourished children (SAM) with additional serious medical complications are treated in an inpatient Stabilisation Centre until they are well enough to be transferred into the OTP.

CMAM cases studies have been mainly focussed on a rural-based model but this outpatient focussed approach is ideally suited to the extremely overcrowded conditions in Dhaka slums. Nevertheless due to the particularly difficult context it is felt that two key changes are necessary to transform it into an urban-based model:

**No provision of inpatient care** – Physical limitations on the size of the CNC means that provision of inpatient care for severely malnourished children with medical complications is unlikely to be cost effective. It is instead proposed to create a referral system to locally available public hospitals or clinics within Dhaka

city with some form of assistance to help with travel, medical costs and food and care of other children. It is important to cover these costs to ensure that the families of malnourished children with medical complications do not face any financial constraints and that the referral system is efficient.

**Complementary feeding for children of working mothers with incapable carers** - Again due to the small physical size of the CNC it is proposed to minimise the numbers of Moderate Acute Malnourished (MAM) IYC admitted to the complementary feeding programme, because many slum children would meet this definition based on findings from previous studies (Pryer et al. 2003). Therefore the MAM children of working mothers with incapable carers are the only group that will be admitted to this programme. This is because the findings of this study in Chapter 4 and 5 have shown that IYC of working mothers are often left in the care of very old, very young or disabled relatives while the mother is at work. These caregivers cannot prepare appropriate CF due to their lack of knowledge, skills, and eagerness. These caregivers will be advised and shown how to cook optimal CF based on a base recipe supplemented with a premix (the premix content will be the result of biochemical analyses conducted in laboratories presented in the scientific implications of this chapter), which does not require a high skill level to prepare. They could also be provided with Ready to Use Supplementary Food (RUSF). RUSF and optimal CF are presented in the scientific implications of this chapter. By supporting these IYC, mothers can continue to work and bring more income into the home for care of other children and additional expenses.

### **CMAM Outreach**

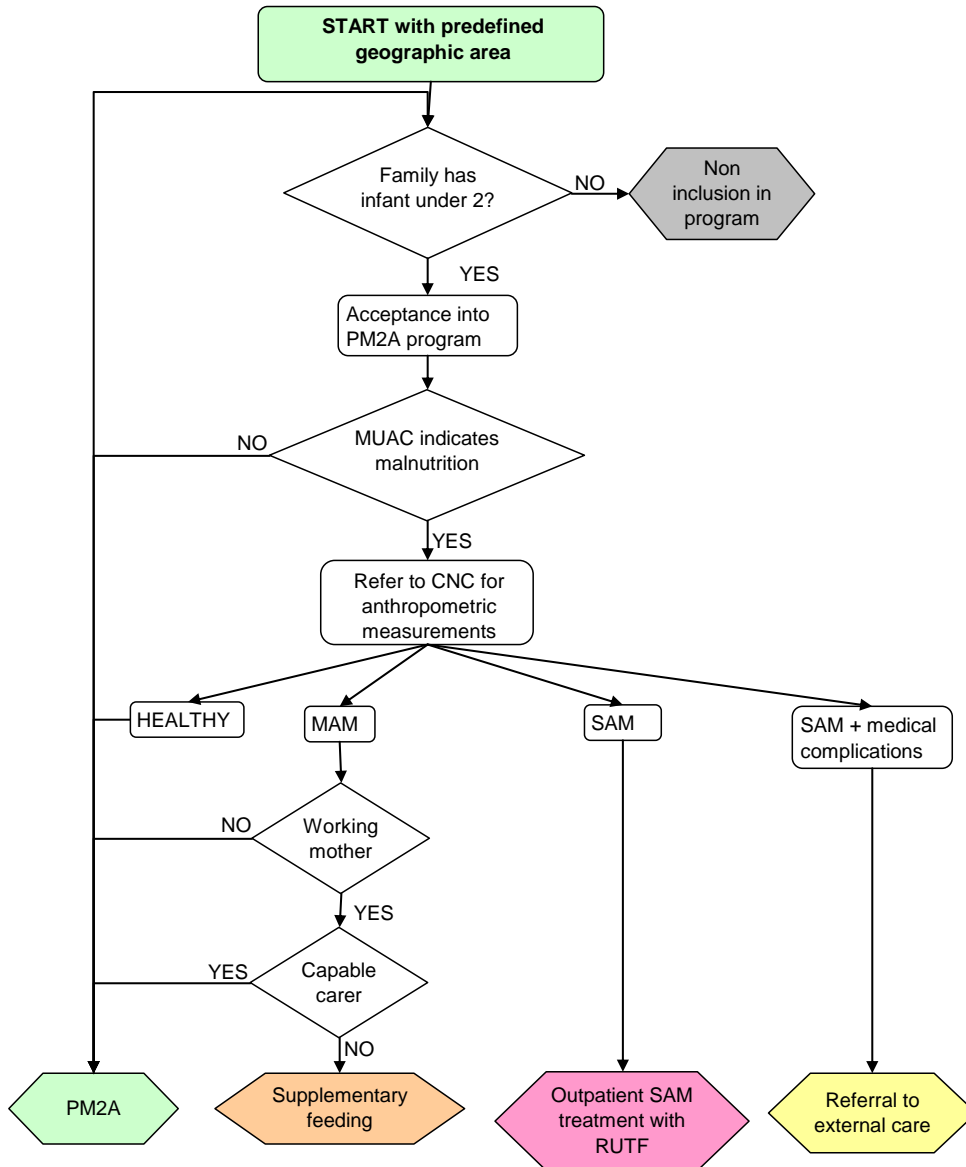
CMAM outreach should be strengthened in the slums through linkages with the existing health providers; traditional healers, homeopath, pharmacy shop dealers (ENN 2004). It is important to include these actors to increase the referral of eligible beneficiaries to the CNC. These health actors should be integrated in the CMAM outreach by ensuring that the important messages on nutrition are understood.

#### **6.1.2.3 Beneficiary Selection**

The overall number of programme beneficiaries is primarily determined by the scale of the PM2A programme as the CMAM beneficiaries will be drawn from this group (Figure 6-1). PM2A beneficiaries will be IYC under 2 years old living in the catchment area; the catchment area will be a defined area surrounding the CNC.

CMAM beneficiaries will be IYC of the PM2A who are MAM with working mothers or SAM with no medical complication.

Figure 6-1 shows the criteria for selections for beneficiaries of PM2A and CMAM.



**Figure 6-1: Criteria for selection for pilot project**

**6.1.2.3.1 PM2A beneficiaries criteria selection**

The sole admission criteria for admitting an infant or young child to the PM2A programme is age and the geographical location in which they live. Infants and children that reach two years during the course of the pilot study will be discharged and new born infants will take their places (ideally referred by BRAC birthing centres). BRAC birthing centres are the only facility for women to give birth in the slums when they decide not to give birth at home. They are potentially a good

means of referring new born infants. Thus, it is suggested that the CNC builds strong working relationships with BRAC birthing centres to follow the infants when the post-natal follow up is done by the BRAC community health workers or *Shasto Shebikas*. BRAC community health workers are women living in the slum who have been chosen as volunteers and trained by BRAC to take part in the Manoshi<sup>43</sup> programme. They are responsible for ante-natal and post-natal care of women giving birth in the BRAC centres. The post-natal follow up consists of visiting the mother and the infant to ensure good breastfeeding practices and good health of both in the 2 weeks after birth. It will also need to be ensured that vulnerable IYC not being born in the birth centres are not left out of the programme. This will be part of the role of the *Pouchti Shebikas* to keep themselves well informed of birth in the coverage area.

#### **6.1.2.3.2 CMAM beneficiaries criteria selection**

Initial screening of PM2A programme participants will be carried out using mid-upper arm circumference (MUAC). MUAC is an indicator of acute malnutrition and reflects mortality risk (IYC are considered severely malnourished if  $MUAC < 110\text{mm}$ , IYC are considered moderately malnourished if  $MUAC \geq 110\text{mm}$  or  $< 125\text{mm}$ ). The choice of using MUAC is driven by the logistics constraints of taking height and weight directly in the home of IYC in the slum setting where the height clearance of buildings and stability of the poor are not conducive to traditional anthropometric measures of weight and height. It has also been promoted as the key indicator for CMAM programmes as it is easy to teach community workers to take and does not require complicated equipment (Collins *et al.* 2006).

The IYC identified by MUAC to be suffering from Global Acute Malnutrition (GAM) (IYC with Weight-for-Height  $< -2$  SD, IYC either moderately or severely malnourished) will be referred to the CNC for full anthropometric measurement (height and weight based on the standard anthropometric measurement guidelines). Depending on their level of malnutrition and the capabilities of their carers they will be referred to one of four eventualities described in figure 6-1:

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<sup>43</sup> The Manoshi project was developed by BRAC to establish a community- based health programme targeted at reducing maternal and child mortality in the urban slums of Bangladesh. The programme is funded by the Bill and Melinda Gates Foundation under the Community Health Solutions (CHS) initiative aiming at strengthening and leveraging community organizations and participants to scale up proven interventions in community settings (BRAC 2009, Khan & Ahmed 2006).

1. Normal IYC will be part of PM2A (IYC with Weight-for-Height / WFH  $\geq -2SD$ ),
2. MAM will receive supplementary feeding (RUSF and/or premix for optimal CF) in CNC (IYC with Weight-for-Height  $< -2SD$  and  $\geq -3SD$ ),
3. SAM will receive outpatient treatment with RUTF (IYC with Weight-for-Height  $< -3SD$ ),
4. SAM with clinical complications will be referred for inpatient care in a hospital (IYC with Weight-for-Height  $< -3SD$  + medical complications).

#### **6.1.2.4 Nutritional teachers or 'pouchti shebikha'**

The backbone of the entire project will be trained members of the local community called '*Pouchti Shebikha*' (PS) – Nutritional Teachers. These women living in the slums will have to be literate to be considered for selection. The primary activity of these PS will be to visit mothers with children under the age of 2 where they will listen to the mothers and accordingly disseminate appropriate nutritional advice, identify malnourished children and monitor outpatient CMAM interventions. These staff will receive basic training from the implementing organisation on:

- Identification of severe malnutrition (MUAC) and appropriate action.
- Appropriate Breastfeeding and CF practices.
- Appropriate care and hygiene practices.
- Listening, advising and recommendation skills.
- Recommendations & demonstration for CF preparation.
- Supervision of outpatient CMAM programmes.

#### **6.1.2.5 Scale of PM2A**

The feasible scale of the PM2A programme and the number of beneficiaries covered are primarily determined by:

1. The number of families covered per PS.
2. The number of PS employed at the CNC

At this point, it's difficult to accurately estimate the potential number of beneficiaries for CMAM as two main pieces of information are unknown and are lacking in previous research; the percentage of SAM with no medical complications and the percentage of MAM with working mothers and incapable caregivers. In addition the prevalence of SAM and MAM will fluctuate depending on the season and the location of the CNC. However the limitation will be the cost as CMAM is an expensive programme to carry out. Therefore a maximum number of beneficiaries



should be set at the beginning of the project in order not to jeopardise financially the other parts, such as PM2A which is extremely cost-effective (Ruel et al. 2008, Menon et al. 2007, IFPRI 2006).

Research in Haiti has shown that direct programme costs per beneficiary-month are higher for a recuperative programme than for a preventive approach (USD \$ 21 versus USD \$ 15) (Ruel et al. 2008). Implementation of PM2A will identify general acute malnutrition (GAM) requiring referral to more costly CMAM. The high cost of treating GAM compared to preventative activities means that the CMAM is likely to vastly dominate the financial costs. This is the inevitable ethical dilemma of choosing between treatments of a few severely malnourished infants or preventing many more from becoming malnourished. Compassion and a basic humanitarian imperative means it is highly likely that the immediate and tangible problems of acute malnutrition will be prioritised. Nevertheless this rationality is bounded as a finite budget inevitably means this will leave fewer resources for preventative activities.

In order to prevent the domination of CMAM over PM2A it is therefore necessary to define what percentage of resources should be allocated to each part of the overall programme at the outset; and to set the number of beneficiaries of CMAM as no accurate estimate can be made. The ultimate determinant of what this cut off point will be is the overall budget. More stringent criteria for selection will need to be defined if more children are found to need CMAM than it was originally estimated and budgeted for.

#### **6.1.2.6 CNC activities**

##### **6.1.2.6.1 PM2A**

###### **Home visit**

PS will visit IYC under 2 years old in their catchment area. They will visit the mothers in their home for listening, counselling and advising sessions. They will prioritise mothers with infants under 3 months old to advise them on optimal breastfeeding practices before any malpractices have already been engaged; such as giving others drinks or starting too early CF (Arifeen et al. 2000). Focusing interventions on the first 3 months of infant's life results in improving a child's growth channel (Arifeen et al. 2000). Educational programmes through home-based

peer counselling have a significant impact in increasing the initiation and duration of exclusive breastfeeding (Haider et al. 2000; Morrow et al. 1999).

The priority in these breastfeeding (BF) counselling visits will be not to give general advice but instead to listen first to the mother, understand her problems, constraints and limitations and accordingly deliver customised messages to change and improve feeding practices (Haque et al. 2002, Bhutta et al. 2008, Arifeen et al. 2000). In Bangladesh repeated organized counselling on appropriate breastfeeding was successful in increasing the rate of exclusive breast-feeding (including colostrum feeding), the rate of timely introduction of complementary feeding; and in preventing discontinuation of breast-feeding during illnesses, such as diarrhoea and ARI (Haque et al. 2002). PS will exclude women in their late pregnancy as potential beneficiaries. This is because they will be already covered by the BRAC Manoshi programme which would make the intervention redundant. For the older IYC ( $\geq 6$  months), the PS will first take time to understand their diet, the composition, frequency, quantity fed and problems encountered during feeding. They may attend the CF cooking preparation to assess the composition of it. As for BF counselling session, their advice will not be general but instead tailored to the visited mother.

### **Specific attention to mothers with problems**

Specific attention and care will be given to mothers with problems related to IYC feeding practices, care and hygiene. The PS with the support of the PS manager will have a proactive approach with caregivers and attempt to understand the roots of their problems. Recommendations based on sustainable solutions will be provided on a case by case basis. When no improvement in IYC's health is seen, household food insecurity and poverty as root causes of poor nutritional health in IYC need to be overcome in combination with other interventions. Conditional cash transfer programmes depending on significant improvement in IYC nutritional health could also be envisaged to promote change in practices and raise the household food security levels (Behrman & Hoddinott 2001, Maluccio 2005). The implementing organisation could also establish links with micro-credit institutions to initiate a positive cycle out of poverty for these women.

### **Monthly follow-up**

Each IYC will have a monthly follow-up in the CNC; anthropometric measurements will be taken, and data recorded in the growth chart of the IYC on two cards; one card will be kept in the CNC to avoid loss or disappearance and to ensure good

recording, the second one will be for the mother or the caretaker (grandparents, siblings or neighbours). The CNC staff will explain to the mother or the caretaker the growth status of their IYC. Any decrease or stabilisation on the growth card will entail a follow-up visit by the PS to discuss further the customised recommendations. Menon et al. (2007) recommended in their preventive approach to malnutrition that mothers should be informed about the change in their child's nutritional status since last weighing. They recommend praising and encouraging the mother when the child is growing well, and advising the mother on recommend practices when the child is not growing well.

CNC staff will accept IYC with a caretaker other than their mother since some mothers may be working or busy due to their domestic workload. From my observations in the slums during vaccination, IYC were accompanied by a sibling, a grandmother or a neighbour when their own mother was unable to come.

### **Monthly BCC session**

BCC (Behavioural Change and Communication) sessions have proven to be successful in prevention of malnutrition (Ruel et al. 2008, Menon et al. 2007). These are programmes that aim to improve child outcomes by improving childcare behaviours (Menon et al. 2004). In Haiti, Ruel et al. used a set of 13 learning sessions for the BCC sessions on topics such as healthy pregnancy, breastfeeding, child development, child caring and feeding practices, hygiene in food handling and storage, and cooking demonstrations of nutrient-dense complementary foods. Formative research will need to be conducted to develop messages that are feasible and acceptable child care and feeding practices in Bangladesh. The BCC sessions will be organized on a monthly basis in the CNC; mothers will be invited to join a session during which experiences, problems and issues encountered by mothers will be discussed. It will be the ground base for change in behaviour.

### **6.1.2.6.2 CMAM**

#### **MUAC check up**

For all IYC under 2 years old living in the catchment area, initial nutritional status will be assessed through MUAC. For the IYC under 2 years old new to the area, MUAC will also be used to assess their nutritional status. The PS will have to routinely check IYC and if they are assessed to be SAM or MAM they will refer them to CNC for anthropometric measurements.

### **SAM follow up**

Those identified to be SAM with no complication will be given RUTF and mothers of these children will be given Intensive Nutrition Counselling (INC) on a case to case basis by PS. Intensive nutrition education significantly improves the nutritional status of malnourished children by improving the behaviour of mothers relating to child-feeding and caring practices (Roy et al. 2005). These children will be followed on a weekly basis by PS.

### **MAM follow up**

Those identified to be MAM with a working mother and incapable care taker will be given supplementary food (SF) in the CNC and their mothers will be given INC. SF will be premixed for optimal CF and/or RUSF for the 6 months old and over. For infants less than 6 months old, counselling with the mothers will be key to re-establish appropriate breastfeeding practices. These children will be followed at home on a bi-monthly basis.

### **Outreach with health providers in the slums**

PS will be responsible to meet slum health providers (traditional healer, homeopath, and pharmacy shop dealer) to assess their level of understanding in nutrition and to provide them with basic skills in how to recognize signs of malnutrition. These health providers will be asked to refer mothers of IYC coming to them for advice to the CNC.

#### **6.1.2.7 Provision during rainy season for nutritionally vulnerable groups**

It is necessary to plan for provision during the rainy season for nutritionally vulnerable groups already included in the programme. The vulnerable groups are IYC under 2 years old becoming MAM or SAM during flooding, the IYC already MAM or SAM and the breastfeeding mothers. The breastfeeding mothers have been added as beneficiaries since our research in Chapter 4 has shown that they perceive themselves to be suffering from a decrease or stop in maternal milk during the floods. In Chapter 3, the importance of maternal BMI as a predictor of child nutritional health was demonstrated. It is therefore recommended to use maternal BMI in addition to child anthropometry as indicator of risk in the post-emergency phase of flooding for beneficiaries' selection. Undernourished mothers with children

under 2 years old (normally nourished or malnourished) will be part of the vulnerable groups.

#### **6.1.2.7.1 Nutritionally vulnerable groups**

During flooding, the findings of this research have shown that there is major restriction of movements and beneficiaries may not be able to come to the CNC. It is important to plan for visits and home delivery of RUTF and RUSF to severely and moderately malnourished children during the flood. The visits could be organised with boats or use of bamboo bridges.

The PS will use MUAC to detect new cases of IYC with MAM or SAM during this time and will provide to them accordingly RUTF or RUSF. Distribution of zinc and Vitamin A tablets should also be planned to reduce prevalence of persistent diarrhoea and dysentery at this risky time to IYC with MAM or SAM as they are more prone to infectious diseases due to their immuno-deficient system (Rahman et al. 2001, Osendarp et al. 2002, Salgueiro et al. 2002, Brooks et al. 2005).

The undernourished mothers and the breastfeeding mothers of IYC under 2 years old will be provided with food supplements. The food supplement could also be the result of laboratory research.

#### **6.1.2.7.2 Non food items**

Non-food items will also be provided to beneficiaries. For example the need for blankets, dry clothes for IYC and adults have been stressed as a result of the qualitative research in Chapter 4. In addition findings in Chapter 5 highlight the need for cooking fuels to ensure that mothers will be able to cook. These items are extremely important for IYC nutritional health during flooding to minimize the risks of morbidity of IYC within the whole household and to make sure that IYC continue to be fed appropriate complementary food.

#### **6.1.2.8 Impact study**

An impact study will be carried out at the end of every year of the programme to estimate how successful the programme is in reducing malnutrition. As children will be measured monthly, the programme will be able to combine longitudinal data for all IYC under 2 years old in the area and compare this to the measures taken at baseline before intervention. There is a need for a control group to control for effects such as unusually severe flood or a good year because of better resources.

The control group will be chosen in an area with similar characteristics in terms of housing structure, socio-economic status and land ownership (private owned versus government owned) and where no nutrition intervention is taking place. The comparison between the intervention group and the control group will be able to separate out such effects. Every year, a progress report will be prepared to assess the impact of the programme.

### **6.1.3 Factory day care centre strengthening**

Factory day care centres for infants of working mothers are a legal requirement under the Bangladeshi Factories act of 1965. In practice these have been largely ignored by many industries as the government has not had the will and/or the capacity to enforce this law. Under rising international concern about pay conditions and workers rights (particularly for the garment industry) many factories that employ slum dwellers now claim to provide day care services for working mothers. These are often more for appeasing international buyers who are concerned about worker welfare. Unfortunately, observations during the fieldwork for this PhD revealed that most of these day care centres are empty and do not have the capacity of welcoming children. However, some NGOs have made a difference in changing the childcare policy in garment factories (Barrientos & Kabeer 2004; Kabeer 2004; Thomas et al. 2003).

#### **6.1.3.1 Creation of a factory support network**

Rather than simply denouncing non existent or poor care facilities in factories this proposal aims to take a more proactive approach by actively engaging with the factories and offering support to factory owners for the establishment of new or maintenance of existing care facilities. For the purposes of simplifying and focussing the efforts of this pilot project it is suggested that activities are focussed on garment factories as these are the main employers in the targeted slums.

Specific activities will need to be determined after further investigation but could include:

- Advice on standard operating procedures and recommended facilities.
- Training for staff
- Equipment for centres (furniture, toys, etc)
- Promotion of productivity benefits, for example:
  - Happy mothers work harder

- Mothers do not have to take time off/quit to look after sick infants
- Healthier infants means healthier and more productive mothers
- Lower staff turn over as mothers with children can be kept.
- Promotion of business benefits, for example:
  - Good worker conditions attracts more ethical buyers
  - Can be used to combat frequent bad press associated with working conditions in factories.
  - Can truthfully claim to comply with 1965 Factories Act.

#### **6.1.3.2 Creation of a Monitoring Network**

In parallel to the creation of the support network, the implementing organisation could set up a monitoring network to independently assess the quality of child care facilities provided by different garment factories. Activities could include: 1) regular visits to factory day care centres, 2) creation of factory league tables (ranking factories in order of achievement) and 3) awards for good practice.

#### **6.1.3.3 Engaging with buyers**

At the same time as engaging with factory owners, the implementing organisation can also engage with their customers. These are the purchasers of multinational fashion labels or middlemen who sell garments to vendors in other countries. Heavy international publicity of abysmal conditions for garment workers means that buyers are often already fully aware of conditions in the factories from where they are buying. Nevertheless, competition forces them to find the best deals or go out of business themselves.

This project therefore proposes to concentrate on highlighting the relative difference between factories within Dhaka which can vary enormously. The primary tool for doing this will be the data gathered as part of monitoring activities. By promoting and distributing the findings of the monitoring work to buyers. They can then make informed decisions about care of workers when deciding which factories to do business with. This will be in the interest of buyers as it reduces the risks of future press exposés of poor working conditions in factories where their products are manufactured.

#### **6.1.3.4 Engaging with International Fashion labels**

Information and learning experiences gathered from the support and monitoring work in the slums will give the implementing organisation the power to approach major international fashion labels to recommend how they could work towards more practical and realistic corporate social responsibility (CSR) policies. These organisations are also potentially extremely valuable as long term donors for the expansion and long term funding of the implementing organisation activities in slums where garment workers live. Partnerships with the implementing organisation and other humanitarian organisations may be seen as valuable to these companies due to their good reputations in the eyes of the general public. If these relationships can be established the implementing organisation will have an increased leverage over CSR policies as subsequent breaking of partnerships would create bad press of the fashion labels.

## **6.2 Scientific research on locally produced RUTF, RUSF and optimal CF**

To ensure sustainability of the programme, research on locally produced RUTF, RUSF and optimal CF instead of imported products should be conducted (ENN 2004). It is recommended that research is conducted by creating a partnership between the Bangladeshi Nutrition Institute and an international research institute. The research will be led by the NGO implementing the programme.

### **6.2.1 RUTF**

Ready-to-use therapeutic food (RUTF) refers to a lipid paste with a formulation that meets the compositional requirements for the treatment of severe malnutrition based on the WHO guidelines. Plumpy'nut<sup>44</sup> is the RUTF developed by Nutriset<sup>44</sup> which is imported and used by most humanitarian organisations. *'It is used directly, as is, without prior dilution. This avoids any risk of bacteriological contamination by polluted water. It is easy to calculate dosage as each sachet contains 500 kcal. It makes logistics easier with an optimal weight / volume ratio. It can be eaten by a child on his/her own, without having to be helped by his/her mother or by the staff of the feeding centre. It makes home treatment possible, under the supervision of the feeding centre. These characteristics make it possible to decrease management costs, by a decrease in hospital or feeding centres stays, and a decrease in the*

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<sup>44</sup> Nutriset is a French private organisation which has developed Plumpy'nut through partnership with the Institute for Research and Development



*number of people necessary for the preparation and the distribution of meals. The product Plumpy'nut can be distributed to families'* (Nutraset 2010). As RUTF is extremely costly to buy and to import, there has been extensive debate, discussion and research globally on producing RUTF in the country through the support of Nutraset or on developing a local recipe for RUTF (Enserik 2008, Manary et al. 2010, Collins et al. 2005, Collins et al. 2006).

In the case of partnering with Nutraset, potential production partners should be identified, provided with technical support for production set-up and training in the management components. Nutraset will also ensure quality control by conducting auditing. However even the RUTF produced in Bangladesh will be relatively expensive as the mineral, and vitamins mix (CMV) would still need to be imported from France. Later on, research could be conducted to try to produce CMV locally.

Some organisations have already locally produced RUTF based on different formulations at a limited price (Collins and Henry 2004, Fellows 2004, Sandige et al. 2004, Diop et al. 2003, Ciciberto et al. 2005). As milk powder accounts for 67% of the Nutraset RUTF cost, some research has looked into decreasing the milk powder content and replacing it with a locally available product such as soy bean. However very few of these locally made RUTFs have been tested through a controlled study. And for the ones that have been tested with a lower content of milk powder compared to the standard composition, the recovery rates of severe malnourished children were lower and the growth rate slower (Manary et al. 2010). Additional research in Bangladesh could look into other suitable ingredients through chemical and microbiological analysis. Contacts or partnership could also be made with ICCDR,<sup>45</sup> which is currently conducting research on various recipes of locally made RUTF. Income generating activities in Dhaka could be implemented for the production through partnership with existing food manufacturing companies or the creation of new ones, which ultimately should have positive development effects for the communities involved. The quality level will need to be maintained through constant checks by the research bodies.

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## 6.2.2 RUSF / optimal CF

### 6.2.2.1 Optimal CF

Supply of appropriate complementary food or of micronutrient-fortified food in addition to promotion is necessary to be of benefit to the child's nutritional status (Oelofse et al. 2003, Adu-Afarwuah et al. 2007, Larrey et al. 1999, Schroeder et al. 2002, Lutter et al. 2008, Bhandari et al. 2001, Obatolu 2003). Supplementation of complementary food with vitamin A and zinc along with promotion of breastfeeding have the greatest potential to reduce the burden of child morbidity and mortality (Bhutta et al. 2008). Kimmons et al. (2004) using simple rapid-assessment techniques tested the feasibility of increasing the consumption of complementary foods by infants by asking mothers to increase meal quantity or frequency or by altering the viscosity/energy density of the food. They also tested the feasibility of using micronutrient supplements either added directly to food or administered as liquid drops. They found that it was possible to successfully change short-term child-feeding behaviours to promote increased food intake, meal frequency, energy density, and micronutrient consumption.

Additional research should be conducted to assess the nutritional content of existing complementary feeding commonly fed to IYC through collection of samples and laboratory analysis. Chapter 4 shows that these CF mainly consist of *suji*, *kitchouri* and family meals. Random samples of *kitchouri* should be collected as preparation may vary a lot between households. For *suji*, mothers have been observed in this research to prepare it in a relatively standard manner. The main difference between *suji* preparation is the use of water or milk (fresh cow's milk, or powdered milk), or sugar. It would be recommended that the research first analyses the nutritional content of *kitchouri* based on the samples collected and based on a standard *suji* recipe as these have been observed to be the two most common CF given to IYC by this research. The results of the CF content analysis should highlight deficiency in energy, protein or micronutrients. It will determine if food or energy consumption at meals could be augmented by decreasing viscosity (by changing the recipe or adding amylase), increasing energy density by adding sugar or oil, or changing the food's organoleptic characteristics. The results should also highlight any micronutrient deficiency and potential need for supplementation. The energy and/or micronutrient deficiencies could be corrected with a micronutrient-fortified fat-based and/or amylase supplement. GRET, international NGO and the French Institute for Research and Development have developed a research and implementation programme called Nutridev (UNICEF 2006). This

programme aims at tackling malnutrition by providing an improved CF to mothers at an affordable price in Vietnam, Burkina Faso and Madagascar. The improved CF is either sold as it is in a package (1 package is for one meal) or as a premix to add to a meal preparation. The programme was assessed by an impact study to be successful in improving the nutritional situation in the intervention area and the IYC feeding practices. Using the same approach as Nutridev, the premix developed by the scientific research could be sold for a limited price in shops located in the slums. Mothers would be advised to prepare a base CF and add the premix at a certain point during cooking time.

Finally this research should also include quantity measurements of food eaten by IYC to assess any problems related to insufficient quantity being fed. As a result, mothers will be advised on how to cook optimal CF for their children either through the use of premix and/or increasing amount/frequency of feeding.

#### **6.2.2.2 RUSF**

Ready to use supplementary food has been shown to be successful in the treatment of moderate malnutrition for wasting and underweight but not for stunting (Maleta et al. 2004, Briend 2007, Nestel et al. 2004, Phuka et al. 2009, Lin et al. 2008, Matilsky et al. 2009). Research on RUSF will be on locally produced supplementary food for treatment of moderate malnutrition based on the WHO guidelines. The end product could take the form of a paste, a spread or a biscuit and could be produced in the same factories as for RUTF and CF premix (Briend 2007, Lin et al. 2008, Matilsky et al. 2009, Nutriset 2006). As for the optimal CF based on the Nutridev experience model, RUSF could be made available for purchase in the slums. It could be easy to develop a network of resellers and PS could also be the point of contact for purchase (UNICEF 2006). The price should be set low in order for it to be affordable.

### **6.3 Further research**

#### **6.3.1 Flood impact on IYC nutritional health in the slums**

Chapter 3 highlights the lack of quantitative data available on the nutritional risk posed by flooding in IYC living in the slums and demonstrates the negative impact of flooding on IYC feeding practices. In Chapter 3, mothers notice a deterioration of

their IYC during a flood and in Chapter 5, pregnant women and community health workers see it as a determinant of malnutrition. The complexity of collecting quantitative data in the slums mainly due to the logistical difficulty of taking anthropometric measurements, could be overcome by using the pilot project as a source of data. Quantitative data on nutritional status, health, socio-economic status of the household, exposure to flooding, water and sanitation for the IYC included in the programme could be collected and analysed. Anthropometric measurements taken before, during and after flooding will be available to explore the impact of flooding on IYC's nutritional status. Thus the proposed pilot project would have the potential to fill some of this important information gap.

### **6.3.2 Access to adequate sanitation in the slums**

The issue of inadequate sanitation is stressed in Chapter 5. Poor sanitation is associated with diarrhoea and is identified as a root cause of malnutrition in IYC living in the slums. Educational interventions in slum communities to alter water and sanitation behaviours were successful to reduce childhood diarrhoea but were not accompanied by a substantial overall improvement in nutritional status in the children of the intervention group (Stanton et al. 1987). The weaknesses and failures of this intervention and others stress the need to explore low-cost sanitation solutions for adequate sanitation and reduced risks to IYC's health in the slums of Dhaka but also to assess the impact of these interventions. Using quantitative data collected through the pilot project, associations between sanitation practices and environment and IYC nutritional health could be explored. It is especially important to know the role of sanitation in floods as it was highlighted earlier in the thesis as a gap in the research. In Chapter 3, water sanitation and hygiene practices were statistically significantly associated with stunting a year after the flood. In Chapter 4, participants stressed the deterioration in sanitation conditions during flooding and in Chapter 5, poor sanitation during flooding was perceived to be a determinant of malnutrition in IYC. However further research should explore which sanitation practices during flooding may entail nutritional deterioration in IYC. Behavioural communication and change sessions in sanitation during the period in between rainy seasons could also be envisaged and the impact of this intervention assessed using the control group.

### **6.3.3 Multi-country comparison**

Slums in Jakarta (Indonesia) and Nairobi (Kenya) like the slums in Dhaka (Bangladesh) are recurrently exposed to flooding making living conditions even more difficult than in normal times. Climate change is predicted to increase the risk of flooding in these countries resulting in more severe flooding and increasing the vulnerability of slum-dwellers (Chambers 1995, Chan & Parker 1996, Few 2003). These slums even though in various countries share the same characteristics of overcrowding, substandard housing, lack of potable water, uncollected garbage, and high prevalences of IYC malnutrition, mortality, and infectious diseases (UN HABITAT 2003a, 2003b). Multi country approaches and comparisons are used to design how interventions can be recommended on a global level and to bring forward a specific issue to the agenda of policy makers (Bryce et al. 2004). Most of the multi country comparisons in health are using quantitative data such as the demographic health studies or globally led surveys by the World Bank, the World Health Organisation or UNICEF (Morris 2000, Garcia-Moreno et al. 2006, Ellsberg et al. 2008). It is key for these studies to have standard collection of data across countries to ensure the comparability between countries.

Using the same methodology as used for this research, qualitative and quantitative data could be collected in slums of other countries to compare coping strategies developed by caretakers in the slums and the impact of flooding on IYC feeding practices. In addition to the novelty of the approach, rare are the multi-country studies with a mixed method design, this proposed research could lead to the globalisation of the findings and recommendations found here. It is hoped that it would bring to the attention of policy makers the issue of IYC living in the slums and their vulnerability to flooding.

## **6.4 Conclusion**

In this chapter, a pilot project on prevention and treatment of malnutrition in the slums is presented based on the main findings of this thesis. The pilot project is inspired by two proven models of intervention, PM2A for prevention of malnutrition and CMAM for treatment of malnutrition. The IYC under 2 years old are the potential beneficiaries of the intervention. The pilot project cornerstones are the community nutrition centre (CNC), the strengthening of day care facilities for garment workers and scientific research on ready to use therapeutic food (RUTF), ready to use supplementary food (RUSF), and optimal complementary food (CF). Further research is suggested on assessing quantitatively the impact of flooding on

IYC nutritional health, the association between sanitation and nutritional health, and generalising the Bangladeshi findings to a global level by comparing the findings to other countries.

**Key Messages**

- There is a need for a pilot project to test interventions aimed at improving the nutritional status of infants and young children in the slums of Dhaka, Bangladesh.
- The pilot project is based on proven interventions, PM2A and CMAM and consists of 3 cornerstones, 1) community nutrition center, 2) strengthening of day care facilities, and 3) research on locally producing RUTF, RUSF and optimal CF.
- *Pouchti Shebika*, the nutrition teachers are trained community women who will be the backbone of the pilot project.
- Further research should be conducted to assess the nutritional impact of flooding, the association between sanitation and nutrition, and to compare the Bangladeshi context to others similar slum contexts.

The next chapter presents the key findings of this dissertation, an overall discussion and the concluding remarks.

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## **Chapter 7 – Key findings and Conclusions**

## **7.1 The key findings**

This dissertation using a quantitative and a mixed-method approach explores IYC nutritional health and feeding practices in Dhaka slums and in relation to flooding. It brings forward new findings and adds to the literature on IYC health in the slums and on the impact of flooding on IYC nutritional health. The research is applied and formative and translates in programmatic and scientific implications.

Quantitative analysis in Chapter 3 shows that the flood affected IYC suffer from a nutritional deterioration overtime; there is an increase of underweight and stunted IYC a year after baseline. Findings suggest that both IYC's and mother's nutritional status could be used to screen households for preventive long-term interventions. These interventions could be especially beneficial to growth and development of children immediately after a crisis like a flood. Mothers with improved nutritional health will be able to provide better care for their children while the household as a whole may be able to develop stronger and more successful coping strategies for the next crisis.

Qualitative research in Chapter 4 on IYC feeding practices in the slums concluded that numerous limiting factors and barriers to appropriate feeding practices for IYCs exist in normal times which are escalated during flooding resulting in extremely poor IYC nutritional health in Dhaka slums. The coping strategies developed by food insecure households during flooding are limited and their resilience capacity is low to external shocks such as floods. The findings also show that gender discrimination increases difficulties encountered by women during flooding and concludes towards a particular focus upon working mothers and the inabilities of the alternate caregiver in order to improve IYC's nutritional health in Dhaka slums. A holistic approach to interventions is suggested that combines preventive actions during normal times and emergency response during floods, 1) provision of relief for nutritionally vulnerable groups during flooding, 2) improvement in mothers working conditions, 3) promotion of appropriate breastfeeding and 4) prevention of malnutrition.

Chapter 5 confirms the findings of Chapter 3 and 4 as flooding is considered as a root cause of malnutrition and the 'slum' environment is highly associated with malnutrition. The main elements of the slum environment associated with IYC malnutrition are: 1) inappropriate care, 2) inappropriate environment, 3) inappropriate food and 4) flooding. It also stresses the need to conduct further

research on, 1) quantitatively assessing the nutritional risk to IYC's nutritional health posed by flooding in the slums and 2) understanding whether slums can become clean and have adequate sanitation.

In Chapter 6, a pilot project on prevention and treatment of malnutrition in the slums is presented. The pilot project is inspired by two proven models of intervention, Prevention of Malnutrition in infants under 2 years old (PM2A) for prevention of malnutrition and Community based Management of Acute Malnutrition (CMAM) for treatment of malnutrition for IYC under 2 years old. The pilot project cornerstones are the community nutrition centre (CNC), strengthening of day care facilities for garment workers and scientific research on ready to use therapeutic food (RUTF), ready to use supplementary food (RUSF), and optimal complementary food (CF). Further research is suggested on assessing quantitatively the impact of flooding on IYC nutritional health, the association between sanitation and nutritional health, and generalising the Bangladeshi findings to a global level by comparing the findings to other countries.

## **7.2 Discussion**

The research findings add to previous literature demonstrating the impact of flooding on IYC nutritional health. The literature review in Chapter 2 shows that the effect of flooding on health is one of the most significant but difficult impacts to evaluate (Kolsky and Shaw 1998). In developing countries such as Bangladesh, infectious disease transmission, when it is already an endemic health problem, becomes a major flood-related health problem (Ahern et al. 2005). The risks of epidemic disease are higher when floods take place in highly-populated areas and where the standards of water and sanitation are not maintained which is commonly the case in the slums (McCluskey 2001). Risks factors for infectious diseases are reported to be related to an increase in population, the deterioration of physical strength, temporary living conditions and poor quality of drinking water (Kondo et al. 2002).

During and after a flood people suffer and die from the same diseases that already exist in the area prior to the flood. However because the disease burden is high and the immune system of people is low, in part due to poor nutrition, people become more vulnerable to sickness (Akter 2004). Floods induce epidemics, and IYC have an even greater risk of suffering from diseases compared to adults since they have

not yet developed a fully competent immune system. A study carried out during the floods of 1998 highlighted that women and children were the most vulnerable groups and that increased food prices resulted in decreased food intakes, and changes in women's diet (Rashid 2000). Further, qualitative findings presented in Chapter 4 suggest that IYC feeding practices deteriorate during flooding in Dhaka slums. As these practices are assessed already to be poor in normal non flood times, they become extremely poor during flooding. Findings from the interviews presented in Chapter 4 show that mothers perceive the negative impact of flooding on their IYC's nutritional health through weight loss and morbidity episodes but do not have the means to prevent it. They can only maintain their IYC health through coping strategies which have other negative consequences. For example, mothers tend to decrease their own food intake to favour their IYC but by doing that they expose themselves to undernutrition. Consequently, they are likely to stop being able to exclusively breastfeed their infant with negative consequences for their child's undernutrition. The decrease in maternal milk has been reported as a frequent problem faced by mothers during flooding. If food is available, they also face difficulties in cooking and the household will be able to eat only dry food such as *muri* (puffed rice) or *chira* (flattened rice).

Unfortunately there are no quantitative data on malnutrition in the slums in relation to flooding as shown in Chapter 4. However in rural or in flood affected areas, IYC nutritional health has been shown in Chapter 3 to be negatively impacted by flooding (Chowdhury et al. 1990, Woodruff et al. 1988, Centers for Disease Control (CDC) 1989, del Ninno, Lundberg 2005, Bloem, Moench-Pfanner & Panagides 2003). In Chapter 3, the analysis of the IFPRI dataset shows that there were significantly more children under 3 years old stunted and underweight a year after the flood. Further research should be conducted to identify nutrition interventions that can lower the exposure of IYC to flooding in the long term but also with a focus in the short term to help households develop coping strategies to avoid some of the negative consequences of the flood. It is unlikely in the short term that slums will cease to exist on these types of marginal flood prone lands where residents feel less vulnerable to eviction.

It also brings novel findings on the flood impact in a slum context and how flooding impacts IYC's health in the slums. Floods dramatically impact IYC health as mothers identify weight loss and morbidity episodes. It worsens already poor, feeding practices and increases the limiting factors for adequate feeding practices. In Chapter 5, flooding is also perceived by community health workers and pregnant

women as a root cause of malnutrition in IYC living in the slums because of the decrease in food intake and the increase in diarrhoea episodes.

This research expands existing literature on a maternal and infant and young children relationship in nutritional status (Rahman et al. 1993, Sanghvi et al. 2001, Rahman and Chowdhury 2006, Faber et al. 2005). The relationship was demonstrated but never in a post-emergency context. The novel findings suggest that maternal nutritional status should be considered during flooding as a key criterion to assess the level of vulnerability of households in future interventions. The research further adds to the literature on mothers taking the burden of food insecurity in a household (Rashid 2000; Rashid & Michaud 2000; Maxwell 1996, Bloem et al. 2003). It also supplements the limited literature on gender and vulnerability during flooding (Wisner et al. 2004, Nasreen 2004, Akter 2004, Rashid 2000, Rashid and Michaud 2000). Findings highlight the increased difficulties encountered by women during flooding to complete their daily domestic tasks.

The dissertation enlarges extremely limited literature on IYC nutritional health in the slums which was assessed to be extremely poor and worse compared to the rest of the country including rural settings (Pryer 2003, Hassan and Ahmad 1991, Kiess 1996, Bloem et al. 1997, BBS 1997, Izutsu et al. 2000). No research to my knowledge, has explored the root causes and perceptions of IYC malnutrition in the slums. Inappropriate food, environment, care and flooding are identified as root causes of malnutrition in IYC. The findings also add to the limited literature on inappropriate and poor feeding practices for IYCs living in the slums (Niport and Mitra 2007; Baqui et al. 1993; Arifeen et al. 2001). The novelty of this research is to determine the limiting factors for appropriate feeding in the slum environment, namely perceived insufficiency of maternal milk, food insecurity with hunger, poverty, difficulty in IYCs food preparation, the demands of the working mother and the low capability of alternate caregivers in this environment.

The combined findings lead to policy implications and recommendations for interventions to promote IYC's nutritional health in the slums with a strong focus on prevention. While the recommendations are based on best practices and already proven interventions, the pilot project will allow the testing of a new approach by combining prevention and treatment of malnutrition. This adds to extensive literature on extremely focussed interventions on the promotion of breastfeeding



and complementary feeding and brings forward a holistic approach to tackle malnutrition.

Finally, the findings supported by the qualitative approach add to limited existing literature on ethnographical research in urban slums. It confirms the complexity of conducting research and adds to the justification of using a qualitative methodology for research in urban slums (Rashid 2009, Raschid 2007). Urban slums are extremely complex and difficult places to conduct research as violence and crime prevail. Researchers are under constant suspicion from slum-dwellers who live in constant fear and danger. It also increases the literature on the challenging living conditions faced by slum-dwellers and their struggle for survival (Rashid and Michaud 2000, Rashid 2006, Rashid 2009).

### **7.3 Strengths and Limitations**

This research combines the strengths of quantitative and qualitative methods. The access to the IFPRI data set provided data for statistical analysis and enabled the demonstration of a negative impact for stunting and underweight of flooding on IYC in Bangladesh. The root causes of the nutritional deterioration were explored through the mixed-method approach. The qualitative part was key for exploring the IYC feeding practices and the root causes of malnutrition in IYC in the slums. The qualitative approach in the slums translated into taking time to build a trust relationship with participants. The trust gained from the participants due to my interest in their lives, their joys and despairs, my attention towards their children and the time I spent playing with them, made me feel like a welcomed guest. Mothers used to call me 'sister' and their children 'auntie'. Spending several months at my arrival to learn the language and to understand the culture had a crucial impact on the success of my research. The knowledge gathered thanks to their trust is immense, deeper and wider than presented in this dissertation.

The novelty of the approach combining Focus Group Discussions (FGDs) and causal modelling using photographs was another strength of this research as it was customised to the slum context. It enabled the in-depth exploration of the root causes of malnutrition. Another strength of the approach was to keep the research applied, thus allowing the translation of findings into policy and intervention recommendations.

One of the limitations is that the results for the quantitative analysis presented in Chapter 3 are valid for Bangladesh in general and not for the slums. There was no

quantitative database at the time of this research available on IYC nutritional health in Dhaka slums. Because of the absence of a control group in the research presented in Chapter 3, it is impossible to state whether the nutritional deterioration observed in the flood affected IYC due to the flood only or to the combined effect of the flood and the changing age of the IYC. Using secondary data is another limitation because all of the measures susceptible to be associated with IYC nutritional status during flooding are not available in the IFPRI data set. Another limitation of this quantitative study is the small sample size. In Chapter 4, the weakness of the approach is that the qualitative research was not conducted during flooding which made the understanding of the coping strategies and the impact of flooding on IYC feeding practices only based on information from interviews and none from observations. Regarding the qualitative approach presented in Chapter 5, the time constraints of participants is a limitation of the study resulting in the use of a limited version of the full causal model.

## **7.4 Conclusion**

This thesis demonstrated that maternal nutritional status measured soon after a flood can predict the current nutritional status and the risk for future deterioration of nutritional status of their children in Bangladesh. The qualitative research suggests that the deterioration of IYC feeding practices during flooding is a determinant of the IYC nutritional deterioration between normal time and flooding. The coping strategies developed by food insecure households during flooding are limited and their resilience capacity to floods is low. While flooding is perceived to be associated with IYC malnutrition and should be considered as a new root cause of IYC malnutrition in the UNICEF conceptual framework, the other perceived determinants are related to more traditional and recognized root causes of malnutrition (inappropriate care, inappropriate environment, and inappropriate food). In Dhaka slums, flooding is an event that exacerbates an already alarming chronic situation for IYC's nutritional health. Despite a good perception of the root causes of malnutrition by participants, findings reveal that feeding practices are poor due to limitations and barriers but also to poor knowledge.

The combined findings lead to recommendations for interventions aimed at improving IYC nutritional health and feeding practices through, 1) malnutrition prevention by improving knowledge and facilitating the care of IYC with working mothers and 2) malnutrition treatment for the under 2 years old. The dissertation

suggests testing these recommendations by conducting a pilot project. Further research is necessary to assess quantitatively the impact of flooding on IYC nutritional health, the association between sanitation and nutritional health, and generalising the Bangladeshi findings to a global level by comparing the findings to other countries.

This dissertation highlighted issues related to flooding, feeding practices and nutritional health in IYC living in the slums. The research brought forward policy implications and recommendations in nutrition. It is crucial to conclude by stressing the importance of tackling malnutrition in the slums to build IYC resilience to external shocks such as flooding.

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## Appendix I – Question guide interviews

1. Infants and young children feeding practices and care in normal time
  - a. Breastfeeding practices
    - i. Drinks given at birth
    - ii. Colostrums (perception)
    - iii. Delayed milk production
    - iv. Exclusive breastfeeding (how long)
    - v. Daily practices of breastfeeding (how often, where, when)
    - vi. Importance of breastfeeding
    - vii. Breastfeeding in public
    - viii. Breastfeeding in relation to religion
    - ix. Breastfeeding and working/or being away from infant
    - x. Breastfeeding and infant's sickness
    - xi. Breastfeeding and mother's sickness
    - xii. Breastfeeding and pregnancy
    - xiii. Differences between boys and girls
    - xiv. Final stop of breastfeeding
    - xv. Obstacles to breastfeeding
    - xvi. Use of bottles and infant's powder milk
  - b. Complementary feeding practices
    - i. Calendar of complementary feeding's introduction (what, how much, detailed preparation, when, for how long)
    - ii. Characteristics of complementary feeding (quantity, quality, density, temperature)
    - iii. Preparation of complementary feeding, specially prepared or part of family meal modified (how, when)
    - iv. Perceptions of foods and sacred/forbidden food items
    - v. Differences between boys and girls
    - vi. Money spent on complementary feeding
    - vii. Food for healing (sickness)
  - c. Care practices
    - i. Hygiene (bathing, sanitation- solid waste)
    - ii. Water source for hygiene (type, distance)
    - iii. Health follow up (height, weight, vaccinations)
    - iv. Growth follow up
    - v. Sickness (morbidity, how treated: traditional/modern/home care practices)
    - vi. Money spent on children's care
    - vii. Relations with other children
2. Experience with floods
  - a. Definition of bad and good flood
  - b. The household's history with floods
  - c. Causes of floods
  - d. Increase of floods over time (climate variability)
  - e. Experience with good floods (benefits)
  - f. Experience with bad floods
    - i. Description of the flood (how much water, how long)
    - ii. Worst flood experienced
    - iii. Impact on the household resources (loss of income)
    - iv. Impact on the house
    - v. Impact on food security
    - vi. Impact on health
    - vii. Gender issue
    - viii. Increase in domestic burden

- ix. Increase in infant-care burden
  - x. Restriction of movement
  - xi. Impact on the household's members occupation and behaviour
  - g. Prevention for floods (housing, storage of food)
  - h. Preparation for floods (housing, cash, saving, microcredit)
  - i. Help provided
  - j. Help needed
  - k. Vulnerability to floods – open canvas
    - i. Poverty
    - ii. Age related (children versus adults)
    - iii. Gender based (women and girls)
    - iv. Over time
  - l. Coping strategies – open canvas
    - i. Borrowing of money (money lenders, family, neighbours...)
    - ii. Sell of assets
    - iii. Microcredit
    - iv. NGOs help (distribution of food)
    - v. Decrease in intake of food
    - vi. Decrease in resources allocated to food
    - vii. Decrease in resources allocated to other expenditure items
    - viii. Migration
3. Infants and young children feeding practices and care during the flood
- a. Breastfeeding
    - i. Continuation, decision to stop breastfeeding
    - ii. Change in breastfeeding practices
    - iii. Stop of milk production
    - iv. Replacement food for maternal milk
    - v. Change in breastfeeding practices if infant has diarrhoea or ARI
    - vi. Impact on infant's health and nutritional status
  - b. Complementary feeding
    - i. Changes in complementary feeding (quantity, quality, density, temperature)
    - ii. Preparation of complementary feeding
    - iii. Evolution over time
    - iv. Change in complementary feeding if infant has diarrhoea or ARI
    - v. Impact on infant's health and nutritional status
    - vi. Help provided
    - vii. Help needed
    - viii. Money spent and borrowing of money to purchase food for infant
  - c. Care
    - i. Change in hygiene practices
    - ii. Change in time available for infant's care
    - iii. Sickness (morbidity, how treated: traditional/modern/home care practices)
    - iv. Water source for hygiene (type, distance)
    - v. Money needed for treatment of sickness
    - vi. Money available, spent for treatment of sickness



## Appendix II – Case list

	ID Number	Age	Number of children	SES
Community health worker Kunibara	1	45	2	H
Community health worker Kunibara	2	22	1	H
Mother Kunibara	3	30	2	M
Mother uttar Begunbari	4	35	5	L
Mother uttar Begunbari	5	30	4	M
Mother Begum uttar Begunbari	6	40	5	M
Community health worker motto Begunbari	7	20	2	M
Mother motto Begunbari	8	35	4	M
Mother motto Begunbari	9	22	1	M
Community health worker Begunbari	10	25	1	H
Mother Mohammedpur	11	19	1	L
Mother Mohammedpur	12	30	1	H
Mother Mohammedpur	13	27	3	L
Mother Mohammedpur Sunibir	14	30	3	L
Mother Mohammedpur Sunibir	15	22	2	M
Mother Mohammedpur Sunibir	16	30	2	L
Mother Mohammedpur Sunibir	17	30	3	M
Mother Kamrangir Char	18	30	6	L
Mother Kamrangir Char	19	35	6	M
Mother Kamrangir Char	20	23	2	L
Mother Kamrangir Char	21	22	1	L
Mother Kamrangir Char	22	30	3	L
Community health worker Mohammedpur	23	23	1	H
<b>Total</b>		28	61	

### Appendix III- Household profile determination

**Infant and Young Children Feeding Practices  
Urban Slums Dhaka  
Profile determination 2008 - 2009**

Date of 1st visit :  dd/mm/yyyy

Site name : -----

Household No.:

Name of head of the HH: -----

Age:   Male, 2= Female

**Household Composition, Migration and Education**

Member ID No.	Name	Sex M=1 F=2	Relation to head of the household (Code-1)	Age (Year)	Marital Status (Code-2)	Resident status (Code-3)	When did the HHH arrive at this site?	From where did the HHH move in this site? (Code-4 + location)	In the past five years, how many times the HHH changed residence? (Number)	Does the individual know how to read and write? (Code-5)	Is the individual in school now?	What was the highest level of education? Maximum class passed
							Always here =2222 Do not know = 1111 (Year)				Yes 1 No 2	
01			HHH = 01									
02												
03												
04												
05												
06												
07												
08												
09												
10												

<b>Code-1: Relation</b> Household head 01 Spouse. 02 Son/daughter. 03 Father/mother. 04 Brother/sister. 05	Son/daughter-in-law. 06 Brother/sister-in-law. 07 Permanent labour. 08 Other relatives. 09 Other non-relatives. 10	<b>Code-2: Marital Status</b> Married. 01 Never married. 02 Separated. 03 Divorced. 04 Widowed. 05 Abandoned. 06	<b>Code-3: Resident Status:</b> Resident family member. 01 Non-resident family member. 02 Contributor. 03 Other. 04	<b>Code-4: Movement</b> Same city. 01 Other city, same district. 02 City, different district. 03 Rural, same district .04 Rural, different district .05 Other country .06 Not applicable .07	<b>Code-5: Literacy</b> Can read only. 01 Can sign name only. 02 Can write only. 03 Can read and write. 04 Can neither read nor write. 05
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**Housing**

1. Where is the cooking place?	<input type="checkbox"/>	Inside 1 Outside 2 NA 3
2. Is it equipped with gas?	<input type="checkbox"/>	Yes 1 No 2
3. How many families share the cooking place?	<input type="checkbox"/>	Number
4. What are the walls made of?	<input type="checkbox"/>	Earth 1 Bamboo/wood 2 Leaves 3
5. What are the floors made of?	<input type="checkbox"/>	Concrete/bricks 4 Tally 5 Tin 6
6. What are the roofs made of?	<input type="checkbox"/>	Polythene 7 Other 9
7. Does the house leak during rain?	<input type="checkbox"/>	Yes 1 No 2
8. Does the house withstand storm without damage?	<input type="checkbox"/>	
9. Does the household feel physically safe in your house during bad weather?	<input type="checkbox"/>	Yes 1 No 2

10. In the past year did the household ever lose control of the house due to flood, eviction, excessive rent and other reasons?	<input type="checkbox"/>	
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**Household Assets**

Description of asset	Asset code	Quantity/ (Nos)
<b>1.</b>	<b>2.</b>	<b>3.</b>
Trunk / Suitcase	01	
Buckets / Pots	02	
Metal cooking pots	03	
Bed / Khat / Choki	04	
Miror	05	
Table / chair	06	
Fans / Iron	07	
Radio / Cassette player	08	
Wall clock / Watch	09	
TV / VCP / VCR / VCD	10	
Jewelry (gold / silver)	11	
Sewing machine	12	
Bicycle	13	
Rickshaw	14	

Did any members of the household have to sell or mortgage needed household assets due to lack of money?

1= Yes, 2= No

**Environment, Water and Sanitation**

Observation

1.1 Floor and walls inside the house in the eyes of interviewer	<input type="checkbox"/>	Dry 1 Damp 2 Unable of observe 3
	<input type="checkbox"/>	Clean 1 Dirty 2 Unable of observe 3
1.2 The surrounding area of the house including 10 meters of public place attached to property in the eyes of interviewer	<input type="checkbox"/>	Dry 1 Damp 2 Unable of observe 3
	<input type="checkbox"/>	Clean 1 Dirty 2 Unable of observe 3

Garbage disposal

2.1. Where does the household dispose garbage?	<input type="checkbox"/>	Garbage is collected from home 1 Dispose in the designated area 2 Burn / bury 3 Gutter or ditch 4 Dispose anywhere 5 Others (specify) 9
2.2. Distance between the house and the place of garbage in feet	<input type="text"/> <input type="text"/> <input type="text"/>	Feet

Source, use and purification of water

3.1. Where does the household usually get water for drinking?	<input type="checkbox"/>	Tube well 1 Ring Well/ Indara 2 Pond 3
3.2. Where does the household usually get water for cooking?	<input type="checkbox"/>	River/Canal 4 Supply Water (piped) 5 Other (specify) 9
3.3. What does the household do to purify water?	<input type="checkbox"/>	None 1 Boil 2 Mechanical Filter 3 Chemical process 4 Other (specify) 9

**Use of latrine**

4.1. What type of latrine do the household members use?	<input type="checkbox"/>	None/open field 1 Pit/ sanitary (water sealed) 2 Pit/ sanitary (unsealed) 3 Hanging 4
4.2. What type of material do the adult members use to clean hand after defecation?	<input type="checkbox"/>	Soap 1 Ash 2 Dirt 3
4.3. What type of material is used by the children ( $\leq 3$ years) to clean hand after defecation?	<input type="checkbox"/>	Just water 4 Not applicable 5 Others (specify) 9

4.4. How many families share the latrine?	<input type="text"/> <input type="text"/>	Number
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**Diarrhea and Other Illnesses**

1. Were any of the household members sick in the last 30 days?  1= Yes, 2= No

IF NO GO TO THE NEXT MODULE

For each household member, ask whether s/he suffered from diarrhoea and/or diseases other than diarrhoea during **last 14 days**.  
**Report only the latest episode of illness for each person.**

Member ID No.	Diarrhoea				Other diseases			
	Did the individual have diarrhoea? Yes 1 No 2	Duration of last episode of diarrhoea (total # days sick)	Where consulted?  (Code-1)	Who consulted? (up to 3 codes, in order visited)  (Code-2)	Did the individual have any other illness? Yes 1 No 2	Duration of this illness (total # days sick)	Where consulted?  (Code-1)	Who consulted? (up to 3 codes, in order visited)  (Code-2)



Code-1: Where consulted		Code-2: Whom consulted	
None / self	01	Doctor's office	07
Government Hospital	02	Pharmacy	08
Family Welfare Center	03	Call doctor at own home	09
Thana Health Complex	04	Bought ORS (for diarrhea only)	10
Satellite Clinic	05	Others (specify)	99
Private Hospital / Clinic	06		
		None	1
		Allopathic registered	2
		Quack	3
		Paramedic	4
		Homeopath	5
		Kabiraj	6
		Spiritual healer	7
		Others (specify)	9

Did any of the household members fail to get needed medical attention due to lack of money?  1= Yes, 2= No

**Household food insecurity based on the Food Access Survey Tool (FAST) (Coates and al. 2003)**

How often did the household members eat three 'square meals' (full stomach meals) a day in the past 12 months (not a festival day)?

- a) Mostly (3 meals each day)
- b) Often (3 at least a few times each week)
- c) Sometimes (3 per day 7-12 times this year)
- d) Rarely (3 per day only 1-6 times this yr)
- e) Never

In the last 12 months, how often did the household members have to eat wheat (or another grain) although they wanted to eat rice (not including when they were sick)?

- a) Never
- b) Rarely (only 1-6 times this yr)
- c) Sometimes (7-12 times this yr)
- d) Often (a few times each month)
- e) Mostly (most days/weeks)

In the last 12 months how often did the mother skip entire meals due to scarcity of food?

Never

- a) Rarely (only 1-6 times this yr)
- b) Sometimes (7-12 times this yr)
- c) Often (a few times each month)
- d) Mostly (most days/weeks)

In the past 12 months how often did the mother personally eat less food in a meal due to scarcity of food?

Never

- a) Rarely (only 1-6 times this yr)
- b) Sometimes (7-12 times this yr)
- c) Often (a few times each month)
- d) Mostly (most days/weeks)

In the past 12 months how often did food stored in the home run out and there was no money to buy more that day?

Never

- a) Rarely (only 1-6 times this yr)
- b) Sometimes (7-12 times this yr)
- c) Often (a few times each month)
- d) Mostly (most days/weeks)

In the past 12 months how often did the household members worry about where food would come from? (Mathar bhitre koto chinta from food or money worries).

Never

- a) Rarely (only 1-6 times this yr)
- b) Sometimes (7-12 times this yr)
- c) Often (a few times each month)
- d) Mostly (most days/weeks)

In the past 12 months, how often did the family purchase rice?

Never

- a) Rarely (once every few months last year)
- b) Sometimes (a few times each month)
- c) Often (every week)
- d) Mostly (every day)

In the past 12 months how often did the family take food (rice, lentils etc.) on credit (or loan) from a local shop?

Never

- a) Rarely (only 1-6 times this yr)
- b) Sometimes (7-12 times this yr)
- c) Often (a few times each month)
- d) Mostly (this happens a lot)

In the past 12 months how often did the family have to borrow food from relatives or neighbours to make a meal?

Never

- a) Rarely (only 1-6 times this yr)
- b) Sometimes (7-12 times this yr)
- c) Often (a few times each month)
- d) Mostly (this happens a lot)

Based on answers to the above questions, in the enumerator's opinion, this household should be classified as:

- a) Food secure
- b) Food insecure without hunger
- c) Food insecure with hunger

**Anthropometry**

**Currently pregnant woman is not eligible for measurement.**

<b>WOMEN</b>	Member ID No.	Name	all women of child bearing age (14 - 49 year old)		
			Height	Weight	Reason for not being measured
			(cm)	(kg)	(Code-1)

<b>CHILDREN</b>	Member ID No.	Name	Mother's ID No.	Child's date of birth					These 6 columns are for all children aged ≤3 year					
				Day	If does not know date, what week of the month?	Month	Year	Confirmed	Height		Weight		Reason for not being measured	Is this child still breast fed?
								1=Yes 2=No	(cm)	(mm)	(kg)	(gm)	(code1)	Yes 1 No 2 N/A 9

<b>Code-1: Reason for not measured</b>	
Absent from household	1
Sick	2
Refused to give measurement	3
Currently pregnant	4
Other (specify)	9

**Appendix III – Coding book**

1. borrow
2. child\_caretaker
3. child\_labor
4. child\_nutrition\_mother working
5. colostrum
6. cooking working mothers
7. flood bed
8. flood cooking problem
9. flood decrease maternal milk extra food
10. flood dirty water
11. flood dry food
12. flood electricity
13. flood food price revenue
14. flood food quality
15. flood food quantity
16. flood health
17. flood market
18. flood migration
19. flood mother suffer
20. flood movement
21. flood relief
22. flood risk
23. flood sell
24. flood water problem
25. flood\_bad smell
26. flood\_complementary food
27. flood\_coping
28. flood\_dirt
29. flood\_hygiene
30. flood\_insect
31. flood\_latrine
32. flood\_preparation
33. flood\_sell
34. flood\_water problem
35. food insecurity
36. normal breastfeeding
37. normal\_complementary food
38. normal\_health
39. normal\_health\_money problem
40. normal\_malnutrition
41. normal\_maternal milk decreases

## **Appendix V: Interview and FGD informed consent form**

### **INTERVIEW AND FGD INFORMED CONSENT FORM (to be completed after Participant Information Sheet has been read)**

#### **“Coping Strategies for Feeding Practices and Nutritional Health of Young Children in Relation to Recurrent Flooding in Urban Slums” (Bangladesh)**

The purpose and details of this study have been explained to me.

I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethical Advisory Committee.

The information sheet and this consent form were read to me and I have understood this information.

I have had an opportunity to ask questions about my participation.

I understand that I am under no obligation to take part in the study.

I understand that I have the right to withdraw from this study at any stage for any reason, and that I will not be required to explain my reasons for withdrawing.

I understand that all the information I provide will be treated in strict confidence.

I agree to participate in this study.

Your name \_\_\_\_\_

Your signature / mark \_\_\_\_\_

Signature of researcher \_\_\_\_\_

Date \_\_\_\_\_

### Appendix VI – Coping Strategies developed during flooding for Food Secure Households (FSH) versus Food Insecure Households (FIH)

COPING STRATEGIES RELATED TO:	FOOD SECURE WITH ADEQUATELY NOURISHED CHILDREN	FOOD INSECURE WITH ADEQUATELY NOURISHED OR MALNOURISHED CHILDREN
MONEY	There was no business then. <b>We had to spend our savings.</b>	In rainy season <b>nobody gives us loan!</b>
	My husband <b>borrowed money from village in preparation for the flood.</b>	We <b>borrowed money</b> from our relatives. Sometimes I had to <b>beg money</b> with my sons.
	We could not work at that time and we had no income. I worked as a house keeper then. <b>I had some savings...I used all of them!</b>	My husband <b>borrowed money</b> from the neighbors... We <b>had to sell</b> the bed, the fan and a mirror to get the money for the rent.
	No, we <b>don't sell things rather than we buy</b> . People sell things at a very low rate. It is easy to buy then. But many people mortgage gold chain and earrings and cannot get it back again because they can not pay the interest of the loan.	I <b>sold</b> our cooking pot, bucket, dish, and clothes like good sari too.
FOOD	We could not work, and could not eat properly. <b>Through we had food in our house but we could not cook.</b> There was no way! We only ate then <i>chira</i> (flattened rice) with water because we couldn't cook.	Very often, <b>we did not eat.</b>
	There is <b>always rice</b> in my house [during flooding].	
	Now we cook <b>1 kg of rice</b> but that time we cooked <b>half a kg of rice.</b>	I cooked <b>half kg instead of 1 kg.</b>
	At the moment we eat fish, meat and vegetables but during flooding only cooked <b>dal, potato and rice.</b>	Now we eat rice with potato and fish. At that time we had to <b>eat rice only with salt.</b>
	Now we eat two items but then we ate only <b>dal, rice and ruti</b> (flat bread).	In normal time we eat fish and vegetables. But during flooding, we ate only <b>potatoes and shak (leaves).</b>
	No [we did not cook different food for children in flooding compared to normal time], <b>we smashed rice with vegetables and fed him.</b>	We fed our <b>children what we ate during flooding</b> . We [mothers] took less food. If fathers are not given much, how would they work?
ENVIRONMENT	Many people suffered to buy wood. But <b>I made cow dung fuel before the flood as a preparation. I used it to cook with the matir chula .</b>	Last year flood water came in to room. I had to <b>buy this bed</b> on credit during flood. We were sleeping at night and then everything went under water.
		We had to cook with a <b>matir chula</b> because the kitchen was under water.
MIGRATION	Every year when flood hits this area, <b>I go to Jatrabari</b> [hometown of the participant].	



## Appendix VII: List of photographs used for the building of conceptual framework

Picture	Description	Topic (conceptual framework)
1	Man heroine addict	Health/ Care
2	Dirty environment plastic bags next to 2 stories mess	Environment
3	Women in orange cooking low gas stove	Food and Nutrition
4	Riskwa-puller	Socio-economic status
5	Dirty road with flooded sewage in bazaar	Environment
6	Tube well with bucket half full of water	Water, Sanitation and Hygiene
7	Pond with bamboo path	Environment
8	Riskwa during flood	Flood
9	Girls at school	Education
10	Women in front of outside cooking low gas stove	Food and Nutrition
11	Hanging latrine	Water, Sanitation and Hygiene
12	Dirty environment garbage next to tin made huts	Environment
13	CNG during flood	Flood
14	Huts on bamboo tilts with surrounding water	Environment
15	Child sitting on a bamboo path above of dirty water	Flood/Care
16	Hanging latrine above garbage field	Water, Sanitation and Hygiene
17	Children with cooking utensils during flood	Flood/Care
18	Inside high cooking place with gas stove	Food and Nutrition
19	Mutir chula outside on the bamboo path next to shoes	Food and Nutrition
20	Cooking items not organised in a hut	Food and Nutrition

Appendix VII: List of photographs used for the building of conceptual framework

21	Legs of child with kwashiorkor (oedema)	Health
22	Gas stove with a chain, fish in one pan and veggies in the other being cooked	Food and Nutrition
23	Happy family, young parents with their first baby	Health/Care
24	Mother carrying child on her shoulder during flood	Flood/Care
25	Mother feeding malnourished child	Food and nutrition/ Care
26	Women and children with water inside their hut during flooding	Health/Flood
27	Women pumping water during bath time	Water, Sanitation and Hygiene
28	Poor quality latrine 'kaccha pai kanna'	Water, Sanitation and Hygiene
29	Clay stove with wood pieces for burning - one pan with oignons and spices and another pan with veggies	Food and Nutrition
30	Women in red and orange sari cooking low gas stove	Food and Nutrition
31	Many cooking items not organised in a hut with garbage on the floor	Food and Nutrition
32	Taka	Socio-economic status
33	Iccdr, b hospital with only one patient, a child with his parents	Health
34	Good quality latrines with a girl in front holding a plate	Water, Sanitation and Hygiene
35	Happy mother with new born baby	Care
36	Rice	Food and Nutrition
37	Happy family, mother with 2 children	Care
38	Happy beautiful mother holding her baby	Care
39	New born baby being bottle fed	Food and Nutrition
40	Seller at the market with fresh tomatoes, lemon and cucumber	Food and Nutrition

Appendix VII: List of photographs used for the building of conceptual framework

41	<b>Skinny women selling old veggies in the market</b>	<b>Food and Nutrition/ Socio-economic status</b>
42	<b>Sad women holding her malnourished child</b>	<b>Food and Nutrition</b>
43	<b>Mother breastfeeding her baby</b>	<b>Food and Nutrition</b>
44	<b>Men working in garment factory</b>	<b>Socio-economic status</b>
45	<b>Boys and girls at school</b>	<b>Education</b>
46	<b>Iccdr, b hospital crowded with patients</b>	<b>Health</b>
47	<b>Women feeding her sick child</b>	<b>Nutrition</b>
48	<b>Grand-mother bathing her grand-child</b>	<b>Care/ Water, Sanitation and Hygiene</b>
49	<b>Many family members living in a small hut</b>	<b>Environment/ Socio-economic status</b>
50	<b>Diarrhoea with blood</b>	<b>Health</b>
51	<b>Women putting money in her 'mutir bank'</b>	<b>Socio-economic status</b>
52	<b>4 children sleeping together</b>	<b>Environment/ Care</b>
53	<b>Child carrying bricks on his head</b>	<b>Care/ Socio-economic status</b>
54	<b>Girl selling flowers on the road</b>	<b>Care/ Socio-economic status</b>
55	<b>Mothers feeding malnourished children</b>	<b>Food and Nutrition</b>
56	<b>3 children smiling wearing dirty clothes</b>	<b>Care</b>
57	<b>Children collecting garbage</b>	<b>Care/ Socio-economic status</b>
58	<b>Women feeding her malnourished child</b>	<b>Food and Nutrition</b>
59	<b>Organised cooking items in a tin made room</b>	<b>Food and Nutrition</b>
60	<b>Crowded kitchen with women Food and Nutrition on elevated gas stove</b>	<b>Food and Nutrition</b>

Appendix VII: List of photographs used for the building of conceptual framework

<b>61</b>	<b>Bamboo path above dirty ground</b>	<b>Environment</b>
<b>62</b>	<b>Grand-mother cooking veggies</b>	<b>Food and Nutrition</b>
<b>63</b>	<b>Man emptying cement bags</b>	<b>Socio-economic status</b>
<b>64</b>	<b>Inside low cooking place with gas stove, a goat is next to the stove</b>	<b>Food and Nutrition</b>
<b>65</b>	<b>Woman cooking roti on a clay stove</b>	<b>Food and Nutrition</b>
<b>66</b>	<b>Child standing on a elevated bamboo path</b>	<b>Care/ Environment</b>
<b>67</b>	<b>2 women sorting out plastic bags</b>	<b>Socio-economic status</b>
<b>68</b>	<b>Baby having its weight being taken</b>	<b>Care/ Health</b>
<b>69</b>	<b>Sleeping baby on a clean bed</b>	<b>Care</b>
<b>70</b>	<b>Woman sawing bazaar shopping bags</b>	<b>Socio-economic status/ Care</b>
<b>71</b>	<b>Child with big belly carried by his mother, the grand-mother is close by</b>	<b>Care/ Health</b>
<b>72</b>	<b>3 teenagers putting toys together</b>	<b>Socio-economic status</b>

**Appendix VIII: Photographs used during FGDs**





Appendix VIII: Photographs used during FGDs

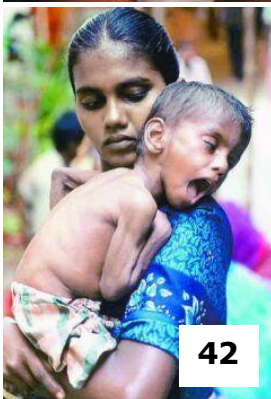
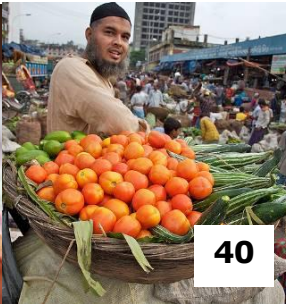




Appendix VIII: Photographs used during FGDs



Appendix VIII: Photographs used during FGDs





Appendix VIII: Photographs used during FGDs



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Appendix VIII: Photographs used during FGDs



Appendix VIII: Photographs used during FGDs

