Determinants of under nutrition among under-2 children: what haven't yet addressed in context of rural Bangladesh?

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TITLE: Determinants of under nutrition among under-2 children: what haven't yet addressed in context of rural Bangladesh?

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Master of Public Health

by

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Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.
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Dedication

I would like to dedicate this thesis

To my beloved son Devneelava Chakraborty (Rommo)

Acknowledgement

First of all I would like to express my gratitude to the Almighty as I was able to finish the thesis with his enormous blessings.

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Abbreviations

ANC	Antenatal care
BCC	Behaviour change Communication
BDHS	Bangladesh Demographic Health Survey
BRAC	Bangladesh Rural Advancement Committee
CNC	Community Nutrition Centre
CNP	Community Nutrition Promoter
HNPSP	Health and Population Sector wide program
HRM	Human Resource Management
IYCF	Infant and Young Child Feeding
LGRD	Local Government of Rural Development
MOHFW	Ministry of Health, Family and Welfare
NNP	National nutrition Program
PHC	Primary Health Care
UNICEF	United Nations International Children's Emergency Fund
VGD	Vulnerable Group Development
WFP	World Food Program
WHO	World Health Organization

Abstract

Undernutrition among the children less than 2 years is one of the major public health problems in Bangladesh. The National Nutrition Program of the Health and Population Sector wide program in Bangladesh has been implementing several nutrition interventions for under 2 children and their mother addressing this problem. But still Bangladesh is categorized as high prevalence country compared to the global context. To design effective intervention program it is essential to recognize the determinants in individual social context. Therefore, the paper aims to identify the contextual factors of undernutrition among under-2children in rural Bangladesh. After recognizing the determinants the paper explored whether these were addressed adequately by NNP program. The main objective of the paper was to provide recommendation for national nutrition program to improve the country situation. The paper identified that the causes of undernutrition in context of rural Bangladesh is multi-factorial including mother's antenatal care and low education, diarrhoea of the children, inappropriate feeding practice for the children, food insecurity, poverty etc. It was found that most of the determinants were addressed by NNP but the coverage of the program is too low (about 22% of the population) to achieve improvement at national level. The paper recognizes that NNP services need to be integrated into the primary health care program to ensure the basic nutrition services for all children and their mother. The paper also recognizes that a multi-sectoral collaboration with different sectors of the Govt and stakeholders is essential to implement the intervention activities at large scale.

Key Words: Undernutrition, under 2 children, Bangladesh, National Nutrition Program

Word Count: 11,922

Introduction

Children under 2 years are easily vulnerable to undernutrition. The magnitude of undernutrition problem among children less than 2 years is very high in Bangladesh compared to the global context. Majority of the undernourished children are living in the rural areas. The negative impact of undernutrition continues as intergeneration cyclic process. Evidence shows that causes of undernutrition are multi-factorial and may vary in different societal context. If proper interventions are delivered before 2 years of age, the problem of undernutrition can be tackled effectively.

My Education background is from nutrition field. I completed my MSc in Food and Nutrition in 2004. Thereafter, I started my work in ICDDR,B and got the opportunity to be involved with several nutrition related research projects including the NNP Baseline Survey 2004. During the baseline survey working period, I observed that there is a huge disparity among the rural households compared to the urban in terms of local norms, behaviour and socio- economic aspects. I was interested to recognize the contextual factors that may contribute to the undrenutrition problem in the rural context of Bangladesh. Therefore I chose the thesis regarding undernutrition problem of under 2 children in rural context of Bangladesh.

This thesis is organized in 5 chapters. Chapter I describes the background information about Bangladesh. Chapter II describes about magnitude of the problem, objectives of the thesis and methodology of the analysis . Chapter III analyzes the determinants of undernutrition among the under-2 children. Chapter IV reviews and analyses the intervention activities of NNP. Chapter V conclude the thesis through providing recommendations for NNP program in Bangladesh.

1. Chapter I: Background

1.1 Geography and Population

Bangladesh is low lying riverine country, located in the north eastern part of South Asia with an area of 147,570 square Kilometres[1]. It attained independence in 1971 from Pakistan after a nine month liberation war. It is bordered by India in the north, east and west. In the south and south-east it is surrounded by the Bay of Bengal and the Myanmar respectively.

The country is divided into 6 divisions, 64 districts, and 508 upazillas (subdistricts)[2]. The rural area of the upazilla is divided into unions and the urban area is divided into wards. The population of the country is about 156 million, with a density of more than 900 per square kilometre[3]. More than 70% of the population live in the rural areas[2]. The religion of the majority (about 88%) population is Islam and others constitute Hindu, Buddhist and Christians[2].

Figure 1: Geography of Bangladesh
Source of image[5,6]

1.2 Natural Calamity

Bangladesh consists of a tropical monsoon climate, with a hot and rainy summer and a dry winter. In general, maximum summer temperatures range between 38°C and 41°C and the average temperature during winter ranges from 10°C to 16°C[6]. Due to heavy rainfall flood occurs every year in Bangladesh. The cyclones and tornadoes generally originate from the Bay of Bengal in the periods of April to May and September to November. The north-west areas are prone to drought and river erosion, the centre north is subject to seasonal flooding which limits crop production and the southern coastal zones are affected by soil salinity. Seasonal food insecurity is a common phenomena in those affected areas specially who are the agricultural labourers.

1.3 Socio- economic Conditions

1.3.1 Household Size and dwelling materials

The mean household size in Bangladesh is 4.7 and the proportion is similar both in urban and rural areas[7]. There is large urban-rural differences in terms of household dwelling materials in Bangladesh. Tin is

the most common (86%) roof materials of which majority in rural areas[7]. Majority of rural households have walls made of natural materials (cane, palm, dirt, bamboo with mud etc) or tin, while most urban households have walls of cement or brick. The common flooring materials in rural areas are earth or bamboo but in urban areas cement floors are the most common.

1.3.2 Access to electricity

About half of the households in Bangladesh have access to electricity however it varies widely between urban (82 percent) and rural areas (37 percent)[7].

1.3.3 Water Sanitation

The overall access to improved source of drinking water in Bangladesh is about 97%[7]. Tube wells are the most common source of drinking water in both urban (69 percent) and rural areas (96 percent) and piped water is accessible only in urban areas. Majority of the households in rural areas don't treat water before drinking, and in urban areas about 20% of households treat water for drinking mainly by boiling. About 71% of the population don't have any access to improved facility of toilets which include shared toilet facilities, hanging toilet, open air defecation etc[7]. The problem is more common in rural areas compared to the urban areas.

1.3.4 Gender

The decision making power also varies from men to women according to the level of education, socioeconomic status, employment status and urban-rural areas. Generally men have more decision making power than women. More than 85% households are headed by male both in urban and rural areas[7]. Even after having health and nutritional knowledge, sometimes the women can not implement it into practice as they are not the ultimate decision maker.

1.3.5 Education

Bangladesh Government adopted the Compulsory primary education policy in 1990 to achieve the universal primary enrolment[9]. In addition, the education Govt sector has several programs to improve the education of the girls for instance, free education for girls up to grade 10, stipend for female students, food for work etc[8]. The number of primary schools are 80397 and secondary schools are 18500[9]. The adult literacy rate in Bangladesh for male is 59% while for female it is 48% [10]. Educational attainment is higher in urban areas and highest wealth quintile people[7].

1.4 Macro economy

The per capita GDP in Bangladesh is $ 554 and GDP growth rate is 6.21% in 2008[2]. Agriculture is occupied by the majority (63%) of the labour force and contributes to about 21% of total GDP[11,12]. A good amount of remittances come from the garment exports and the manpower working abroad. Obstacles of the economic development include slow implementation of economic reforms, political instability, unemployment problems, global financial crisis, downward trend of agricultural growth, frequent natural disasters etc. About 36% of population in Bangladesh are living below the poverty line (<Int. $1 per day)[13] and face severe deficiencies in food security, quality of health, population and nutrition services.

1.5 Food Production

In Bangladesh, rice occupies the major portion (71%) of the gross cropped area and accounts for more than 94 percent of food grain production[14]. There is national deficit in production of non cereal foods those are major source of protein, vitamins and minerals [15]. Production of meat, fish, and egg which are the major source of animal protein are also inadequate according to the national requirements [14]. Prices of food vary according to the production of food. Households with low income have difficulties when the food prices are high due to the low production of food.

1.6 Health System

Following the Primary Health Care Approach adopted in 1988, the health system of Bangladesh went through several reforms. Recently in 2003 with the assistance of developing partners, the Govt reformed the Health and Population sector with an inclusion of nutrition as Health, Nutrition and Population Sector wide program (HNPSP). The services under HNPSP include the essential health and nutrition care services responsive to the needs of the poor and vulnerable groups.

1.6.1 Health Services and infrastructure

The health system in Bangladesh is centralized. The operational level of PHC constitutes the lower tier: ward, union and upazilla. At union/ward level, the health care services include EPI, MCH, primary curative care and upward referral. At the ward level, the community clinic, staffed with health and family welfare assistants, serves 6000-7000 population and makes home visits for preventive health care services[16]. The Union Health and Family Welfare Centre, staffed with Medical Assistants and Family Welfare Visitors (Midwife) provide outpatient care services and supervise the field activities at the ward level. The Upazilla Health

Complex at sub district level, staffed by qualified medical practitioners, serve as the first-level referral facility and provide outpatient and inpatient health care services (31-50 beds)[17]. The district hospitals (100-250 beds) and medical colleges (650 beds) provide secondary and tertiary level care facilities[17]. In the private sector, there are community health workers trained by the NGOs, informal health care providers like traditional healers, village doctors, homeopathic practitioners etc.

1.6.2 Nutrition Program infrastructure

The National Nutrition Program (NNP) of HNPSP in collaboration with NGOs and development partners have been implementing nutrition services and interventions in 109 Upazillas of 34 Districts from 6 Divisions since 2004[18]. The design and formulation of NNP intervention was led by the earlier intervention of Bangladesh Integrated Nutrition Program (BINP) completed between1995-2002. The nutrition services of NNP are delivered from the Community Nutrition Centre (CNC) which is staffed by the Community Nutrition Promoters[16,18]. Each of the Community Nutrition Centers is established to serve an average of 1200 population[18]. The activities of the Community Nutrition Promoters are supervised by the Community Nutrition Organizers at union level. There are about 23246 Community Nutrition Promoters (CNP) and 2378 Community Nutrition Organizers (CNO) those are contracted through the NGOs[18]. For community mobilization and intersectoral collaboration, there is a Nutrition Management Committee in each district, upazilla, Union and CNC[16,18]. It involves both the official staff and the community people.

1.6.3 Core nutrition services by NNP

The target group for the community nutrition services under NNP are:

- Children under 2 years of age
- Pregnant women
- Lactating Mothers
- Newly married women
- Adolescent girls

The core services provided by NNP are illustrated below based on the information of NNP report[16,18]:

a

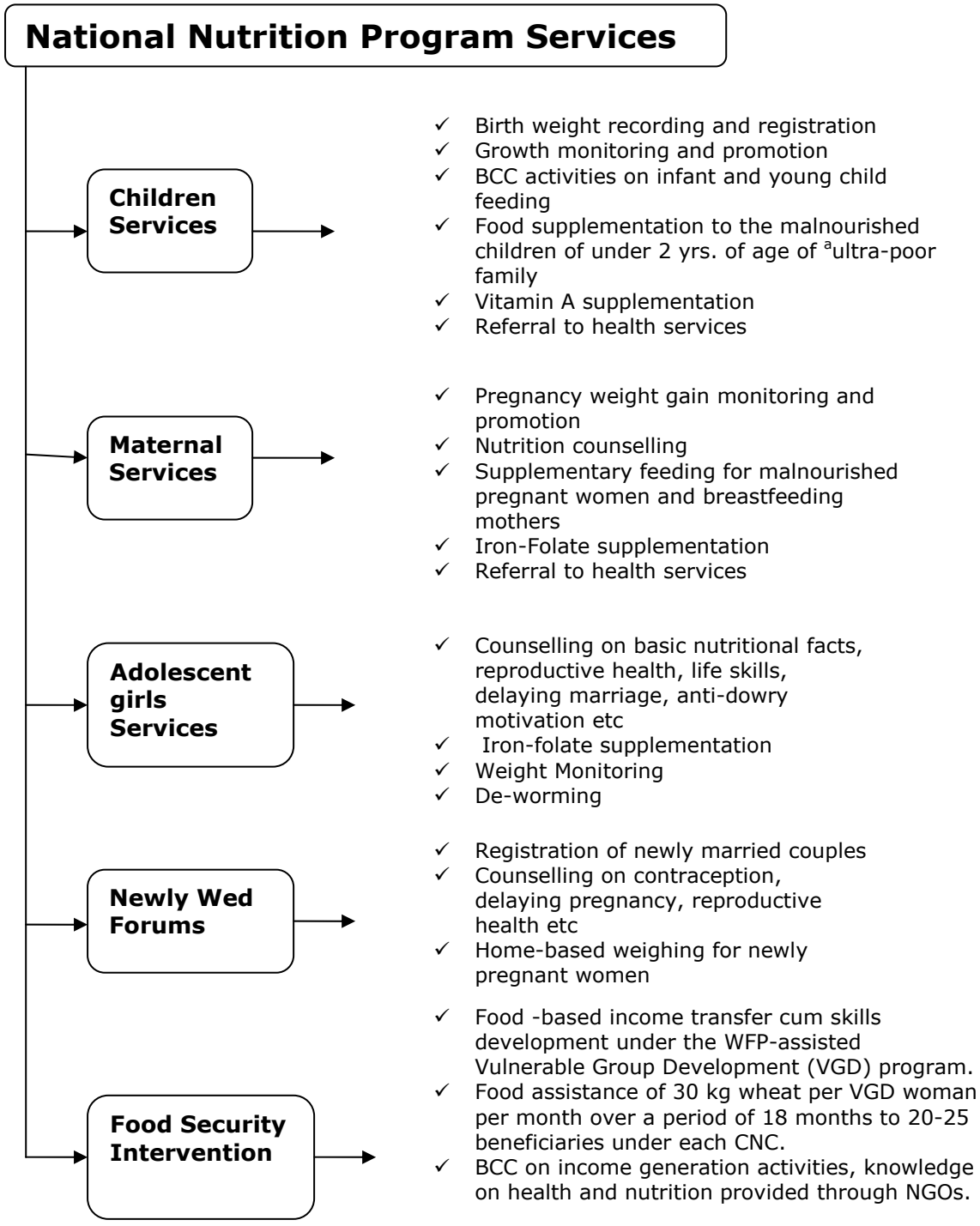

Figure2 : Services of National Nutrition Program

[a] Ultra-poor is the poorest segment of the population with few or no assets, often lacking the most basic necessities including food, shelter and suffer from extreme under nutrition and vulnerable to disease[19]

2. Chapter II

2.1 Problem Statement

Under nutrition is one of the major underlying causes of infant and young child mortality. The lancet series 2008 estimated that more than one third under- 5 child deaths and disease burden are associated with under nutrition that can be tackled if proper intervention can be delivered at early 2 years of life[20,21]. The effects of undernutrition among the under 2 children continue as an intergenerational cyclic process. Stunting in the first 2 years of life leads to long term physical and cognitive damage including shorter adult height, lower educational achievement, reduced economic productivity and decreased off spring birth weight[22]. In addition, undernourished children less than 2 years are at high risk of chronic diseases in adulthood if they have rapid weight gain after infancy[22]. In Bangladesh the burden of under nutrition among infant and young children is much higher compared to the global context. According to the NNP baseline survey 2004, 67%, 71% and 47% of under-2 children were stunted, underweight and wasted respectively[23]. The National Nutrition program has been implementing several intervention activities and services since 2004 for the under 2 children in the vulnerable rural areas to overcome the situation. Despite of the slight downward trends of the problem from 2004 to 2007, still Bangladesh is categorized as high prevalence country[20] (Figure4).

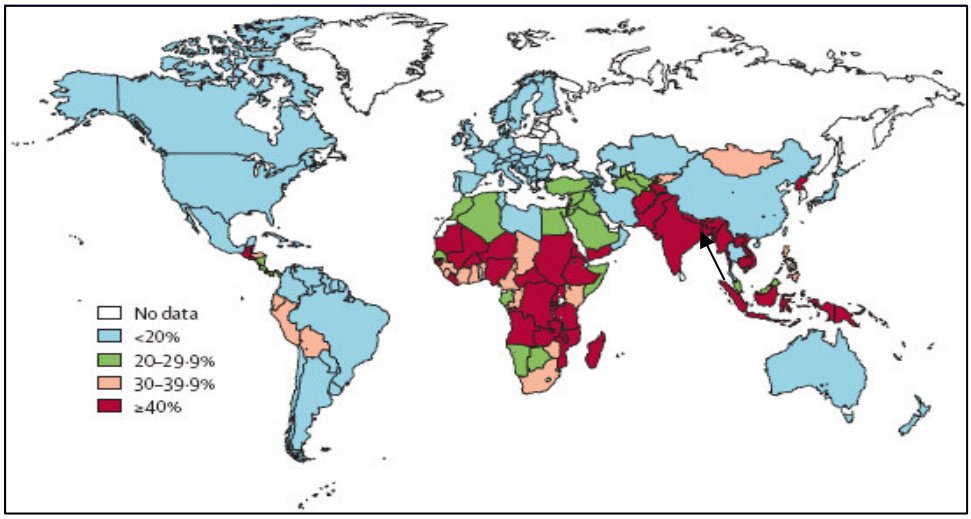

Figure 3: Bangladesh is still in High Prevalence category
(Global Prevalence of Stunting among children <5 years)
Source: Lancet 2008

In this scenario it is essential to recognize the contextual factors that are contributing to the undernutrition problem in Bangladesh. At the same time it is also necessary to identify by what extent these determinants are addressed by the existing intervention program. Evidence shows that undernutrition is caused by the interaction of multiple determinants[20]. The

NNP baseline survey assessed that risk of undernutrition is higher among the post weaning age group and also among the children who are from less educated mother and food in-secured family or low socioeconomic status. But these may not be the only risk factors for undernutrition among the children as there are other contextual factors related to nutrition. The nutritional status of the children is determined from the pregnancy period of the mother**.** According to the NNP Baseline survey 2004, about half of the mothers in the rural Bangladesh never received any antenatal care and the situation still remains almost similar (44%) according to the BDHS 2007 report[23,7]. In spite of the presence of NNP intervention activities, still majority of the children (57%) are not fed colostrums within one hour of birth and exclusive breastfeeding up to 6 months is not well practiced[23,7]. Frequent illness (Figure 4) is also quite common among the children (84%)[23]. In rural areas, treatment are usually sought from the informal village quacks during the illness of the children[23]. There are also other factors that may have influence on child's health and nutritional status, for instance poor health seeking behaviour, availability of health services, access of safe drinking water and hygienic toilet facility etc. It is necessary to explore to what extent these factors are contributing to the undernutrition problem among the children of less than 2years.

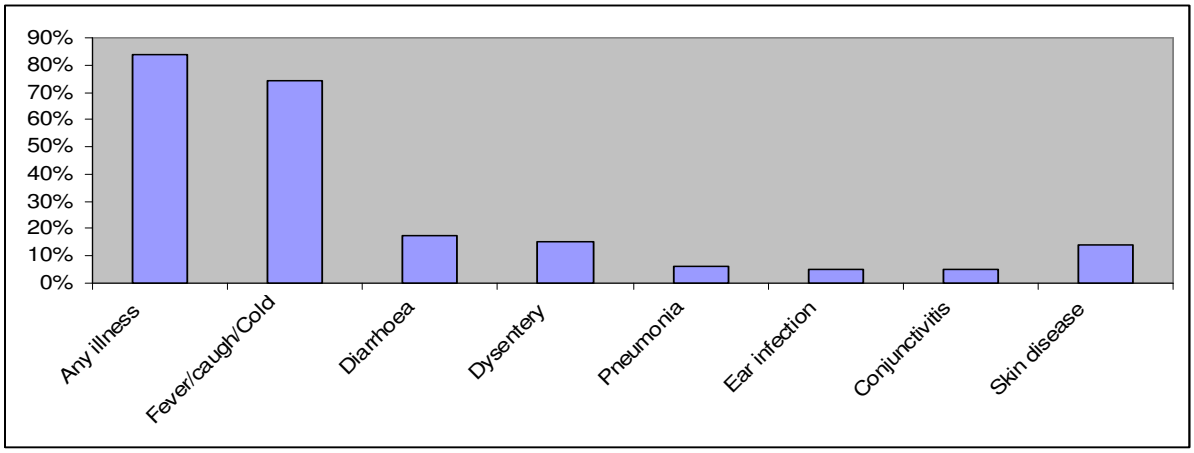

Figure 4: Morbidity pattern among under 2 children (NNP Baseline Survey)

The current intervention program of NNP is focusing on growth monitoring, BCC activities, pregnancy care counselling, iron supplementation for the mothers, vitamin A supplementation for the children and food supplementation for moderately malnourished children. The question that arises is, even after the implementation of these intervention activities why the situation has not improved yet. Therefore, this thesis, first attempts to assess if there are other risk factors not yet addressed by NNP that are contributing to the persistence of the problem. And to what extent they are contributing to the under nutrition among the children less than 2 years in rural Bangladesh. Finally it intends to review the intervention activities of the NNP program to identify whether the determinants have been addressed adequately. The paper is intended to make recommendation for further improving the NNP services.

2.2 Objectives

2.2.1 General Objective:

- To identify the determinants of undernutrition among children less than 2 years that need to be addressed for further improvement of the nutrition program in Bangladesh

2.2.2 Specific Objectives:

- To assess the relationship between child health status and undernutrition
- To assess the relationship between caring practice of the child with undernutrition
- To determine the relationship between unhealthy household environment with the nutritional status of children
- To explore the relationship with the availability of health services and nutritional status of the children
- To provide recommendations for further improvement of the nutrition program for under 2 children

2.2.3 Proxy Indicators for each of the determinants

Variables	Proxy Indicators
Undernutrition[b]	• Stunting (deficit in height for age) • Wasting (deficit in weight gain for height) • underweight (deficit in weight gain for age)
Health Status	• Morbidity pattern (occurrence of diarrhoea, pneumonia, infection etc.)
Caring practice	• ANC of the mothers • Early initiation of breast feeding • Colostrum feeding • Age of introduction of additional food in addition to breast milk • Breast feeding practice • Treatment seeking pattern
Unhealthy Household Environment[c]	• Type of toilet facility used • Source of drinking water
Health Services	• Availability of Health Services

[b] as defined by international literatures[23,24,25,26] provided in annex 1.
[c] as defined by UNICEF and WHO [27] provided in annex 1.

2.2.4 Based on the proxy indicators the specific objectives will address the following Research Questions:

Objective: 1

- To what extent does the morbidity status of under 2 children contribute to their nutritional status?

Objective: 2

- Is early initiation of breastfeeding contributing to the nutritional status of the children?
- To what extent does colostrum feeding affect the nutritional status of the under-2 children?
- Is there any association between the age of introduction of additional food with the nutritional status of the young (<2) children?
- To what extent the breast feeding practice is associated with the nutritional status of the young (<2) children?
- How does the treatment seeking pattern of the children determine their nutritional status?

Objective 3

- Is there any association of the use of hygienic toilet of the household with the nutritional status of the under2 children?
- Does the source of drinking water relate with the nutritional status of the children?

Objective 4

- Is there any association between the nutritional status of the children and the availability of Health Care Services?

Objective 5

- Which of the above determinants are the most important contributors to undernutrition amongst under 2yr old children?
- Have these determinants been addressed adequately by the nutrition program in Bangladesh?

2.3 Thesis Methodology

2.3.1 Target population of the study

Under 2 Children

2.3.2 Database

The data on the nutritional determinants of under-2 children from the NNP baseline survey 2004 were used for further analysis after receiving the necessary approval from the National Research Ethics Committee of Bangladesh. Required information those were not covered by NNP Baseline survey, was sourced based on published reports and studies.

2.3.3 Methodology of NNP Baseline Survey

The survey was carried out in 2004 to 2005 in 113 upazillas of 6 divisions in Bangladesh through a collaborative effort of ICDDR,B, Institute of Public Health Nutrition and the National Institute of Population Research and Training (NIPORT). The listing of the households with target population was made by the data collection Agency (Mitra and Associates) following the provided listing by 1991 Census [23]. Then from the listed households, the required number of households with under 2 children were selected randomly and independently. The segments of households constituted the primary sampling unit (PSU). The estimation of the target sample size has been shown below:

Table 1: Estimation of target sample size in NNP Baseline Survey

Target Population	Upazillas	Number of PSU	Sample size per PSU	Sample Size at national level
Under 2 children	NNP intervention (44) and Non-intervention (16) upazillas	480	17	8160
	BINP (53) upazillas (The earlier nutrition intervention program (1995-2002) before NNP)	228	10	2280

Source: NNP Baseline Survey Report 2004

About 96% of target the households were selected for the survey and about 98% of the selected households were successfully interviewed[23]. There were some non response due to the absence of the inhabitants

during the interview time, vacant/destroyed dwellings. Structured questionnaire was used to collect their background information. The anthropometry e.g., weight and height were measured using respectively UniScale and locally made Length boards. Data were first entered using the Fox Pro Program and then converted into SPSS/PC (version 10). Anthropometric indices were calculated using the ANTHROPAC package and Epiinfo 2000 (using 1978 CDC/WHO reference values).

2.3.4 Design of the thesis

2.3.4 1 Sample Size and Indicators for analysis:

Based on the availability of the recorded anthropometric data, the analysis of this thesis included 8819 children. Regarding variables and indicators the thesis focused on children's morbidity history, treatment seeking behaviour, early initiation of breastfeeding, colostrums feeding practice and breastfeeding practice, indicators of unhealthy environment such as use of modern latrine, source of drinking water, mothers antenatal care and education, household wealth index and anthropometry (weight and height) of the children. Though the age and sex of the children, mothers education and household wealth index were previously analysed in the survey report, still they are included in the analysis of the thesis to have an overview information for all the determinants according to the new WHO growth standards for undernutrition. Wealth index was created by the baseline survey through principal component analysis where each asset (such as bed, television, bike, wall material of the dwelling unit, land ownership etc) was assigned a weight (factor score). Each household was then assigned a score for each asset, and the scores were summed for each household. Then on the basis of the factor score households were divided into quintiles from the lowest 20% to the highest 20%. The data that were analysed based on literature and reports include the availability of health care providers and Health expenditure patterns.

2.3.4.2 Data Analysis

Data analyses were performed using SPSS/PC (version 13) program. The severe and moderate malnourished children were included in the analysis as the malnourished group. The reference standards for anthropometry indices were calculated according to the WHO 2006 new growth standards using WHO anthrop software. The children whose height for age z score were below -2SD (standard deviation) they were included as stunted. The children whose weight for height z score were below -2SD they were included as wasted group and whose weight for age z score were below -2SD , they were categorized as underweight. Cross-tabulation was run to estimate the malnutrition percentage among the exposed and non exposed group. Then Logistic Regression was run to calculate the unadjusted and adjusted odds ratio for different exposures. Based on the significant results of the adjusted odds ratio the major determinants of under-nutrition were identified.

The analysis of the information that were not covered by the NNP baseline database, were done by literature review. Then based on the findings, the nutrition services for under- 2 children delivered by NNP were analyzed to find out whether the current services focusing on those associated determinants. This step analysis was supported by international literature review and the published report of NNP on their nutrition services. Literature search was done using PubMed and Google, global public Health websites (WHO, UNICEF, HKI).
The methodology according to the objective have been summarized below

Table 2: Research Table

General Objective: To identify the determinants of the under nutrition among infant and young children that needs to be addressed for further improvement of the nutrition program in Bangladesh		
Specific Objectives	**Proxy Indicators**	**Data source**
To assess the relation ship between child health status with undernutrition	• Morbidity pattern (occurrence of diarrhoea, pneumonia, infection etc.)	NNP Baseline Survey 2004 database
To assess the relationship between caring practice of the child with undernutrition	• ANC of the mothers • Early initiation of breast feeding • Colostrum feeding • Age of introduction of additional food in addition to breast milk • Breast feeding practice • Treatment seeking pattern	NNP Baseline Survey 2004 database
To determine the relationship between unhealthy household environment with the nutritional status of children	• Type of toilet facility used • Source of drinking water	NNP Baseline Survey 2004 database
To explore the relationship with the availability of health services and nutritional status of the children	• Availability of Health Care services	Literature review
To provide recommendations for further improvement of the nutrition program for under 2 children		Literature review

2.4 Conceptual Framework

Child under nutrition results from the interaction of multiple determinants at individual, community and societal level. Based on the conceptual framework developed by UNICEF[28], the analysis of this paper focused on the determinants at each level using some proxy indicators to present the overview of the important determinants in context of rural Bangladesh.

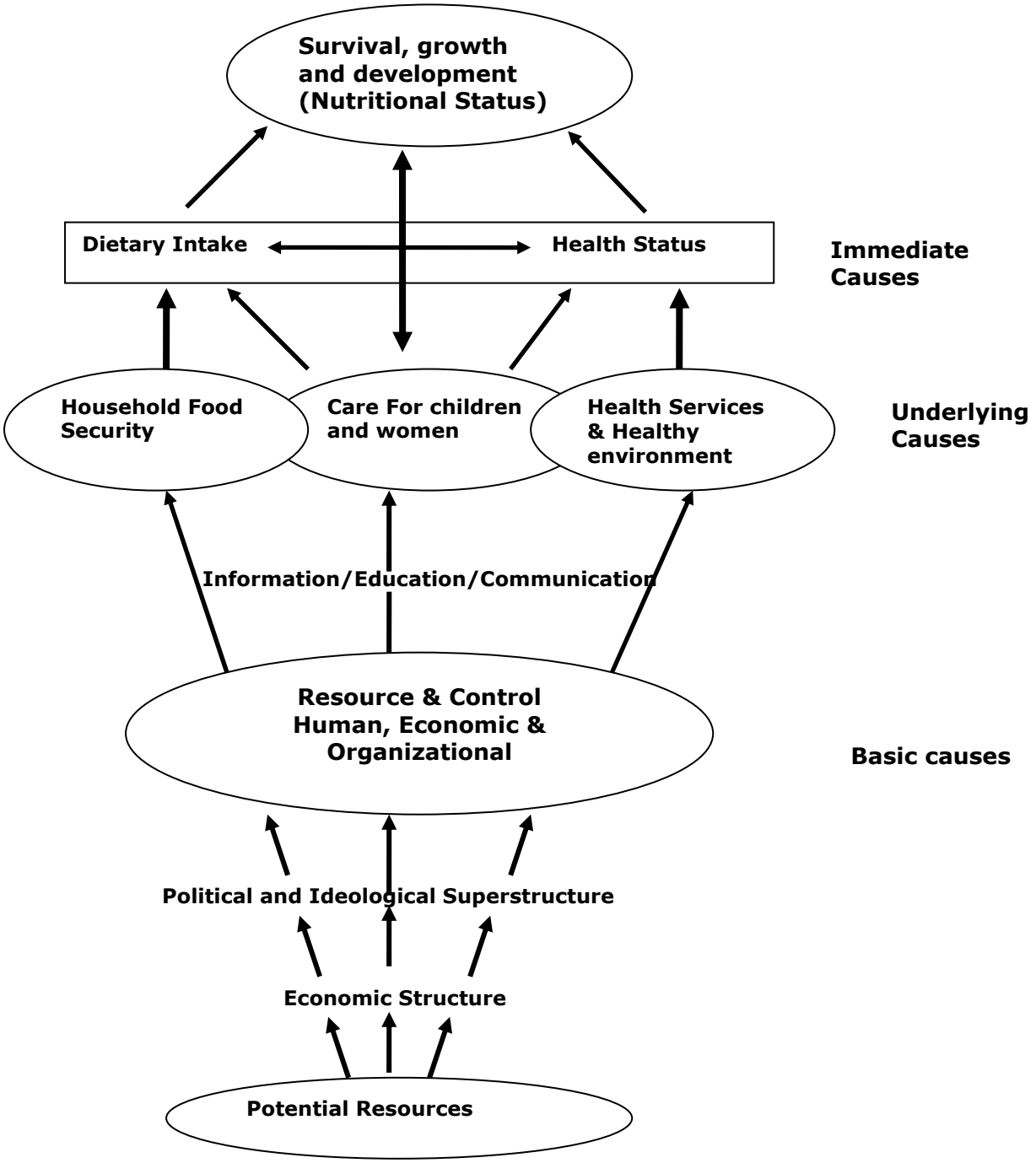

Figure 5: Conceptual Framework of Proximal, underlying and basic determinants of child undernutrition
Adapted from UNICEF 1990, 1998; and Engle, Menon, and Haddad 1999

2.4.1 Immediate Causes

2.4.1.1 Dietary intake and Health Status

The proximal causes of undernutrition highlight the importance of both food intake and the absence of disease. Adequacy of dietary intake is determined by the amount of food per meal, energy and nutrient density of the food and biological utilization. The poor dietary intake lowers the immune resistance and make the child more susceptible to infections. Literature reviews showed that children develop infections around the time of weaning from breast milk to other foods, and subsequently they are more prone to growth faltering[29]. In Bangladesh majority of the children are undernourished in the post-weaning age group (after 6 months)[7,23].According to the WHO recommendation infants should be exclusively breast-fed for the first 6 months of life and after 6 months of age infants should be given frequent small complementary meals that are rich in micronutrients, protein and energy[30,31]. In this continuation, this paper analyses the situation to recognize the dietary intake pattern of rural infant young children in terms of the adequacy of breastfeeding and quality of diet based on the earlier reports. It is also experienced that frequent infections deplete the nutritional stores because of low appetite, poor absorption of nutrients as well as the increased demands. Recurrent episodes of infection without sufficient food or inadequate recovery time is a cause of poor growth among children in developing countries[32]. Limited literatures are available regarding the association of morbidity pattern and the nutritional status of under 2 children in context of Bangladesh. This paper attempts to identify to what extent the morbidity history is associated with the anthropometric status of under-2 children. This step analysis will be done using the NNP baseline survey database.

2.4.2 Underlying Causes

The immediate causes are closely linked with the three underlying determinants including food insecurity at household level, inappropriate caring practice for the child and feeding behaviours and unhealthy environment and availability of health services. These factors can contribute individually or together to the development of malnutrition.

2.4.2.1 Household Food Security

Dietary inadequacies might be caused by food insecurity at household level or inappropriate feeding behaviours and caring practice. The household food insecurity can be the result of inadequate production and supply of food, high price of food, and poor income by the household. Evidence shows that food insecurity and lowest wealth index at household level are significantly associated with the poor nutritional status of the children in Bangladesh[23,33]. To identify the overall picture for each

cluster of underlying causes, food insecurity and household wealth index are still included in the analysis of this paper.

2.4.2.2 Caring Practice

Appropriate and adequate caring practice, for instance, mothers antenatal care and child's feeding practice and health seeking behaviour all can contribute to the nutritional status of the children either individually or together. According to Baseline Survey findings half of the mother did not have any antenatal care check up that can be a negative indicator for the nutritional status of the child. Regarding feeding practice though overall breastfeeding practice is good (96%), but the exclusive breast feeding practice up to 6 months is very low (11%)[23]. Appropriate feeding practice is vital to develop the immune system of the child and provide adequate nutrition for the growth**.** Another important indicator of child care is the treatment seeking behaviour of the mothers for the children by trained health care provider. The NNP baseline survey revealed that about 23% mothers don't sought treatment for their children during illness like fever, pneumonia, diarrhoea etc. and more than half of the children are given treatment by the village quacks or pharmacies. Thus the children mught be receiving incorrect or incomplete treatment. This might be a cause of frequent morbidity. Therefore this step analysis will be done using the NNP Baseline survey database to explore the extent of the association of the children's nutritional status with their mother's antanatal care, feeding behaviour and their treatment seeking pattern.

2.4.2.3 Environmental factors and availability of Health services

Inadequate access to safe drinking water and inadequate toilet facilities for excreta disposal can contribute to poor health status and malnutrition. Inadequate access to water also affects nutrition indirectly by increasing the work-load of women, thus reducing the time available for the child care. Unhygienic toilet use and unsafe drinking water can lead to the development of gastrointestinal infections, such as diarrhea, and facilitate the spread of infectious disease. Though the source of drinking eater taken by the rural people is good but still most of households don't have any modern toilet facility and open defecation is also very common. Therefore in this step the analysis is focussed on the toilet facility and drinking water. It is also important to recognize as most of the mothers are taking their child for treatment from village quacks, it could be due to insufficient doctors or high fee. To explore this problem a literature review will be done.

2.4.3 Basic causes

Finally, the framework links the underlying determinants to a set of basic determinants including the availability of human, economic and organizational resources. Most underlying causes are the result of the unequal distribution of resources in society. It has been well documented that addressing the basic causes like poverty, inequity, poor institutional structures and lack of resources can result in substantial reductions in undernutrition[34,35]. Therefore, in this step, the analysis is focussed on the distribution of Health care expenditure in the country. This is done through a literature review and also based on my own experience. The results of this analysis can be useful in recognizing those determinants which are still not covering by the NNP intervention program. Thereafter, international literatures have been reviewed to find out the evidence on the effective approach for addressing these determinants. This will help inform the recommendation for the National Nutrition Program of Bangladesh.

3 Chapter III

3.1 Dietary intake pattern by the infant and young children in Rural Bangladesh

In Bangladesh breast feeding is commonly practiced, it is socially valued. But exclusive breastfeeding practice upto 6 months is less commonly practiced[7,23,36]. Most of the children are given complementary foods before 6 months of age. Literature review showed that in rural areas of Bangladesh the children are given complementary foods such as gruels and other liquids before 6 months of age, a period when they should be exclusively breast-fed[37]. Foods commonly given to the children after 6 months are rice and wheat (48% of the meals) in addition to breast milk[38,39]. But the quantities of other food (egg, fish, vegetables and fruits) containing good quality protein and micronutrient are relatively small (35% of the meals)[38,39]. The following figures show the diet generally given to the children in rural Bangladesh and how frequently the children are given egg lentils, vegetables or fish.

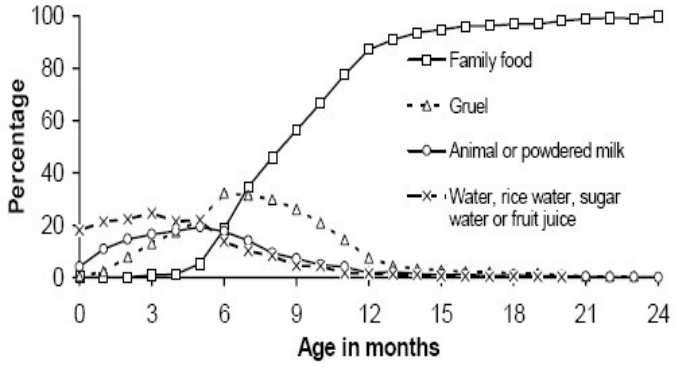

Figure 6: The main type of foods given to young children and infants aged less than 24 months in rural Bangladesh

Source: HKI Bangladesh Report 2001

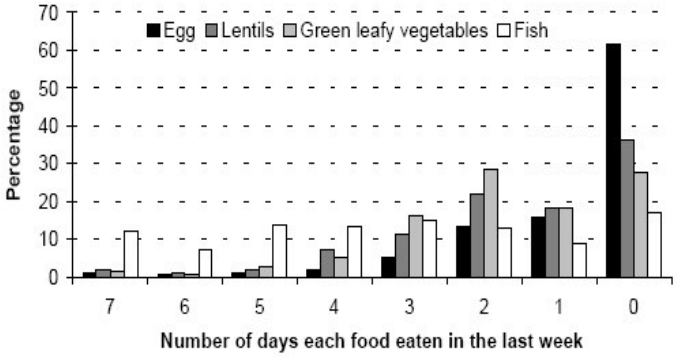

Figure 7: The number of days each food taken by the children (aged between 12 and 59 months) in the last seven days in rural Bangladesh

Source: HKI Bangladesh Report 2002

The above information indicates that the complementary foods given to the children are not well diversified with good quality protein and micronutrients rich food to meet the extra nutritional demands of the infants and young children.

3.2 Prevalence of Undernutrition among under 2 children according to WHO new growth Standards

Before analysing the association of determinants with undernutrition the prevalence of undernutrition among the children less than 2 years was estimated according to the WHO new growth reference standards 2006. The results showed that the prevalence of moderate and severe stunting, underweight and wasting among the under 2 children were respectively 41%, 36% and16% compared to 35%, 41% and 13 % according the CDC/WHO 1978 standard.

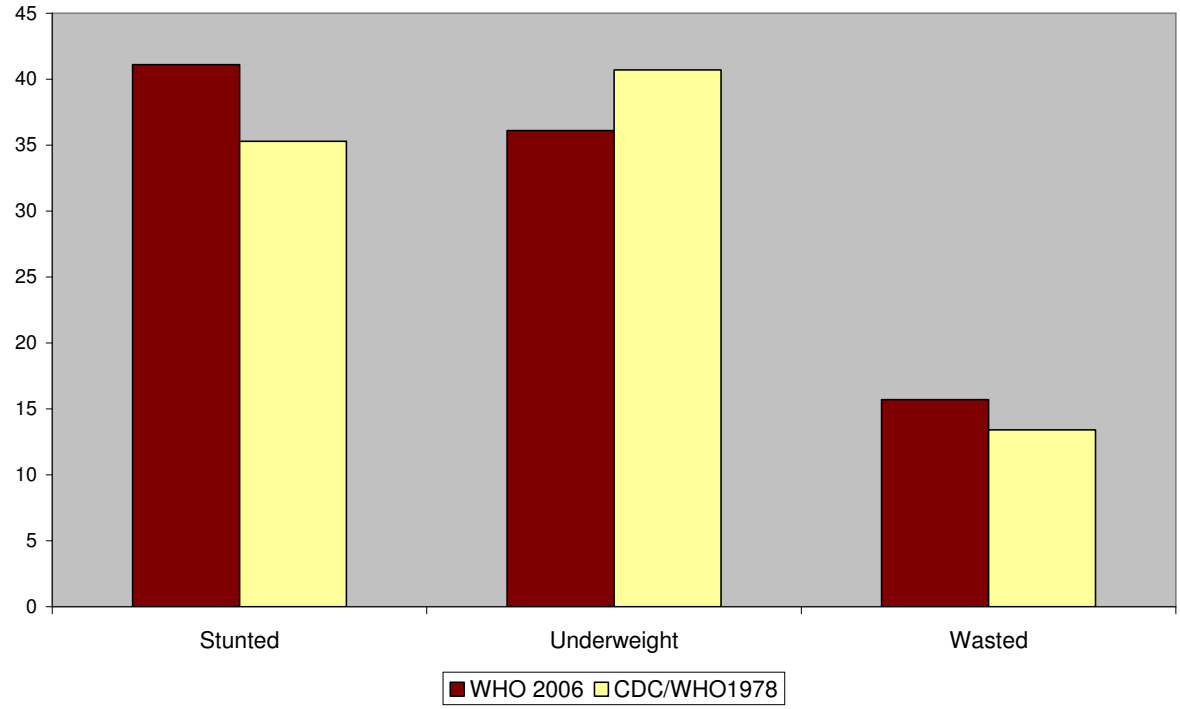

Figure 8: Prevalence of undernutrition among children less than 2 years of NNP Baseline Survey according to new WHO growth standards 2006 and CDC/WHO 1978 standards

Stunting= Height for age Z score <-2 SD
Wasting=Weight for height Z score <-2SD
Underweight=Weight for age Z score <-2SD

3.3 Results of Multivariate analysis

At the initial stage the results of the univariate analysis (Annex 1) showed significant results for the following determinants:

Age, sex, diarrhoea, dysentery, pneumonia, ear infection, eye infection, skin disease, wealth index, food insecurity, early initiation of breast feeding, colostrum feeding, age of introduction of any food or drink in addition to breast milk, breastfeeding continuation status on the survey period, treatment seeking behaviour, mothers antenatal care, mothers education, food insecurity, toilet facility and source of drinking water.

However the results of the multivariate analysis showed significant results for only some of these variables. These have been discussed in this section.

3.3.1 Demographic characteristics of the children

Table 3: Demographic Characteristics of the children

Demo-graphy	**N (8819)**	**% stunted**	**N (8819)**	**% Wasted**	**N (8819)**	**% underweight**
Age (months)						
0-5	1849	19.6	1849	10.6	1849	22.9
6-11	2592	33.6	2593	12.8	2592	30.4
12-23	4377	54.7	4377	19.5	4377	45.1
Missing	1				1	
Sex						
Male	4429	43.8	4429	16.8	4429	38.4
Female	4390	38.5	4390	14.5	4390	33.8
Adjusted Odds Ratio		**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**
Age (months)						
0-5		1		1		1
6-11		2.11*(1.8-2.5)		1.18*(1.0-1.5)		1.42*(1.2-1.7)
12-23		5.29*(4.6-6.1) P<0.001		1.95*(1.6-2.4) P<0.001		2.77*(2.4-3.2) P<0.001
Sex						
Male		1		1		1
Female		0.78*(0.7-0.9) P<0.001		0.86*(0.8-1.0) P=0.012		0.82*(0.8-0.9) P<0.001

(* if p is <0.05)

The table shows that with increase of age, the risk of stunting, wasting and underweight among the children also increases. It indicates that the feeding practice and dietary intake by the children is not adequate. Evidence shows if exclusive breastfeeding is not practiced up to 6 months and after 6 months if the intake of complementary food is not sufficient in quality and quantity, the children gradually develop undernutrition. The results also showed the girls have less risk of undernutrition compared to

boys. Perhaps the caregivers have a tendency to introduce other foods to the sons before 6 months compared to daughters because they don't know that exclusive breast feeding is sufficient to ensure the good nutrition for the first 6 months of age. As a result these male children may have more frequent infections that deplete their nutritional stores.

3.3.2 Immediate Causes

Table 4: Association between morbidity history and nutritional status of the children

Morbidity	**N (8819)**	**% Stunted**	**N (8819)**	**% Wasted**	**N (8819)**	**% Underweight**
Diarrhoea						
Yes	1522	48.1	1522	20.0	1522	45.7
No	7297	39.7	7297	14.8	7297	34.1
Eye Infections						
Yes	437	46.1	437	13.5	466	37.3
No	8352	40.9	8352	15.8	8353	36.0
Adjusted Odds Ratio	**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**	
Diarrhoea						
Yes	1.23*(1.8-1.4)		1.27*(1.1-1.5)		1.40*	(1.24-1.58)
No	1		1			1
	P<0.001		P=0.002			P<0.001
Eye Infections						
Yes			0.74* (0.56-0.98)			
No			1			
			P=0.037			

Initially, the results of univariate analysis showed that diarrhoea, dysentery, pneumonia, fever and cough, ear infections, and skin disease are significant exposures for undernutrition. But when the odds ratio were calculated using the multivariate analysis to adjust the effects of morbidity with all other variables and confounders, the diarrhoea remained as the only significant risk factor for stunting, wasting and underweight. The results showed that the children who had diarrhoea during last 15 days at the time of survey they had (aOR 1.23 times for stunting, 1.27 times for wasting and 1.40 times for underweight) higher risk of having undernutrition compared to those children did not have any diarrhoea. ($p<0.01$). Specially stunting (48%) and underweight (20%) were more common among the children who had diarrhoeal history. Eye infections showed as protective factor ($p=0.037$) for undernutrition in the wasting group when it was checked as a confounder. However for the wasting and underweight group it did not show any significant results. Information error or bias by the respondents may lead the result as a protective factor.

3.3.2 Underlying Causes

3.3.2.1 Food insecurity and Household Wealth Index

Table5 : Association with Food insecurity and Household Wealth Index with the nutritional status of the children

Food Insecurity	**N (8819)**	**% stunted**	**N (8819)**	**% Wasted**	**N (8819)**	**% underweight**
Yes	2500	50.6	2501	20.3	2501	46.5
No	6318	37.4	6318	13.9	6318	32.0
Missing	1					
Household Wealth Index						
Lowest quintile	1832	53.9	1833	21.9	1833	21.9
Second Quintile	1752	45.8	1753	18.1	1753	18.1
Middle	1740	44.3	1740	15.5	1740	15.5
Fourth Quintile	1780	36.2	1780	12.8	1780	12.8
Highest	1713	24.7	1703	9.7	1713	9.7
Missing	2					
Adjusted Odds Ratio	**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**	
Food Insecurity						
Yes	1.17(1.05-1.3)		**1.14(0.99-1.3)**		1.16*(1.03-1.3)	
No	1		**1**		1	
	P=0.006		P=0.068		P=0.011	
Household Wealth Index						
Lowest quintile	1		1		1	
Second Quintile	0.79*(0.68-0.91)		0.85(0.72-1.0)		0.86*(0.74-0.99)	
Middle	0.78*(0.67-0.91)		0.73*(0.61-0.87)		0.68*(0.59-0.79)	
Fourth Quintile	0.65*(0.55-0.77)		0.65*(0.54-0.79)		0.56*(0.47-0.66)	
Highest	0.45*(0.37-0.55)		0.54*(0.43-0.68)		0.41*(0.34-0.50)	
	P<0.001		P<0.001		P<0.001	

Both in the univariate and multivariate analysis food insecurity and household wealth index were found as significant determinants of undernutrition. Food insecurity was determined for the households those could not provide 3 meals for the family during the last year at the minimum for 1 month. The households having food insecurity are 1.2 times more likely to have stunted and underweight children compared to those who did not have food insecurity. But for wasting it did not show any significant result. Food insecurity is also an indicator of poverty. Those who have less income and property they are more likely to suffer from food insecurity. The results also showed that compared to the

children from lowest quintile households the children from the higher quintile households are at low risk of undernutrition. The results indicate that there is a inverse relationship between poverty and undernutrition.

3.3.2.2 Mother's Antenatal Caring Practice

Table 6: Association between mother's antenatal care and nutritional status of the children

Number of ANC visits	**N (8819)**	**% stunted**	**N (8819)**	**% Wasted**	**N (8819)**	**% underweight**
No visit	4454	39.8	4454	15.4	4454	46
Single visit	1377	34.6	1377	12.6	1377	39.8
Two visit	1117	32.1	1117	12.0	1117	35.9
3 or more visits	1871	27	1871	10.0	1871	31.5
Adjusted Odds Ratio		**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**
						ANC visits
No visit		1.32*(1.15-1.50)		1.47*(1.23-1.75)		1.54*(1.35-1.76)
Single visit		1.22*(1.04-1.44)		1.17(0.94-1.46)		1.22*(1.04-1.44)
Two visit		1.16(0.98-0.1.38)		1.16(0.92-1.47)		1.22*(1.02-1.45)
3 or more visits		1		1		1
		P=0.001		P<0.001		P<0.001

The results showed that the proportion of stunted, wasted and underweight children are higher among the mothers who never had any antenatal care visit or less than 3 antenatal care visit. The risk of having stunted, wasted and underweight children are 32%, 47% and 54% higher among the mothers who never had any antenatal care visit compared to the mothers who had 3 or more antenatal care visits. Antenatal Care (ANC) refers to a package of health care services including education, counselling, screening and treatment to monitor and to promote the well-being of the mother and foetus. So it is very likely that inadequate antenatal care of the mother have negative impact on the nutritional status of the children.

3.3.2.3 Mother's Education

Table 7: Association between mother's education and nutritional status of the children

Mothers Education	N (8819)	% stunted	N (8819)	% Wasted	N (8819)	% underweight
No Education	3019	43.6	3019	17.1	3019	50.5
Primary Incomplete	1636	37.3	1636	13.3	1636	43.2
Primary Complete	1253	34.7	1253	14	1253	39.6
Secondary Incomplete	2293	28.3	2293	9.9	2292	32.1
Secondary & Above	618	16.2	618	7.3	618	19.6
Missing					1	
Mothers Education						
No - Education		1		1		1
Primary Incomplete		0.84*(0.73-0.96)		0.71*(0.60-0.84)		0.77*(0.68-0.88)
Primary Complete		0.81*(0.70-0.94)		0.82*(0.68-0.99)		0.81*(0.70-0.94)
Secondary Incomplete		0.74*(0.65-0.85)		0.72*(0.60-0.86)		0.69*(0.60-0.79)
Secondary & Above		0.46*(0.36-0.59)		0.50*(0.35-0.72)		0.44*(0.34-0.57)
		P<0.001		P<0.001		P<0.001

Mothers with little or no education showed significant association with undernutrition among the children. Mothers education can influence mother's knowledge and awareness about the caring practice of the child. It also might be that the women with low education are little empowered to take decision for self-care or for their child even after having good knowledge.

3.3.2.4 Feeding Practice of the children

Table 8: Association of feeding practice with the nutritional status of the children

Feeding Practice	**N (8819)**	**% stunted**	**N (8819)**	**% Wasted**	**N (8819)**	**% underweight**
Early Initiation of BF						
Immediately after birth	2648	38.3	2648	13.1	2648	36.9
Within 24 hours	4381	41.9	4380	16.8	4380	42.8
After 24 hours	1750	43.5	1749	16.6	1749	41.0
Missing	40		42	42	42	
Colostrum						
Yes	8181	40.5	8181	15.1	8180	35.3
No	638	49.5	638	23.4	638	46.4
Missing					1	
Age of Introduction of food						
<4 months	4032	43.3	4032	15.4	4032	37.9
4 to 6 months	3178	43.5	3178	16	3178	36.8
> 6months	1299	33.2	1299	17	1299	32
Missing						
Adjusted Odds Ratio	**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**	
Early Initiation of BF						
Immediately after birth	1		1			
Within 24 hours	1.07(0.96-1.2)		1.22*(1.05-1.41)			
After 24 hours	1.21*(1.06-1.4)		1.18(0.99-1.41)			
	P=0.022		P=0.026			
Colostrum						
Yes			1		1	
No			1.32*(1.1-1.6)		1.22*(1.03-1.46)	
			P=0.010		P=0.024	
Age of Introduction of food						
> 4 months	1.40*(1.2-1.6)		0.83*(0.70-0.99)		1.22*(1.06-1.1)	
4 to 6 months	1.18*(1.02-1.4)		0.84(0.69-1.01)		1.06(0.91-1.2)	
<6months	1		1		1	
	P<0.001		P=0.103		P=0.004	

The prevalence of stunting, wasting and underweight were higher among those children who were not initiated breastfeeding immediately after birth and who were not fed colostrum. The results of univariate analysis showed also the significant relationship of these determinants with undernutrition. When the multivariate analysis was run to calculate the adjusted odds ratio, the results still showed the significant association of

early initiation with stunting and wasting and colostrum feeding with wasting and underweight. Those who were not fed colostrums they have 1.32 times higher risk of developing wasting and 1.22 times higher risk of developing underweight compared to those children who were fed colostrums. The children who were given any liquid or any food in addition to breast milk before 6 months they are more likely of having stunting and underweight. However for wasting it was not found to be a risk factor.

3.3.2.5 Health Care Seeking for the children

Table 9: Relationship between health care seeking pattern for the children with their nutritional status

Sought treatment for recent illness	N (8819)	% stunted	N (8819)	% Wasted	N (8819)	% underweight
Didn't seek treatment	1669	43.4	1668	13.9	1669	37.3
Qualified Doct.Govt	425	42.6	425	16.7	425	35.1
Paramedics Govt.	9	55.6	9	11.1	9	33.3
NGO Clinic	32	40.6	32	16.1	32	37.5
Pvt.Qualified Doct.	958	33.4	958	17.4	958	34.6
Paramedics (pvt)	31	58.1	31	12.5	31	41.9
Pharmacy/ Vill. Doct.	3066	43.7	3065	18.1	3066	40.0
Homeopathy	1001	36.1	1001	11.7	1001	30.7
Traditional Healers	120	64	120	15.0	120	38.3
Others	58	14	57	14.0	57	22.4
Missing	1450		1453		1450	
Adjusted Odds Ratio	**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**	
Didn't seek treatment	1.11(0.97-1.3)		0.75*(0.63-0.89)		0.97 (0.85-1.11)	
Qualified Doct.Govt	1.12(0.9-1.4)		1.02(0.77-1.4)		0.95(0.75-1.19)	
Paramedics Govt.	1.59(0.39-6.5)		0.94(0.14-6.2)		0.98(0.22-4.29)	
NGO Clinic	0.96(0.42-2.2)		1.10(0.42-2.9)		0.97(0.43-2.16)	
Pvt.Qualified Doct.	0.91(0.76-1.07)		1.30*(1.06-1.6)		1.18(1.0-1.4)	
Paramedics (pvt)	1.84(0.83-4.1)		0.58(0.20-1.7)		0.97(0.45-2.1)	
Pharmacy/ Vill. Doct.	1		1		1	
Homeopathy	0.97(0.82-1.14)		0.68*(0.55-0.85)		0.81*(0.69-0.96)	
Traditional Healers	1.39(0.93-2.1)		0.76(0.45-1.27)		0.81(0.54-1.21)	
Others	0.42*(0.23-0.80) P0.042		0.84(0.40-1.8) P<0.001		0.45*(0.23-0.86) P=0.007	

The results showed that those who did not seek any treatment for their children during the last illness among them 43% were stunted, 14% were wasted and 37% were underweight. The adjusted odds ratio indicates

that those who have taken treatment from homeopathy and others category they are less likely of having undernutrition compared to those have taken treatment from village doctors or pharmacies. Though it is not clear from report who were categorized as "others", but it might be the home care option. Generally when the status of the illness is not so severe, the guardians tend to give home treatment without going to any health care provider to save the user fee as well as time. Perhaps most of these children who took treatment from "others" category did not have severe infection and thereby they did not develop undernutrition. No significant association was found for those children who have taken treatment from qualified doctor or trained paramedics or NGO clinic. Those who have taken treatment from private qualified doctor they have higher risk of wasting but for stunting and underweight it was not found to be a significant risk factor. The rural uneducated people also can have tendency to categorize the quack doctor as private qualified doctor that could be a cause of information error. Or another cause could be the private qualified doctors are not well trained.

3.3.2.6 Environmental Factors

Table 10: Relationship of the environmental factors with the nutritional status of the children

Toilet Facility used	**N (8819)**	**% stunted**	**N (8819)**	**% Wasted**	**N (8819)**	**% underweight**
Septic tank modern latrine	412	17.2	412	9.2	412	22.1
Slab latrine	1029	25.5	1029	10.1	1029	29.5
Pit latrine	4657	34.3	4657	13.6	4657	40.7
Hanging latr.	273	44	273	15	273	50.4
Open latrine	1552	43.4	1552	15.8	1552	46.7
Bush/field	843	44.2	843	14.4	843	49.7
Others	53	28.3	53	5.8	53	30.8
Adjusted Odds Ratio	**aOR (95% CI)**		**aOR (95% CI)**		**aOR (95% CI)**	
Septic tank modern latrine	0.79(0.6-1.03)				0.74*(0.55-0.99)	
Slab latrine	0.94(0.8-1.1)				0.93(0.78-1.09)	
Pit latrine	1				1	
Hanging latr.	0.95(0.73-1.2)				0.87(0.67-1.14)	
Open latrine	1.14*(1.0-1.3)				0.89(0.77-1.01)	
Bush/field	1.23*(1.03-1.5)				1.29*(1.09-1.53)	
Others	0.63(0.3-1.2)				0.62(0.32-1.20)	
	P=0.025				P<0.001	

The proportion of stunting wasting and underweight children were respectively 34% , 14% and 29% among those households who use pit latrines compared to 17% , 6% and 22% who use modern latrines. The odds ratio shows that those who have modern latrine they are protective from undernutrition compared to those who use pit latrine. And those who are using bush/field or open latrine they have higher risk of having stunted or wasted children. For wasted children use of toilet facility did not show any significant result. This data might suffer from response bias. If the information regarding latrine use is collected in front of other people especially from women, they may hesitate to tell that they are really using open latrine or bush yard. This type of information error can overlap the results. Similarly the response may vary not only according to the setting in which the question is asked, but also depending upon what is socially desirable or what the respondents perceive as the kind of response the surveyors would like to hear.

3.3.2.7 Availability of Health Care Providers

The following information describes the availability of Health care providers in Bangladesh[40]

Table 11: Availability of Health Care Providers in Bangladesh

Health Workforce	Number	Density per 10000 population
Physicians	42881	3
Nurses and Midwives	39471	3
Community Health Workers	21000	2
Dentistry Personnel	2344	<1
Other Health Service Providers[d]	24035	2
Hospital Beds		3

Source: WHO. World health Statistics 2009

The information indicates that there is a shortage of Health care providers. This may be one of the reasons of poor health seeking pattern of the mothers for ANC and also for their children. There is also unequal distribution of health care providers in urban and rural areas. Physicians also prefer to work in the urban areas to get better user fee, income opportunities, better living facilities and other socio-cultural services. In remote areas for instance, *char* areas (river islands) where transport, road infrastructure are not developed yet, it is difficult to get doctors to stay. According to the WHO estimates the countries with fewer than 23 health-care professionals (counting only physicians, nurses and midwives) per 10 000 population will be unlikely to achieve adequate coverage rates for the key primary health-care interventions prioritized by the Millennium Development Goals[40]. Evidence shows that in Bangladesh the number of health care providers and health facilities are quite small in the union and *upazilla* level centres compared to the district level [17]. People generally tend to go to the nearest traditional doctors or quacks to minimize their user fee and distance, if the situation gets worsen they go for qualified doctor[41].

[d] Other Health Care providers include Pharmacists, laboratory Health Workers, Nutritionists, Traditional Healers, Medical Assistants and others

3.2.3 Basic Causes

3.2.3.1 Training Capacity

The following table indicates that there is a shortage of training Institutes for producing adequate health care providers [42]. The number of Health care providers trained by the Institutes is not sufficient to meet the health care demands of the Population. These factors are associated with the health seeking behaviour of the mothers and their children.

Table 12: Number of Training Institutes for Health Care Providers

Training Institute	Number including public and private	Capacity of seat for total
MBBS	50	4620
Homeopathy and traditional	3	125
Nursing Colleges and Institutes	65	2300
Institutes for Midwifery training		140
Training for Medical Assistants	30	650

3.2.3.2 Distribution of Health expenditure

In Bangladesh major portion of health expenditure is occupied by the private sector and 88% of this comes from out of pocket of the population. The following box shows the health expenditure pattern[40] in Bangladesh.

Table 13: Distribution of Health Expenditure

Health expenditure as % of GDP	3.2
Govt. Expenditure on health as % of total expenditure on health	31.8
Private expenditure on health as % of total health expenditure	68.2
Govt expenditure on health as % of total expenditure	7
Out of pocket expenditure as % of private expenditure on health	88.3
External resources as % of total health expenditure	15.8

Source: WHO. World health Statistics 2009

There is no insurance scheme or risk pooling strategy for the curative services to minimize the health care cost for the poor segment population. Expensive pocket payment may prevent the mothers for seeking treatment from trained health care providers.

The distribution of health expenditure in urban and rural areas is not equitable. Major portion of national health expenditure is spent on urban areas[43] while more than 70% of the population are living in rural areas (Figure 9).

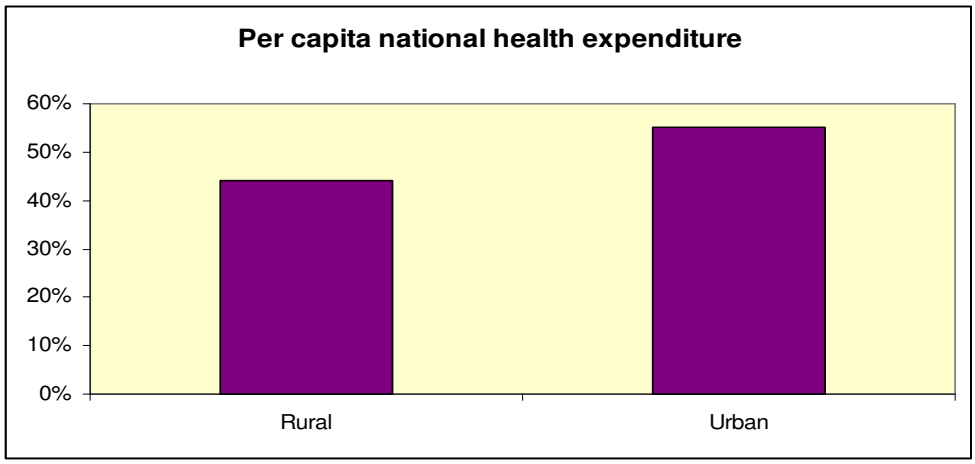

Figure 9: Distribution of per capita national Health expenditure in urban and rural areas

Source: Bangladesh National Health accounts 1999-2001

3.2.7 Political and ideological structure

There are several reasons for giving low priority for nutrition by the Govt., stakeholders and development partners[44]. In most cases negative impacts of undernutrition is not visible. The households and the community have less demand for nutrition services because they are not aware about the long-term and intergenerational effect of undernutrition. In addition, the poor people who are main victims by undernutrition have little voice. As it is a long term investment the political leaders may have little interest on investment in Nutrition. In addition, there is no single line Ministry for nutrition. As a result it reflects as the partial responsibility of ministry of health or agriculture or other sectors.

3.2.8 Potential resources

Bangladesh has around 150 million people, out of them 57% is from productive age group (15-59)[7] Bangladesh is also rich in fertile land with enough sunshine. Proper use and management of the resources and

implementation of the existing policies and action plans may create an opportunity to improve the current situation of the country.

4. Chapter IV

4.1 Review of NNP interventions

It is essential to implement effective interventions on priority basis for those determinants which are significantly contributing to the undernutrition problem in rural Bangladesh. As we stated in chapter 1 about the components of existing nutrition activities of NNP, this chapter attempts to review the components in support with available reports and literature to recognize the gaps that might be addressed to improve the situation.

4.1.1 Intervention for Immediate Causes

4.1.1.1 Morbidity

From the results of the analysis, we found that diarrhoea is the most important immediate cause of stunting (aOR 1.23; 95%CI:1.8-1.4), wasting (aOR1.27; 95%CI:1.1-1.5) and underweight (OR:1.40 95% CI:1.24-1.58) among the under-2 children in rural Bangladesh. The question is, to what extent NNP intervention program addressing diarrhoea to reduce undernutrition. From the available report of NNP it is evident that there are area based growth monitoring activities, food supplementation program, BCC activities for improving knowledge and practice on nutrition, and intervention for food security[16,18]. There is no specific or routine BCC activity or monitoring session regarding sanitation and hygiene.

In Bangladesh, more than 80% children are given ORS during the diarrhoea either in packet form or home made[7,23] Still remaining 20% children are not able to manage the diarrhoea even after having good progress of the widespread use of ORS. There is a national policy and strategic plan for safe water and sanitation approved by the Local Government of Rural Development (LGRD) Ministry in 1998, but the implementation at large scale is not visible[45,46]. Literature review shows that intervention on hygiene education, latrine installation, hand washing promotion with soap before handling food and after defecation have been proven to be effective in reducing the risk of diarrhoeal incidence in the developing countries including Bangladesh[47,48,49].

The National Nutrition Program in Thailand can be mentioned as a good example for their achievement in reducing underntrition through investment on hygiene and sanitation[50]. Thailand's national nutrition program prioritized hygiene and sanitation in their national plan for improving the nutritional status of the children and implemented

successfully in co-operation with the water and sanitation programs [49] There are success story of several area based sanitation program conducted in Bangladesh as well as other south Asian countries for instance BRAC hand wash program, Community led total sanitation project, Water Aid sanitation program etc[51] . The experiences of these programs could be brought together as one of the components of NNP intervention activities and can be integrated with LGRD.

4.1.1.2 Dietary Intake

The another immediate cause of undernutrition is the poor dietary intake pattern of the children. The analysis on the dietary intake pattern shows that the diet given to the children are not adequately diversified with micronutrient enriched food. Addressing this issue, NNP implements vitamin A supplementation program at national level in collaboration with IPHN. According to the BDHS survey report, the coverage of vitamin A supplementation reached 88% for the children aged 9-59 months and there is not much disparities observed between rural and urban or poor and rich [7].

The food supplementation provided by NNP is mainly targeted for the moderately and severely malnourished children. For 6 months old children food supplementation is continued until the body weight of the child increases by >600gm and for 12-24 months old children supplementation is continued up to >300 gm in 3 consecutive growth monitoring sessions[52]. The ingredients of the food supplements *(pushti packet)* include roasted rice (20g), lentil (10g), molasses(5g), and oil(2.5g)[52]. Severe malnourished children are given the daily ration twice while the moderately malnourished children for once. The feeding are given in the CNC during the official days to ensure the full benefit of the supplementation and counselled to give the same during off days with available ingredients. The duration of supplementation is limited to three or four months to reduce the dependence of the mothers on the program. It also intends to make the mother aware that feeding small amount of additional complementary foods can improve the nutritional status of the children.

Several reports recommended that inclusion of micronutrients in the *pushti* packet either in fortified form or sprinkles would be useful to enrich supplements[23, 53]. It is also necessary to assess whether the monitoring and supervision is adequate to maintain the quality of food provided and the preparation and storage of food as well as feeding guidelines are followed by the CNCs. An explorative study by BRAC on two NNP upazillas reported that the quality of ingredients of the *Pushti* Packet is medium when compared with market price, availability in local market and physical appearance and most of the packets (74%) have leakage[52]. About 37% children can not finish the food at a time in CNC and when they are provided the food in home they share it with other household

members[52]. Though the findings of the research on 2 NNP upazillas can not be generalized for 109 upazillas, but these issues can be considered for monitoring and supervision to ensure the maximum benefits of the existing food supplementation program. Evidence shows that incentives or award for the staffs based on good performance have positive impact on the quality of service[50].

4.1.2 Intervention for underlying Causes

When we look at the underlying causes of undernutrition, the significant risk factors were found inadequate antenatal care and education for the mothers, inappropriate feeding practice of the children, food insecurity and poverty and scarcity of Health Care Providers.

4.1.2.1 Antenatal Care (ANC)

The coverage of ANC is secured by the existence of a fully operational health facility with sufficient functional equipments, trained health workers and also the awareness of the mothers, households and community. It has been found that those mother did not have any ANC visit or only one ANC visit, their children are vulnerable to undernutrition. In Bangladesh the antenatal Care services are provided by the Health and Family welfare Centres and community clinic that is within the Health and Family Planning Management unit. NNP has the provision of area based iron-folate supplementation activities during the antenatal period.

The reasons for poor ANC coverage in Bangladesh include both the shortage of health care providers as well as lack of awareness of the mothers and households. According to the BDHS survey, more than 70% of the mothers don't feel it is necessary and 25% mothers consider it as expensive. Other perceptions include expensive fee, don't know where to go, not permitted by household head and also the distance.

Who recommended that those countries have a shortage of trained delivery birth attendants , resources need to be channelled more effectively into training to produce a mix of health care providers with complementary skills and the traditional birth attendants can be built up to provide supportive care during the antenatal and postpartum periods[53]. This strategy can be used in context of Bangladesh as well.

According to the information of NNP evaluation report only 20% of the registered women received iron-folate supplementation. Most of the women don't come to the CNC to receive iron-folate. It is also uncertain that those who received iron-folate whether they consumed it. It indicates that there is a need for intervention among the women and the decision makers of households to increase the awareness about the importance of Antenatal care. In Srilanka there is an integrated maternal and child health and nutrition program [54] which provides a full range of services

during pregnancy including maternal care, weight monitoring, nutrition education and provision of mineral supplements (iron, folic acid, calcium, vitamin C). The education and counselling services are provided both at home and clinic. The services are provided by the midwives and family health workers (FHWs) through maintaining a network with the clinics and no user fees are charged. In addition, nutrition education messages are displayed in the clinic. The program is also highly accepted by the population. The example of success in Srilanka and other countries can be used to design effective strategy in Bangladesh to improve the ANC coverage.

4.1.2.2 Mother's Education

Women's education links mother's knowledge, socioeconomic status, empowerment etc. As there is compulsory primary education policy and free education opportunity for girls up to grade 10, the implementation needs more campaign and counselling. Majority of women in Bangladesh specially in rural areas are not sufficiently empowered to make decision on their own. Women may know what they should do, but they do not practice it.
NNP has counselling program for the adolescent girls to increase their social awareness that is implemented through a adolescent girl's forum. It can be expanded for the household members as well. That means, some sessions of adolescent forum can be planned for the household members. It is necessary to make them aware about the importance of girl's education and the free education opportunity for the girls. On the other side, compulsory education policy does not work in large scale if there are not sufficient education Institutes. All theses constraints can be minimized if education sector collaborate with NNP for the education activities. In Thailand the collaboration of Nutrition program with other sectors were made successful through monthly meeting with the different sectors and also due to the strong commitment of each line agency as the part of the nutrition program[50]. In many countries of Latin America stunting among the children reduced through the implementation of Nutrition Policy that focused on the mainstream nutrition with other sectors[21]. In Bangladesh, a food and nutrition policy was adopted in 1997 which needs to reanalyse to what extent the policy mainstreamed nutrition with other sectors and what are the major constraints of the implementation of the existing policy.

4.1.2.3 Feeding Practice

The results of the analysis showed that those children have not started breast feeding immediately afterbirth, they have higher risk of stunting (aOR:1.21; 95% CI:1.06-1.4) and wasting (aOR:1.22; 95% CI: 1.05-1.41). Similarly, those who were not fed colostrum they have risk of wasting (aOR:1.32; 95% CI:1.1-1.6) and underweight (aOR: 1.22; 95%

CI:1.03-1.46) . Introducing food before 6 months in addition to breast milk also found to be as a significant risk factor of undernutrition. Addressing these determinants, NNP is implementing BCC activities on breast feeding promotion in collaboration with Bangladesh Breast Feeding Foundation. The positive impact of the breastfeeding promotion activities reflected as the gradual improvement of exclusive breast feeding and colostrums feeding practice in the NNP areas. As breastfeeding promotion is a national priority for improving the nutritional status of the children it is essential to implement the existing intervention activities at national level beyond the NNP areas. A scoring done by WHO regarding the intervention activities on infant and young child feeding practices (IYCF) in Bangladesh indicates that there is a need of large scale intervention for the implementation of the national IYCF strategy[55]

Criteria	Results ✓ *Check that apply*		
	Yes	To some degree	No
11.1) All pregnant women have access to community-based support systems and services on infant and young child feeding.	2	1	0
		✓	
11.2) All women have access to support for infant and young child feeding after birth.	2	1	0
		✓	
11.3) Infant and young child feeding support services have national coverage.	2	1	0
		✓	
11.4) Community-based support services for the pregnant and breastfeeding woman are integrated into an overall infant and young child health and development strategy (inter-sectoral and intra-sectoral.	2	1	0
	✓		
11.5) Community-based volunteers and health workers possess correct information and are trained in counselling and listening skills for infant and young child feeding.	2	1	0
		✓	
Total Score:	**6/10**		

Figure 10: WHO scoring on IYCF intervention activities in Bangladesh (Sources used by WHO for scoring[efghijk])

Evidence shows that large scale coverage (99%) on appropriate breast feeding practice can significantly contribute to the reduction of morbidity among the children (36 months) that is the immediate cause of undernutrition. According to WHO recommendation, integration of IYCF services need to be integrated in the health system for large scale

[e] NNP project report
[f] Plan Bangladesh activity report
[g] Project document of Jibon O Jibika of SC-USA
[h] Project document of Access programme of SC-USA
[i] National IYCF strategy
[j] Saving New Born Lives Bangladesh programme evaluation, January 2004-SC-USA(NGO)
[k] Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a cluster-randomised controlled trial. *(Lancet* 2008; 371: 1936–44)

coverage. It needs to be prioritized as one of the elements of activities that are needed to strengthen the health system [56].

4.1.2.4 Food insecurity and Poverty

Food insecurity and household level poverty were found to be the major risk factors of undernutrition in Bangladesh. NNP has area based food security intervention program and income generation activities implemented in collaboration with WFP. The selected participants for the intervention are the vulnerable families who are of child bearing age, landless (less than 0.15 acres) and have a daily income less than taka 300 per head per month[14,57,58]. The packages of the intervention include food aid, training in income generating skills basic knowledge on nutrition, health and social issues and provision of micro-credit. Initially NNP included interventions on household vegetable gardens and poultry farms but due to implementation difficulties this component was discontinued in 2006.

According to NNP report, 96% of the ultra-poor VGD families received direct food-aid (30 Kg wheat/Atta per month for 24 months) in NNP upazillas in 2006[18]. Of them 58% had been engaged in income generating activities and 41% received nutrition services from the community nutrition centres. It seems within the intervention areas all the VGD families are not getting the benefits of the intervention. The possible reasons might be inadequate training or counselling given to the participants for developing their skills or inadequate monitoring and supervision of the activities.

Appropriate geographical targeting is important issue because some geographical areas are more vulnerable to poverty and food insecurity. For instance the char areas (river islands) and the coastal zones in the north part of the country are more vulnerable to food insecurity due to natural disasters and inadequate food production due to the soil conditions. Recently BBS has published the update poverty mapping of Bangladesh in assistance with World food program and World Bank. This mapping will create an opportunity to identify and target the vulnerable groups appropriately for intervention. There is an opportunity of NNP to expand the services in collaboration with WFP and ministry of LGRD and agriculture in those vulnerable areas.

There is also provision of micro credit scheme for the VGD population. However, limited information was found regarding the implementation in NNP areas. Weather based insurance could be another option to address poverty for the poor farmers. In Malawi, affordable index-based drought insurance for the poor farmers was found to be effective to make the farmers enable purchasing hybrid seeds, and thus greatly increase their productivity[59, 60]. In this scheme if rainfall is low to produce crops, then the insurance company provides loan and if rains are good, farmers are

expected to pay back the loan from the profits of their harvest. In Bangladesh some NGOs also provide disaster insurance in small scale. If all the small scale projects are be integrated together with NNP it is likely to achieve successful implementation.

4.2 Coverage of the NNP services

NNP delivers area based nutrition services 109 upazillas out of 508 upazillas[18]. It indicates that the coverage for the nutrition program is about 25% of the population where more than 40% infant and young children are undernourished and half of the population are living below the national poverty line. Evidence shows that large scale coverage of all nutrition related intervention can significantly contribute in reducing undernutrition[49].

Table 14: Effect of all nutrition related interventions on stunting in 36 countries by coverage level

Coverage	**Reduction in Prevalence of stunting**	
	12 months	**24 months**
99% coverage with all interventions	33.1%	35.8%
90% coverage with all interventions	31.1%	32.4%
70% coverage with all interventions	22.7%	24.1%

(Source: Lancet 2008)

To increase the coverage it is essential to mainstream the nutrition in all the sector as discussed earlier. In addition, there are several small scale nutrition programs, that can be integrated with NNP services. In Peru the National Nutrition program is integrated with several sub nutrition program to provide the nutrition service at national level[61]. Though it is not clear to what extent this strategy contributed to increase the coverage, but it can be used as a sample strategy to improve the implementation at national level.

4.3 Health Services

It is found that there is a severe shortage of Health Care services in Bangladesh. To address this problem it is important to share the experiences of the other countries which were succeeded to solve this problem within the available resources. For example, in Thailand, to increase the Health workforce in rural areas, rural health infrastructure development was prioritized as part of an integrated national rural development project [62]. When there was staff shortage occurred due to

migration, the Govt. enforced compulsory contracts with medical students to perform three years of public work after graduation or face high fines[62]. The similar strategy can be used in context of Bangladesh. There is also a need of adequate budget allocation to increase the number of Training Institutes.

To minimize the out of pocket payment expenditure, health insurance scheme can be introduced through risk pooling strategy from rich to poor. In most of the developed countries the Health service coverage is universal because they included the mechanism of risk pooling strategy with an appropriate mix of young, old, rich, poor, healthy, and sick, so that the health care costs are affordable for all.

To allocate resources more efficiently in urban and rural areas, recently an action plan has been developed for decentralization of the HRM functions at the Upazilla levels. Though, it is not implemented yet. Evidence shows that to secure the positive impact of decentralisation of HRM functions requires an enabling environment such as management training, changes in bureaucratic procedures and appropriate preparation in structures and staffing[63,64] Therefore it is necessary to justify whether the capacity of the management system is adequate to adapt with the new roles of decentralization. It is still possible to ensure the basic health and nutrition services for all people within the current centralized system, if a strong commitment can be built up among all the stakeholders.

5. Chapter V

5.1 Conclusion and recommendations:

From the above discussion and analysis it is evident that determinants of undernutrition are complex in context of rural Bangladesh. It requires a multi-sectoral collaboration through health, agriculture, rural development, water and sanitation, education and community. To achieve this, a national nutrition policy and strategic plan with clear terms of reference is needed that put nutrition as a central development agenda for the country. To ensure implementation of the policy and the strategic plan at national level, the operational framework for intervening on nutrition by individual sector needs to be well defined.

As undernutrition is concentrated among the poor segments, appropriate targeting of specific groups needs to be ensured using the poverty map of the country. The upazillas which are not currently served by NNP, it is important to think about how to expand the intervention in those areas specially where most of the poor people reside. The expansion of key nutrition interventions can be done at national level through mainstreaming nutrition as a component of PHC within the health services. This can be done by integrating NNP services into the PHC system rather putting it as a separate vertical program. There are several small scale projects on nutrition related interventions implementing by the NGOs and private sectors. These projects are often overlapping the geographical areas while other areas are not targeted for any intervention. If a national network is built to conduct large scale programs in combination with all those small scale projects, it is likely to achieve the national level coverage within the available financial resources.

To promote hygiene and sanitation, counselling and campaign activities can be implemented in collaboration with the water and sanitation program of LGRD. Network can be built with other NGOs who have intervention activities on hygiene and sanitation.

Bangladesh has fertile land for agriculture. As production of micronutrient enriched foods are not sufficient, efforts can be focussed on increasing the production of micronutrient enriched foods by the agriculture sector. There are some private and multinational company which are investing a huge amount of financial resources on formula milk or tin milk. There is an opportunity to motivate these stakeholders for investing their money on micronutrient enrich food production instead of investing on tin milk. In rural Bangladesh majority of the labour force earn their livelihood from the agriculture sector. Weather based insurance scheme can be introduced for those poor farmers as part of income generation intervention program. If the weather is not favourable for producing agriculture they can be supported by providing loan. When the weather becomes fine for the cultivation then they will give back the money.

Strong motivation and campaign is necessary to encourage the women and community for going to school. Counselling need to be targeted the decision maker of the households, the girls and the community. If the education sector shares the responsibility of improving nutrition through education and counselling program with NNP, the implementation is likely to be achievable at large scale.

Monitoring and supervision need to be strengthened to achieve maximum benefits of the intervention activities. Award for good performance of the community worker and Area manager could be introduced to improve the quality of the services.

The health status of the mothers and children is closely linked with the nutritional status of the children. Accessibility of health care services for all the children and their mothers needs to be assured. This can be done by several ways as described below:

- Health Insurance scheme through risk-pooling mechanism can be developed to ensure the services for the poor. It would also be effective to minimize the financial risk of the Govt.

- Allocating more budget to increase the number of health workers. To retain the Health workforce in rural areas rural health infrastructure development can to be prioritized. This can be implemented as part of national rural development project. To implement this, financial resources can be secured by minimizing the budget for urban development infrastructure until the target achieved.

- Bangladesh has enough human resources. If they are given training and guided appropriately it will compensate the shortage of human resources as well as create employment opportunity for them. Resources can be channelled into training to produce a mix of health care providers with complementary skills to provide supportive care during the antenatal and postpartum periods. To provide leadership and strengthen the capacity of the management system, it is necessary to produce more experts on health and nutrition. This can be done by building more training Institutes on health and nutrition. It can be implemented through adequate budget allocation and increasing collaboration with development partners.

We know who are the victims by undernutrion and where they are living. The requirement is just to build a strong commitment between the stakeholders and different sectors to make the services reachable to the affected population.

5.2 Limitations of the study

- The analysis was done based on some limited proxy indicators.
- In this thesis two important determinants (immunization status and Mothers Nutrition knowledge) have not been analyzed. As these two determinants are quite broad issue, an in-depth analysis of these two indicators could be considered for future.
- Some of the information regarding food supplementation and food security intervention activities were analysed based on the report of NNP- contracted NGOs.

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Annex: 1

Undernutrition

The three anthropometric indicators of undernutrition among the under 2 children include stunting, wasting and underweight.

Stunting: It is the process of failure to reach linear growth potential (length for age) due to inadequate nutrition or poor health. If the z score of length for age, is below -2 standard deviations (-2SD) of the median according to the WHO growth standard, then the child is considered as stunted. It is the reflection of past growth failure and chronic umdernutrition.

Wasting: Wasting results if a child does not gain sufficient weight for length due to inadequate nutrition or poor health. If the z score of weight for height is below -2 standard deviations (-2SD) of the median according to the WHO growth standard, then the child is considered as stunted. It is an indicator of short term undernutrition.

Underweight: Underweight is measured based on the weight for age. If the z score of weight for age is below -2 standard deviations (-2SD) of the median according to the WHO growth standard, then the child is considered as stunted. It indicates both short term and long term undernutrition.

Sanitation

Toilet facilities that ensure hygienic separation of human excreta from human contact are considered as improved sanitation facilities. These include flush or pour-flush toilet/latrine with piped sewer system or septic tank, pit latrine with slab or improved ventilation.

Facilities that do not ensure hygienic separation of human excreta from human contact are considered as unimproved facilities including pit latrines without a slab or platform, hanging latrines and bucket latrines.

Improved drinking water: Sources of drinking water are considered improved if they are protected from outside contamination, particularly faecal matter. These include piped water in a dwelling, plot or yard, and other improved sources e.g., public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection.

Annex: 2

	N	% Stunted	OR	95%CI	N	% Wasted	OR	95%CI	N	% Underweight	OR	95%CI
Demography												
Age (months)												
0-5	1849	19.6	1	1	1849	10.6	1		1849	22.9	1	
6-11	2592	33.6	2.07*	1.8-2.4	2593	12.8	1.24*	1.03-1.5	2592	30.4	1.47*	1.3-1.7
12-23	4377	54.7	4.97*	4.4-5.7	4377	19.5	2.05*	1.7-2.4	4377	45.1	2.77*	2.5-3.1
Missing	1						P<0.000		1			
			P<.001								P<.001	
Sex												
Male	4429	43.8	1		4429	16.8	1		4429	38.4	1	
Female	4390	38.5	0.80*	0.7-0.9	4390	14.5	0.84*	0.8-0.9	4390	33.8	0.82*	0.8-0.9
			P<0.001				P=0.003				P<0.001	
Household Wealth Index												
Lowest Quintile	1832	53.9	1		1833	21.9	1		1832	49.5	1	
Second Quintile	1752	45.8	0.72*	0.6-0.8	1753	18.1	0.79*	0.7-0.9	1752	43.8	0.72*	0.6-0.8
Middle	1740	44.3	0.68*	0.6-0.8	1740	15.5	0.65*	0.5-0.8	1741	37	0.68*	0.6-0.8
Fourth	1780	36.2	0.49*	0.4-0.6	1780	12.8	0.52*	0.4-0.6	1780	29.6	0.49*	0.4-0.6
Highest Quintile	1713	24.7	0.28*	0.2-0.3	1713	9.7	0.38*	0.3-0.5	1713	19.8	0.28*	0.2-0.3
Missing	2						p<0.001				P<0.001	
			P<0.001									
Food Insecurity												
Yes	2500	50.6	1.72*	1.6-1.9	2501	20.3	1.58*	1.4-1.8	2501	51	1.85*	1.7-2.04
No	6318	37.4	1		6318	13.9	1		6318	36.6	1	
Missing	**1**											
			P<0.001				P<0.001				P<0.001	

* if p<0.05

Morbidity history	**N (8819)**	**% Stunted**	**OR**	**95%CI**	**N (8819)**	**% Wasted**	**OR**	**95%CI**	**N (8819)**	**% Underweight**	**OR**	**95%CI**
Diarrhoea	1522	48.1	1.41*	1.3-1.6	1522	20.0	1.44*	1.3-1.7	1522	45.7	1.63*	1.5-1.8
Yes	7297	39.7	1	1	7297	14.8	1		7297	34.1	1	
No			P<0.001				P<0.001				P<0.001	
Dysentery	1359	42.3	1.06	0.9-1.2	1259	17.8	1.198*	1.0-1.4	1359	38.6	1.13*	1.0-1.3
Yes	7460	40.9			7460	15.3	1		7460	35.7	1	
No												
			P=0.34				P=.02				P=0.039	
Fever caugh & Cold												
Yes	6540	40.9	0.97	0.9-1.1	6540	16.2	1.18	1.0-1.4	6540	36.7	1.11*	1.01-1.2
No	2279	41.7	1		2279	14.0	1		2279	34.3	1	
			P=0.50				P=0.014				P=0.35	
Pneumonia												
Yes	537	46.4	1.25*	1.1-1.5	537	20.3	1.40*	1.1-1.7	538	44.2	1.44*	1.2-1.7
No	8282	40.8	1		8282	15.4	1		8281	35.6	1	
			P=0.012				P=0.003				P<0.001	
Ear Infections												
Yes	454	51.0	1.52*		453	17	1.11	0.9-1.4	453	44.4	1.44*	1.2-1.7
No	8365	40.6	1	1.3-1.8	8366	15.6	1		8366	35.6	1	
			P<0.001				P=0.404				P<0.001	
Eye Infections												
Yes	437	46.1	1.33*	1.1-1.6	467	13.5	0.83	0.64-1.1	466	37.3	1.06	0.9-1.3
No	8352	40.9	1		8352	15.8	1		8353	36	1	
			P=0.003		1		P=0.190				P=0.588	
Skin Disease												
Yes	1246	44	1.24*	1.0-1.4	1246	16	1.03	0.9-1.2	1246	39.3	1.17*	1.0-1.3
No	7573	40.7	1		7573	15.6	1		7573	35.6	1	
			P=0.025				P=0.681				P=0.011	

Caring Practice	**N (8819)**	**% Stunted**	**OR**	**95%CI**	**N (8819)**	**% Wasted**	**OR**	**95%CI**	**N (8819)**	**% Underweight**	**OR**	**95%CI**
Feeding practice												
Early Initiation of BF												
Immediately After Birth	2648	38.3	1		2648	13.1	1		2648	32.5	1	
Within 24 hours of Birth	4381	41.9	1.16*	1.1-1.3	4380	16.8	1.35*	1.2-1.6	4380	37.9	1.27*	1.14-1.40
After 24 hours of Birth	1750	43.5	1.24*	1.1-1.4	1749	16.6	1.32*	1.1-1.6	1749	37.2	1.23*	1.08-1.39
Missing	40				42				42			
			P=.001				P<0.001				P<0.001	
Colostrum												
Yes	8181	40.5	1		8181	15.1	1		8180	35.3	1	
No	638	49.5	1.45*	1.2-1.7	638	23.4	1.71*	1.4-2.1	638	46.4	1.59*	1.4-1.9
			P<0.001				P<0.001		1			
Age of Introduction of any food in addition to breast milk												
Between 4 months	4032	43.3	1.54*	1.3-1.8	4032	15.4	0.89	0.8-1.05	4032	37.9	1.30*	1.1-1.5
Between 4 to 6 months	3178	43.5	1.55*	1.4-1.8	3178	16	0.93	0.8-1.1	3178	36.8	1.24*	1.1-1.4
After 6 months	1299	33.2	1		1300	17	1		1299	32.0	1	
Missing	310				310				310			
			P<0.001				P=0.361				P=0.001	
Continuing BF at survey period												
Yes	8477	40.8	1.41*	1.1-1.8	8477	15.6	1.12	0.8-1.5	8477	36.1	1.04	0.8-1.3
No	342	49.4	1		342	17.3	1		341	37	1	
			P=0.002				P=0.443		1		P=0.747	

Sought treatment for recent illness	**N (8819)**	**% Stunted**	**OR**	**95%CI**	**N (8819)**	**% Wasted**	**OR**	**95%CI**	**N (8819)**	**% Under-weight**	**OR**	**95%CI**
Didn't seek treatment	1669	43.4	0.99	0.9-1.1	1668	13.9	0.73*	0.6-0.9	1669	37.3	0.89	0.8-1.0
Qualified Doct.Govt	425	42.6	0.95	0.8-1.2	425	16.7	0.91	0.7-1.2	425	35.1	0.81*	0.7-1.0
Paramedics Govt.	9	55.6	1.41	0.4-5.3	9	11.1	0.78	0.1-5.0	9	33.3	0.81	0.2-3.2
NGO Clinic	32	40.6	0.89	0.4-1.8	32	16.1	0.93	0.4-2.4	32	37.5	0.95	0.5-1.9
Pvt.Qualified Doct.	958	33.4	0.65*	0.6-0.8	958	17.4	0.96	0.8-1.2	958	34.6	0.79*	0.7-0.9
Paramedics(pvt)	31	58.1	1.84	0.9-3.7	31	12.5	0.65	0.2-1.9	31	41.9	1.09	0.5-2.2
Pharmacy/ Vill. Doct.	3066	43.7	1		3065	18.1			3066	40.0		
Homeopathy	1001	36.1	0.73*	0.6-0.8	1001	11.7	0.60*	0.5-0.7	1001	30.7	0.66*	0.6-0.8
Traditional Healers	120	64	1.45	1.0-2.1	120	15.0	0.82	0.5-1.4	120	38.3	0.93	0.6-1.3
Others	58	14	0.42*	0.2-0.8	57	14.0	0.77	0.4-1.6	57	22.4	0.43*	0.3-0.8
Missing	1450				1453				1450			
			P<0.001				P<0.001				P<0.001	
Caring of the Mothers												
Number of ANC												
No Visit	4454	39.8	1.78*	1.6-2.01	4454	15.4	1.63*	1.37-1.93	4454	46	1.85*	1.66-2.08
Single Visit	1377	34.6	1.43*	1.2-1.7	1377	12.6	1.29*	1.04-1.61	1377	39.8	1.44*	1.24-1.67
Two visits	1117	32.1	1.28*	1.1-1.5	1117	12	1.21	0.96-1.54	1117	35.9	1.22*	1.04-1.43
3 or more visits	1871	27	1		1871	10	1		1871	31.5	1	
			P<0.000								P<0.001	
Mothers Edu.												
No Education	3019	43.6	1		3019	17.1	1		3019	50.5	1	
Primary Incomplete	1636	37.3	0.78*	0.7-0.9	1636	13.3	0.75*	0.63-0.88	1636	43.2	0.75*	0.66-0.84
Primary Complete	1253	34.7	0.69*	0.6-0.8	1253	14	0.78*	0.65-0.94	1253	39.6	0.64*	0.56-0.73
SecondaryIncomplete	2293	28.3	0.51*	0.5-0.6	2293	9.9	0.53*	0.45-0.63	2292	32.1	0.46*	0.41-0.52
Secondary & Above	618	16.2	0.25*	0.2-0.3	618	7.3	0.38*	0.28-0.52	618	19.6	0.24*	0.19-0.30
Missing									1			
			P<0.001				P<0.001				P<0.001	

Environmental factors	**N**	**% Stunted**	**OR**	**95%CI**	**N**	**% Wasted**	**OR**	**95%CI**	**N**	**% Underweight**	**OR**	**95%CI**
Toilet facility used												
Septic tank Modern Latrine	412	17.2	0.40*	0.3-0.5	412	9	0.63*	0.45-0.90	412	22.1	0.41*	0.33-0.53
Slab latrine	1029	25.5	0.66*	0.6-0.8	1029	10.1	0.71*	0.58-0.89	1029	29.5	0.61*	0.53-0.71
Pit latrine	4657	34.3	1		4656	13.6	1		4657	40.7	1	
Hanging Latrine	273	44	1.50*	1.2-1.9	274	15	1.12	0.80-1.58	273	50.4	1.48*	1.16-1.89
Open latrine	1552	43.4	1.47*	1.3-1.7	1553	15.8	1.19*	1.01-1.40	1552	46.7	1.28*	1.14-1.44
Bush Field Yard	843	44.2	1.52*	1.4-1.4	843	14.4	1.06	0.86-1.31	843	49.7	1.44*	1.24-1.67
Others	53	28.3	0.74	0.4-1.4	52	5.8	0.42	0.14-1.30	53	30.8	0.65	0.36-1.17
			P<0.001				P<0.001				P<0.001	
Source of Drinking water												
Tap(pipe)	73	17.8	0.395*	0.2-0.8	73	8.2	0.582	0.25-1.34	73	21.9	0.416*	0.24-0.72
Tubewell	8482	35.4	1		8482	13.5	1		8482	40.9	1	
Ring Well	80	31.3	0.84	0.5-1.4	80	15	1.12	0.60-2.08	80	40	0.95	0.61-1.49
Pond	83	37.3	1.08	0.7-1.7	83	11.1	0.78	0.39-1.57	83	38.6	0.90	
Ditch/Canal Lake	18	44.4	1.51	0.6-3.9	18	16.7	1.27	0.36-4.42	18	50	1.49	0.59-3.76
River/Fountain	38	42.1	1.30	0.7-2.5	38	7.7	0.46	0.13-1.64	38	46.1	1.22	0.65-2.31
Rain water	5	20	0.29	0.02-3.9	5	0	0.00	0.00	5	40	0.76	0.12-4.91
Others	40	30	0.81	0.4-1.6	40	12.1	0.85	0.33-2.21	40	29.2	0.61	0.31-1.20
			P=0.086				P=0.788				P=0.069	