Trends and predictors of diarrhoea and acute respiratory infection and their association with infant feeding practices in South Asia: Nation-wide cross-sectional surveys.

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Dedication

I would like to dedicate this thesis to my son, Julquarnain Akbar, and to my daughter, Raphaela Akbar who have made me stronger, better and more fulfilled than I could have ever imagined.

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Author's Declaration

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

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(Signature)

Abstract

Childhood diarrhoea and acute respiratory infection (ARI) remain a major cause of morbidity and mortality worldwide, especially in many parts of the world including South Asia. These illnesses are known to occur most frequently under circumstances of poor environmental sanitation and hygiene, inadequate water supplies, and poverty. In most South Asian countries, the control of diarrhoeal disease, including promotion of breastfeeding, oral rehydration therapy and specific health education has been a part of national strategies aimed at improving the quality of life and reducing the burdens caused by these diseases. Data from the most recent Demographic and Health Surveys of four south Asian Countries (Bangladesh, India, Pakistan and Nepal) were utilised in this thesis to conduct multivariate modelling for all analyses. This thesis first examines the socio-demographic and other factors associated with childhood diarrhoea and acute respiratory infection in each of the four countries. The thesis then explores trends and predictors of childhood diarrhoea and acute respiratory infection (ARI) in two of the four countries. Finally, the thesis further examines the association of childhood diarrhoea with infant and young child feeding practices in south Asia.

Chapter 5 presents the results of analysis of factors associated with childhood diarrhoea and ARI in Bangladesh. Significant factors from this analysis include limited or lack of maternal education, children in older age bracket, stunted children, household poverty. **Chapter 6** presents the results of analysis of factors associated with childhood diarrhoea and ARI in India. Significant factors from this analysis include children living in the South region, male children, limited access to the mass media and unimproved sources of drinking water. **Chapter 7** presents the results of analysis of factors associated with childhood diarrhoea and

ARI in Pakistan. Significant factors from this analysis include young mothers, children perceived to be small at birth, underweight children, and children resident in the North West Frontier region. **Chapter 8** presents the results of analysis of factors associated with childhood diarrhoea and ARI in Nepal. Significant factors from this analysis include formerly married mothers, children living in households with unimproved toilet facilities, household poverty and children living in the Far West region. **Chapters 9** and **10** present the results of analysis of trends of childhood diarrhoea and ARI in Bangladesh and Nepal respectively. Both childhood diarrhoea and ARI appear to prevail in children from poor households, and declines in prevalence of these diseases still persist in the two countries. **Chapter 11** presented the association of infant and young child feeding practices with childhood diarrhoea and found that children whose mothers put them to the breast within the first hour after they were born, children who were exclusively breastfed and those whose mothers did not practise predominant breastfeeding were associated with decreased likelihood of diarrhoea.

This study suggests the need for a comprehensive (or multifaceted) interventions which involves the adoption of social protection policies such as cash transfer programs and education interventions to reduce childhood diarrhoea and ARI especially among socioeconomically disadvantaged groups in four South Asia countries (Bangladesh, Nepal, India Pakistan) thus, setting these countries on its path to achieving the post-2015 sustainable development goals of improving health.

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Abbreviations

ARI	Acute Respiratory Infection
AIDS	Acquired Immune Deficiency Syndrome
ALRI	Acute Lower Respiratory Illness
BPL	Below Poverty Line
BSS	Bangladesh Bureau of Statistics
CAFE	Computer-Assisted Field Editing
CAPI	Computer-Assisted Personal Interviewing
CDD	Childhood Disintegrative Disorder
CEB	Census Enumeration Block
CI	Confidence Interval
DHS	Demographic and Health Survey
EA	Enumeration Area
FATA	Federally Administered Tribal Areas
GLLAMM	Generalized Linear Latent and Mixed Model
HIV	Human Immunodeficiency Virus
ICDDR,B	International Center for Diarrheal Disease Research, Bangladesh
ICDS	Integrated Child Development Services
IFSS	Internet File Streaming System
IYCF	Infant and Young Child Feeding
LRI	Lower Respiratory Tract Infection
MDG	Millennium Development Goals
NFHS	National Family Health Survey
NIPORT	National Institute of Population Research and Training
NPHC	National Population and Housing Census
NIPS	National Institute of Population Studies
OR	Odds Ratio
ORS	Oral Rehydration Salt
PBS	Pakistan Bureau of Statistics
PPS	Proportional to Population Size
PSU	Primary Sampling Unit
RVI	Respiratory Virus Infection
SDG	Sustainable Development Goal
SES	Socio Economic Status
SMA	Statistical Metropolitan Area
TWG	Technical Working Group
URI	Upper Respiratory Tract Infection
UNAIDS	United Nations Programme on HIV and AIDS
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Introduction and statement of the problem

Childhood diarrhoea and Acute Respiratory Infection (ARI) in children are two important childhood diseases that often lead to morbidity and mortality in children [1-3], especially in developing countries [4]. This chapter first presents backgrounds for both childhood diarrhoea and ARI, as well as the overview of the two diseases. It then presents the research questions posed in the thesis. The chapter further states the general objective of the thesis as well as the specific objectives. This is followed by justification of the specific objectives of the thesis. The section that follows gives a description of the south Asia region, as well as description of the countries studied in the thesis: Bangladesh, Pakistan, India and Nepal. The next section presents the definition of key terms of this study. This is followed by how the thesis is organised. The last section summarises the chapter.

1.2 Diarrhoea

Diarrhoeal disease is thought to be the second leading cause of death among children aged less than five years and accounts for the deaths of approximately 760,000 children each year [4]. It mostly results from contaminated food and water sources. Globally, 780 million individuals lack access to improved drinking water, and 2.5 billion lack improved sanitation[4]. Duration of diarrhoea can be up to several days, and can deplete the body of the water and salts needed for survival. Most deaths due to diarrhoea are as a result of severe dehydration and fluid loss. During a diarrhoeal episode, water and electrolytes (sodium, chloride, potassium and bicarbonate) may be

lost through liquid stools, vomit, sweat, urine and breathing. When these losses are not replenished, it may lead to dehydration. The level of dehydration is rated on a scale of three: (1) Early dehydration - for this, there are no signs or symptoms, (2) Moderate dehydration - this is accompanied by thirst, restless or irritable behaviour, decreased elasticity of the skin, and sunken eyes, (3) Severe dehydration – this is accompanied by more severe symptoms, and shock, with diminished consciousness, lack of urine output, cool, moist extremities, a rapid feeble pulse, low or undetectable blood pressure, and pale skin. Severe dehydration can lead to death if body fluids and electrolytes are not replaced, either through the use of oral rehydration salts (ORS) solution or through an intravenous drip. Individuals who are most at risk of life-threatening diarrhoea are children who have impaired immunity and are malnourished, as well as people who are infected with the HIV virus.

Diarrhoea is one of the symptoms of an infection of the intestinal tract. Among the main causes of intestinal tract infection include a variety of bacterial, viral and parasitic organisms, most of which are spread by faeces-contaminated water. Infection is all the more predominant when there is inadequate sanitation and unhygienic water for drinking, cooking and cleaning. The two most common etiological agents of diarrhoea in developing countries are *Rotavirus* and *Escherichia coli*.

Diarrhoea takes three clinical forms, namely, (i) acute watery diarrhoea – this may last for several hours or days, and may even include cholera. (ii) acute bloody diarrhoea – also known as dysentery. (iii) persistent diarrhoea – this may last for fourteen days or longer.

Diarrhoeal disease may also spread from person-to-person, accelerated by poor personal hygiene. Another major cause of diarrhoea is food. When food is prepared or stored in unhygienic conditions, it can cause diarrhoea when consumed. Water can contaminate food during irrigation. Fish and seafood from polluted water may also contribute to the disease.

A number of measures may be taken to prevent the occurrence of diarrhoea. These include: access to potable water, use of improved sanitation, washing hands with soap, exclusively breastfeeding a child for the first six months of life, maintaining good personal and food hygiene, embracing health education about how infections are propagated, and receiving rotavirus vaccinations.

In the event of a diarrhoea episode, a number of measures could be taken to offer treatment. These include: (a) Rehydration - with ORS solution, which is a mixture of clean water, salt and sugar. It costs a few cents per treatment and is absorbed in the small intestines; and replaces the water and electrolytes lost in the faeces. Since 2004, UNICEF and the WHO have recommended treating childhood diarrhoea by replacing lost fluids with oral rehydration therapy [5]. (b) Zinc supplements - these reduce the duration of a diarrhoea episode by 25%, and are associated with a 30% reduction in stool volume(c) Rehydration - with intravenous fluids in case of severe dehydration or shock (d) Nutrient-rich foods - the vicious circle of malnutrition and diarrhoea can be broken by continuing to give nutrient-rich foods – including breast milk - during an episode, and by giving a nutritious diet - including exclusive breastfeeding for the first six months of life - to children when they are well (e) Consulting a health professional -

in particular, for management of persistent diarrhoea, when there is blood in the stool or if there are signs of dehydration.

1.2.1 Acute Diarrhoea in Early Life

In younger children acute diarrhoea may lead to severe dehydration. Fluid loss and dehydration are the cause of death in nearly all children with acute diarrhoea. Over three decades ago, the discovery of mechanisms of intestinal electrolytes transport, which was the basis for the development of oral treatment of dehydration, was hailed as the most important medical advance of the 20th century [6]. Complications can be prevented by the early and adequate oral administration of a rehydration solution, by normal food for the child's age, and through induction of beneficial intestinal microbiota composition (4). The evidence-based guidelines of the ESPGHAN and Cochrane analyses, based also on studies reported in this manuscript, indicate zinc and probiotics as useful therapeutic aids for children younger than 3 years with acute diarrhoea [7-11].

1.2.2 Chronic Diarrhoea in Early Life

Chronic diarrhoea in early life includes a group of rare chronic enteropathies characterized by a heterogeneous aetiology, which in most cases is related to an identified or to an as yet unidentified genetic defect, generally inherited as an autosomal recessive trait. These congenital diarrheal disorders represent one of the most challenging clinical conditions for paediatric gastroenterologists because of the severity of the clinical picture and the broad range of conditions in its differential diagnosis [12]. Early in life, patients affected by CDD usually present with severe diarrhoea that within a few hours leads to a life-threatening condition secondary to massive dehydration and metabolic acidosis [12]. Consequently, children affected by

CDD require a prompt diagnosis and assistance. Clinical manifestations are variable from severe conditions leading to intestinal failure, to milder forms with subtle clinical signs that may remain undiagnosed until adulthood, when patients have just developed irreversible complications. Intestinal failure may lead to the necessity of total parenteral nutrition with further complications for the health of the subject affected by these disorders. The number of conditions included within the CDD group has gradually increased over the years [12]. Now it is clear that CDD depends on defects in the structure and function of absorptive, enteroendocrine or inflammatory cells of the gut, determined by mutations in genes expressed throughout the gastrointestinal tract involving different segments and different cells.

1.2.3 Overview of Childhood Diarrhoea

Globally, diarrhoea has been reported to kill children more than Acquired Immune Deficiency Syndrome (AIDS), malaria and measles [13]. One in nine child deaths worldwide is attributed to diarrhoeal diseases, which makes diarrhoea the second leading cause of death among under-5 children. Diarrhoea is even more deadly for children with human immunodeficiency virus (HIV). For such children, the death rate is 11 times higher than the rate for those without HIV [14]. These sobering statistics notwithstanding, efforts made over the last two decades have revealed that, in addition to rotavirus vaccination and breastfeeding, prevention of diarrhoea focused on safe water and improved hygiene and sanitation is not only possible but cost effective: every $1 invested yields an average return of $25.50[15].About 88% of diarrhoea-associated deaths are attributable to unsafe water, inadequate sanitation, and insufficient hygiene [16, 17].

1.3 Acute Respiratory Infection

Acute respiratory infection is an infection that may interfere with normal breathing, and usually begins as a viral infection in the nose, trachea (windpipe), or lungs. If the infection is not treated, it can spread to the entire respiratory system[18]. Acute respiratory infections are infectious, that is, they can spread from one person to another. The disease is quite widespread. It is particularly dangerous for children, older adults, and people with immune system disorders [18].

While some causes of ARI are not known, a few have been identified: (1) Adenoviruses are a class of microorganisms that can cause acute respiratory infection. Adenoviruses consist of more than 50 different types of viruses known to cause the common cold, bronchitis, and pneumonia (2) Pneumococcus is a type of bacterium that causes meningitis. It can also trigger certain respiratory illnesses like pneumonia (3) Rhinoviruses are the source of the common cold. Colds are uncomplicated in most cases. However, in the very young, older adults, and those with a weak immune system, a cold can lead to acute respiratory infection[18].

Although it is almost impossible to avoid viruses and bacteria, certain risk factors increase an individual's chances of developing ARI. The immune systems of children and older adults are more prone to being affected by viruses. Because of their constant contact with other kids who could be virus carriers, children are especially at risk. Furthermore, children often do not wash their hands regularly; they rub their eyes and put their fingers in their mouths, resulting in the spread of viruses. Individuals with heart disease or other lung problems are more likely to contract an ARI. Anyone whose

immune system might be weakened by another disease is at risk. Smokers also are at high risk and have more trouble recovering [19].

Early symptoms of ARI usually appear in the nose and upper lungs. The symptoms include: congestion, either in the nasal sinuses or lungs, runny nose, cough, sore throat, body aches and fatigue. There may be high fever and chills if the disease advances. Other serious symptoms are: difficulty in breathing, dizziness, low blood oxygen level and loss of consciousness [18].

Doctors usually focus on a patient's breathing during a respiratory examination. Fluid and inflammation in the lungs are checked for, by listening to a patient's breath sounds in the lungs. The doctor may peer into the patient's nose and check their throat. If detected early, over-the-counter medications can help alleviate symptoms while the virus runs its course. However, if the infection is advanced, an X-ray or CT scan may be necessary to check the condition of the lungs. Lung function tests have been useful as diagnostic tools. Pulse oximetry, also known as pulse ox, can check how much oxygen gets into the lungs. A physician may also need a sputum (material coughed up from the lungs) sample to check for the type of virus causing the disease [20].

With many viruses, there are no known cures. A doctor may prescribe medications to manage a patient's symptoms, while monitoring their condition. If the viral infection results in a secondary infection caused by bacteria, tests will help the patient's doctor determine the appropriate type of antibiotic to use [20].

Complications of ARI are extremely serious and can result in permanent damage, and even death. They include: respiratory arrest, respiratory failure and congestive heart failure [21].

Most causes of an acute respiratory infection are not treatable. Therefore, prevention is the best method to ward off harmful respiratory infections. Individuals are advised to practice good hygiene by doing the following: (1) Wash hands frequently, especially after using a public place of convenience (2) Always sneeze into the arm of their shirt, or in a tissue. Although this may not ease one's own symptoms, it will prevent them from spreading infectious diseases (3) Avoid touching one's face, especially their eyes and mouth, in order to prevent introducing germs into their system. Avoidance of smoking and making sure to include plenty of vitamins in one's diet, such as vitamin C, which helps boost the immune system is paramount to prevention of ARI [21].

1.3 Overview of Acute Respiratory Infection

Acute respiratory infections (ARIs) are classified as upper respiratory tract infections (URIs) or lower respiratory tract infections (LRIs). They kill an estimated 3.9 million individuals annually, and in developing countries, are the leading causes of mortality in children under five years of age [13]. Major contributions to the burden of this disease include specific respiratory virus infections (RVIs), such as influenza and respiratory syncytial virus (RSV).

A recent systematic review estimated that, worldwide, in 2010, 11.9 million episodes of severe and 3 million episodes of very severe acute lower respiratory illness (ALRI) resulted in hospital admissions in young children [22]. The authors used hospital-based studies to estimate that approximately 265,000 in-hospital deaths and a fourfold

greater number of out-of-hospital deaths occurred in young children, with 99% of these deaths in developing countries. Among ALRI syndromes, respiratory viruses have been detected by molecular diagnostic techniques in 43–67% of CAP cases in children [23] over 90% of bronchiolitis cases in infants, and approximately 85% of asthma exacerbations in children. In adults, approximately 20–40% of CAP cases, up to 80% of asthma exacerbations and 20–60% of chronic obstructive pulmonary disease exacerbations are linked to RVIs. Preceding RVIs are significant predisposing events to secondary bacterial infections in the lung and other sites in the respiratory tract [24, 25], and are likely precipitating factors in syndromes affecting other organ systems (cardiac ischemia, myocardial infarction, congestive heart failure, venous thromboembolism, stroke and loss of diabetic control) [23, 26-31]. This 'hidden' burden of RVIs is not well appreciated, especially in low-resource settings where it may be disproportionately high.

1.4 Infant and Young Child Feeding Practices

Globally, it is estimated that undernutrition is associated with about 2.7 million child deaths annually or 45 % of all child deaths [32]. One key area for improving child survival and promoting healthy growth and development is Infant and Young Child Feeding (IYCF) [33]. The first 2 years of a child's life are particularly important, as optimal nutrition during this period lowers morbidity and mortality, reduces the risk of chronic disease, and fosters better development overall [34]. Optimal breastfeeding is so critical that it could save the lives of over 800 000 children under the age of 5 years each year[35].

The World Health Organisation (WHO) and United Nations Educational, Scientific and Cultural Organization (UNICEF) recommend that: 1) early initiation of breastfeeding within 1 hour of birth, 2) exclusive breastfeeding for the first 6 months of life and 3) introduction of nutritionally adequate and safe complementary (solid) foods at 6 months together with continued breastfeeding up to 2 years of age or beyond [36]. However, many infants and children do not receive optimal feeding. For example, only about 36% of infants aged 0–6 months worldwide were exclusively breastfed over the period of 2007-2014.

1.4.1 Breastfeeding

Exclusive breastfeeding for 6 months has many benefits for the infant and mother. Key among these is protection against gastrointestinal infections which is observed not only in developing but also industrialized countries [37]. Early initiation of breastfeeding, within 1 hour of birth, protects the newborn from acquiring infections and reduces newborn mortality [38]. The risk of mortality due to diarrhoea and other infections can increase in infants who are either partially breastfed or not breastfed at all [38].

Breast-milk is also an important source of energy and nutrients in children aged 6–23 months. It can provide half or more of a child's energy needs between the ages of 6 and 12 months, and one third of energy needs between 12 and 24 months. Breast-milk is also a critical source of energy and nutrients during illness, and reduces mortality among children who are malnourished [39].

Children and adolescents who were breastfed as babies are less likely to be overweight or obese. Additionally, they perform better on intelligence tests and have higher school attendance. Breastfeeding is associated with higher income in

adult life. Improving child development and reducing health costs results in economic gains for individual families as well as at the national level [39].

Longer durations of breastfeeding also contribute to the health and well-being of mothers: it reduces the risk of ovarian and breast cancer and helps space pregnancies–exclusive breastfeeding of babies under 6 months has a hormonal effect which often induces a lack of menstruation [40]. This is a natural (though not fail-safe) method of birth control known as the Lactation Amenorrhoea Method.

Breastfeeding practices are highly responsive to supportive interventions, and the prevalence of exclusive and continued breastfeeding can be improved over the course of a few years.

1.4.2 Complementary Feeding

Around the age of 6 months, an infant's need for energy and nutrients starts to exceed what is provided by breast milk, and complementary foods are necessary to meet those needs. An infant of this age is also developmentally ready for other foods. If complementary foods are not introduced around the age of 6 months, or if they are given inappropriately, an infant's growth may falter [41]. Guiding principles for appropriate complementary feeding are: 1) continue frequent, on-demand breastfeeding until 2 years of age or beyond 2) practise responsive feeding (for example, feed infants directly and assist older children. Feed slowly and patiently, encourage them to eat but do not force them, talk to the child and maintain eye contact), 3) practise good hygiene and proper food handling, 4) start at 6 months with small amounts of food and increase gradually as the child gets older, 5) gradually increase food consistency and variety, 6) increase the number of times that the child is fed: 2–3 meals per day for infants 6–8 months of age and 3–4

meals per day for infants 9–23 months of age, with 1–2 additional snacks as required, 7) use fortified complementary foods or vitamin-mineral supplements as needed, and 8) during illness, increase fluid intake including more breastfeeding, and offer soft, favourite foods [42].

This thesis seeks to explore trends and factors associated with childhood diarrhoea and acute respiratory infection and how these diseases are associated with infant and young child feeding practices in four south Asian countries. The next section spells out the research questions that lead to the specific objectives of the study.

1.5 Research questions

The study answered the following five basic questions:

1. What are the factors associated with childhood diarrhoea among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan)?
2. What are the factors and key predictors of ARI among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan)?
3. What are the trends and predictors of diarrhoea among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan)?
4. What are the trends and predictors of Acute Respiratory Infection among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan)?
5. How do Infant and Young Child Feeding practices relate with diarrhoea and ARI in four south Asian countries (Bangladesh, India, Nepal, and Pakistan)?

1.6 Research objectives

1.6.1 General objective

The general objective of the study was to explore childhood diarrhoea, acute respiratory infection, and the association of these two diseases with infant and young child feeding practices in four South Asian countries.

1.6.2 Specific objectives

The specific objectives of the study are:

1. To identify factors associated with childhood diarrhoea among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan).
2. To identify factors and key predictors of ARI among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan).
3. To assess trends and predictors of diarrhoea among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan).
4. To examine trends and predictors of ARI among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan).
5. To assess Infant and Young Child Feeding (IYCF) practices and their association with diarrhoea and ARI among children aged less than two years in four south Asian countries (Bangladesh, India, Nepal, and Pakistan).

1.7 Justification of the study

Childhood diarrhoea and ARI have remained public health problems in south Asia. Most deaths from diarrhoea occur among children less than 2 years of age living in south Asia and sub-Saharan Africa [5, 43]. India's population of more than one billion, in addition to the young and large populations in Bangladesh and Pakistan, implies that

south Asia the world's second largest of children [44]. One of the stated aims of the Millennium Development Goals (MDGs) was the reduction of childhood deaths (MGD 4), the target of which was to reduce childhood mortality rates by two-third between 1990 and 2015. Available statistics show that unlike most countries in south Asia, Bangladesh had been on track to achieving the MGD 4. India, Pakistan, and Nepal were all not on track to meet the MDG 4 due to the high under five mortality rates in these countries [44]. Childhood diarrhoea and ARI account for 18% and 20% of all deaths in south Asia [44]. In proportionate terms, diarrhoea as a single proximate cause of child death is said to be at its worst in the south Asia region.

So as to draw scientific strategies to solve problems regarding childhood diarrhoea and ARI, it is crucial to focus research efforts on the trends in these diseases and the risk factors associated with the diseases in these south Asian countries; hence the specific objectives of this thesis.

1.7.1 Identifying factors associated with childhood diarrhoea among children aged 0-59 months in four south Asian countries (Bangladesh, India, Nepal, and Pakistan)

Several attempts have been made to estimate mortality from diarrhoea over the past decades and in recent years [45-47]. However, the uncertainty surrounding its current level is still quite high, and may be partly due to lack in quality and number of available data, and partly due to constituency in methods. In 2004, among the countries which accounted for three-quarters of deaths due to diarrhoea in the developing regions of the world, three came from south Asia [45]. The south Asian countries in this category were: India (highest), Pakistan (fifth highest) and Bangladesh (seventh highest) [45]. One way to tackle the menace of childhood diarrhoea would be to identify the socio-demographic factors associated with this burden. This thesis aims to identify the

factors associated with childhood diarrhoea in four south Asian countries, using pooled data from the 2004, 2007, 2011 and 2014 of those countries' Demographic and Health Surveys (BDHS). Specifically, the aim of this study was to assess community, socioeconomic, child factors associated with childhood diarrhoea. Findings from this study could be useful to public health professionals to inform policies and programmes to reduce the rate of childhood diarrhoea in south Asia.

1.7.2 Identifying the factors associated with ARI among children aged 0-59 months in the four south Asian countries

Several past studies have explored the burden of ARI in under-five children [48-51]. However, there is limited literature on factors associated with ARI in under-five children, especially in countries where the burden of this disease is high. This study therefore seeks to identify and explore the factors associated with ARI among children aged 0-59 months in four south Asian countries; results of which could be of immense use to public health professionals and other stakeholders in the south Asia.

1.7.3 Assessing the trends and predictors of childhood diarrhoea among children aged 0-59 months in the four south Asian countries

A past research has suggested that reliable information on the magnitude, patterns and trends of causes of death of under-five children helps stakeholders and decision-makers to assess the programme needs, prioritise interventions and monitor progress [45].This thesis sought to utilise population data from the four most recent datasets of the four south Asian countries (2004, 2007, 2011 and 2014) to assess the trends and predictors of childhood diarrhoea among children aged 0-59 months in four south Asian countries. Results from our study would be useful to stakeholders in intensifying health care provisions to mothers, especially rural mothers.

1.7.4 Examining trends and predictors of ARI among children aged 0-59 months in the four south Asian countries

In order for decision-makers to assess the needs of programmes, and to give priority to interventions, as well as monitor progress of intervention programmes, reliable information the magnitude, patterns and trends of factors that result in under-5 mortality have to be obtained [45]. This thesis aims to examine trends and predictors of ARI among children aged 0-59 months in four south Asian countries, using the 2007, 2004, 2011 and 2014 versions of their Demographic and Health Surveys [14, 53, 54]. Findings from this study may enable policy-makers to redirect resources to the most vulnerable children at greater risk of dying before the age of five.

1.7.5 Assessing infant and young child feeding practices and their association with diarrhoea and ARI among children aged less than two years in four south Asian countries

The extant literature is replete with studies on the association of infant feeding with childhood diarrhoea [52-55] and ARI [54, 55]. These studies are important in order for decision-makers to provide interventions to minimise the burden of diarrhoea and ARI due to inappropriate or inadequate infant feeding practices. This study aims to assess infant and young child feeding practices and their association with childhood diarrhoea and ARI among children aged less than two years in the four south Asian countries.

1.8 The study area

1.8.1 South Asia

Asia is the largest among the world's seven continents [56]. Its physical landscapes, political units, and ethnic groups are both wide-ranging and many. Regions in Asia include South Asia, East Asia, and Southeast Asia.

South Asia extends south from the main part of the continent to the Indian Ocean. The Indian Ocean, the Himalayas, and Afghanistan constitute the principal boundaries of south Asia (Figure 1). The Arabian Sea borders Pakistan and India to the west, and the Bay of Bengal borders India and Bangladesh to the east. The western boundary is the desert region where Pakistan shares a border with Iran [57].

The South Asia region housed the birthplace of two of the world's great religions, Hinduism and Buddhism, but there are also immense Muslim populations and large groups of followers of various other religions as well. Hinduism, Islam, and Buddhism are the top three religions of South Asia. While Pakistan and Iran are both Islamic republics, each represents a significant branch of that faith; Iran is predominantly Shia, and Pakistan is mostly Sunni. Religious differences are also evident on the eastern border of the realm, where Bangladesh and India share a border with Myanmar. Bangladesh is mainly a Muslim country, while most in India align themselves with Hinduism [58]. In Myanmar, most follow Buddhist traditions. In addition, Sikhism is a major religion in the Punjab region, which is located on India's northern border with Pakistan [58].

The countries that constitute south Asia include Sri Lanka, India, Bangladesh, Bhutan, Nepal, Pakistan, and the Maldives. The Himalayas, separating South Asia from East Asia along the border of China's autonomous region of Tibet, are the highest

mountains in the world, and the dominant physical feature of the northern rim of South Asia. Other countries that share the Himalayas include Nepal, Bhutan, India, and Pakistan. Farther north along the Himalayan range, the traditional region of Kashmir is divided between India, Pakistan, and China. On the opposite side of the Himalayas are two island countries off the coast of southern India. The first is Sri Lanka, a large tropical island off India's southeast coast, and the other is the Republic of Maldives, an archipelago (group of islands) off the southwest coast of India. Maldives comprises almost 1,200 islands that barely rise above sea level; the highest elevation is merely seven feet, seven inches. Only about two hundred islands in the Maldives are inhabited [57].

South Asia is highly populated, with about 1.8 billion people representing a wide range of ethnic and cultural groups [59]. The diverse population has been brought together into political units that have roots in the realm's colonial past, primarily under Great Britain. British colonialism had a significant impact on the realm; its long-term effects include political divisions and conflicts in places such as Kashmir and Sri Lanka.

Figure 1: Location and map of south Asia showing the various countries in this study. Source: University of Texas libraries [60].

A 2011 World Bank report indicated that, based on 2005 International Comparison Program, and Public Private Partnership, about 24.6% of the population of South Asian fell below the international poverty line of $1.25/day [60]. The highest ranked countries were Afghanistan and Bangladesh, with 30.6% and 43.3% of their respective populations below the poverty line. India lifted the most people in the region above the poverty line between 2008 and 2011, around 140 million. As of 2011, 21.9% of the population of India lived below the poverty line, compared to 41.6% in 2005 [61].

The World Bank estimated that India was one of the highest ranking countries in the world in terms of the number of children suffering from malnutrition. The prevalence of underweight children in India was among the highest in the world, and was nearly double that of Sub Saharan Africa with dire consequences for mobility, mortality, productivity and economic growth [62].

According to a World Bank report, 70% of the population of South Asian and about 75% of South Asia's poor dwell in rural areas and most of them rely on agriculture for their livelihood according to the UN's Food and Agricultural Organisation. In 2015, approximately 281 million people in the south Asia region were malnourished.

The 2006 World Bank report stated that "the low status of women in South Asian countries and their lack of nutritional knowledge are important determinants of high prevalence of underweight children in the region", and mentioned that although there has been a reduction in malnutrition due to the Green Revolution in South Asia, there is concern that South Asia has "inadequate feeding and caring practices for young children"[63].

1.8.2 Bangladesh

Bangladesh, which is the world's 8th most populous country, shares borders with India and Myanmar (Burma); and although countries such as Bhutan, China and Nepal are close to the country, they do not share boundaries with it (Figure 2). The maritime territory of Bangladesh in the Bay of Bengal is approximately equal in size to its land area [64].

The land in Bangladesh is mostly flat and fertile; and most parts of the country are less than 12 metres above sea level, which subsequently would make 10% of the country's

land to be flooded in the event of a 1 metre sea level rise [65]. Furthermore, forests occupy about 17 percent of the country's land, with 12% of the land being occupied by hill systems [65].

Bangladesh consists of seven administrative divisions, namely, Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet [66]. Each division was named after their respective divisional headquarters.

The climate of Bangladesh, which straddles the Tropic of Cancer, is tropical with mild winter occurring between October and March; a hot humid summer occurring between March and June. Between June and October, the country experiences a warm and humid monsoon season [67].

Bangladesh has been widely recognised as one of the countries in the world with high vulnerability to climate change, which brings about natural hazards resulting from increased rainfall, rising sea levels and tropical cyclones; each of which seriously affects agriculture. Water and food security, human health and shelter [68].

Although estimates of the population Bangladesh varies, the 2016 United Nations (UN) data puts it at 163 million [69]. The population was estimated at 142.3 million in the 2011 census [70]. It is the world's most densely populated large country; and ranks 11th in population density when small countries and city-states are taken into consideration [70]. Relatively, the population of Bangladesh is young, with 34% of citizens aged 15 years or younger, and 5% aged 65 years or older [71]. In spite of Bangladesh's rapid economic growth, 43% of her citizens still live below the international poverty line on less than $1.25 per day [72].

The literacy rate in Bangladesh is low, estimated at 66.5% for males and 63.1% for females as of 2014 [71]. Education in Bangladesh is heavily subsidised; the government runs many schools at the primary, secondary and higher-secondary levels, and subsidises many private schools. At the tertiary level, the government provides funding for more than 15 state universities through the Universities Grants Commission [73]. Primarily, education is in Bengali; however, English is commonly taught and used.

Although health and education have improved due to decreased poverty levels, they remain relatively low. In rural areas of the country, about 62% of healthcare providers who practise “modern medicine” have little or no formal training, with only 4% being formerly-trained providers of healthcare. There have been deficiencies treatment of practices of village doctors with extensive inappropriate and harmful drug prescription [74].

The poor health conditions in Bangladesh are attributed to the government’s lack of healthcare provision. A 2010 World Bank report, healthcare spending in 2009 was 3.35% of the Gross Domestic Product (GDP) of the country [75].

Figure 2: Map of Bangladesh. Source: CIA World Fact book [71]

According to the latest WHO data, deaths due to diarrhoeal diseases reached 19,951 (2.53%) of total deaths in Bangladesh. There are about 800 rivers in Bangladesh, with the total river length of around 24,140 km flowing through the country. These rivers, together with plentiful rainfall, provide adequate water resources to the population [76]. However, the intensive agriculture, unsanitary latrines and frequent floods make the water resources vulnerable to faecal contamination [77]. As a result, pathogen-contaminated water leads to a high prevalence of diarrheal diseases in this area.

1.8.3 India

India is the world's 7th largest country by area, the world's second most populous country, with over 1.2 billion people; and the world's most populous democracy. It is bounded by the Indian Ocean to the south, the Arabian Sea to the southwest, and the Bay of Bengal on the southeast. India shares land

borders with Pakistan to the west; China, Nepal, and Bhutan to the northeast; and Bangladesh and Myanmar to the east. In the Indian Ocean, India is in the vicinity of Sri Lanka and the Maldives [78] (Figure 3).

The coastline of India measures about 7.517 km in length, out of which 5423 km belong to the Indian Peninsular and 2094 km to the Andaman, Nicobar and Lakshadweep island chains [79].

The climate of India is effectively influenced by the Himalayas and Thar deserts. The Himalayas and Thar deserts drive the “economically and culturally pivotal” summer and winter monsoons [80].

Figure 3: Map of India. Source: CIA World Fact book [71]

There are 6 main regions in India, Namely, Central, Eastern, Northeast, South and Western [81], and with 1,210,193,422 citizens reported in the 2011 provisional census report, India is the world's second most populous nation [82]. According to the 2011 census, the human sex ratio in India is 940 females 1000 males [82], and the median age of its citizens is 26.7 years.

In India, education is provided by both public and private sectors, with control and funding being provided from three levels, namely, central, state and local. Under various articles of the constitution of India, free and compulsory education is provided as a fundamental right to children aged between 6 and 14 years. The ratio of public schools to private schools in India is 7:5 [83].

The Indian constitution makes health the responsibility of the state governments, instead of the central federal government. It makes every state responsible for "raising the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties". The National Health Policy was endorsed by the Parliament of India in 1983 and updated in 2002 and then in 2017[84, 85]. There are great inequalities in health between states in India.

Health improvements over the last thirty years notwithstanding, lives continue to be lost to early childhood diseases, inadequate newborn care and childbirth-related causes in India. More than two million children die every year from preventable infections [86].

In India, roughly 1.72 million children die each year before turning one [86]. The under-5 mortality and infant mortality rate declined in India; from 202 and 190 deaths per thousand live births respectively in 1970 to 64 and 50 deaths per thousand live births in 2009 [86, 87]. A study conducted by the Future Health Systems Consortium in Murshidabad, West Bengal indicated that barriers to immunisation coverage are adverse geographic location, absent or inadequately trained health workers and low perceived need for immunization [88]. Infrastructure such as hospitals, roads, water and sanitation are lacking in rural areas [89]. Shortage of healthcare providers, poor intra-partum and newborn care, diarrheal diseases and acute respiratory infections also contribute to the high infant mortality rate [86].

1.8.4 Nepal

Nepal is a landlocked country in South Asia; it is mainly located in the Himalayas and incorporates parts of the Indo-Gangetic Plain. With an estimated population of 26.4 million, Nepal is 48th largest country by population and 93rd largest country by area [90, 91]. It borders China in the north and India in the south, east, and west while Bangladesh is located within only 27 km of its south-eastern tip Figure 4). Bhutan is separated from Nepal by the Indian state of Sikkim. Nepal has a diverse geography, including fertile plains, subalpine forested

Figure 4: Map of Nepal. Source: CIA World Fact book [71]

hills, and eight of the world's ten tallest mountains, including Mount Everest, the highest point on Earth. The capital and largest city of Nepal is Kathmandu. Nepal is a multiethnic nation with Nepali as the official language.

According to the Nepal 2011 census, the population of the country grew from 9 million people in 1950 to 26.5 million in 2011; and between 2001 and 2011, the average family size in Nepal declined from 5.44 to 4.9 [90].

As at April 2018, Nepal is divided into seven provinces, namely, Province 1, Province 2, Province 3, Province 4, Province 5, Province 6 and Province 7. Furthermore, there are 6 metropolises, 11 sub-metropolises, 276 municipal councils and 460 village councils [92].

The overall literacy rate among citizens aged 5 years and older increased from 54.1% in 2001 to 65.9% in 2011. The male literacy rate was 75.1% compared to the female literacy rate of 57.4%. Kathmandu district reported the highest literacy rate was

reported in Kathmandu district of 86.3% whilst the lowest was reported in Rautahat (41.7%) [90].

Increasing access to secondary education (grade 9–12) remains a major challenge in Nepal, as evidenced by the low net enrolment rate of 24% at this level. More than 50% of primary students do not enter secondary schools, and only one-half of them complete secondary schooling. Additionally, fewer girls than boys join secondary schools and; among those who do, fewer complete the 10th grade Nepal has seven universities [93].

Public health and health care services in Nepal are provided by both the public and private sectors and fare poorly by international standards. According to 2011 census, more than one-third (38.17%) of the total households do not have a toilet [90]. Tap water is the main source of drinking water for 47.78% of households, tube well/hand pump is the main source of drinking water for about 35% of households, while spout, uncovered well/*kuwa*, and covered well/*kuwa* are the main source for 5.74%, 4.71%, and 2.45% respectively[90]. Based on 2010 World Health Organization (WHO) data, Nepal ranked 139th in life expectancy in 2010 with the average Nepali living to 65.8 years [94]

Diseases are more prevalent in Nepal than in other South Asian countries, especially in rural areas. Leading diseases and illnesses include diarrhoea, gastrointestinal disorders, goitres, intestinal parasites, leprosy, visceral leishmaniosis and tuberculosis [95].

Nearly 4 out of 1,000 adults aged between 15 and 49 years had human immunodeficiency virus (HIV) whose prevalence rate was 0.5% [96,

97]. Malnutrition also remains very high: about 47% of under-5 children are stunted, 15% wasted, and 36% underweight. Despite declines for these rates over the past five years, they remain alarmingly high [98]. There have been improvements in health care, most notably in maternal-child health, in spite of these figures. In 2012, the under-5 infant mortality was estimated to be 41/1000 children[99]. In 2011, the overall the Human Development Index of Nepal (health) was 0.77, ranking Nepal at 126 out of 194 countries, up from 0.444 in 1980 [100].

1.8.5 Pakistan

Pakistan is the fifth-most populous country in the world, with a population exceeding 212,742,631 people [101]. In terms of area, it is the 33rd largest country, spanning 881,913 square kilometres (340,509 square miles). Pakistan has a 1,046-km coastline along the Arabian Sea and Gulf of Oman in the south. It is bordered by India to the east, Afghanistan to the west, Iran to the southwest, and China in the far northeast; and separated narrowly from Tajikistan by Afghanistan's Wakhan Corridor in the northwest (Figure 5). Pakistan also shares a maritime border with Oman, and has an extremely diverse climate, and is home to a wide variety of wildlife [102].

It is a constitutional requirement in Pakistan that the state should provide free primary and secondary education to Pakistanis [103]. Education is divided into six major levels, namely, nursery (preparatory); primary (grades one through five); middle (grades six through eight); matriculation (grades nine and ten, which leads to the secondary certificate); intermediate (grades eleven and twelve, which leads to a higher secondary certificate) and university programmes which lead to graduate and postgraduate degrees [104]. Pakistan has a vast network of both public and private universities.

Although this network includes collaboration among the universities aimed at providing research and higher education opportunities in the country, there is concern about the low quality of teaching in many of the newer schools [105]. There are about 3,193 technical and vocational institutions in Pakistan[106]. In addition, there are also *madrassahs* which

Figure 5: Map of Pakistan. Source: CIA World Fact book [71]

provide free Islamic education and offer free boarding and lodging to students. These students mostly come from the poorer strata of society [107]. Consequent of initiatives adopted in 2007, the English language was made compulsory in all schools across the country [108]. Additional reforms enacted in 2013 required all educational institutions in Sindh to begin offering Chinese language courses, reflecting China's growing role as a superpower and its increasing influence in Pakistan [109] The literacy rate of the population is about 58 %. Furthermore, the literacy rate for males is

approximately 70% whilst the rate for female is about 46% [106] Pakistan currently spends 2.2% of its GDP on education[106] which, according to the Institute of Social and Policy Sciences, is one of the lowest in South Asia [110].

Pakistan has struggled in the area of health such as to be ranked 122 out of 191 countries in a WHO performance report [111]. The per capita income of Pakistan in 2013 was $5,041[112], and its total expenditure on health per capita in 2014 was $129, which was only 2.6% of GDP. Life expectancy at birth was 66 years (65 for males; 67 for females) [113]; the lowest in comparision to other south Asian countries (2010-2015) [114]. The health care delivery in Pakistan both state and non-state; as well profit and not for profit service provision. The health sector of the country is marked by urban-rural disparities in terms of healthcare delivery and inequities in the health workforce, with inadequate health managers, paramedics, nurses and skilled birth attendants in impoverished areas [115].

Communicable diseases have remained the key cause of mortalities in Pakistan. The rapid spread of these diseases has been a consequence of overcrowded cities, unsafe drinking water, inadequate sanitation, poor socio-economic conditions, limited health awareness and inadequate vaccination coverage. Communicable diseases include ARI, viral hapatitis, malaria, diarrhoea, dysentery, scabies, goitre and tuberculosis [116].

Several factors influence Pakistan's health system. These include communicable and non-communicable diseases, malnutrition aming children and women; as well as child morbidities. The country ranks 22 in the world under-5 mortality rate; accounting for under-5 mortality rate of 81 per 1000 live births in 2015. Infant and neonatal mortality rates were 66 and 46 per 1000 live births respectively. Maternal mortality ration has

been high – at 178 per 100000 per live births in 2015; and as few as 52% were attended by skilled professionals [117].

Aside of nutritionally deprived Pakistani children being faced with learning difficulties, they have remained at the prime risk of infections and face hardship in conbatting and recovering from diseases. Moreover, extreme nutritional deficiency could have devastative effect on these children such as stunting, wasting and underweight [117].

1.9 Definition of Key outcome variables

1.9.1 Childhood Diarrhoea

Childhood diarrhoea may be defined as passage of three or more loose or watery stools in the past 24 hours, or passage of stools with blood or mucus in a young child [118]. For young breastfed infants, change in the consistency of stool was considered a case of diarrhoea.

1.9.2 Acute Respiratory Infection (ARI)

ARI may be defined as acute infection of the respiratory tract, as judged by clinical features based on the guidelines of the World Health Organization, lasting for less than 30 days [119].

1.9.3 Infant and Young Child Feeding

Infant and Young Child Feeding is a combination of breastfeeding (practice of feeding a baby with the mother's breast milk) and complementary feeding (practice of giving a child solid, semi-solid and soft foods alongside breast milk when they are aged 6 months or older) [33].

1.10 Organisation of the thesis

This thesis is organised as follows: Chapter 1 presents the background to the study. Chapter 2 provides the theoretical framework of the study and reviews the extant

literature. Chapter 3 presents the methodology employed in this study. The various statistical analyses applied in the thesis are presented in chapter 4. Chapter 5 presents results of factors associated with childhood diarrhoea in the four south Asian countries. Results of factors associated with ARI in Bangladesh are presented in chapter 6. Chapter 7 presents results of the impact of antenatal care, iron folic acid supplementation and tetanus toxoid vaccination during pregnancy on child mortality in Bangladesh. Results on factors associated with under-5 mortality in Bangladesh are presented in chapter 8. Chapter 9 gives a discussion of the whole thesis. Finally, a summary and recommendations for future research are presented in chapter 10.

1.11 Summary

In this chapter, the introduction and statement of the problem to the study have been presented. The public health importance of childhood diarrhoea and ARI has been highlighted. The research questions, research objectives and specific objectives have also been clearly presented in this chapter. The chapter also presented a description of the south Asia region, as well as that of the four countries under study. The next chapter presents the conceptual framework of the study and a critical review of the relevant literature on factors associated with childhood diarrhoea and ARI in general, and among children from the four countries in particular. It also examines the trends in both childhood diarrhoea and ARI in these countries. The chapter further discusses current perspectives on childhood diarrhoea and ARI, reveals the gaps in the literature and stresses the need for the present study. The chapter ends with a summary.

CHAPTER 2

CONCEPTUAL FRAMEWORKS AND REVIEW OF RELEVANT LITERATURE

2.0 Introduction

In this chapter, the theoretical frameworks of the thesis and a critical review of the relevant extant literature are presented. Literature sources such as JSTOR (Journal Storage), Google search engine, Google Scholar search engine, PubMED, HINARI, CAB direct, edited books and reports were utilized in collecting important literature directly related to this study. In carrying out the literature search, keywords and mesh terms such as childhood diarrhoea, ARI, infant and young child feeding, trends and predictors, south Asia, Bangladesh, India, Nepal and Pakistan were included. The search also included terms such as multivariate analysis of childhood diarrhoea and determinants of ARI. The extant literature on demographic and public health studies abound in various outcomes of child health and survival. There have been diverse findings on the determinants of childhood diarrhoea and factors associated with ARI in many studies on infant and child mortality. There is evidence that child health outcomes are generally poor in South Asia and sub-Saharan Africa, which, incidentally, have been found to be the major global contributors to statistics on childhood morbidity. The rest of this chapter is organised as follows: The theoretical frameworks that inform this study and accompanying components are presented in sections 2.1 and 2.2. Sections 2.3 and 2.4 review the extant literature on the factors associated with childhood diarrhoea and ARI respectively in Bangladesh, India, Nepal and Pakistan. A summary concludes this chapter.

2.1 Determinants of Childhood Diarrhoea and Acute Respiratory Infection – Theoretical Frameworks

The theoretical frameworks for diarrhoeal morbidity and ARI are shown in the Figures 6 [120] and 7 [121] respectively, below:

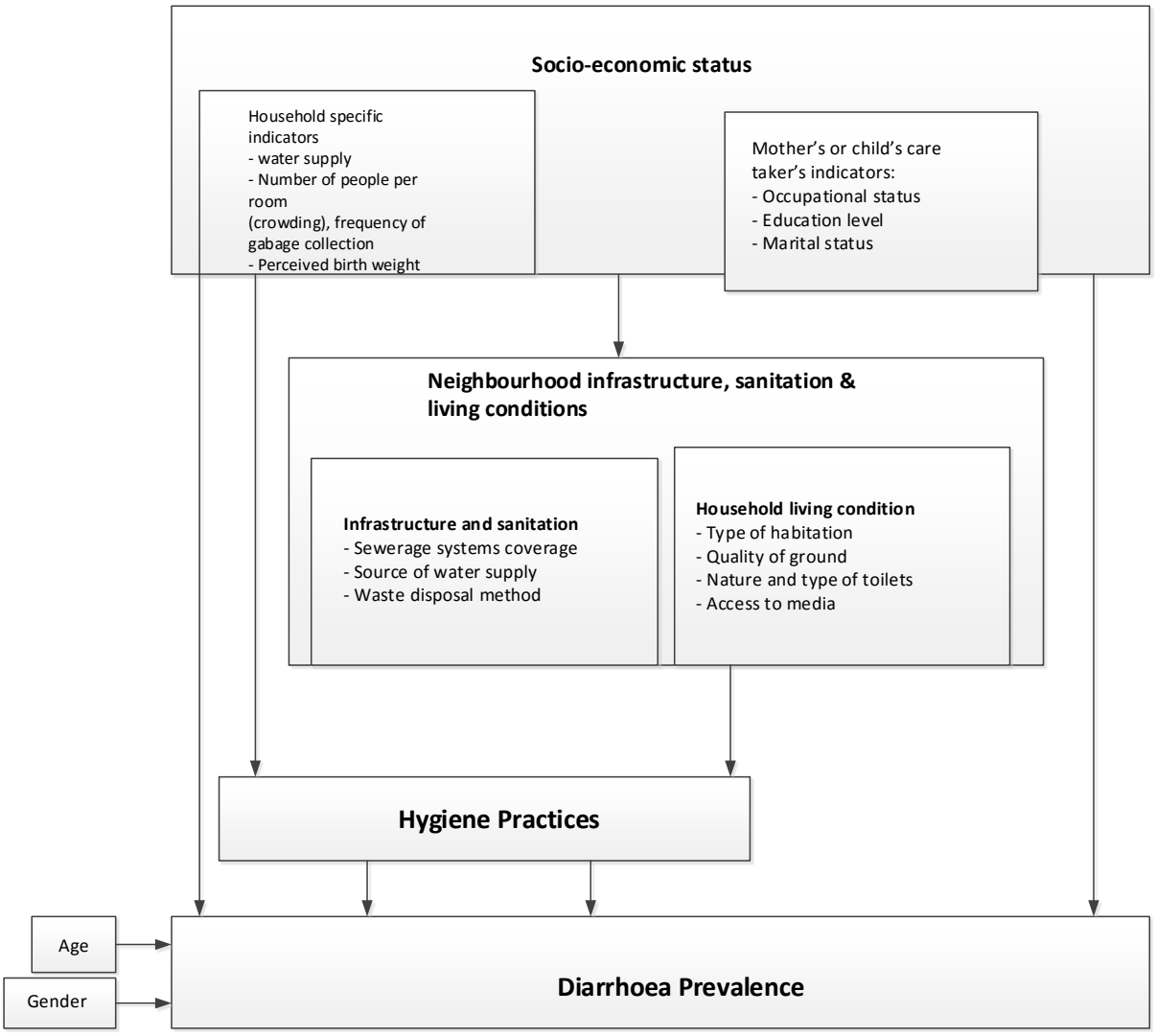


Figure 6: Conceptual framework visualising the inter-relationships between potential risk factors and prevalence of diarrhoea.

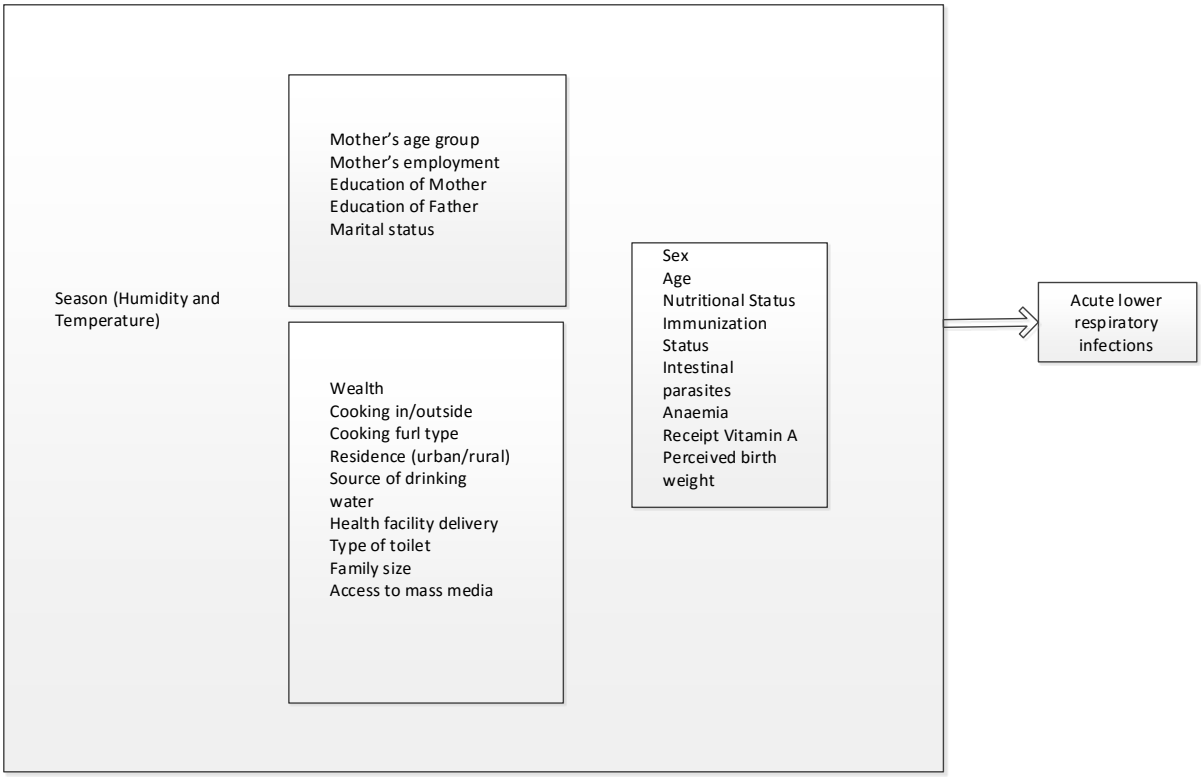


Figure 7: Conceptual framework of risks factors for acute lower respiratory infection.

The prevalence of diarrhoea and ARI is influenced by the interplay of many associated factors, including: a) socio-economic status b) infrastructural factors c) hygienic factors d) demographic factors. Some of the factors associated with childhood diarrhoea and ARI are described in the next section.

2.1.1 Socio-economic status

Socio-economic status (SES) is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position in relation to others, based on income, education, and occupation. In analysing the SES of a family, the household income, education and occupation of the earner, as well as the combined income are examined. On the other hand, for the SES

of an individual, only their own attributes are assessed. Nonetheless, SES is more commonly used to depict an economic difference in society as a whole National [122].

Typically, socioeconomic status can be broken into three levels, namely, *high*, *middle*, and *low*; to describe the three places a family or an individual may fall into. To place a family or individual into one of these categories, any or all of the three variables, *income*, *education*, and *occupation* may be assessed.

Furthermore, low income and low level of education have been shown to be strong predictors of a range of physical and mental health problems, including respiratory viruses, arthritis, coronary disease, and schizophrenia. These problems may be due to environmental conditions in their workplace, or, in the case of mental illnesses, may be the entire cause of that person's social predicament to begin with [123-125].

Education among families of higher socioeconomic status is typically stressed as much more important, both within the household as well as the local community. In poorer settings, where food, shelter and safety are priority, education can take a backseat.

2.1.1.1 Household Wealth

Sometimes referred to as household affluence, *household wealth* is a term used to describe the net worth of a specific household, or the average net worth of households within a defined geographic area. Calculating this type of personal wealth figure requires identifying the current market value of all assets owned by the household, and subtracting the sum of all liabilities from that total value. Measurements of household wealth are helpful in assessing the stability of a local or national economy, as well as in planning or adjusting the budget for an individual household.

As it relates to understanding the economy of a defined geographical location, determining household wealth provides valuable clues into the changes in the standard of living that apply in that area over time. For example, the average wealth of households in a town may increase or decrease over a five-year period. Analysts will use these changes to determine the level of impact that events in the community had on that local economy. This means that if a business established a manufacturing plant in the area and hired a significant number of residents who were unemployed, assessing the household or residential wealth for the area will provide an idea of how much impact that employer has on the financial stability of the community.

2.1.1.2 Occupational Status of Mothers

Mothers who worked full-time tended to use higher-quality substitute childcare and to show higher levels of sensitivity to her child [126]. Past research speculates that the higher levels of maternal sensitivity seen in employed mothers' might have stemmed from their having greater financial security [127].

A recent meta-analysis of 69 research studies spanning five decades [128], evaluating the impact of maternal employment, came to similar conclusions as those summarized above. Early maternal employment was found to be associated with beneficial child outcomes when families were at risk because of either financial challenges or as the result of being single-parent families. In those families, children of working mothers showed higher levels of achievement and lower levels of internalizing behaviours such as anxiety and depression [126].

These benefits are generally explained by a compensatory hypothesis that views work in those families as providing added financial security, lower levels of family stress and

enhanced learning opportunities for children who would otherwise be home with a parent who is dealing with the ongoing stress of poverty and child-rearing challenges with little external support.

Employment was associated with negative child outcomes, however, when children were from intact, middle class families that were not at risk financially. In those families, early full-time employment (relative to mothers who were not working outside the home) was associated with later risk for child behavioural difficulties [126].

It is worthy of note, however, that this increased risk was not the case when mothers worked full-time when their children were toddlers or pre-schoolers. It appears that working full-time when the child is an infant – a critical period in terms of attachment and emotional and cognitive growth – is more likely to be associated with subsequent difficulties.

In summary, the consensus of the empirical studies on the impact of maternal employment finds that child adjustment is tied to a number of relevant variables. In the case of single-parent families, or families otherwise facing poverty, the impact of maternal employment appears to be mostly positive. In the case of middle class or wealthy families when the mother is working full-time, particularly in the early months of a child's life, there appears to be a mildly increased risk for later behavioural problems and subtle cognitive impact relative to mothers who aren't working or are working part-time.

2.1.1.3 Educational Level of Parents

There are different channels through which parental education can affect the health of their children. Education is likely to have a direct impact on child health because it

increases the ability to acquire and process information. This helps parents to make better health investments for themselves and their children and may result in better parenting in general. Alternatively, education can affect the health of a child through indirect pathways. An increased level of education can give access to more skilled work with higher earnings and these resources could be used to invest in health and to cushion the impact of adverse health shocks [129]. In the presence of assortative mating, individuals with a higher level of education also marry partners with higher levels of education, which positively affect family income. Case et al [129] reveal that parents' long run income is important for the child's health. Furthermore, attending school for a longer time could lead to a change in preferences by either lowering the discount rate or increasing risk-aversion [130]. Finally, increased education can increase the opportunity cost of having children and change fertility choices or delay having children. However, McCrary and Royer [131] do not find any effect of mother's education on fertility choices.

While all these channels are potential explanations to why parental education might induce better child health, parental education and child health can also be related in non-causal ways. Indeed, endowments that are transmitted across generations can cause a positive association between parental education and child health.

2.1.1.4 Mother's Marital Status

A past research found that children of unmarried mothers were disadvantaged relative to children whose parents were married [132]. Although the benefits of growing up in a two-parent household in developed countries are well-known, in resource-poor settings, not having two parents present can lead to dire outcomes. Having an ever unmarried mother has been found to increase the probability that a child dies before

the age of five [132]. There is variation in the effects of mother's marital status both across countries and by type of unwed mother [132]. In Ethiopia, where single motherhood is less common, the effects of being unmarried are most pronounced, while in Kenya, where a relatively high proportion of women give birth before marriage or experience a union rupture, the effects are less severe [132]. These findings could indicate that in countries where single motherhood is less common, but potentially more stigmatized, unmarried women face considerable challenges in meeting the needs of their children. It seems plausible that children of unmarried or newly married mothers would be at least slightly less likely to live with them [133]. Children who are cared for by grandparents, other relatives, or even non-relatives may receive fewer household resources. One study on orphans in Africa, for example, found that children who were not closely related to the household head were significantly less likely to be enrolled in school [134]. Additionally, research in North America found that single mothers were disproportionally represented among the poor [135]. Careful analyses which attempted to disentangle the effects of poverty from those of marital status per se found that about half of the detrimental effects on children can be attributed to the lower household income of single-parent families [136]. Unmarried mothers may be stretched between care of their children and securing an adequate income to support themselves and their children. As such, single mothers may be less able to provide supervision or lack the ability to seek medical care when a child falls sick. These children are also likely to be missing critical financial and emotional inputs from their fathers early in life.

2.1.2 Neighbourhood infrastructure, sanitation and living conditions

2.1.2.1 Water Supply

Water supply is the provision of water by public utilities commercial organisations, community endeavours, or by individuals usually via a system of pumps and pipes. Safe and readily available water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. Improved water supply and sanitation, and better management of water resources, can boost the economic growth of countries and can contribute greatly to poverty reduction [137].

In 2010, the UN General Assembly explicitly recognised the human right to water and sanitation. Everyone has the right to sufficient, continuous, safe, acceptable, physically accessible and affordable water for personal and domestic use.

The Millennium Development Goal (MDG 7) on drinking-water was universally met in 2010. The target was to halve the proportion of the world's population without sustainable access to safe water. The 48 least developed countries did not meet the target; however, substantial progress has been made with 42% of the current population in these countries gaining access to improved drinking-water sources since 1990.

Sharp geographic, socio-cultural and economic inequalities persist, not only between rural and urban areas but also in towns and cities where people living in low-income, informal or illegal settlements usually have less access to improved sources of drinking-water than other residents.

Contaminated water and poor sanitation are associated with transmission of diseases such as cholera, diarrhoea, dysentery, hepatitis A, typhoid and polio. Absent, inadequate, or inappropriately managed water and sanitation services

expose individuals to preventable health risks, particularly in health care facilities where both patients and staff are placed at additional risk of infection and disease when there is a lack of water, sanitation and hygiene services. Globally, 15% of patients develop an infection during a hospital stay, with the proportion much greater in low-income countries.

Inadequate management of urban, industrial and agricultural wastewater means the drinking-water of hundreds of millions of people is dangerously contaminated or chemically polluted.

It is estimated that 842 000 people die each year from diarrhoea as a result of unsafe drinking-water, sanitation and hand hygiene. But diarrhoea is largely preventable, and the deaths of 361 000 children aged under 5 each year could be avoided each year if these risk factors were addressed. Where water is not readily available, people may decide hand washing is not a priority, thereby adding to the likelihood of diarrhoea and other diseases.

Diarrhoea is the most widely known disease linked to contaminated food and water but there are other hazards. Almost 240 million people are affected by schistosomiasis – an acute and chronic disease caused by parasitic worms contracted through exposure to infested water.

In many parts of the world, insects that live or breed in water carry and transmit diseases such as dengue fever. Some of these insects, known as vectors, breed in clean, rather than dirty water, and household drinking-water containers can serve as breeding grounds. The simple intervention of covering water storage containers can reduce vector breeding and may also have a co-benefit of reducing faecal contamination of water at the household level.

People spend less time and effort in physically collecting water when it comes from improved and more accessible sources; meaning the people could be productive in other ways. In addition, improved and more accessible water sources may also result in greater personal safety by reducing the need to make long or risky journeys to fetch water. Availability of better water sources also means less expenditure on health, as people are less likely to fall ill and incur medical costs, and are better able to remain economically productive.

Children are particularly at risk from water-related diseases; therefore access to improved sources of water can result in better health, and therefore better school attendance, with longer-term consequences for their lives.

The Millennium Development Goals (MDG) water target was measured by the proxy indicator of use of 'improved' or 'unimproved' drinking-water sources. But 'improved sources' are not necessarily safe. At least 1.8 billion people use a drinking-water source that is contaminated with faecal matter. A substantial proportion of water supplied through pipes is contaminated, especially where water supply is intermittent or treatment is inadequate. Even where the source is good, water can be contaminated while being transported or stored, especially in environments where sanitation is inadequate.

2.1.2.2 Overcrowding

The WHO defines overcrowding as the situation in which more people are living within a single dwelling than there is space for, so that movement is restricted, privacy secluded, hygiene impossible, rest and sleep difficult. The terms *crowding* and *overcrowding* are often used interchangeably to refer to the same condition. The effects on quality of life due to crowding may be due to

children sharing a bed or bedroom, increased physical contact, lack of sleep, lack of privacy, poor hygiene practices and an inability to care adequately for sick household members [138].While population density is an objective measure of number of people living per unit area, overcrowding refers to people's psychological response to density. But, definitions of crowding used in statistical reporting and for administrative purposes are based on density measures and do not usually incorporate people's perceptions of crowding.

The standards for overcrowding as defined by the WHO [139] is as follows:

1) The room standard is contravened when the number of persons sleeping in a dwelling and the number of rooms available as sleeping accommodation is such that two persons of opposite sexes who are not living together as husband and wife must sleep in the same room. For this purpose, children under the age of ten shall be left out of account, and a room is available as sleeping accommodation if it is of a type normally used in the locality either as a bedroom or as a living room.
2) The WHO accepted standards for floor space are as follows. A baby under 12 months is not counted, and children between 1 and 10 years are counted as half a unit.
3) Overcrowding is considered to exist if two persons over 9 years of age, not husband and wife, of opposite sexes are obliged to sleep in the same room

Table 2.1: WHO recommendation of number of persons per unit area

Area (Square metres)	Number of persons
11 or more	2
9 to 10	1.5
7 to 9	1

5 to 7	0.5
Under 5	Nil

2.1.2.3 Residence Type (Urban/Rural)

Human settlements are classified as rural or urban depending on the density of human-created structures and resident people in a particular area. Urban areas can include town and cities while rural areas include villages and hamlets [140].

While rural areas may develop randomly on the basis of natural vegetation and fauna available in a region, urban settlements are proper, planned settlements built up according to a process called urbanization. Many times, rural areas are focused upon by governments and development agencies and turned into urban areas [140].

Unlike rural areas, urban settlements are defined by their advanced civic amenities, opportunities for education, facilities for transport, business and social interaction and overall better standard of living. Socio-cultural statistics are usually based on an urban population [140].

While rural settlements are based more on natural resources and events, the urban population receives the benefits of man's advancements in the areas of science and technology and is not nature-dependent for its day to day functions. Businesses stay open late into the evenings in urban areas while, sunset in rural areas means the day is virtually over.

The flip side of this is that rural areas do not have pollution or traffic problems that beset regular urban areas. Many governments, though focusing on the development of rural areas, have also tried to 'protect' these areas as preservation of their country's basic culture and traditions.

Urban areas are also classified according to land use and density of population. But this can vary from developed countries to developing countries. For example, in Australia, urban cities must include at least a 1,000 residents with 200 or more people

per square kilometre while in Canada, an urban area is defined with a density of 400 people per square kilometre [140]. In China, the density requirement for an urban area is about 1,500 people per square kilometre Statistically, two urban areas with less than two kilometres between them are considered one urban zone [140].

2.2 Factors Associated with Childhood Diarrhoea

2.2.1 Demographic Factors

The extant literature is replete with evidence that diarrhoea prevalence is significantly higher in younger children compared to older ones [141-147]. The prevalence of childhood diarrhoea has been found to be highest for children aged 6-11 months, remain at a high level among the one year-old children, and decrease in the third and fourth years of life [141, 142, 147, 148]. Prevalence of childhood diarrhoea has been found in past studies to be significantly higher in boys than in girls [141, 144, 148, 149].

Other demographic factors, such as mothers' younger age [143, 147], low level of mother's education [141-143, 150-152] high number of siblings [142, 153], birth order [154], were significantly associated with high prevalence of diarrhoea occurrence in under-5 children.

2.2.2 Socio-economic Factors

Some past studies have found a statistically significant association between socio-economic factors, such as poor housing, crowded conditions [141, 142] [144, 150], low household income [141, 142, 150] and prevalence of childhood diarrhoea.

2.2.2.1 Maternal factors and Childhood Diarrhoea

Some key maternal factors found in past studies to be associated with childhood diarrhoea include age of the mother, her educational status and occupation. Maternal

factors are an important set of influences on child health as they reflect the kind of care that the child is exposed to.

A past cross-sectional study in the Democratic Republic of Congo revealed that children whose mothers were aged 40 years and older were significantly more likely to contract diarrhoea [155]. That Congolese study [155] examined a very low proportion of older mothers (7.5%) compared to the mothers who were aged less than 40 years (92.5%); and this may have overestimated the strength of that association.

Other past studies have found that the likelihood of childhood diarrhoea was significantly higher among children whose mothers had a low level of formal education or who had no schooling at all [155-158]

2.2.3 Water-related Factors

Diarrhoea is thought to be contracted through contaminated water and foods. Consequently, water-related factors are key determinants of diarrhoea occurrence. Increased distance from water sources [147, 154], poor storage of drinking water [144, 147, 148, 159] (e.g. obtaining water from storage containers by dipping, no drinking water storage facility), use of unsafe water sources (such as rivers, pools, dams, lakes, streams, wells and other surface water sources) [143, 145, 149, 151, 152, 160, 161], water storage in wide-mouthed containers [161, 162], low per capita water used [151, 152], have been found to be risk factors for more diarrhoea occurrence among under-5 children. A past study by Guerrant and colleagues [163] revealed that the sources of water for households may be linked to prevalence of diarrhoeal illness. This prospective study of households in the Pacatuba province of Brazil revealed that the variation in the prevalence of diarrhoea in young children depended on the sanitary state of their water source that was also linked to their living conditions [163]. This

revelation was further confirmed in a Nigerian study [164] where untreated water sources were found to be significantly associated with the prevalence of childhood diarrhoea after adjustment had been made for confounders including age and sex. However, the study may have underestimated the strength of the association; since diarrhoeal episodes were only reported for eight days before the interviews as compared to fourteen days for similar studies [142, 165]. An additional significant association was identified between the use of rainwater for drinking compared to the use of closed sources of water like piped water and the prevalence of childhood diarrhoea [164]. Unprotected sources of water like rainwater and water from the stream act as potential sources of contamination.

In another community study examining the factors associated with childhood diarrhoea in four developing countries (Egypt, Thailand, Brazil and Ghana), using secondary analysis of the national demographic health survey (DHS) data, Timaeus and Lush [165] found that in Thailand, children who did not drink water from piped sources were less likely to have diarrhoea episodes. This unusual finding was largely attributed the use of bottled water as their main source of drinking water in these Thai households.

In another secondary analysis of information from Malawi, it was shown that household sources of water were significantly associated with the risk of diarrhoeal disease [166]. Here the use of private taps located inside the house was associated with a reduced risk of diarrhoea, compared to the use of public piped water sources in that study population. This rather useful information was, however weakened by the use of retrospective data with its attendant risk of being incomplete.

In spite of the plethora of evidence for the association between drinking water sources and childhood diarrhoea, Han and Myint [157] in a prospective cohort study that examined risk factors for childhood diarrhoea in a sub urban community in Burma concluded that there was no significant association between sources of drinking water and diarrhoea. Han and Myint [157] followed a randomly selected cohort of 1,545 children under the age of five years in a suburban community in Burma. That Burmese study [157] collected information on demographic, socioeconomic and environmental factors and diarrhoea incidence.

Analysis of data was based on the complete data of 1,475 children (220 with diarrhoea and 1255 healthy cohorts) and use of other sources of water was not significantly associated with the risk of diarrhoea when compared with the use of piped water or tube well water for drinking. A tube well is an improved well that has been constructed using concrete walls to prevent contamination of the water in the dug well from ground water. In this study the other sources of water which were not explicitly stated, was present in only 4.1% of the households with children with diarrhoea and 7.4% of those without diarrhoea. This proportion is quite low and may be responsible for the findings not showing significance in this study.

2.2.4 Sanitation Factors

Undoubtedly, sanitation plays a key role in reducing diarrhoea morbidity. Some sanitation factors, such as indiscriminate or improper disposal of children's stool and household garbage [148, 151, 152, 161, 167], non-existence of latrines [142, 147, 153, 167], or use of unhygienic toilets [150, 151], sharing latrines [160], lack of sewage systems in homes [167], increased the likelihood of diarrhoea in children.

In a cross sectional study to explore the factors associated with prevalence of diarrhoeal illnesses in young children in a rural area of Ondo State in the south western area of Nigeria [148], 1,000 mothers of children below the age of five years were selected by stratified and systematic random sampling; and information about a two-week prevalence of childhood diarrhoea, demographic factors, household and community environmental factors as well as socioeconomic factors were obtained, using a pre-designed open questionnaire. Although this Nigerian study [148] did not provide any information on the study definition of diarrhoea, the results showed a significant association between household sanitation conditions and the prevalence of diarrhoea. Inappropriate disposal of household refuse and children's faeces was predictive of diarrhoeal diseases. The inappropriate disposal of refuse and children's faeces contributed to the contamination of poorly stored drinking water, which was also significantly associated with a high risk of diarrhoeal disease.

In an analysis of multi-country data, Timaeus and Lush explored the information in the Demographic and Health survey (DHS) for Ghana, Brazil, Thailand and Egypt. The survey collected information on demographic, environmental and health care factors from eligible women selected by random sampling in these four countries (Table 2.2 below).

Table 2.2 Study sample description for Timaeus and Lush 1995

Country	Number of women	Description of women	Response rate (%)
Brazil	4514	All women aged 15 – 49 years	Unknown
Ghana	1523	All women aged 15 – 49 years	82
Egypt	4409	Only ever married women	84
Thailand	2423	Only ever married women	92

Despite the fact that the DHS surveys used for the analysis in the study did not give detailed information on all the environmental and economic factors required to

establish the degree of association and environmental factors on diarrhoea morbidity, it is useful, especially for policy development, to help in understanding the presence of any association [165].

Unlike the Eritrean study [142] which also used DHS data to explore the effect of socioeconomic and environmental factors on the risk of diarrhoeal diseases, the study by Timaeus and Lush focused its analysis on children aged between six months and 36 months, mainly because of the vulnerability of this age group to environmental conditions, and to minimise the effect of reporting errors (forgotten exact dates of birth of index children) inherent in the data [165]. The Eritrean study however focused its study on 2,153 children aged less than 35 months; because some information on the age pattern of prevalence of diarrhoea in the study population was sought [142]. Both studies showed that environmental factors were significantly associated with the diarrhoeal morbidity in Eritrea [142] and Egypt, Brazil and Thailand [165] after adjusting for socioeconomic differentials. Timaeus and Lush [165] confirmed that poor toilet facilities situated in poorer households was a significant risk factor in the prevalence of childhood diarrhoea in children, even though the study group in Egypt may be underestimated because the history of childhood diarrhoea was limited to one week compared with two weeks in the other countries examined.

2.2.5 Hygiene Factors

Some past studies have revealed that children not washing hands before meals or after defecation [147, 160, 168-170], mothers not washing hands before feeding children or preparing food [147, 160, 168, 170], children eating with their hands rather than with spoons [167], eating of cold leftovers [149], use of dirty feeding bottles and utensils [148, 161, 170], unhygienic domestic places (kitchen, living room, yard) [142,

150, 169, 170], unsafe food storage [170], presence of animals and houseflies [170] inside the house [149, 170], were found to be significantly associated diarrhoea morbidity in children.

The association between hand washing behaviour and prevalence of childhood diarrhoea may be due to the fact that faeco-oral contamination of food with enterotoxic organisms could lead to enteric infection, which in turn manifests as diarrhoea. Hand washing before preparing food has been found to be significantly associated with a lower prevalence of childhood diarrhoea in urban areas of Bangladesh [171]. Other past studies further confirmed that poor hand washing practices were associated with a higher prevalence of diarrhoea [166, 172].

Hand washing with water only was significantly associated with increased odds of diarrhoea prevalence when compared with washing with soap and water [172]. In that cross sectional study, the source of water for the study units (market women) were all different and could not be verified during the time of the study. These sources may have been contaminated before use and therefore overestimated the effect of hand washing on reducing the prevalence of childhood diarrhoea. A similar study in Malawi [166] showed a significant inverse association between the hand washing practices of the household and the prevalence of diarrhoea.

2.2.6 Inappropriate Infant Feeding

The literature on the association between inappropriate child feeding practices and the likelihood of diarrhoea is extensive. In general, the prevalence of diarrhoea has been found to be lowest in exclusively breast-fed children, higher in partially breast-fed children, and highest in fully-weaned-children [141, 145, 173, 174]. Further, there is evidence of a significant association between diarrhoea bottle-feeding [141, 161].

Many past studies have revealed the strong protective effect of breast feeding. A high concentration of specific antibodies, cells, and other mediators in breast milk reduces the risk of diarrhoea following colonization with entero pathogens [141].

Guerrant and colleagues [163] examined the epidemiological pattern of diarrhoeal illnesses in young children in north-eastern Brazil. In this prospective survey, the likelihood of disease was found to be increased in infants who were fed a diet mixed with breastfeeding and even further increased when breastfeeding was discontinued altogether. This finding suggests that breast milk contains elements that offer protection against diarrhoeal diseases. In addition, the introduction of increasing amounts of weaning diet also introduces potential sources of contaminated food to the child. The results of this study may be weakened however, by the poorly defined study outcome – diarrhoeal episodes. In this study, diarrhoeal episodes were reported by caregivers as a change in stool consistency or frequency and which was a subjective classification based on the caregivers' perception of diarrhoea [163].

Breastfeeding was associated with the prevalence of diarrhoea in children in a mixed community study in the Republic of Congo [155]. This cross sectional survey carried out in communities in four (three rural and one urban) districts in the Republic of Congo collected information from mothers of 612 children below the age of 30 months. This sample was selected by systematic random sampling and the information collected included demographic, socioeconomic, environmental data as well as information on feeding practices and health care. This study [155] found that breastfeeding the child aged 12 months or less conferred a protection against diarrhoeal illness while, after the age of 12 months breastfeeding was significantly associated with a higher risk of diarrhoea. This association was linked to the fact that

extended breastfeeding (at more than 12 months) is commoner in households with a poor socioeconomic status. Thus extended breastfeeding may actually be seen as a proxy for socio environmental factors.

The higher risk of diarrhoea in children over the age of 12 months who were still being breastfed was further strengthened by Guerrant and colleagues [163], which found that the risk of diarrhoeal disease was significantly increased when weaning foods were introduced.

The protective effect of breastfeeding against diarrhoeal illnesses for children less than six months is one of the more important reasons why childhood diarrhoea is more commonly found prevalent in children older than six months in communities [175].

2.2.7 Undernutrition

The association between childhood diarrhoea and malnutrition is common in low-income settings; such that the concept of a vicious circle is apparent, with diarrhoea leading to malnutrition and malnutrition predisposing to diarrhoea [141, 176]. Children whose immune systems have been weakened by malnutrition are found to be the most vulnerable to diarrhoea. Diarrhoea (especially persistent and chronic diarrhoea) undermines nutritional status, resulting in mal-absorption of nutrients or the inability to use nutrients properly to maintain health. A number of past studies have reported higher prevalence of diarrhoea in malnourished children [141, 176, 177]. A tendency of increased incidence of diarrhoea was also found in children with low weight-for-age, or, in particular, in stunted children [149].

The nutritional status of the child is intrinsically linked with its immunity and so a malnourished child is susceptible to enteric infection. Furthermore when the child is ill with diarrhoea, it is at an additional risk of being malnourished because of the

persistent loss of nutrients through the frequent stools as well as the inadequate replacement as the ill child is unable to eat well because of loss of appetite. As this state leads to the compromised immunity of the illness, there is worsening of the illness and thus the vicious cycle continues which eventually leads to death if it remains unchecked.

In their cross sectional study, Mock and colleagues [155] showed that almost half of the children in a sample of 612 children below the age of 30 months were malnourished using weight-for-age measurements [155]; however there was no reported significant association with the risk of diarrhoea. Mock and colleagues [155] also reported a higher risk of diarrhoea in children with a birth weight of 2500g or less, compared to those with a birth weight of more than 2500g. This association was however not significant. This may be a factor of the small sample size (612 children), so that with a larger sample size, it may be possible to demonstrate the significance of this effect. Breastfeeding the low birth weight infants (</=2500g) may also have played a part in improving the health of the young infants.

In an inquiry examining the risk factors for the prevalence of childhood diarrhoea in a hospital-based case control study [178], malnutrition was shown to be the most significant factor influencing childhood diarrhoea. Selected from a hospital in Palestine, cases (300) were children who were treated for diarrhoeal illness while controls (165) were matched for age, sex, and geographical area and presented with non-diarrhoeal illnesses. In addition to collecting information on demographic, environmental and socioeconomic factors, stool samples were collected to assess identify enteric pathogens in this study. This study is a weak study mainly because the controls (165) are much less than the cases (300). For a case control study to be able

to prove an association with statistical power, the recommended proportion of controls to cases is equal to or greater than one. Furthermore in this study, the nutritional status was assessed using the level of haemoglobin which classifies the child at being anaemic or not. This measure is less sensitive than the more widely used Gomez classification of malnutrition used by Mock and colleagues [155] which uses weight for age [179].

2.3 Literature on Factors Associated with Childhood Diarrhoea

2.3.1 Literature on Factors Associated with Childhood Diarrhoea - Bangladesh

There have been numerous studies on childhood diarrhoea in relation to other factors in Bangladesh [180-195]. However, a few of these studies examined the association between certain factors and childhood diarrhoea. For instance, one study [180] utilised the 2011 Bangladesh Demographic and Health Survey to reveal that low socio-economic status and uneducated mothers were associated with the likelihood household food insecurity in relation to childhood diarrhoea. Another study [183] revealed that slum-dwelling children were more likely to contract diarrhoea than their non-slum-dwelling counterparts. This study, however, utilised data on under-5 children, extracted from the hospital-based Diarrhoea Disease Surveillance System, which comprised 17 548 under-5 children with diarrhoea, who attended the Dhaka Hospital of icddr,b. from slum and non-slum areas of the city. The current study will be investigating mainly the socio-demographic factors associated with childhood diarrhoea in Bangladesh.

2.3.2 Literature on Factors Associated with Childhood Diarrhoea - India

Several studies have been carried out regarding diarrhoea and its associated factors in India [196-207]. However, some of those studies examined other factors associated

with diarrhoea other than socio-economic factors. For instance, the studies by Schmidt and colleagues [207], Kumar and colleagues [208], Kattula and colleagues [205], Nandi and colleagues and Collinet-Adler and colleagues [204] were based on childhood diarrhoea in relation to environmental factors; whilst the works of Dhingra and colleagues [196], Ajjampur and colleagues [198] and Lamberti and colleagues [209] were based on childhood diarrhoea in relation to clinical factors. Although some of these past studies were based on the association of socio-economic factors with childhood diarrhoea, their scope was limited and was not population-based [197, 199, 203]. This current study utilizes a population-based dataset of the India DHS to examine the association of socio-demographic factors with childhood diarrhoea in India.

2.3.3 Literature on Factors Associated with Childhood Diarrhoea - Nepal

Past studies have been carried out concerning childhood diarrhoea and its associated factors in Nepal [210-215]. A few of the studies however examined socio-demographic factors associated with childhood diarrhoea. Further, such studies were not country-representative, and only limited to a section of Nepal [212, 213].

The next section of this chapter presents factors associated with ARI in the four south Asian countries being surveyed.

2.3.4 Literature on Factors Associated with Childhood Diarrhoea - Pakistan

There have been a number of studies regarding childhood diarrhoea and associated factors [216-221]. Some of the studies, however, did not examine the socio-demographic factors associated with childhood diarrhoea [216, 219, 220]. The studies that assessed socio-demographic factors in relation to childhood diarrhoea were either

limited in scope or out-dated. For instance, the studies by Ahmed and colleagues [217] utilised data from a prospective analytical case control study carried out in the Department of Paediatrics, Dow Medical College and Civil Hospital, Karachi, during 1993-94. A total of 50 cases of persistent diarrhoea and 50 acute diarrhoeal controls (matched for age and sex) under 5 comprised the study subjects in that analysis.

2.4 Factors Associated with ARI

2.4.1 Literature on Factors Associated with ARI - Bangladesh

Several factors have been established by past research as being significantly associated with ARI in Bangladesh. One study was undertaken to determine the prevalence and risk factors of this disease among under five children in a rural community of Bangladesh [222]. The study found that factors associated with ARI included malnutrition, illiteracy of mothers, household poverty, overcrowding and parental smoking. This study, however, was limited in scope, as it involved only three villages of a single district in Bangladesh. A study by Silverman and colleagues [223] used a nationally-representative data from the 2004 Bangladesh DHS and found that women who experienced internal partner violence were more likely to report a recent ARI of their children. That study, however, did not examine other socio-economic factors in relation to ARI.

2.4.2 Literature on Factors Associated with ARI – India

There have been numerous studies on factors associated with ARI India. Two of such studies were those carried out by Pore and colleagues [224] as well as Taksande and Yeole [225]. A case-control study carried out by Prasad and colleagues [224] on under-five children revealed that factors such as nutritional status, immunization status, weaning, and mothers' literacy status were found to be significantly associated with

ARI. A child who was born premature had more than seven times the risk of developing ARI. This study, however, was not nationally-representative, as it was undertaken on ARI patients at a hospital in one city (Solapur). Taksande and Yeole [225] undertook a case-control study on under-five children. The research revealed that lack of breastfeeding, nutritional status, immunization status, delayed weaning, prelactal feeding, living in overcrowded conditions, mothers' literacy status, low birth weight and prematurity were significantly risk factors for ARI. However, the study was limited as it was only a hospital-based and not nationally representative. There are other studies on the risk factors for ARI in India but which were limited in scope [226-230].

2.4.3 Literature on Factors Associated with ARI - Nepal

A number of studies have been carried out Nepal to examine the determinants of ARI in that country for under-five children. A past study [231] revealed that factors which were statistically significantly associated with ARI included infancy, poor economic status, illiterate parents, cooking fuel other than liquid petroleum gas, low birth weight, prematurity, lack of exclusive breast feeding, vitamin A deficiency and incomplete immunization. The study was however limited in scope as it was carried out in a hospital in Central Nepal and therefore was not population-based. Another study by Thapa and colleagues [232] on non-exclusively-breastfed under-five children in households which had at least one smoker revealed that ARI was significantly associated with households with no separate kitchens, children whose mothers spent at least two hours in the kitchen, and children around whom people smoked. This study was however limited in scope as it was not population-based – it was conducted at a children's hospital in Kathmandu, the capital city.

2.4.4 Literature on Factors Associated with ARI – Pakistan

There is a slight dearth of studies in Pakistan regarding the determinants of ARI among children. Nonetheless, a recent study was carried out by Maheen and Dharmalingam [233] on the social determinants of ARI among babies and infants in Pakistan. The study revealed that ARI was significantly associated with children whose mothers did not have any formal education, and those from Sindhi, Siraiki and Baloch regions. Although this study was a population-based one (it used the 2005-2006 Pakistan Demographic and Health Survey), it was limited in scope as it did not focus on only the prevalence of ARI but also on its treatment. This approach limited the factors associated with ARI in Pakistan.

2.5 Summary

This chapter presented the theoretical frameworks and accompanying components that informed the study. Some of the accompanying components of the childhood diarrhoea framework were: socio-economic factors, neighbourhood infrastructure, sanitation and living conditions as well as hygiene factors. Some of the components of the ARI framework included parents' demographics, type of cooking fuels and type of residence. The chapter also discussed the extant literature on factors associated with childhood diarrhoea in the four countries studied. It also discussed the extant literature on factors associated with ARI in those four countries. The next chapter presents the methodology, including the statistical analyses employed in the study.

CHAPTER 3

METHODS

3.0 Introduction

This chapter discusses the methodology carried out in the current research. Generally, the study utilised data from a nationally representative, population-based survey programme, known as the Demographic and Health Surveys (DHS). The rest of the chapter is organised as follows: Section 3.1 presents the sources of data for the various studies. This is followed by a comprehensive description of the DHS programme, together with its data collection procedure. The next four sections present the aspects of the DHS of the countries surveyed that were relevant to the current study. The India DHS is referred to as the National Family Health Surveys. Section 3.2 presents the study variables, and a summary concludes the chapter.

3.1 Data Sources

The sources of data for this current study were the most recent Demographic and Health Surveys (DHS) of the various countries; namely, 2014 Bangladesh DHS, 2005-06 India DHS, 2016 Nepal DHS and 2012-13 Pakistan DHS. The next section highlights the DHS programme in general and how data collection is carried out.

3.1.1. Demographic and Health Surveys

The Demographic and Health Surveys is a periodic project which has earned a worldwide reputation for collecting and disseminating accurate, nationally representative, population-based data on fertility, family planning, maternal and child health, gender, HIV/AIDS, malaria, and nutrition. The project is funded by the U.S. Agency for International Development (USAID), and implemented by ICF International.

The surveys are also supported by contributions from other donors such as UNICEF, UNFPA, WHO and UNAIDS as well as funding from participating countries.

The aims of the DHS Programme include the following:

1. Promotion of widespread dissemination and utilization of DHS data among policymakers
2. Expansion of the international population and health database
3. Advancement of survey methodology
4. Development the skills and resources necessary to conduct high-quality demographic and health surveys in participating countries

The DHS Programme has provided technical assistance to more than 260 demographic and health surveys in over 90 countries since 2004, and has played a vital role in advancing global understanding of health and population trends in developing countries. In addition to other functions, the DHS surveys collect data on child health, child mortality and nutrition among children. The strategic objective of the DHS programme is to improve and institutionalise the collection and use of data by host countries for programme monitoring and evaluation and for policy development decisions. The Programme also provides programme managers, health care providers, policy makers, country leaders, researchers, members of the media and others who can promote the improvement of public health with survey data. Further, the DHS programme distributes unrestricted survey data files for legitimate academic research free of charge, and uses standardised methods in their surveys to ensure uniformity of results from different countries.

In order to collect data that are comparable across countries, the DHS programme developed standard model questionnaires. In addition to these questionnaires, there is usually a written statement explaining the inclusion of certain questions or sections. The model questionnaires, which form the basis of the questionnaires applied in each country, have undergone reviews and modifications in each of the six phases of the DHS Program. According the DHS Programme's rules, it is mandatory for a country to adopt the model questionnaire in its entirety. However, any country can add questions of particular interest. If questions in the model are irrelevant in a particular country, they can be deleted.

3.1.1.1 DHS Questionnaires: Overview

Surveys of the majority of countries concentrate on collection of information about basic demographic and health topics. The Model Questionnaires of the DHS Program lay emphasis on basic indicators and flexibility. In most of the DHS surveys, people who qualify for individual interviews include women of reproductive age (between 15 and 49 years) and men aged 15-49 years, 15-54 years, or 15-59 years. Information on fertility, mortality, family planning, marriage, reproductive health, child health, nutrition, and HIV/AIDS are some of the features of the Individual questionnaires.

In some countries, the model questionnaires contain special information about topics which are not featured in other countries' questionnaires. To take this into consideration, and for achieving a certain level of comparability across countries that need to collect such data, various additional topics are addressed in optional questionnaire Modules.

Furthermore, to meet local conditions and needs, country-specific questions are normally included. The questionnaires differ from country to country, although they contain essentially the same information. It is worthy of note that the content of the questionnaires are modified from time to time, both model questionnaires and questionnaire modules having been changed with each DHS phase. There has been a substantial change between the current DHS-7 questionnaires and those used in the first phase of DHS conducted in the 1980's. The various questionnaires administered in the DHS programme are explained in the next sections.

3.1.1.2 Household Questionnaire

The following topics are contained in the "Household Questionnaire":

1. Household Schedule: Information about age, sex, relationship to the head of the household, education, parental survivorship and residence, and birth registration for usual members of a particular household and visitors is collected.
2. Household characteristics: Information about the quality of source of drinking water, quality of toilet facilities, type of cooking fuel, assets of the household, and exposure to second-hand smoke is collected. In areas where malarial diseases are prevalent, questions about the use of mosquito nets are asked.

3.1.1.3 Women's Questionnaire

Information on the following topics is contained in the "Women's Questionnaire":

1. Background characteristics: Information about characteristics that have the likelihood of influencing the demographic and health behaviour of women are

obtained from questions on their age, marital status, education, employment, media exposure, and place of residence.

2. Reproductive behaviour and intentions: This portion of the questionnaire include dates and survival status of all births, pregnancies that did not end in a live birth, current pregnancy status, fertility preferences, and future childbearing intentions of each woman.
3. Contraception: Questions under this portion of the questionnaire include knowledge and use of specific contraceptive methods, source of contraceptive methods, respondents' exposure to family planning messages, informed choice, and unmet need for family planning. With regard to women who do not use contraception, questions on knowledge of a source of contraception are included.
4. Antenatal, delivery, and postnatal care: This aspect of the questionnaire gathers information on antenatal and postnatal care, place of delivery, type of delivery assistance, birth weight, and the nature of complications during pregnancy for recent births.
5. Breastfeeding and nutrition: Information on feeding practices, breastfeeding duration, consumption of liquids and solid food by children, and micronutrient supplementation is covered in questions in this portion of the questionnaire.
6. Children's health: Questions examined coverage of immunization, vitamin A supplementation, recent episodes of diarrhoea, fever, cough among young children and treatment of childhood diseases.
7. Status of women: The questionnaire asks about various aspects of empowerment for women, which includes decision making, autonomy,

ownership of houses and land, barriers to medical care, and attitudes towards domestic violence.

8. HIV and other sexually transmitted infections: Questions examine women's knowledge of HIV and other sexually transmitted infections, the sources of their knowledge about HIV, knowledge about ways to avoid contracting HIV, HIV testing, stigma and discrimination, and high-risk sexual behaviour.
9. Husband's background: The questionnaire collects information the age, education, and husbands' occupation of currently married women.
10. Other topics: The questionnaire also collects information on behaviour related to environmental health, the use of tobacco, and health insurance.

3.1.1.4 Men's Questionnaire

Features of the men's questionnaire included the following:

1. Background characteristics: Questions in the questionnaire which provides information on characteristics likely to influence men's behaviour include the age, education, employment status, marital status, exposure to media, and place of residence.
2. Reproduction: Questions are asked about the number of children that the man has fathered in his lifetime, survival status of the births, number of women the man has fathered children with, antenatal and delivery care for the last child born in the previous 3 years, and his knowledge on feeding practices for children with diarrhoea. Questions are also asked about fertility preferences and future childbearing intentions of each man.
3. Knowledge and use of contraception: Questions are designed to examine the knowledge and use of specific family planning methods. Questions are asked

about men’s exposure to family planning messages through both the media and health professionals, about the most fertile days in a woman's cycle, and condom (male and female) sources.

4. Employment and gender roles: Questions are asked about men’s employment and occupation, as well as about men’s attitude towards various aspects of women's empowerment, such as decision making, childbearing, women's autonomy, and domestic violence.
5. HIV and other sexually transmitted infections: Questions are asked about men's knowledge of HIV and other sexually transmitted infections, the sources of their knowledge about HIV, knowledge about ways to avoid contracting HIV, HIV testing, stigma and discrimination, and high-risk sexual behavior.
6. Other health issues: Questions are asked about various men’s health issues such as circumcision, injections, use of tobacco, health insurance, and health and care for their children.

3.1.1.5 Biomarker Questionnaire

Information contained in the "Biomarker Questionnaire" includes the following:

1. Anthropometry: This involves the measurement of the height and weight of children, women, and men to determine their nutritional status.
2. Anaemia: This involves the measurement of hemoglobin level in the blood measured by using a finger stick capillary blood sample. The level of hemoglobin is used to determine whether the respondent is anaemic or not. Results are shared with the adult respondent, the minor respondent and parent/guardian of the minor respondent, and the parent/guardian of the child. A blood sample is only collected only with consent by the respondents.

3. HIV: A capillary blood sample is collected on a filter paper card, dried overnight, and the dried blood sample (DBS) is sent to a laboratory for HIV prevalence testing. Results of the testing are kept completely anonymous and cannot be identified with the respondent. A blood sample is only collected with consent from the respondent.

3.1.2 The 2014 Bangladesh DHS

The Bangladesh Demographic and Health Survey (BDHS) 2014 is the seventh national-level demographic and health survey designed to provide information meant to address the monitoring and evaluation needs of the Health, Population and Nutrition Sector Development Program (HPNSDP). It is also meant to provide managers and policy makers involved in the program with the information they need to effectively plan and implement future interventions. The survey was implemented through a collaborative effort of the National Institute of Population Research and Training (NIPORT), ICF International, USA and Mitra & Associates. The United States Agency for International Development (USAID), Bangladesh, provided the financial support for the survey. In addition, the survey has generated evidences on basic national indicators of social progress; these include fertility, childhood mortality, fertility preferences and fertility regulation, maternal and child health, nutritional status of mothers and children, and awareness and attitude towards HIV/AIDS.

Apart from presenting the main findings from the 2014 BDHS on fertility, family planning, maternal and child health and nutrition, the report highlights the major changes that have taken place in the demographic and health situation in Bangladesh since 1993-94.

3.1.2.1. Survey Objectives and Implementing Organizations

The main objectives of the 2014 BDHS included the following:

1. Provision of information to meet the requirement for monitoring and evaluation of Bangladesh's health, population, and nutrition sector development program (HPNSDP)
2. Provision of the information needed by program managers and policy makers involved in the programme to plan and implement future interventions

The specific objectives of the 2014 BDHS were to:

1. To provide up-to-date data on demographic rates, including fertility rates and infant and child mortality rates, at the national and divisional level
2. To measure the level of contraceptive use by currently married women
3. To provide data on maternal and child health, including antenatal care, assistance at delivery, postnatal care, newborn care, breastfeeding, immunizations, and prevalence and treatment of diarrhoea and other diseases among under-5 children.
4. To assess the nutritional status of under-5 children and women by means of anthropometric measurements (weight and height), and to assess infant and child feeding practices
5. To provide data on women's knowledge and attitudes about sexually transmitted infections and HIV/AIDS
6. To measure key education indicators, including school attendance ratios
7. To provide community-level data on how accessible and available are health and family planning services.

3.1.2.2. Sample Design

The 2014 BDHS survey used a sampling frame from the list of enumeration areas (EAs) of the 2011 Population and Housing Census of the People's Republic of Bangladesh, provided by the Bangladesh Bureau of Statistics (BBS). The primary sampling unit (PSU) for the survey is an EA created to have an average of about 120 households.

Bangladesh is divided into seven administrative divisions, namely; Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet. Each division is divided into *zilas*, and each *zila* into *upazilas*. Each urban area in an *upazila* is divided into wards, which are further subdivided into *mohallas*. A rural area in an *upazila* is divided into *union parishads* (UPs) and, within UPs, into *mouzas*. These divisions allow the country as a whole to be separated into rural and urban areas.

The survey was based on a two-stage stratified sample of households. In the first stage, 600 EAs were selected with probability proportional to the EA size, with two hundred and seven EAs in urban areas and three hundred and three in rural areas. A complete household listing operation was then carried out in all of the selected EAs to provide a sampling frame for the second-stage selection of households. In the second stage of sampling, a systematic sample average of thirty households was selected for each EA to provide statistically reliable estimates of key demographic and health variables for the country as a whole, for urban and rural areas separately, and for each of the seven divisions. With this design, 18,000 residential households were selected by the survey. These were expected to result in completed interviews with about 18,000 ever-married women.

Analysis using the 2014 BDHS data required sampling weights to be applied to ensure the actual representation of the survey results at the national and domain levels.

Although the weighted distribution of urban-rural households in the survey was based on the urban-rural distribution in the 2011 population census, the sampling weights were adjusted to reflect a modified urban-rural household distribution recently reported by the BBS. After adjusting for undercount and including statistical metropolitan areas (SMAs) among the urban areas, the BBS estimated that the urban population was 28% (BBS 2014). The adjustment in the 2014 BDHS sampling weight was to generate a revised urban/rural population distribution and was not expected to lead to any significant differences in the overall survey indicators.

3.1.2.3 Questionnaires

The 2014 BDHS used three types of questionnaires: a Household Questionnaire, a Women's Questionnaire, and a Community Questionnaire. The contents of the Household and Women's questionnaires were based on the MEASURE DHS Model Questionnaires described in section 3.1.1. These model questionnaires were adapted for use in Bangladesh during a number of meetings with a Technical Working Group (TWG) consisting of representatives from NIPORT, Mitra and Associates, International Center for Diarrheal Disease Research, Bangladesh (ICDDR,B), USAID/Bangladesh, and ICF International. Subsequently, draft questionnaires were circulated to other interested groups and reviewed by the 2014 BDHS Technical Review Committee. The questionnaires were developed in English and subsequently translated into and printed in Bangla.

The Household Questionnaire was utilised listing all the usual members as well as visitors in the selected households. Basic information on the characteristics of each person listed, such as age, sex, education, current work status, birth registration, and individual possession of mobile phones was collected. The main objective of the

Household Questionnaire was to identify women who were qualified for the individual interview. Information about the dwelling unit, such as the source of water, type of toilet facilities, materials used to construct the floor, roof, and walls, ownership of various consumer goods, and availability of hand washing facilities was also collected. Additionally, the household questionnaire was utilised in recording the height and weight measurements of ever-married women aged between 15 and 49 years, as well as children aged under age six years.

The Women's Questionnaire was utilised in collecting information from ever-married women aged between 15 and 49 years. Women were asked questions on topics including: a) Background characteristics (e.g., age, education, religion, media exposure), b) Reproductive history, c) Use and source of family planning methods, d) Antenatal, delivery, postnatal, and newborn care, e) Breastfeeding and infant feeding practices, f) Child immunizations and illnesses, g) Marriage, h) Fertility preferences, i) Husband's background and respondent's work, j) Awareness of AIDS and other sexually transmitted infections.

The Community Questionnaire was administered in each selected cluster during the household listing operation. It included questions about the existence of development organizations in the community and the availability and accessibility of health services and other facilities. During the household listing operation, the geographic coordinates and altitude at the centre of each cluster were also recorded using *Garmin eTrex Legend H units* [234]. A list of health facilities and health service providers in each selected EA was provided to the interviewing teams to verify information gathered in the Woman's Questionnaires on the types of facilities accessed and health services personnel seen. The Community Questionnaire was administered to a group of four to

six key informants who were knowledgeable about socioeconomic conditions and the availability of health and family planning services/facilities in the cluster. Key informants included community leaders, teachers, government officials, social workers, religious leaders, traditional healers, and health care providers among others.

3.1.2.4 Training and Fieldwork

To undertake the listing of households, to delineate EAs, and to administer Community Questionnaires, 54 people were trained. In addition, those 54 people were trained to use global positioning system (GPS) units to obtain coordinates of locations of each selected EA. The training of the 54 people lasted a total of five days, from May 14 to May 20, 2014. A household listing operation performed in all selected EAs between May 21 and August 17, 2014, in four phases, each lasting three weeks. Initially, 20 teams of two persons each were deployed to undertake the listing of households and to administer the Community Questionnaires. In the third phase, the number of teams was reduced to 19, and in the final phase, the number was reduced to 11. In addition, 10 supervisors were deployed to check and verify the work of the listing teams.

Training of the fieldworkers who carried out the main survey was conducted between June 1 and June 26, 2014. A total of 164 fieldworkers were recruited, based on their level of education, prior experience with surveys, maturity, and willingness to spend up to four months on the project. Training included lectures on how to complete the questionnaires, mock interviews amongst participants, and field practice. A former NIPORT staff member offered a talk on family planning methods and maternal and child health.

Fieldwork for the BDHS was carried out by interviewing teams. Each team consisted of one male supervisor, one female field editor, five female interviewers, and one

logistics staff member. Data collection was carried out in four phases, commencing on June 28, 2014, and ending on November 9, 2014. The number of teams decreased with each subsequent phase, starting with 20 teams in the first phase and ending with 16 teams by the end of data collection. Data quality measures were carried out through several activities. There were four quality control teams from Mitra and Associates, each consisting of one male and one female staff member. They were sent to the field to visit the interviewing teams throughout the data collection period. Furthermore, the professionals of the survey team made several visits to check the fieldwork.

Additionally, NIPORT monitored fieldwork by sending two quality control teams, each consisting of three members. The teams hit the field for about three weeks in each phase, overseeing the use of the household listings and maps, observing one household and one individual interview of each interviewer, and spot-checking the completed questionnaires. The teams also revisited half of the households of one completed cluster for each survey team and checked whether selected households were visited and eligible respondents were properly identified and interviewed. Debriefing sessions were held between tours of the fieldworkers, so as to discuss problems encountered in the field, and also to resolve administrative matters. Field check tables generated concurrently with data processing were used to monitor data quality. The main purpose of the tables was to allow the quality control teams to advise field teams of problems detected during data entry. Representatives from USAID, The DHS Program, and NIPORT, and other Technical Review Committee members, also monitored fieldwork through several field visits.

3.1.2.5 Data Processing

The completed questionnaires of the 2014 BDHS were returned to the capital city, Dhaka, periodically for data processing at Mitra and Associates. Processing of the collected data commenced shortly after start of the fieldwork, and involved office editing, coding of open-ended questions, data entry, and editing of inconsistencies found by the computer programme. Data were processed by eight data entry operators and two data entry supervisors. Processing of data (which was carried out using the Census and Survey Processing System (CSPro), a software jointly developed by the U.S. Census Bureau, ICF Macro, and Serpro S.A) started on July 24, 2014, and ended on November 20, 2014.

3.1.2.6 Sample Coverage

The results of the household and individual women's interviews are presented in Table 3.1. Out of a total of 17,989 selected households, 17,565 were found to be occupied. Interviews were successfully completed in 17,300 households, where a total of 18,245 ever-married women aged between 15 and 49 years were identified and 17,863 were interviewed, thus yielding a response rate of 98%. The main reason for nonresponse among women was their absence from home despite repeated visits to the household.

Table 3.1: Results of the household and individual interviews

Number of households, number of interviews, and response rates, according to residence (unweighted), Bangladesh 2014

	Residence		
Result	Urban	Rural	Total
Household interviews			
Households selected	6210	11779	17989
Households occupied	6062	11503	17565
Households interviewed	5930	11370	17300
Household response rate[1]	97.8	98.8	98.5

Interviews with women aged 15-49 years			
Number of eligible women	6324	11921	18245
Number of eligible women interviewed	6167	11696	17863
Eligible women response rate[2]	97.5	98.1	97.9

[1] Households interviewed/households occupied

[2] Respondents interviewed/eligible respondents

Source: 2014 BDHS [66]

3.1.3 The 2005-06 India DHS (National Family Health Survey 2005-06)

The India National Family Health Survey 2005-06 is also known as the NFHS-3 (the third survey since the inception of the India National Family Health Survey). Funding for the programme was provided by the USAID, the United Kingdom Department for International Development (DFID), the Bill and Melinda Gates Foundation, UNICEF, UNFPA, and the Government of India. Technical assistance was provided by Macro International, Maryland, USA. Eighteen research organizations conducted fieldwork for NFHS-3. Thirteen of these are private sector research organizations and five are Population Research Centres (PRCs) established by the GOI in various states. Each research organization had responsibility for collecting the data in one or more states.

The programme was coordinated by the International Institute for Population Sciences (IIPS) under the auspices of the India Government and conducted in 2005-06. The NFHS-3 was tasked with the provision of information on fertility, mortality, family planning, HIV-related knowledge, and important aspects of nutrition, health, and health care in India. Men aged between 15 and 54 years, women aged 15-49 years who were never married as well as ever-married women were interviewed in the survey. The NFHS-3 featured questions on several emerging issues such as perinatal mortality, male involvement in maternal health care, adolescent reproductive health,

higher-risk sexual behaviour, family life education, safe injections, and knowledge about tuberculosis. Additionally, the NFHS-3 conducted blood testing for HIV to provide population-based data on HIV prevalence in India (for the first time).

The NFHS-3 gathered information from a nationally-representative sample of 109,041 households, made up of 124,385 women aged between 15 and 49 years, and 74,369 men aged 15-54 years, which covered 99% of the population of India in all 29 states. Out of all those interviewed nationwide, 102,946 were tested for HIV. The programme provides estimates of HIV prevalence for adult women and men at the national level, for Uttar Pradesh and for five high HIV prevalence states (Andhra Pradesh, Karnataka, Maharashtra, Manipur, and Tamil Nadu). In addition, blood haemoglobin levels of women and men and of children aged between 6 and 59 months were tested by health investigators to assess the prevalence of anaemia. Furthermore, the NFHS-3 gathered information on population and health indicators for slum and non-slum populations in eight cities, including Chennai, Delhi, Hyderabad, Indore, Kolkata, Meerut, Mumbai, and Nagpur.

3.1.3.1 Questionnaires

The NFHS-3 utilised three types of questionnaire, namely, the Household, the Women's, and the Men's Questionnaires. The general content and format of the questionnaires were generated through a number of workshops and meetings held in 2005-06. The workshops were attended by representatives of a broad spectrum of research and development organisations in the population and health fields, personnel from the Ministry of Health and Family Welfare and other government agencies, representatives from international agencies, and experts working on gender and

HIV/AIDS issues. The questionnaires for each state were bilingual; questions in the questionnaires were both the principal language of the particular state and English.

All usual residents in each sample household and any visitors who stayed in the household the night prior to the interview were listed in the Household Questionnaire. Information on age, sex, marital status, relationship to the head of the household, and education of each listed individual was collected. Information was collected on birth registration was collected for children aged 0-4 years. Questions about school/college attendance for children aged 5-18 years were asked. In addition, questions about the activities of children aged between 5 and 14 years were asked. Information gathered in the household questionnaire included the main source of drinking water, type of toilet facility, source of lighting, type of cooking fuel, religion and caste/tribe of the household head, ownership of a house, ownership of agricultural land, ownership of livestock, ownership of other selected items, and whether the household had a BPL (Below Poverty Line) card. Furthermore, health issues such as the prevalence of tuberculosis, use of private or public health facilities, and ownership of mosquito nets were included in the questionnaire. Additionally, a test was conducted to assess whether households used iodine-fortified cooking salt.

Several biomarker measurements were included in the Household Questionnaire. The heights and weights of women aged 15-49 years, those of men aged 15-54 years, and those of children born since January 2000 (in states where fieldwork started in 2005) or January 2001 (in states where fieldwork started in 2006) were measured by two health investigators on each survey team. Data on height and weight are used to assess nutritional statuses of the population. Blood samples from women aged 15-49

years, men aged 15-54 years, and children aged 6-59 months were also taken by the health investigators to measure haemoglobin levels, which are used to determine the prevalence of anaemia. Portable HemoCue instruments which provide test results in less than one minute were used in the field to measure haemoglobin levels. Informational brochures about anaemia and proper nutrition were supplied to all respondents. Adults and children who were severely anaemic were subsequently referred to local public health facilities for treatment.

The Women's Questionnaire was utilised in interviewing all ever-married and never-married women aged 15-49 years who were usual residents of the sample households or were visitors who stayed in the sample households during the night prior to the survey. Topics covered in the questionnaire included:

1. Background characteristics: age, marital status, caste/tribe, religion, education, employment status, exposure to mass media, place of residence, and background of the husband.
2. Reproductive behaviour and intentions: dates and survival status of all births, current pregnancy status, pregnancy losses, use of ultrasound for recent pregnancies, and future childbearing intentions.
3. Marriage and cohabitation: duration of marriage and cohabitation, number of times married. Knowledge and use of contraception: knowledge and use of specific contraceptive methods, source of family planning methods, and reasons for non-use of contraception and intentions not to use contraception in the future.

4. Quality of care and contacts with health personnel: quality of family planning and health services.
5. Antenatal, delivery, and postnatal care: antenatal and postnatal care, antenatal services received, place of delivery, attendance at delivery, and complications during pregnancy for recent births.
6. General health: smoking, alcohol use, injections, tuberculosis, asthma, diabetes, and thyroid disorders.
7. Child immunizations, child health, and child feeding practices: immunization coverage, breastfeeding and feeding practices, and recent occurrences of diarrhoea, fever, and cough for young children.
8. Women's and children's nutrition: food intake and nutrition-related practices for women and children.
9. Utilization of ICDS Services: utilization of various services of the Integrated Child Development Services (ICDS) Scheme for women and children.
10. Status of women and spousal violence: women's autonomy, gender relations, men's involvement in health care for women, and various forms of physical and sexual violence experienced by women.
11. Sexual life: sexual intercourse (first and recent intercourse), high-risk sexual behaviour, number of sexual partners, age difference between partners, and duration of sexual relationships.

The Men's Questionnaire was utilised in interviewing men aged between 15 and 54 years who were either regular residents of the sample households or visitors who had stayed in the sample households during the night prior to the survey. The questionnaire features some questions covered in the Women's Questionnaire, in

addition to questions that apply to only men. Topics covered in the Men's Questionnaire include the following:

1. Background characteristics: age, marital status, caste/tribe, religion, education, employment status, exposure to mass media, and place of residence.
2. Reproductive behaviour and intentions: number of children, number of surviving children, fertility preferences, and future intentions to have children.
3. Knowledge and use of contraception: knowledge and use of specific contraceptive methods, and sources of family planning methods.
4. Male involvement in health care: men's involvement in health care for their child and the mother of their children, and quality of health services obtained by men.
5. Sexual life: sexual intercourse (first and recent intercourse), high-risk sexual behaviour, number of sexual partners, age difference between partners, and duration of sexual relationships.
6. Health and nutrition: food intake, smoking, alcohol use, injections, tuberculosis, asthma, diabetes, and thyroid disorders. Attitude toward gender roles: attitude about gender roles, attitude about spousal violence, and men's perception of wife's involvement in decision making.

3.1.3.2 Sample Design

Samples from urban and rural settings within each state were drawn separately and, to the extent possible, except when oversampling was required to allow separate estimates for urban slum and non-slum areas. The sample within each state was allocated in proportion to the size of the urban and rural populations of each state. A uniform sample design was adopted in all states. The rural sample was selected in two

stages in each state, with the selection of Primary Sampling Units (PSUs) (villages); with probability proportional to population size (PPS) at the first stage, followed by the random selection of households within each PSU in the second stage. In urban areas, a three-stage procedure was conducted. In the first stage, wards were selected with PPS sampling. In the next stage, one census enumeration block (CEB) was randomly selected from each sample ward. In the final stage, households were randomly selected within each selected CEB.

Regarding sample selection in rural areas, the first level of stratification was geographic; districts were then sub-divided into contiguous regions. Within each of these regions, villages were further stratified by utilising selected variables from a list which includes: village size, percentage of males working in the non-agricultural sector, percentage of the population belonging to scheduled castes or scheduled tribes, and female literacy.

A mapping and household listing operation was conducted in each sample area in every state. The objective of the listing was to provide the necessary framework that would help in selecting households at the second stage. The household listing operation involved the preparation of up-to-date notional and layout sketch maps of each selected PSU, allotting numbers to structures, recording addresses or the location of those structures, identifying residential structures, and listing the names of the heads of all the households in residential structures in the selected PSUs. Large sample villages (with more than a specified number of households, usually 500) were segmented, and two segments were selected randomly using the PPS method.

Household listing in the segmented PSUs was carried out only in the selected segments. Each household listing team comprised one lister and one mapper.

Senior field staff of the concerned research organization supervised the listing operation. The households to be interviewed were selected with equal probability from the household list in each area using systematic sampling. The interval applied for the selection was determined to obtain a self-weighting sample of households within each domain. On average, 30 households were initially targeted for selection in each selected enumeration area. To avoid extreme variations in the workload, minimum and maximum limits were put on the number of households that could be selected from any area, at 15 and 60, respectively. Each survey team supervisor was provided with the original household listing, layout sketch map, and the list of selected households for each PSU. All the households which were selected were contacted during the main survey, and no replacement was made if a selected household was absent during data collection. However, if a PSU was inaccessible, a replacement PSU with similar characteristics was selected by IIPS and provided to the research organization.

With regard to sample selection in urban areas, a similar approach to that conducted in the rural areas was used in the first stage of sampling. In the second stage, a single census enumeration block, which consisted of roughly 150-200 households, was selected from each chosen ward by utilising the PPS method. Similar to that in the rural areas sampling, a household listing operation was conducted in each selected census enumeration block, which provided the desired framework for the selection of households in the third stage of sample selection. On average, 30 households were

targeted for selection from each census enumeration block with minimum and maximum limits from any area of 15 and 60 households.

3.1.3.3 Sample Weights

The NFHS-3 was designed for self-weighting within the urban and rural areas of each state, and the slum and non-slum areas of each of the eight selected cities (collectively referred to as domains). Thus all households and individuals in the same domain share a common household weight and individual weight respectively. The design weight was defined as the inverse of the overall sampling fraction in each domain. The overall sampling fraction was the product of the selection probabilities at each sampling stage (two stages in rural areas and three stages in urban areas). The design weight was adjusted for household non-response in the calculation of the household sampling weight. Further, the household sampling weight was adjusted for individual non-response to obtain the individual sampling weight. Both adjustments for non-response were done at the domain level in order to preserve the self-weighting nature of the sample within domains. The sampling weights were further normalised at the national level to obtain national standard weights and at the state level to obtain standard state weights for each of the 29 states. The national standard weights were normalized so that the total number of weighted cases equals the total number of unweighted cases at the national level. The state standard weights were calculated to ensure that the total number of weighted cases equals the total number of unweighted cases for each state. Weights for the men's subsample, the HIV subsample, and the subsample of women selected for the domestic violence section of the questionnaire were calculated in a similar way.

3.1.3.4 Sample Implementation and Data Collection

In order to achieve better coordination and supervision in the implementation of the survey, fieldwork for the NFHS-3 was conducted in two phases. In the first phase, twelve states were canvassed. The remaining 17 states were canvassed in the second phase.

The first phase of fieldwork covered Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Uttar Pradesh, and West Bengal. States which were covered in the second phase were Arunachal Pradesh, Bihar, Goa, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Manipur, Madhya Pradesh, Mizoram, Nagaland, Sikkim, Tamil Nadu, Tripura, and Uttaranchal.

The number of household interviews, the number of interviews with women and men, and response rates for the entire country by urban-rural residence are presented in Table 3.2. In Table 3.3, the period of fieldwork, number of households and eligible women and men interviewed, and response rates for each state are presented. A total of 109,041 households were interviewed. The household response rate (the number of households interviewed per 100 occupied households) was 98% for India as a whole, 97% in urban areas, and 99% in rural areas. The household response rate was equal to or higher than 96% in all states.

Table3.2: Results of the household and individual interviews

Number of households, number of interviews with women and men, and response rates, according to residence, India, 2005-06

	Residence		
Result	Urban	Rural	Total
Household interviews			
Households selected	54,453	62,199	116,652
Households occupied	51,846	59,713	111,559

Households interviewed	50,236	58,805	109,041
Household response rate1	96.9	98.5	97.7
Interviews with women age 15-49	61,028	70,568	131,596
Number of eligible women			
Number of eligible women interviewed	56,961	67,424	124,385
Eligible women response rate2	93.3	95.5	94.5
Interviews with men age 15-54			
Number of eligible men	45,133	40,240	85,373
Number of eligible men interviewed	38,199	36,170	74,369
Eligible men response rate[2]	84.6	89.9	87.1

Note: Eligible women and men are women age 15-49 and men age 15-54 who stayed in the household the night before the household interview (including both usual residents and visitors). This table was based on the unweighted sample.

[1]Households interviewed/households occupied.

[2]Respondents interviewed/eligible respondents.

Out of 131,596 eligible women, 124,385 were successfully interviewed, yielding an overall response rate of 95%, 93% in urban areas and 96% in rural areas. The response rate for eligible women varied from 90% in Maharashtra and Meghalaya to 99% in Madhya Pradesh and Chhattisgarh. Of the 85,373 eligible men, 74,369 were successfully interviewed, yielding an overall rate of 87%, 85% in urban areas and 90% in rural areas. The response rate for eligible men varied between 76% in Delhi and 98% in Madhya Pradesh.

Table 3.3: Number of households, women, and men interviewed by state

Month and year of fieldwork, number of households, women, and men interviewed, and response , India, 2005-06

	Month of year of field work		Households interviewed		Women interviewed		Men interviewed	
State	From	To	Number	RR	Number	RR	Number	RR
India	11/05	8/06	109,041	97.7	124,385	94.5	74,369	87.1
North								
Delhi	12/05	4/06	3,324	96.1	3,349	91.1	1,436	75.9
Haryana	4/06	6/06	2,302	98.8	2,790	95.5	1,083	85.3
Himachal Pradesh	4/06	7/06	2,790	96.3	3,193	95.0	1,067	88.2

Jammu & Kashmir	4/06	8/06	2,415	97.3	3,281	92.2	1,076	77.8
Punjab	12/05	3/06	2,968	98.0	3,681	93.5	1,329	82.2
Rajasthan	12/05	4/06	3,282	99.0	3,892	98.4	1,471	95.5
Uttaranchal	4/06	7/06	2,659	97.5	2,953	91.2	983	81.5
Central								
Chhattisgarh	11/05	3/06	3,031	99.4	3,810	98.6	1,384	96.6
Madhya Pradesh	4/06	8/06	5,488	99.1	6,427	98.8	2,725	98.1
Uttar Pradesh	12/05	4/06	10,026	96.6	12,183	93.9	11,458	86.9
East								
Bihar	4/06	7/06	3,016	98.5	3,818	97.3	1,214	92.7
Jharkhand	4/06	8/06	2,483	96.3	2,983	94.0	996	86.5
Orissa	11/05	4/06	3,910	98.9	4,540	96.1	1,592	92.7
West Bengal	12/05	5/06	5,992	97.8	6,794	95.6	2,669	90.0
Northeast								
Arunachal Pradesh	4/06	7/06	1,526	98.8	1,647	96.9	711	94.7
Assam	12/05	4/06	3,437	98.3	3,840	95.0	1,394	85.7
Manipur	5/06	8/06	3,498	98.7	4,512	94.7	3,951	88.4
Meghalaya	12/05	5/06	1,900	97.8	2,124	89.8	720	78.0
Mizoram	5/06	7/06	1,513	99.7	1,791	98.3	665	97.4
Nagaland	4/06	8/06	3,866	97.9	3,896	95.1	3,971	91.6
Sikkim	4/06	7/06	1,902	98.7	2,127	95.6	810	92.4
Tripura	4/06	7/06	1,574	97.7	1,906	97.4	711	91.6
West								
Goa	4/06	7/06	3,231	97.2	3,464	91.0	1,185	79.5
Gujarat	12/05	3/06	3,216	97.7	3,729	95.4	1,428	88.7
Maharashtra	12/05	3/06	8,315	95.9	9,034	89.5	8,867	77.9
South								
Andhra Pradesh	12/05	4/06	6,668	97.8	7,128	93.5	7,128	89.4
Karnataka	4/06	7/06	5,342	96.7	6,008	92.3	5,528	83.4
Kerala	4/06	8/06	3,023	99.3	3,566	96.4	1,121	90.3
Tamil Nadu	4/06	7/06	6,344	98.6	5,919	97.6	5,696	95.6

Note: This table is based on the unweighted sample; all subsequent tables are based on the weighted sample unless otherwise specified. The number of women and men is based on the de facto population. The household response rate is defined as the number of households interviewed per 100 occupied households. The response rates for women and men are the percentages of eligible women and men with completed interviews.

3.1.4 The 2016 Nepal DHS

The 2016 Nepal DHS is the 5th population-based, nationally representative comprehensive survey conducted as part of the global Demographic and Health Surveys (DHS) project in the country. New ERA, Nepal, implemented the survey, under the auspices of the Population Division of the Nepal Ministry of Health and Population.

ICF International provided technical support for the survey, and financial support was obtained from the United States Agency for International Development (USAID) through its mission in Nepal.

The main objective of the 2016 NDHS was the provision of up-to-date and reliable data on various issues relating to population and health that would promote the provision of guidance in planning, implementation, monitoring, and evaluation of health programmes in Nepal. Included in the survey are topics on fertility levels and determinants, family planning, fertility preferences, childhood mortality, children and women's nutritional status, the utilization of maternal and child health services, knowledge of HIV/AIDS and sexually-transmitted infections (STIs), women's empowerment and for the first time, information on domestic violence against women. In addition, the survey provides information on the anaemia status of women aged between 15 and 49 years, as well as children aged 6-59 months.

Apart from providing national estimates, the survey report also provides disaggregated data at the level of various domains such as ecological region, development regions and for urban and rural areas. The 2016 NDHS compares very well with surveys conducted in other countries and thus, allows for an international comparison. Furthermore, the 2016 NDHS adds to the vast and growing international database on demographic and health-related variables. The 2016 NDHS collected demographic and health information from a nationally representative sample of 10,826 households, which yielded completed interviews with 12,674 women age 15-49 in all selected households and with 4, 121 men age 15-49 in every second household.

3.1.4.1 Sample Design

The sampling frame used for the 2016 NDHS was an updated version of the frame from the 2011 National Population and Housing Census (NPHC), which was conducted by the Central Bureau of Statistics (CBS). The census frame was a complete list of all census wards created for the 2011 NPHC. Although the NPHC was conducted only 4 years ago, the frame had to be updated due to consecutive changes in urban/rural classifications at the ward level; new municipalities were declared and old municipalities were upgraded by adding more wards. Originally, the 2011 NPHC included 58 municipalities; this number increased to 191 municipalities during 2014, and 26 more were declared in 2015, yielding a total of 217 municipalities. In addition, in March 2017, structural changes were made in the classifications of urban and rural locations officially known as “Nagarpalika” and “Gaonpalika.” The country now has 263 municipalities, and 59% of the total population lives in urban areas. The 2016 NDHS results are based on the updated urban-rural classification. Nepal consists of 75 districts distributed across the different ecological zones and development regions. After recent changes approved by Nepal’s Constituent Assembly in September 2015, administratively Nepal is divided into seven provinces (Province 1, Province 2, Province 3, Province 4, Province 5, Province 6, and Province 7). Each province is sub-divided into urban and rural areas. The demarcation of the provinces involves inclusion of selected districts within their boundaries. Although entire districts were selected for inclusion in most cases, two districts, Rukum and Nawalparasi, were split into two separate provinces. The districts are divided into urban and rural locations, which are in turn divided into wards. The sampling frame contains information about ward location, type of residence (urban or rural), estimated number of residential households, and

estimated population. In rural areas, the wards are small in size (average of 104 households) and serve as the primary sampling units (PSUs). In urban areas, the wards are large, with average of 800 households per ward. The CBS has a frame of enumeration areas (EAs) for each ward in the original 58 municipalities. However, for the 159 municipalities declared in 2014 and 2015, each municipality is composed of old wards, which are small in size and can serve as EAs. The 2016 NDHS sample was stratified and selected in two stages in rural areas and three stages in urban areas. In rural areas, wards were selected as primary sampling units, and households were selected from the sample PSUs. In urban areas, wards were selected as PSUs, one EA was selected from each PSU, and then households were selected from the sample EAs. Each province was stratified into urban and rural areas, yielding 14 sampling strata. Samples of wards were selected independently in each stratum. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection, according to administrative units at different levels, and by using a probability proportional to size selection during the first stage of sampling. In the first stage, 383 wards were selected with probability proportional to ward size and with independent selection in each sampling stratum. The ward size is the number of residential households in the ward census used in the 2011 NPHC. Due to the large size of the urban wards, in a second stage of sample selection, one EA was randomly selected from each of the sample urban wards. A household listing operation was carried out in all of the selected sampling clusters (rural wards or urban EAs), and the resulting lists of households served as the sampling frame for the selection of households in the next stage. Some of the selected clusters were large. In order to minimize the task of

household listing for the selected clusters with more than 200 households, each large cluster was segmented. Only one segment was selected for the survey with probability proportional to segment size. Household listing was conducted only in the selected segment. Thus, a 2016 NDHS cluster is a ward, an EA, or a segment of a ward or an EA. In the last stage of selection, a fixed number of 30 households per cluster were selected with an equal probability systematic selection from the newly created household listing. The survey interviewers were to conduct interviews only in the pre-selected households. In order to prevent bias, no replacements of or changes in the pre-selected households were allowed in the implementing stages. Because of the non-proportional sample allocation, the sample was not self-weighting. Weighting factors have been calculated, added to the data file, and applied so that results are representative at the national level as well as the regional and provincial levels. All women age 15-49 who were either permanent residents of the selected households or visitors who stayed in the households the night before the survey were eligible to be interviewed. In half of the households (every second household) selected, all men age 15-49 who were either residents of the selected households or visitors who stayed in the households the night before the survey were eligible to be interviewed. The survey involved collection of biomarker information from respondents in a subsample of the households.

3.1.4.2 Questionnaires

Six questionnaires were administered in the 2016 NDHS: the Household Questionnaire, the Women's Questionnaire, the Men's Questionnaire, the Biomarker Questionnaire, the Fieldworker Questionnaire, and the Verbal Autopsy Questionnaire (for neonatal deaths). The first five questionnaires, based on The DHS Programme's

standard Demographic and Health Survey (DHS-7) questionnaires were adapted to reflect the population and health issues relevant to Nepal. The Verbal Autopsy Questionnaire was based on the recent 2014 World Health Organization (WHO) verbal autopsy instruments [235]. Input on the questionnaires was solicited from various stakeholders representing government ministries and agencies, nongovernmental organizations, and international donors. The survey protocol was reviewed and approved by the Nepal Health Research Council (NHRC) and the ICF Institutional Review Board. The 2016 NDHS required written consent from the household head to carry out the interviews and anaemia testing. After all questionnaires were finalized in English, they were translated into Nepali, Maithili, and Bhojpuri. The Household, Woman's, and Man's Questionnaires were programmed into tablet computers to facilitate computer-assisted personal interviewing (CAPI) for data collection purposes, with the capability to choose any of the three languages for each questionnaire. The Biomarker Questionnaire was completed on paper during data collection and then entered into the CAPI system. The Fieldworker Questionnaire and the Verbal Autopsy Questionnaire were completed on paper

The Household Questionnaire was used to list all of the usual members and visitors in the selected households. Basic information collected on the characteristics of each listed respondent included age, sex, education, and relationship to the head of the household. For children aged less than 18 years, the survival status of the parents was assessed.

The Household Questionnaire was used to identify women and men who were qualified to take part in the individual interview. It was also used to identify women

who were eligible for the interview which focused on domestic violence. The Household Questionnaire also collected information on characteristics of the dwelling unit of households, such as source of drinking water, type of toilet facilities, materials used for the floor of the house, ownership of various durable goods, ownership of mosquito nets, and household food security.

The women's questionnaire was used to collect information from women who were aged between 15 and 49 years. Questions featured in the Women's questionnaire included the following:

1. Background characteristics such as education, residential history, access to media exposure
2. Pregnancy history and childhood mortality
3. Knowledge and use of family planning methods
4. Fertility preferences
5. Antenatal, delivery, and postnatal care
6. Breastfeeding and infant feeding practices
7. Vaccinations and childhood illnesses
8. Marriage and sexual activity
9. Work characteristics and husband's background characteristics
10. Awareness and behaviour regarding AIDS and other sexually transmitted infections
11. Domestic violence

The Men's Questionnaire was administered to all men age 15-49 in the subsample of households selected for the male survey. The Man's Questionnaire collected much of

the same information elicited from the Woman's Questionnaire but was shorter because it did not contain a detailed reproductive history or questions on maternal and child health.

3.1.4.3 Pretest

Twelve enumerators, five members of the core project team, and four data processing personnel from New ERA participated in the training to pretest the NDHS survey protocol over a 3-week period in February 2016. Most of the participants had previous experience carrying out NDHS surveys. The idea behind having the data processing staff to participate in the pretest was to familiarize them with the CAPI system. The training was carried out by ICF staff focusing on the technical components of the survey, biomarkers, and CAPI system.

Along with discussions on the technical aspects of the survey, the pretest training was designed to prepare the trainers for the main training. The training focused on key components such as age probing; interview techniques and procedures for completing the NDHS questionnaires; birth histories, family planning, and contraceptive calendars; completion of the vaccination section; standardization procedures for anthropometry; blood pressure measurement; and haemoglobin testing. The participants worked in groups using various training techniques, including interactive question-and-answer sessions, case studies, and role plays. Along with the enumerators, the trainers administered the questionnaires in the field, provided feedback on the content and language of the questionnaires, tested the CAPI software program, and learned the various training techniques. Adult learning principles were emphasized through hands-on training, and various in-class exercises were carried out.

The fieldwork for the pretest was carried out in three locations focusing on Nepal's three language groups (Nepali, Maithili, and Bhojpuri). These locations were Sarlahi district for Maithili, Kalaiya district for Bhojpuri, and Dhading district for Nepali. The reason for selecting Dhading was to gain an understanding of the issues in earthquake-affected areas. Each team carried out the pretest in an urban and a rural location, completing six clusters in total. Following the fieldwork, a debriefing session was held with the pretest field staff, and modifications to the questionnaires were made based on lessons drawn from the exercise

3.1.4.4 Training of Field Staff

The main training for the 2016 NDHS started on May 15, 2016, in Kathmandu. The training included 2 weeks of orientation on use of paper questionnaires followed by 1 week of CAPI training. Selected participants were trained in the collection of biomarker information during the fourth week. Specialized training on conducting a verbal autopsy was carried out for the supervisors and selected enumerators.

The participants for the main training included 101 trainees, selected through a strict vetting process. They took a written test and a computerized test and also completed a personal interview to qualify for participation in the main training. Attendees came from different parts of Nepal and represented major language groups within the country. Most of the candidates had previous fieldwork experience, and some had experience gained through previous rounds of the NDHS.

Five members of the core project staff and three data processing personnel from New ERA also participated in the training as facilitators. The New ERA staff members were trained during the pretest training in preparation for the main training. They took the

initiative in managing the training. ICF staff provided technical support during the training sessions.

The participants were divided into two classrooms of about 50 participants each. The training sessions included discussions of concepts, procedures, and methodology related to conducting the DHS survey. Participants were guided through the questionnaires. In-class exercises were carried out, keeping in mind that involving participants in the training process would give them a better understanding of the training content. Various techniques were used to facilitate the training, including role playing on completing a household schedule, age probing in pairs, consistency checking for age and date of birth, correcting errors in the pregnancy history table, completing a contraceptive calendar with given cases, creating a vaccination card for an imaginary child, and filling in the questionnaires using cards prepared by colleagues. Resource personnel from the Ministry of Health and the Nepal Health Research Council attended the sessions to provide technical guidance. The training also included discussions on the CAPI system, demonstrations of the CAPI DHS menus, and practice in conducting interviews through the CAPI system.

As noted, the 2016 NDHS collected data on three major types of biomarkers: anthropometry, haemoglobin/anaemia, and blood pressure. Two female members and one male member of each team were trained to take height and weight measurements. The two female members were also trained in carrying out anaemia testing and blood pressure measurements, and the single male member was trained in taking blood pressure measurements. Unlike the 2011 NDHS, the survey involved measuring the heights and weights of men. The supervisors of the teams were also

trained in taking blood pressure measurements. The biomarker training included lecture sessions, hands-on demonstrations, and practical exercises. Children were brought to the training venue for the participants to practice taking their measurements and testing blood samples for haemoglobin (finger and heel pricks). A complete day was assigned to practice blood pressure measurement and haemoglobin testing. After intense training and practice sessions, an anthropometry standardization exercise was carried out in which the instructor and all measurers weighed and measured the same group of children twice to assess the accuracy and precision of the measurements. The results of the standardization exercise were entered into an Excel spreadsheet and presented to the participants. Accuracy and precision results were compared against the true values as well as the mean values of the measurers. Those who were out of range three or more times were invited to a separate session and trained further.

Participants were evaluated through in-class exercises, quizzes, and observations made during field practice. Ultimately, 16 supervisors were identified based on their performance. Similarly, 64 participants were selected to serve as enumerators, while the rest were kept as reserves. Specialized training on conducting verbal autopsies on causes of neonatal deaths was carried out for one female interviewer and the supervisor of each team. The supervisors received additional training in performing supervisory activities with the CAPI system, data quality control procedures, fieldwork coordination, and management. The supervisors were trained on assigning households and receiving completed interviews from the interviewers, recognizing and dealing with error messages, receiving system updates and distributing updates to the interviewers, completing the Biomarker Questionnaires, resolving duplicated cases,

closing clusters, and transferring interviews to the central office via the secure Internet File Streaming System (IFSS) developed by the DHS Program. Six quality controllers were identified from among the individuals who underwent training with the supervisors. They also received additional training on supporting the teams and monitoring fieldwork.

3.1.4.5 Data Processing

The processing of the 2016 NDHS data began simultaneously with the fieldwork. As soon as data collection was completed in each cluster, all electronic data files were transferred via the IFSS to the New ERA central office in Kathmandu. These data files were registered and checked for inconsistencies, incompleteness, and outliers. The field teams were alerted to any inconsistencies or errors. Secondary editing carried out in the central office, involved resolving inconsistencies and coding the open-ended questions. The New ERA senior data processor coordinated the exercise at the central office. The NDHS core team members assisted with the secondary editing. The biomarker paper questionnaires were compared with the electronic data files to check for any inconsistencies in data entry. Data entry and editing were carried out using the CSPro software package. The concurrent processing of the data offered a distinct advantage in that it maximized the likelihood of the data being error-free and accurate. Timely generation of field check tables allowed for effective monitoring. The secondary editing of the data was completed in the second week of February 2017. The final cleaning of the data set was carried out by The DHS Program data processing specialist and was completed by the end of February 2017.

3.1.4.6 Response Rate

Table 3.4 shows response rates for the 2016 NDHS. A total of 11,473 households were selected for the sample, of which 11,203 were occupied. Of the occupied households, 11,040 were successfully interviewed, yielding a response rate of 99%. In the interviewed households, 13,089 women age 15-49 were identified for individual interviews; interviews were completed with 12,862 women, yielding a response rate of 98%. In the subsample of households selected for the male survey, 4,235 men age 15-49 were identified and 4,063 were successfully interviewed, yielding a response rate of 96%. Response rates were lower in urban areas than in rural areas. The difference was slightly more prominent for men than for women, as men in urban areas were often away from their households for work.

Table 3.4: Results of the household and individual interviews

Number of households, number of interviews, and response rates, according to residence (unweighted), Nepal 2016

	Residence		
Result	Urban	Rural	Total
Household interviews			
Households selected	7294	4179	11473
Households occupied	7106	4097	11203
Households interviewed	6978	4062	11040
Household response rate[1]	98.2	99.1	98.5
Interviews with women aged 15-49 years			
Number of eligible women	8460	4629	13089
Number of eligible women interviewed	8279	4583	12862
Eligible women response rate[2]	97.9	99.0	98.3
Interviews with men aged 15-49 years			
Number of eligible men	2812	1423	4235
Number of eligible men interviewed	2667	1396	4063

Eligible men response rate[2]	94.8	98.1	95.9

[1] Households interviewed/households occupied

[2] Respondents interviewed/eligible respondents

Source: 2016 Nepal DHS [236]

3.1.5 The 2012-13 Pakistan DHS

The 2012-13 Pakistan DHS (PDHS) is the third survey conducted so far in Pakistan under the auspices of the global DHS programme. The two previous surveys were conducted in 1990-91 and 2006-07. The 2012-13 PDHS specifically collected information regarding knowledge and practice of family planning, fertility levels, marriage, fertility preferences, child feeding practices, nutritional status of children and women, childhood mortality, maternal and child health, awareness and attitudes regarding HIV/AIDS, knowledge about other illnesses (e.g., tuberculosis, hepatitis B and C), and domestic violence. Information for the survey was mainly collected from ever-married women; however, some of the information was also collected from ever-married men.

3.1.5.1 Objectives of the Survey

The 2012-13 Pakistan DHS was carried out to provide up to date and reliable data on fertility and family planning, childhood mortality, maternal and child health, women's and children's nutritional status, women's empowerment, domestic violence, and knowledge of HIV/AIDS; with the broad aim of assisting policymakers and other stakeholders to monitor and evaluate interventional programmes based on empirical evidence. The specific objectives of the survey as follows:

1) Collection of high-quality data on topics including fertility levels and preferences, contraceptive use, maternal and child health, infant (and especially neonatal) mortality levels, awareness regarding HIV/AIDS, and other

indicators associated with the Millennium Development Goals and the Pakistan's Poverty Reduction Strategy Paper

2) Investigation of the factors affecting maternal and neonatal morbidity and mortality, namely, antenatal, delivery, and postnatal care
3) Provision of information to assess the evaluation needs of health and family planning programs for evidence-based planning
4) Provision of guidelines to programme managers and policymakers to enable them to effectively plan and implement future interventions

3.1.5.2 Organisation of the Survey

The 2012-13 PDHS project was implemented by the Pakistan National Institute of Population Studies (NIPS), executed by the Pakistan Planning and Development Division (Islamabad). Input to the different stages of the project was provided by the Technical Advisory Committee, which consisted of thirty Pakistani experts, professionals, researchers, and representatives from the provinces. The planning, organisation, and overseeing of the survey operations (including hosting technical meetings, recruiting, training and supervising fieldworkers and data processing staff as well as writing of the report) were the sole responsibilities of NIPS. The sample design and household listings for the sampled areas across the country was provided by the Pakistan Bureau of Statistics (PBS). The United States Agency for International Development (USAID) funded the survey, while technical and logistical support was provided by ICF International through its MEASURE DHS project.

3.1.5.3 Sample Design

The 2012-13 PDHS is nationally-representative and population-based, except that it did not include Azad Jammu and Kashmir, FATA as well as restricted military and

protected areas. The survey covered all urban and rural areas of the four provinces of Pakistan and Gilgit Baltistan, as defined in the 1998 Population Census. The urban area frame was developed by the PBS. All urban cities and towns were divided into mutually exclusive and small areas, known as enumeration blocks, which were identifiable with maps. Each enumeration block consisted of an average of between 200 and 250 households, which were in turn grouped into low-, middle-, and high-income categories. The urban area sampling frame consisted of 26,543 enumeration blocks, which were updated through the economic census conducted in 2003. In rural areas, lists of villages/mouzas/dehs which were developed in the 1998 Pakistan population census were used as the sample frame. In the sample frame, each village/mouza/deh was identifiable by its name. In Balochistan, Islamabad, and Gilgit Baltistan, there was over-sampling in urban areas. Consequently, proportions were adjusted by applying sampling weights during the analysis.

A sample size of 14,000 households was estimated to provide reasonable precision for the survey indicators. Forty three PBS staff members were trained by NIPS to obtain fresh listings from 248 urban and 252 rural survey sample areas across the country. The household listing was carried out between August and December 2012.

The second stage of sampling involved the selection of households. Twenty eight households were selected at each sampling point. This was done by applying a systematic sampling technique with a random start and resulted in a total of 14,000 households selected - 6,944 in urban areas and 7,056 in rural areas. The survey was conducted in a total of 498 areas. Two areas of Balochistan province (Punjgur and Dera Bugti) were excluded due to their deteriorating law and order situations. Overall, 24

areas (mostly in Balochistan) were replaced, mainly due to their adverse law and order situation

3.1.5.4 Questionnaires

The 2012-13 PDHS utilised four types of questionnaire, namely, household, women's, men's, and community questionnaires. The content of the household, women's, and men's questionnaires was based on model questionnaires developed by the MEASURE DHS programme. The questionnaires were, however, modified, in consultation with a broad spectrum of research institutions, government departments, and local and international organizations, to reflect issues relevant to the Pakistani population, including migration status, family planning, domestic violence, HIV/AIDS, and maternal and child health. A series of questionnaire design meetings were organized by NIPS, and discussions from these meetings were used to finalize the survey questionnaires. The questionnaires were then translated into Urdu and Sindhi and pretested, after which they were further refined. The questionnaires were presented to the Technical Advisory Committee for final approval.

The Household Questionnaire was used to list the usual members and visitors in the selected households. Basic information was gathered on the characteristics of each person listed. This included the age, sex, marital status, education, and relationship to the head of the household. Data on current school attendance, migration status, and survivorship of parents among those under aged less than 18 years were also gathered. The questionnaires were used to identify ever-married women and men aged between 15 and 49 years, who were qualified for individual interviews; and children aged between 0 and 5 years who were qualified for anthropometry measurements. Additionally, the Household Questionnaire gathered information on

characteristics of the dwelling unit, including the source of drinking water; type of toilet facilities; type of cooking fuel; materials used for the floor, roof, and walls of the house; and ownership of durable goods, agricultural land, livestock/farm animals/poultry, and mosquito nets.

Information from ever-married women aged between 15 and 49 years collected in the Women's Questionnaire included the following topics:

1. Background characteristics (education, literacy, native tongue, marital status, etc.)
2. Reproductive history
3. Knowledge and use of family planning methods
4. Fertility preferences
5. Antenatal, delivery, and postnatal care
6. Breastfeeding and infant feeding practices
7. Vaccinations and childhood illnesses
8. Woman's work and husband's background characteristics
9. Infant and childhood mortality
10. Women's decision making
11. Awareness about AIDS and other sexually transmitted infections
12. Other health issues (e.g., knowledge of tuberculosis and hepatitis, injection safety)
13. Domestic violence

Similarly, the Men's Questionnaire, which was utilised in the collection of information from ever-married men aged 15-49 years, covered the following topics:

1. Background characteristics
2. Knowledge and use of family planning methods
3. Fertility preferences
4. Employment and gender roles
5. Awareness about AIDS and other sexually transmitted infections
6. Other health issues

Features of the community questionnaire included questions about the availability of various types of health facilities and other services, especially transportation, education, and communication facilities.

All data of the PDHS were pretested in June 2012 by three teams. Each of the three teams consisted of a supervisor, a male interviewer, and three female interviewers. The first team worked in the Sukkur and Khairpur districts in the province of Sindh, the second team in the Peshawar and Charsadda districts in Khyber Pakhtunkhwa, and the third in the district of Rawalpindi in Punjab. Each team covered one rural and one urban non-sample area. Data collection started on 20 June 2012 and took approximately one week to complete.

3.1.5.5 Training and Fieldwork

Most of the field staff recruited were university graduates. Three-quarters of the field staff possessed a master's degree. A few of them had been involved in work for the 2006-07 PDHS. They came from 57 districts of Pakistan, including Gilgit Baltistan. A 3-week training session was organised by NIPS for the 144 participants during September and October 2012 in Islamabad.

The training was conducted in accordance with the standard DHS procedures. This included class presentations, daily reviews, mock interviews, class exercises, and a

written test at the end of the training. Potential candidates who failed the test were excluded. The trainers were made up of mainly ICF International and NIPS staff. For the first time, the PDHS used the computer-assisted field editing (CAFE) system in the survey. Skilled training was conducted for the participants selected to be field editors.

Three days were set aside for field practice in Islamabad and Rawalpindi. This took place towards the end of the training. At the end of each practice session, senior staff reviewed the completed questionnaires, and any emerging problems identified were discussed in the morning plenary sessions. Responses from the questionnaires were then entered in the CAFE system for the field editors to practise.

Data collection was conducted by a total of 20 teams. Each team was composed of a supervisor, a field editor, one male interviewer, and three female interviewers. The teams were initially deployed around Islamabad and Rawalpindi to enable intense supervision and technical backstopping at an early stage. Each of the teams completed data covering one field cluster, which was then electronically transferred to the central office. A review session was organised each day to share the experiences of the teams. Any necessary feedback on all aspects of the fieldwork was provided by the trainers. This included field management and rapport building with respondents. Most of the fieldwork was conducted between October 2012 and March 2013.

3.1.5.6 Data Processing

The processing of the collected data and the fieldwork began simultaneously. Field staff edited the completed questionnaires and entry of data was done immediately in the field. The data were uploaded on the same day. This was done in order to enable retrieval in the central office at NIPS in Islamabad. Further, the Internet File Streaming

System was used to transfer data from the field to the central office. The completed questionnaires were then returned periodically from the field to the NIPS office in Islamabad by courier. Subsequently, the data were edited and entered by data processing personnel who were specially trained for this task. In this way, all data were entered twice for 100% verification. Data were entered using the CSPro computer package. The concurrent processing of the data assured that the data were error-free and authentic. Moreover, the double entry of data enabled easy identification of errors and inconsistencies, which were resolved via comparisons with the paper questionnaire entries. The secondary editing of the data was completed in the first week of May 2013.

3.1.5.7 Response Rates

Response rates for the 2012-13 PDHS are presented in Table 3.5. A total of 13,944 households were selected for sampling. Out of these, 13,464 were found to be occupied at the time of the fieldwork, and subsequently, 12,943 took part in the interview. This yielded a household response rate of 96%.

Overall, 14,569 ever-married women aged between 15 and 49 years were identified in the 12,943 households interviewed. Out of the identified women, 13,558 were successfully interviewed. This yielded a response rate of 93%. Response rates were lower in urban areas than in rural areas.

Of the 3,991 men who were deemed eligible for the survey, 3,134 were successfully interviewed. This yielded a response rate of 79*%.*

Table 3.5: Results of the household and individual interviews

Number of households, number of interviews, and response rates, according to residence (unweighted), Pakistan 2012-13

	Residence		
Result	Urban	Rural	Total
Household interviews			
Households selected	6944	7000	13944
Households occupied	6685	6779	13464
Households interviewed	6335	6608	12943
Household response rate[1]	94.8	97.5	96.1
Interviews with ever-married women aged 15-49 years			
Number of eligible women	6964	7605	14569
Number of eligible women interviewed	6351	7207	13558
Eligible women response rate[2]	91.2	94.8	93.1
Interviews with ever-married men aged 15-49 years			
Number of eligible men	2007	1984	3991
Number of eligible men interviewed	1521	1613	3134
Eligible men response rate[2]	75.8	81.3	78.5

[1] Households interviewed/households occupied

[2] Respondents interviewed/eligible respondents

Source: 2012-13 Pakistan DHS [237]

3.2 The Study Variables

The outcome variables for this research were childhood diarrhoea and Acute Respiratory Infection. The potential covariates in the study were identified and classified into six main groups, namely: child, socio-economic, environmental, health services, media access and community factors. The child factors were: age, sex, perceived size at birth, birth rank and birth interval. Birth order and birth interval were combined because the impact of birth order may be mediated by the birth interval between children [238, 239]. The socio-economic factors included household wealth

index, mother's working status, parental education, mother's age and mother's marital status. Household wealth index was constructed using principal components analysis (PCA) to determine the weights for the index based on information collected about several household assets and facilities [240]. Weights were assigned to two housing characteristics (availability of electricity and type of toilet facility) and six household assets (possession of a radio, television, refrigerator, bicycle, motorcycle/scooter and car). The household wealth index variable was categorized into five quintiles: poorest, poorer, middle, richer and richest. This was then divided into three categories: the bottom 40% of households were referred to as poor households, the next 40% as the middle households and the top 20% as rich households [241]. Environmental factors were the source of drinking water and type of toilet facility, which were classified as improved or unimproved, according to WHO/UNICEF guidelines [242]. Improved source of water included: Piped water connection to household, public taps or standpipes, boreholes or tube wells, protected dug well, protected spring and rainwater collection. Unimproved source of water included; Unprotected dug well, unprotected spring, cart with small tank or drum, surface water (e.g., river, dam, lake, pond, stream, canal or irrigation channel) and bottled water. Nutrition factors were: breastfeeding status, stunting, wasting and underweight defined as < 2 standard deviations (SD) below the WHO Child Growth Standards median [242]. Media access included mother's access to newspapers/magazines, radio and television. The community-level factors were: type of residence (rural/urban), ecological zone (only in Nepal) and geographical or administrative region.

Categorisation of the potential covariates is shown in the Table 3.6

Table 3.6: Covariates and their categorisation

COVARIATES	CATEGORISATION
Child factors	
Child's age in months	Child age (1=6-11; 2=12-17; 3=18-23)
Size of baby	Baby size (1=Small; 2=Average; 3=Large)
Birth order	Birth order (1=1; 2=2-4; 3=>5)
Preceding birth interval	Birth interval preceding (0=No previous birth; 1=<24months; 2=>24months)
Socio-economic factors	
Mother's age in years	Age of mum (1=15-24; 2=25-34; 3=35-49)
Mother's age at child's birth in years	Age at child's birth (1=<20; 2=20-29; 3=30-39; 4=>40)
Mother's education	Mother education (1=No education; 2=Primary; 3=Secondary or higher)
Household wealth index	Wealth index (1=Poor; 2=Middle; 3=Rich)
Environmental factors	
Source of drinking water	Source of water (1=Unimproved; 2=Improved)
Type of toilet facility	Type of toilet (1=Unimproved; 2=Improved)
Health services factors	
Mode of delivery of baby	Mode of delivery (1=non-caesarean; 2=caesarean section)
Place of delivery of baby	Place of delivery (1=Home; 2=Health facility)
Type of delivery assistance	Delivery assistance (1=Health professional; 2=Traditional birth attendant; 3=Other untrained)
Antenatal clinic visits	Antenatal visit (1=Yes; 2=No)
Timing of postnatal check-up	Postnatal care (1=Yes; 2=No)
Media access factors	
Mother read newspaper or magazine	Read newspaper/magazine (0=No; 1=Yes)

Mother listened to the radio	Listened to radio (0=No; 1=Yes)
Community factors	
Type of residence	Residence (1=Urban; 2=Rural)
Geo-political region	Region (the numerals 1, 2 3…were assigned to the different geographical regions of the countries surveyed)

3.3 Summary

The methodology for answering the various research questions was presented in this chapter. The datasets used in the study were extracted from the Demographic and Health Surveys (DHS) of the various countries studied, which are released approximately every five years. The 2014 Bangladesh DHS, 2005-06 India DHS, 2011 Nepal DHS and 2012-13 Pakistan DHS were utilised in the study. The outcome variables used in answering the various research questions were childhood diarrhoea and ARI, as well as inappropriate infant and young child feeding practices. Independent variables used in the study were mainly chosen on the basis of the Mosely-Chen model for the study of the determinants of child survival in low-income and middle-income countries. These variables include individual-, household- and community-level factors such as characteristics of the child and mother, household wealth index, type of residence (rural/urban), as well as administrative region. The statistical analyses used to answer all five research questions are presented in the next chapter (Chapter 4).

CHAPTER 4

STATISTICAL ANALYSES

4.0 Introduction

This chapter presents the statistical analyses which were conducted to answer the five research questions of this thesis. The statistical software package STATA versions 13 and 14 (Stata Corporation, College Station, USA) was used for all statistical analyses of this study. Adjustment for sampling weights and the cluster survey design was done by using the "svy" command. The chapter is organised as follows: Section 4.1 presents the statistical analysis carried out to assess the factors associated with childhood diarrhoea and ARI. The statistical analyses employed in examining the trends in childhood diarrhoea and ARI are presented in section 4.3. The section that follows (section 4.4) highlights the statistical analyses performed to assess the association between infant and young child feeding practices and childhood diarrhoea/ARI. The ethical consideration is stated in section 4.4. The chapter concludes with a summary.

4.1 Analyses: First Two Research Questions

4.1.1 Factors Associated with Childhood Diarrhoea and ARI

Frequency tabulations were performed to calculate prevalence. The Taylor series linearization method was used to estimate confidence intervals (CIs) around prevalence estimates. This was followed by logistic regression generalized linear latent and mixed models (GLLAMM) [243] to adjust for cluster variability. Univariable and multivariable analyses were used to examine associated factors, after adjusting for potential confounding variables.

As part of the multivariable analysis, a five stage model was employed. In the first modelling stage, community and socioeconomic factors were entered into the model

to assess their associations with the study outcome. A manually executed backward elimination method was conducted to select factors significantly associated with the outcome. In the second model, the significant factors in the first stage were added to child factors and this was followed by backward elimination procedure. A similar approach was used for environmental, health services, media access in the third, fourth and fifth stages respectively. To avoid statistical bias, any collinearity in the final model was tested and reported. Odds ratios and their 95% confidence intervals obtained from the adjusted multilevel logistic models were used to assess the factors associated with childhood diarrhoea and ARI.

4.2 Analyses: Third and Fourth Research Questions

4.2.1 Trends in Childhood Diarrhoea and ARI

Differences in the socioeconomic variables between the two surveys were expressed as percentages. Chi-squared test was used to assess the significance of association between the surveys, and setting a 5% significance level. The dependent variables (childhood diarrhoea, ARI) were converted into binary variables and the logistic regression model was used to perform multivariable analysis.

4.2.1.1 Econometric analysis

Econometric analysis was performed on two levels. In the first level, the concentration index (CI) with the STATA '*conindex*' command, provides point estimates and standard errors[244]. This was used to measure and compare the degree of socioeconomic inequality in childhood morbidity among under-5 children. Decomposition (a distributional statistic between two groups and represent changes over time (trend) taking into account various explanatory factors) of the concentration indices to

identify factors that contribute to inequality in childhood morbidity was executed by the second level analysis with the STATA '*rdecompose*' command.

4.2.1.2 The Concentration Index

The Concentration Index (CI) was computed so as to understand the contributions of individual socioeconomic factors to childhood morbidity. It is calculated as twice the area between the concentration curve and the line of equality, ie, the 45-degree line. The formula for calculating the CI, described by O'Donnell[244, 245] as follows: let μ_h be the mean of childhood morbidity in under-5 children, and childhood morbidity be *h*, where h_i is childhood morbidity for individual *i*. Then if r_i is the fractional rank of individual i in the distribution of household socioeconomic status, the concentration index (CI) would be expressed as:

$$CI = \frac{2 * Cov\ (h_i, r_i)}{\mu_h} \qquad (1)$$

The CI of childhood morbidity can take a value between -1 and +1. If CI is zero, it implies perfect equality among under-five morbidity; if the CI is negative, it implies inequality concentrated among the relatively poor, and if CI is positive, it implies that the concentration of under-five morbidity is higher among the relatively rich.

4.2.1.3 Decomposition of the Concentration Index

The CI can be decomposed to estimate both unadjusted and adjusted factors which contribute to inequalities in childhood morbidity. Let the vector ***X*** represent those variables influencing *h*, and assuming that the childhood morbidity can be described by a linear regression of the form:

$$h_i = \alpha + \beta_k X_{ki} + \varepsilon_i \qquad (2)$$

Therefore CI can be given as:

$$CI = \sum_{k} \left(\frac{\beta_k \ \bar{X}_k}{\mu_h} \right) CI_k \ + \frac{GCI_g}{\mu_h} \qquad (3)$$

where the index *k* represents the regressors in the equation; CI_k is the concentration index for each of the individual regressors; β_k is the coefficient for each childhood morbidity determinant and X_k is the mean value of each individual regressor. GCI_g is the generalized concentration index for the residual from the regression (ε_i).

The above mathematical expressions represent the situation where childhood morbidity is continuous. However, when childhood morbidity h_i are binary outcomes, h_i takes on a value of 0 or 1. In this case, a normalization *n* must be applied to the CI (since the bounds would not be -1 and +1). In our analysis we applied the Erregeyers[246] normalization CI_g = $4\mu_h \mathrm{CI}$ = $4\mu_h$ (1 - μ_h)CI_n to the CI and its decomposition.

4.3 Analyses: Fifth Research Question

4.3.1 Association of Infant and Young Child Feeding Practices with Childhood Diarrhoea

Preliminary analyses involved percentage and frequency count for each of the selected potential confounding factors (i.e., socioeconomic, health service, individual and household factors) considered in this study. This was followed by estimation of prevalence and standard errors (for calculation of 95% confidence intervals) of infant feeding indicators associated with diarrhoea using the “svy” command to adjust for sampling weights and the cluster sampling.

Multilevel logistic regression that adjusted for cluster and survey weights were used after adjusting for potential confounding factors (socio-economic, health service, individual and household factors) to determine the association between infant feeding practices (i.e., early initiation of breastfeeding, exclusive breastfeeding, predominant breastfeeding, continued breastfeeding at one year, continued breastfeeding at two year, bottle feeding and introduction solid, semi-solid and soft food) and diarrhoea in the selected south Asian countries using "GLLAMM" command to estimate the adjusted odd ratios. The modifying effect of the type of sanitation and sources of drinking water on the association between infants feeding indicators and diarrhoea was also examined for the type of toilet use and sources of drinking water. These models were restricted to the youngest living child aged less than 24 months living with the respondent (woman aged 15–49 years) to minimise recall bias. All statistical analyses were conducted in STATA version 14.0 (Stata Corporation, College Station, TX, USA).

4.4 Ethics

Permission was sought and granted by MEASURE DHS/ICF International, Rockville, Maryland, USA to download and use the DHS datasets of the various countries surveyed. This current study considered all the ethical requirements to conduct an epidemiological research. Ethical approval was obtained from the School of Health and Science of the Western Sydney University.

CHAPTER 5

FACTORS ASSOCIATED WITH CHILDHOOD DIARRHOEA AND ACUTE RESPIRATORY INFECTION - BANGLADESH

5.0 Introduction

Results of the first and second research questions for Bangladesh are presented in this chapter. Community, socio-economic, child, exposure to media, environmental as well as nutrition factors significantly associated with childhood diarrhoea and acute respiratory infection (ARI) in Bangladesh are assessed. The rest of the chapter is organised as follows: Section 5.1 describes the characteristics of the study participants. Section 5.2 presents the prevalence of childhood diarrhoea by various independent variables, while section 5.3 presents the prevalence of ARI by the various independent variables. Factors associated with childhood diarrhoea are examined in section 5.4 and section 5.5 presents the factors associated with ARI. The chapter ends with a summary.

5.1 Characteristics of the Sample

Table 6.1 shows the distribution of the community, socio-economic, child, exposure to media, environmental and nutrition factors of the respondents. Nearly three-quarters of the sample (74.4%) were rural dwellers. In terms of geographical residence, most people lived in the Dhaka region (35%) with the smallest proportion residing in the Barisal region.

The majority of mothers (41.5%) lived in poor households. Approximately three-quarters of the mothers (74%) were not in paid employment in the 12 months preceding the survey. More than half of the mothers (56%) had secondary education or higher; however, the majority of their partners (44%) had no formal education.

Almost half of the mothers (49%) belonged to the youngest age bracket (15-19 years), and a vast majority of them (99%) were married at the time of the survey.

Table 5.1: Characteristics of the sample - Bangladesh, 2014 (n=7760)

INDEPENDENT VARIABLE	n=7760 (%)
Community level factors	
Residence	
Urban	1984 (25.6)
Rural	5777 (74.4)
Geographical region	
Barisal	444 (5.7)
Chittagong	1668 (21.5)
Dhaka	2733 (35.2)
Khulna	580 (7.5)
Rajshahi	797 (10.3)
Rangpur	768 (9.9)
Sylhet	771 (9.9)
Socioeconomic factors	
Wealth index	
Poor	3216 (41.5)
Middle	3051 (39.3)
Rich	1493 (19.2)
Mother working status in the previous 12 months	
Not working	5752 (74.1)
Working	2008 (25.9)
Maternal Education	
No education	1270 (16.4)
Primary	2165 (27.9)
Secondary or higher	4325 (55.7)
Partner education	
Secondary or higher	2009 (25.9)
Primary	2333 (30.1)
No education	3417 (44.0)
Mother's age (years)	
15-19	3771 (48.6)
20-34	3401 (43.8)
35-49	589 (7.6)
Maternal marital status	
Currently married	7653 (98.6)
Formerly married	108 (1.4)

Child factors	
Child's age (months)	
48-59	1515 (19.5)
36-47	1535 (19.8)
24-35	1563 (20.2)
12-23	1633 (21.0)
0-11	1514 (19.5)
Sex of the baby	
Female	4051 (52.2)
Male	3710 (47.8)
Perceived size of the baby	
small	935 (19.9)
Average	3194 (67.8)
Large	580 (12.3)
Birth rank and birth interval	
2nd/3rd birth rank, >2 years interval	3664 (47.2)
1st birth rank	3001 (38.7)
2nd/3rd birth rank, ≤ 2 years interval	532 (6.8)
4th birth rank, >2 years interval	472 (6.1)
4th birth rank, ≤2 years interval	91 (1.2)
Exposure to media factors	
Mother Read newspaper/magazine	
No	6663 (86.0)
Yes*	1084 (14.0)
Mother Listened to the radio	
No	7386 (95.2)
Yes*	375 (4.8)
Mother Watched television	
No	3260 (42.0)
Yes*	4500 (58.0)
Environmental factors	
Sources of drinking water	
Improved	6889 (98.4)
Unimproved	820 (10.6)
Type of toilet facilities	
improved	4911 (63.3)
Unimproved	2849 (36.7)
Nutrition factors	
Stunting	
Not stunted	4573 (63.8)
Stunted	2599 (36.2)
Wasting	
Not Wasted	6143 (85.6)
Wasted	1030 (14.4)
Underweight	

Not underweight	4831 (67.4)
Underweight	2341 (32.6)

*less than once a week/At least once a week/ almost everyday

The majority of the children were aged between 12 and 23 months, and there were more females than males. A mothers' perception of the size of a baby at birth has been shown to be a good population-level indicator of birth weight [247, 248]. More than two-thirds of the children were of average size at birth. Most of the children (47%) were second or third-born, with a birth interval of more than two years.

The majority of mothers did not read newspapers or magazines (86%) or did not listen to the radio (95.2). However, more than half of them (58%) watched television. A vast majority of households had access to improved source of drinking water; and close to two-thirds of those households had improved toilet facilities.

Less than half of the children (36%) were stunted; the majority of them were not wasted (86%), neither were they underweight (67%).

5.2 Prevalence of Childhood Diarrhoea

The prevalence of childhood diarrhoea by the various independent variables is presented in Table 5.2. Rural and urban children who contracted diarrhoea were equally represented [95% confidence interval (CI): (4.6, 7.0) for urban and 95% CI: (4.5, 7.2) for rural children]. The majority of children who had diarrhoea came from the Chittagong region [P = 6.7%, 95% CI: (5.3, 8.4)] whilst the minority of those who had the disease were from the Rangpur region [P = 2.7%, 95% CI: (1.7, 4.2)].

The highest proportion of children who contracted diarrhoea came from poor households [P = 6.3%, 95% CI: (4.6, 8.4)], and the lowest proportion came from rich households [P = 5.2%, 95% CI: (4.1, 6.6)]. Prevalence of diarrhoea was higher among

children whose mothers were unemployed then among those whose mothers were employed [P = 6.3%, 95% CI: (5.0, 7.8)].

Table 5.2: Prevalence of childhood diarrhoea - Bangladesh, 2014 (n=7760)

INDEPENDENT VARIABLE	%	95% Confidence Interval
Community level factors		
Residence		
Urban	5.7	[4.6 ,7.0]
Rural	5.7	[4.5, 7.2]
Geographical region		
Barisal	6.5	[4.3, 9.7]
Chittagong	6.7	[5.3, 8.4]
Dhaka	6.5	[4.4, 9.5]
Khulna	3.6	[2.4, 5.3]
Rajshahi	4.3	[2.7, 6.8]
Rangpur	2.7	[1.7, 4.2]
Sylhet	6.1	[4.2, 8.8]
Socioeconomic factors		
Wealth index		
Poor	6.3	[4.6, 8.4]
Middle	5.3	[4.3, 6.5]
Rich	5.2	[4.1, 6.6]
Mother working status		
Not working	6.3	[5.0, 7.8]
Working	4.0	[3.0, 5.3]
Maternal Education		
No education	5.9	[3.7, 9.2]
Primary	6.2	[5.0, 7.7]
Secondary or higher	5.3	[4.2, 6.7]
Partner education		
No education	5.2	[3.9, 6.8]
Primary	6.7	[4.7, 9.4]
Secondary or higher	5.3	[4.3, 6.5]
Mother's age (years)		
15-19	6.0	[5.0, 7.2]
20-34	5.6	[4.1, 7.6]
35-49	3.7	[2.2, 5.9]
Maternal marital status		
Currently married	5.7	[4.7, 6.9]
Formerly married	2.8	[1.0, 7.6]
Child factors		

Child's age (months)		
0-11	4.3	[2.8, 6.7]
12-23	4.0	[2.9, 5.4]
24-35	5.1	[3.5, 7.3]
36-47	8.5	[6.8, 10.5]
48-59	6.4	[4.6, 8.8]
Sex of the baby		
Male	5.7	[4.6, 7.1]
Female	5.6	[4.4, 7.1]
Perceived size of the baby		
Small	7.9	[6.1, 10.2]
Average	6.6	[5.0, 8.6]
Large	4.9	[3.1, 7.7]
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	6.0	[4.5, 7.8]
1st birth rank"	5.9	[4.8, 7.2]
2nd/3rd birth rank, ≤ 2 years interval	3.9	[2.3, 6.5]
4th birth rank, >2 years interval	4.5	[2.8, 7.3]
4th birth rank, ≤2 years interval	3.1	[1.2, 7.7]
Exposure to media factors		
Mother Read newspaper/magazine		
No	5.9	[4.8, 7.2]
Yes*	4.4	[3.2, 6.0]
Mother Listened to the radio		
No	5.4	[4.5, 6.6]
Yes*	10.2	[6.3, 16.2]
Mother Watched television		
No	6.4	[4.8, 8.3]
Yes*	5.2	[4.3, 6.2]
Environmental factors		
Sources of drinking water		
Improved	5.7	[4.6, 7.0]
Unimproved	6.1	[4.3, 8.7]
Type of toilet facilities		
Improved	5.1	[4.3, 6.0]
Unimproved	6.7	[4.9, 9.1]
Nutrition factors		
Stunting		
Not stunted	4.8	[3.8, 6.2]
Stunted	7.3	[5.9, 9.0]
Wasting		
Not Wasted	5.8	[4.6, 7.2]
Wasted	5.6	[4.1, 7.5]
Underweight		
Not underweight	5.7	[4.2, 7.6]

Underweight	5.8	[4.8, 7.1]

*less than once a week/At least once a week/ almost everyday

Diarrhoea was most prevalent among children whose mothers had primary education only [P = 6.2%, 95% CI: (5.0, 7.7)], and also among those whose fathers had primary education only [P = 6.7%, 95% CI: (4.3, 9.7)]. The majority of children who had diarrhoea belonged to mothers of the youngest age group (15-19 years) [P = 6.0%, 95% CI: (5.0, 7.2)]; the minority of those who had the disease were from mothers of the oldest age bracket (35-49 years) [P = 3.7%, 95% CI: (2.2, 5.9)]. Diarrhoea was found to be more prevalent among children whose mothers were married than among those whose mothers were single at the time of the survey [P = 5.7%, 95% CI: (4.7, 6.9)].

Whilst the prevalence of diarrhoea was least prevalent among children aged between zero and eleven months [P = 4.0%, 95% CI: (2.9, 5.4)], it was found to be most prevalent among those who were aged between 36 and 47 months [P = 8.5%, 95% CI: (6.8, 10.5)]. Slightly more male children had diarrhoea than their female counterparts [P = 5.7%, 95% CI: (4.6, 7.1)]. Most of the children who had diarrhoea were second or third born, with more than two years birth interval [P = 5.9%, 95% CI: (4.3, 9.7)], whilst diarrhoea was least prevalent among fourth-born children who were born less than two years after the previous birth by their mother [P = 3.1%, 95% CI: (1.2, 7.7)].

Diarrhoea was found to be more prevalent among children whose mothers did not read newspapers/magazines than those whose mothers did [P = 5.9%, 95% CI: (4.8, 7.2)], among children whose mothers did listen to the radio than those whose mothers did not [P = 10.2%, 95% CI: (6.3, 16.2)], and among children whose mothers did not watch television than those whose mothers did [P = 6.4%, 95% CI: (4.8, 8.3)].

Prevalence of diarrhoea was found to be higher in households with unimproved source of drinking water than those with improved drinking water sources [P = 6.1%, 95% CI: (4.3, 8.7)], and in households with unimproved toilet facilities than those with improved ones [P = 6.7%, 95% CI: (4.9, 9.1)].

Prevalence of diarrhoea was found to be higher among children who were stunted than those who were not [P = 7.3%, 95% CI: (5.9, 9.0)], among children who were not wasted than those who were wasted [P = 5.8%, 95% CI: (4.6, 7.2)] and among children who were underweight than those who were not [P = 5.8%, 95% CI: (4.8, 7.1)].

5.3 Prevalence of ARI

Table 5.3 shows the prevalence of ARI by the various independent variables of the respondents. Prevalence of ARI was slightly higher among urban children than among their rural counterparts [Prevalence (P) = 44.8%, 95% confidence interval (CI): (39.6, 50.1)]. The highest percentage of ARI occurred in the Chittagong region [P = 46.1%, 95% CI: (4.09, 5.13)].

The highest percentage of ARI also occurred in poor households [P = 50.1%, 95% CI: (4.56, 5.45)]; among children whose mothers were in paid employment [P = 45.7%, 95% CI: (4.08, 5.06)], among mothers who were educated up to primary level [P = 48.7%, 95% CI: (4.45, 5.29)], among children whose fathers had secondary education or higher [P = 48.9%, 95% CI: (4.33, 5.46)], among children of the youngest mothers (aged 15- 19 years) [P = 45.6%, 95% CI: (4.15, 4.98)], and among children of formerly married mothers [P = 70.90%, 95% CI: (4.49, 4.88)].

Table 5.3: Prevalence of ARI - Bangladesh, 2014 (n=7760)

INDEPENDENT VARIABLE	%	95% Confidence Interval
Community level factors		
Residence		
Urban	44.8	[39.6, 50.1]
Rural	43.8	[40.4, 47.2]
Geographical region		
Barisal	44.9	[39.1, 50.9]
Chittagong	46.1	[40.9, 51.3]
Dhaka	45.3	[39.1, 51.7]
Khulna	40.9	[33.9, 48.2]
Rajshahi	45.7	[40.2, 51.3]
Rangpur	34.1	[27.0, 42.1]
Sylhet	45.4	[36.3, 54.8]
Socioeconomic factors		
Wealth index		
Poor	50.1	[45.6, 54.5]
Middle	41.6	[36.7, 46.7]
Rich	35.3	[29.6, 41.5]
Mother working status in the previous 12 months		
Not working	43.5	[39.7, 47.3]
Working	45.7	[40.8, 50.6]
Maternal Education		
No education	46.1	[38.9, 53.4]
Primary	48.7	[44.5, 52.9]
Secondary or higher	40.7	[37.0, 44.5]
Partner education		
Secondary or higher	48.9	[43.3, 54.6]
Primary	46.7	[42.2, 51.4]
No education	39.2	[35.0, 43.5]
Mother's age (years)		
15-19	45.6	[41.5, 49.8]
20-34	42.4	[38.6, 46.3]
35-49	41.2	[33.9, 48.9]
Maternal marital status		
Currently married	43.6	[40.4, 46.7]
Formerly married	70.9	[44.9, 88.0]
Child factors		
Child's age (months)		
48-59	49.1	[43.8, 54.3]

36-47	48.9	[43.3, 54.5]
24-35	43.1	[37.7, 48.8]
12-23	40.3	[34.6, 46.4]
0-11	35.5	[28.1, 43.7]
Sex of the baby		
Female	45.2	[41.4, 49.1]
Male	42.7	[38.7, 46.7]
Perceived size of the baby		
Small	44.4	
Average	48.2	
Large	47.2	
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	42.6	[39.0, 46.2]
1st birth rank	43.7	[39.1, 48.5]
2nd/3rd birth rank, ≤ 2 years interval	49.2	[40.0, 58.4]
4th birth rank, >2 years interval	52.3	[43.0, 61.4]
4th birth rank, ≤2 years interval	32.8	[13.7, 60.1]
Exposure to media factors		
Mother Read newspaper/magazine		
No	44.6	[41.6, 47.5]
Yes*	39.6	[32.3, 47.4]
Mother Listened to the radio		
No	44.3	[41.2, 47.3]
Yes*	39.8	[28.6, 52.3]
Mother Watched television		
No	46.7	[42.4, 51.0]
Yes*	42.0	[38.2, 45.8]
Environmental factors		
Sources of drinking water		
Improved	44.0	[41.0, 47.2]
Unimproved	44.8	[37.2, 52.6]
Type of toilet facilities		
Improved	40.3	[36.5, 44.2]
Unimproved	50.0	[45.8,54.1]
Nutrition factors		
Stunting		
Not stunted	42.9	[39.4,46.4]
Stunted	46.6	[41.9, 51.3]
Wasting		
Not Wasted	42.9	[39.8, 46.1]
Wasted	51.5	[45.3, 57.6]
Underweight		
Not underweight	42.7	[39.5, 46.0]
Underweight	47.3	[42.9, 51.7]

*less than once a week/At least once a week/ almost everyday

The oldest children (aged 48-59 months) had the highest percentage of ARI [P = 49.1%, 95% CI: (43.8, 54.3)]; more female children suffered ARI than their male counterparts [P = 45.2%, 95% CI: (41.4, 49.1)]. Children whose mothers perceived them to be of average size at birth [P = 48.2%, 95% CI: (XX, XX)], and those who were fourth-born with a birth interval of more than two years [P = 52.3%, 95% CI: (43.0, 61.4)] had the highest percentage of ARI.

Acute respiratory infection was found to be more prevalent among children whose mothers did not read newspapers/magazines than those whose mothers did [P = 44.6%, 95% CI: (41.6, 47.5)], among children whose mothers did not listen to the radio then those whose mothers did [P = 44.3%, 95% CI: (41.2, 47.3)], and among children whose mothers did not watch television than those whose mothers did [P = 46.7%, 95% CI: (42.4, 51.0)].

Prevalence of ARI was found to be higher in households with unimproved source of drinking water than those with improved drinking water sources [P = 44.8%, 95% CI: (37.2, 52.6)], and in households with unimproved toilet facilities than those with improved ones [P = 50.0%, 95% CI: (45.8, 54.1)].

Prevalence of ARI was found to be higher among children who were stunted than those who were not [P = 46.6%, 95% CI: (41.9, 51.3)], among children who were wasted than those who were not [P = 51.5%, 95% CI: (45.3, 57.6)] and among children who were underweight than those who were not [P = 47.3%, 95% CI: (42.9, 51.7)].

5.4 Factors Associated with Childhood Diarrhoea

Unadjusted and adjusted odds ratios were calculated to estimate the strength of association between independent variables and childhood diarrhoea. As shown in Table 5.4, the likelihood of childhood diarrhoea was lower among rural children compared with their urban counterparts [UOR = 0.86, 95% CI: (0.65, 1.13)]. Children from the Sylhet region were found to be most likely to contract childhood diarrhoea. Children from rich households were less predisposed to diarrhoea compared with those from poor households [UOR = 0.86, 95% CI: (0.65, 1.13)].

Table 5.4: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with childhood diarrhoea - Bangladesh, 2014 (n=7760)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Community level factors		
Residence		
Urban	1	
Rural	0.86 (0.65, 1.13)	
Geographical region		
Barisal	1	
Chittagong	1.07 (0.65, 1.77)	
Dhaka	0.78 (0.48, 1.26)	
Khulna	0.56 (0.30, 1.07)	
Rajshahi	0.63 (0.35, 1.13)	
Rangpur	0.40 (0.21, 0.76)	
Sylhet	1.04 (0.60, 1.83)	
Socioeconomic factors		
Wealth index		
Poor	1	
Middle	0.80 (0.63, 1.02)	
Rich	0.93 (0.69, 1.26)	
Mother working status		
Not working	1	
Working	0.65 (0.50, 0.84)	
Maternal Education		
No education	1	
Primary	1.18 (0.87, 1.61)	
Secondary or higher	1.03 (0.77, 1.39)	
Partner education		
No education	1	1

Primary	1.46 (1.12,1.92)	1.51 (1.14, 2.01)
Secondary or higher	1.22 (0.93, 1.60)	1.35 (1.02, 1.79)
Mother's age (years)		
15-19	1	
20-34	0.85 (0.69, 1.05)	
35-49	0.59 (0.37, 0.94)	
Maternal marital status		
Currently married	1	
Formerly married	0.37 (0.11, 1.19)	
Child factors		
Child's age (months)		
0-11	1	1
12-23	1.01 (0.70, 1.45)	0.88 (0.60, 1.29)
24-35	1.29 (0.91, 1.82)	1.25 (0.87, 1.79)
36-47	2.07 (1.51, 2.82)	2.01 (1.45, 2.77)
48-59	1.61 (1.16, 2.25)	1.77 (1.25, 2.51)
Sex of the baby		
Male	1	
Female	1.04 (0.85, 1.27)	
Perceived size of the baby		
Small	1	
Average	0.83 (0.62, 1.11)	
Large	0.62 (0.38, 0.99)	
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank	1.00 (0.81, 1.23)	
2nd/3rd birth rank, ≤ 2 years interval	0.59 (0.37, 0.94)	
4th birth rank, >2 years interval	0.80 (0.50, 1.28)	
4th birth rank, ≤2 years interval	0.58 (0.17, 1.96)	
Exposure to media factors		
Mother Read newspaper/magazine		
No	1	
Yes*	0.80 (0.58, 1.10)	
Mother Listened to the radio		
No	1	
Yes*	2.37 (1.63, 3.43)	
Mother Watched television		
No	1	
Yes*	0.86 (0.70, 1.06)	
Environmental factors		
Sources of drinking water		
Improved	1	
Unimproved	1.09 (0.79, 1.50)	
Type of toilet facilities		
Improved	1	

Unimproved	1.27 (1.02, 1.57)	
Nutrition factors		
Stunting		
Not stunted	1	1
Stunted	1.60 (1.30, 1.98)	1.78 (1.43, 2.21)
Wasting		
Not Wasted	1	
Wasted	1.01 (0.75, 1.36)	
Underweight		
Not underweight	1	
Underweight	1.03 (0.83, 1.29)	

*less than once a week/At least once a week/ almost everyday

The likelihood of childhood diarrhoea was less among children of mothers who were in paid employment compared with those whose mothers were unemployed [UOR = 0.65, 95% CI: (0.50, 0.84)]. Compared with children whose mothers had no formal education, those whose mothers had primary education only were more likely to contract diarrhoea [UOR = 1.18, 95% CI: (0.87, 1.61)]. In addition, the likelihood of diarrhoea was higher among children whose fathers had only primary education compared with those whose fathers had no education [UOR = 1.46, 95% CI: (1.12, 1.92)]. The same pattern of result was obtained when all potential covariates were adjusted for [OR = 1.51, 95% CI: (1.14, 2.01)]. Children whose mothers belonged to the middle age bracket (20-34 years) were less likely to contract diarrhoea compared to those of mothers belonging to the youngest age bracket (15-19 years) [UOR = 0.85, 95% CI: (0.69, 1.05)]. The likelihood of diarrhoea was higher among children of formally married mothers [UOR = 0.37, 95% CI: (0.11, 1.19)]. Children whose mothers were aged between 36 and 47 years were most likely to contract diarrhoea [UOR = 2.07, 95% CI: (1.51, 2.82)]. When all covariates were adjusted for, the same pattern of results were obtained [OR = 2.01, 95% CI: (1.45, 2.77)]. Female children were more predisposed to diarrhoea than their male counterparts [UOR = 1.04, 95% CI: (0.85,

1.27)], and also children who were perceived by their mothers to be of average size at birth were less likely to contract diarrhoea compared with those who were perceived to be small [UOR = 0.83, 95% CI: (0.62, 1.11)]. Fourth-born children with birth intervals of more than two years were least likely to contract diarrhoea [UOR = 0.80, 95% CI: (0.50, 1.28)].

The likelihood of diarrhoea was less among children whose mothers read newspapers/magazines [UOR = 0.80, 95% CI: (0.58, 1.10)] and among children whose mothers watched television [UOR = 0.86, 95% CI: (0.70, 1.06)] compared with those whose mothers did not read newspapers/magazines and did not watch television. However, children whose mothers listened to the radio were found to be more likely to contract diarrhoea than those whose mothers did not listen to the radio [UOR = 2.37, 95% CI: (1.63, 3.43)]. The likelihood of diarrhoea was higher among children in households with unimproved sources of drinking water [UOR = 1.09, 95% CI: (0.79, 1.50)], and among those from households with unimproved toilet facilities [UOR = 1.27, 95% CI: (1.02, 1.57)]. Stunted children were more predisposed to diarrhoea than unstinted ones [UOR = 1.60, 95% CI: (1.30, 1.98)]. When all covariates were adjusted for, the same pattern of results was found [UOR = 1.78, 95% CI: (1.43, 2.21)]. Furthermore, the likelihood of diarrhoea was higher among wasted children [UOR = 1.01, 95% CI: (0.75, 1.36)] and underweight children [UOR = 1.03, 95% CI: (0.83, 1.29)] than children who were not wasted and not underweight.

5.5 Factors Associated with Acute Respiratory Infection

Table 5.5 presents the unadjusted and adjusted odds ratios for factors associated with ARI. The likelihood of ARI was higher among rural children compared with their urban counterparts [UOR = 1.12, 95% CI: (0.78, 1.29)]. Children from the Dhaka region were

found to be most likely to contract ARI. Children from households which were neither rich nor poor were less predisposed to ARI compared with those from poor households [UOR = 0.66, 95% CI: (0.54, 0.80)]. The same result was obtained when all covariates were adjusted for [OR = 0.78, 95% CI: (0.63, 0.97)].

Table 5.5: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with acute respiratory infection (ARI) - Bangladesh, 2014 (n=7760)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Community level factors		
Residence		
Urban	1	
Rural	1.12 (0.78, 1.29)	
Geographical region		
Barisal	1	
Chittagong	1.04 (0.67, 1.61)	
Dhaka	1.06 (0.69, 1.63)	
Khulna	0.84 (0.50, 1.40)	
Rajshahi	1.04 (0.65, 1.67)	
Rangpur	0.70 (0.43, 1.15)	
Sylhet	0.99 (0.60, 1.64)	
Socioeconomic factors		
Wealth index		
Poor	1	1
Middle	0.66 (0.54, 0.80)	0.78 (0.63, 0.97)
Rich	0.53 (0.40, 0.69)	0.61 (0.45, 0.83)
Mother working status in the previous 12 months		
Not working	1	
Working	1.04 (0.85, 1.27)	
Maternal Education		
No education	1	
Primary	1.10 (0.84, 1.43)	
Secondary or higher	0.78 (0.60, 0.99)	
Partner education		
Secondary or higher	1	1
Primary	0.86 (0.68,1.09)	0.96 (0.75, 1.22)
No education	0.61 (0.49, 0.77)	0.72 (0.56, 0.94)
Mother's age (years)		
15-19	1	
20-34	0.85 (0.71, 1.02)	
35-49	0.79 (0.55, 1.11)	

Maternal marital status		
Currently married	1	1
Formerly married	4.86 (2.31, 10.19)	4.35 (2.06, 9.38)
Child factors		
Child's age (months)		
48-59	1	1
36-47	1.24 (0.92, 1.68)	0.89 (0.68, 1.15)
24-35	1.42 (1.06, 1.91)	0.78 (0.59, 1.02)
12-23	1.82 (1.36, 2.42)	0.65 (0.49, 0.87)
0-11	1.89 (1.42, 2.51)	0.48 (0.36, 0.65)
Sex of the baby		
Female	1	
Male	0.84 (0.70, 0.99)	
Perceived size of the baby		
Small	1	
Average	1.22 (0.94, 1.60)	
Large	1.24 (0.83, 1.80)	
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank	1.07 (0.89, 1.29)	
2nd/3rd birth rank, ≤ 2 years interval	1.30 (0.92, 1.85)	
4th birth rank, >2 years interval	1.37 (0.96, 1.96)	
4th birth rank, ≤2 years interval	0.67 (0.30, 1.51)	
Exposure to media factors		
Mother Read newspaper/magazine		
No	1	
Yes*	0.80 (0.62, 1.04)	
Mother Listened to the radio		
No	1	
Yes*	0.95 (0.63, 1.41)	
Mother Watched television		
No	1	
Yes*	0.79 (0.65, 0.95)	
Environmental factors		
Sources of drinking water		
Improved	1	
Unimproved	1.15 (0.86, 1.54)	
Type of toilet facilities		
Improved	1	
Unimproved	1.54 (1.27, 1.85)	
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	1.14 (0.95, 1.38)	
Wasting		

Not Wasted	1	1
Wasted	1.40 (1.10, 1.78)	1.33 (1.05, 1.70)
Underweight		
Not underweight	1	
Underweight	1.19 (0.98, 1.44)	

*less than once a week/At least once a week/ almost everyday

The likelihood of childhood ARI was higher among children of mothers who were in paid employment compared with those whose mothers were unemployed [UOR = 1.04, 95% CI: (0.85, 1.27)]. Compared with children whose mothers had no formal education, those whose mothers had secondary education or higher were less likely to contract ARI [UOR = 0.78, 95% CI: (0.60, 0.99)]. In addition, the likelihood of ARI was less among children whose fathers had no formal education compared with those whose fathers had secondary education or higher [UOR = 0.61, 95% CI: (1.12, 1.92)]. The same pattern of result was obtained when all potential covariates were adjusted for [OR = 0.72, 95% CI: (0.56, 0.94)]. Children whose mothers belonged to the oldest age bracket (35-49 years) were less likely to contract ARI compared to those of mothers belonging to the youngest age bracket (15-19 years) [UOR = 0.79, 95% CI: (0.55, 1.11)]. The likelihood of ARI was higher among children of formally married mothers [UOR = 4.86, 95% CI: (2.31, 10.19)]. A similar result was found when all covariates were adjusted for [OR = 4.35, 95% CI: (2.06, 9.38)].

Male children were less predisposed to ARI than their female counterparts [UOR = 0.84, 95% CI: (0.70, 0.99)], and children who were perceived by their mothers to be large at birth were more likely to contract ARI compared with those who were perceived to be small [UOR = 1.24, 95% CI: (0.83, 1.80)]. Fourth-born children with birth intervals of more than two years were most likely to contract ARI [UOR = 1.37, 95% CI: (0.96, 1.96)].

The likelihood of ARI was less among children whose mothers read newspapers/magazines [UOR = 0.80, 95% CI: (0.62, 1.04)], among children whose mothers listened to the radio [UOR = 0.95, 95% CI: (0.63, 1.41)] and among those whose mothers watched television [UOR = 0.79, 95% CI: (0.65, 0.95)] compared with those whose mothers did not read newspapers/magazines, did not read newspapers/magazines and did not watch television. The likelihood of ARI was higher among children in households with unimproved sources of drinking water [UOR = 1.15, 95% CI: (0.86, 1.54)], and among those from households with unimproved toilet facilities [UOR = 1.54, 95% CI: (1.27, 1.85)]. Stunted children were more predisposed to ARI than those who were not stunted [UOR = 1.14, 95% CI: (0.95, 1.38)]. Furthermore, the likelihood of ARI was higher among wasted children [UOR = 1.40, 95% CI: (1.10, 1.78)] and underweight children [UOR = 1.19, 95% CI: (0.98, 1.44)] than children who were not wasted and not underweight.

5.6 Summary

This chapter presented the characteristics of the study variables and also presented the prevalence of both childhood diarrhoea and ARI among Bangladeshi children aged 0-59 months. Factors associated with childhood diarrhoea and ARI among this group of children were also presented in the chapter. The next chapter presents the factors associated with diarrhoea and ARI in Indian children aged 0-59 months. Prevalence of both childhood diarrhoea and ARI in those Indian children also presented.

CHAPTER 6

FACTORS ASSOCIATED WITH CHILDHOOD DIARRHOEA AND ACUTE RESPIRATORY INFECTION – INDIA

6.0 Introduction

In this chapter, results of the first and second research questions for India are presented. Community, socio-economic, child, exposure to media, environmental as well as nutrition factors significantly associated with childhood diarrhoea and ARI in India are assessed. The rest of the chapter is organised as follows: The characteristics of the study respondents are presented in section 6.1. Section 6.2 presents the prevalence of childhood diarrhoea by various independent variables, while section 6.3 presents the prevalence of ARI by the various independent variables. Factors associated with childhood diarrhoea are examined in section 6.4 and section 6.5 presents the factors associated with ARI. The chapter ends with a summary.

6.1 Characteristics of the Sample

The distribution of the community, socio-economic, child, exposure to the media, environmental and nutrition factors of the respondents is shown in Table 6.1. Nearly three-quarters of the sample (74.4%) were rural dwellers. In terms of geographical residence, most people lived in the Central region (29%) with the smallest proportion residing in the Northeast region.

The majority of mothers (47%) lived in poor households, and seven out of every ten of them were not in paid employment in the 12 months preceding the survey.

Table 6.1: Characteristics of the sample - India, 2005-06 (n=52868)

INDEPENDENT VARIABLE	n (%)
Residence	
Urban	13665 (25.8)
Rural	39203 (74.2)
Geographical region	
North	6876 (13)
Central	15393 (29.1)
East	13413 (25.4)
Northeast	1907 (3.6)
West	6744 (12.8)
South	8534 (16.1)
Socioeconomic factors	
Wealth index	
Poor	24871 (47.0)
Middle	20176 (38.2)
Rich	7821 (14.8)
Mother working status in the previous 12 months	
Not working	37434 (70.8)
Working	15419 (29.2)
Maternal Education	
Higher	2757 (5.2)
Secondary	16749(31.7)
Primary	7401 (14)
No education	25960 (49.1)
Partner education	
Higher	5353 (10.2)
Secondary	23961 (45.8)
Primary	7812 (14.9)
No education	15138 (29)
Mother's age (years)	
15-24	22079 (41.8)
25-34	26275 (49.7)
35-49	4514 (8.5)
Maternal marital status	
Currently married	52159 (98.7)
Formerly married	709 (1.3)
Child factors	
Child's age (months)	
48-59	10835 (20.5)
36-47	10828 (20.5)
24-35	10383 (19.6)

12-23	10419 (19.7)
0-11	10403 (19.7)
Sex of the baby	
Female	25242 (47.7)
Male	27626 (52.3)
Perceived size of the baby	
Large	10094 (20.2)
Average	29090 (58.3)
Small	10747 (21.5)
Birth rank and birth interval	
2nd/3rd birth rank, >2 years interval	19627 (37.1)
1st birth rank	15949 (30.2)
2nd/3rd birth rank, ≤ 2 years interval	8888 (16.8)
4th birth rank, >2 years interval	5853 (11.1)
4th birth rank, ≤2 years interval	2550 (4.8)
Exposure to media factors	
Mother Read newspaper/magazine	
No	38797 (73.4)
Yes*	14024 (26.6)
Mother Listened to the radio	
No	31893 (60.3)
Yes*	20964 (39.7)
Mother Watched television	
No	23974 (45.4)
Yes*	28884 (54.6)
Environmental factors	
Sources of drinking water	
Improved	41762 (86.6)
Unimproved	6485 (13.4)
Type of toilet facilities	
Improved	16039 (33.3)
Unimproved	32135 (66.7)
Nutrition factors	
Stunting	
Not stunted	23579 (52)
Stunted	21798 (48)
Wasting	
Not Wasted	26094 (57.5)
Wasted	19284 (42.5)
Underweight	
Not underweight	36386 (80.2)
Underweight	8992 (19.8)

*less than once a week/At least once a week/ almost everyday

Only 5% of them had secondary education or higher, and more than half of them did not have any formal education. However, the majority of their partners (46%) had secondary education, whilst 29% of them did not have any formal education. Almost half of the mothers (49.7%) belonged to the middle age bracket (25-34 years), and a vast majority of them (99%) were married at the time of the survey.

The majority of the children were aged between 36 and 59 months, and there were more males than females. According to the mothers' perception of birth size, which has been shown to be a good population-level indicator of birth weight [247, 248], more than half of the children were of average size at birth. Most of the children (37%) were second or third-born, with a birth interval of more than two years.

More than three-quarters (73%) of mothers did not read newspapers or magazines, and the majority of them did not listen to the radio (60%). However, more than half of them (54%) did watch television. A vast majority of households (87%) had access to improved source of drinking water, but more than two-thirds of those households did not have access to improved toilet facilities.

Less than half of the children (48%) were stunted; the majority of them were not wasted (58%), and about 8 in every ten of them were not underweight (89%).

6.2 Prevalence of Childhood Diarrhoea

Table 6.2 presents the prevalence of childhood diarrhoea by the various independent variables. Prevalence of diarrhoea was higher among rural children than among their urban counterparts [P = 9.0%, 95% CI: (8.5, 9.6)]. The highest percentage of childhood diarrhoea occurred in the East and West regions [P = 9.9%, 95% CI: (8.9, 11.0) and (8.8, 11.2) respectively].

The lowest proportion of diarrhoea occurred in rich households [P = 8.3%, 95% CI: (7.5, 9.2)]; and the highest proportion of diarrhoea occurred among children whose mothers were unemployed [P = 9.2, 95% CI: (8.7, 9.7), educated up to secondary level [P = 9.6%, 95% CI: (8.9, 10.3)], among children whose fathers had up to secondary education [P = 9.4%, 95% CI: (8.8, 9.9)], among children of the youngest mothers (aged 15- 19 years) [P = 10.2%, 95% CI: (9.6, 10.9)], and among children whose mothers were married at the time of the survey [P = 9.0%, 95% CI: (8.6, 9.5)].

Table 6.2: Prevalence of childhood diarrhoea - India, 2005-06 (n=9466)

INDEPENDENT VARIABLE	**%**	95% Confidence Interval
Community level factors		
Residence		
Urban	8.9	[8.1,9.7]
Rural	9.0	[8.5,9.6]
Geographical region		
North	9.8	[8.8,10.9]
Central	8.8	[8.0,9.7]
East	9.9	[8.9,11.0]
Northeast	8.4	[7.0,10.2]
West	9.9	[8.8,11.2]
South	6.6	[5.9,7.5]
Socioeconomic factors		
Wealth index		
Poor	8.9	[8.3,9.6]
Middle	9.4	[8.8,10.0]
Rich	8.3	[7.5,9.2]
Mother working status		
Not working	9.2	[8.7,9.7]
Working	8.5	[7.9,9.2]
Maternal Education		
Higher	7.1	[6.0,8.5]
Secondary	9.6	[8.9,10.3]
Primary	9.5	[8.6,10.6]
No education	8.7	[8.1,9.3]
Partner education		
Higher	8.9	[7.9,10.0]
Secondary	9.4	[8.8,9.9]

Primary	9.0	[8.1,10.0]
No education	8.5	[7.8,9.3]
Mother's age (years)		
15-24	10.2	[9.6,10.9]
25-34	8.3	[7.8,8.9]
35-49	6.9	[5.9,7.9]
Maternal marital status		
Currently married	9.0	[8.6,9.5]
Formerly married	8.5	[6.0,11.8]
Child factors		
Child's age (months)		
48-59	3.9	[3.4,4.5]
36-47	5.0	[4.4,5.6]
24-35	8.3	[7.5,9.1]
12-23	13.8	[12.8,14.8]
0-11	14.4	[13.5,15.4]
Sex of the baby		
Female	8.4	[7.9,9.0]
Male	9.5	[9.0,10.1]
Perceived size of the baby		
Large	8.9	[8.0,9.8]
Average	8.2	[7.7,8.8]
Small	11.3	[10.5,12.3]
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	8.9	[8.3,9.5]
1st birth rank	9.0	[8.3,9.6]
2nd/3rd birth rank, ≤ 2 years interval	9.0	[8.2,9.9]
4th birth rank, >2 years interval	9.6	[8.5,10.8]
4th birth rank, ≤2 years interval	8.7	[7.2,10.4]
Exposure to media factors		
Mother Read newspaper/magazine		
No	8.9	[8.4,9.4]
Yes*	9.4	[8.7,10.1]
Mother Listened to the radio		
No	9.2	[8.7,9.8]
Yes*	8.7	[8.1,9.3]
Mother Watched television		
No	9.1	[8.5,9.8]
Yes*	8.9	[8.4,9.4]
Environmental factors		
Sources of drinking water		
Improved	8.9	[8.4,9.4]
Unimproved	8.9	[7.9,10.0]
Type of toilet facilities		

improved	8.5	[7.9,9.2]
Unimproved	9.1	[8.6,9.7]
Nutrition factors		
Stunting		
Not stunted	9.5	[8.9,10.1]
Stunted	9.2	[8.5,9.8]
Wasting		
Not Wasted	8.9	[8.4,9.5]
Wasted	9.9	[9.2,10.6]
Underweight		
Not underweight	8.7	[8.2,9.2]
Underweight	11.9	[10.9,13.1]

*less than once a week/At least once a week/ almost everyday

The youngest children (aged 0-11 months) had the highest percentage of diarrhoea [P = 14.4%, 95% CI: (13.5, 15.4)]; more male children suffered diarrhoea than their female counterparts [P = 9.5%, 95% CI: (9.0, 10.1)]. Children whose mothers perceived them to be of a small size at birth [P = 11.3%, 95% CI: (10.5, 12.3)], and those who were fourth-born with a birth interval of more than two years [P = 9.6%, 95% CI: (8.5, 10.8)] had the highest percentage of diarrhoea.

Diarrhoea was found to be more prevalent among children whose mothers did read newspapers/magazines than those whose mothers did not [P = 9.4%, 95% CI: (8.7, 10.1)], among children whose mothers did not listen to the radio than those whose mothers did [P = 9.2%, 95% CI: (8.7, 9.8)], and among children whose mothers did not watch television than those whose mothers did [P = 9.1%, 95% CI: (8.5, 9.8)].

Prevalence of diarrhoea was found to be equally represented between households with improved and unimproved sources of drinking water [P = 8.9%, 95% CI: (8.4, 9.4) and (7.9, 10.0) respectively]. Diarrhoea was also more prevalent in households with unimproved toilet facilities than in those with improved ones [P = 54.3%, 95% CI: (52.1, 56.4)].

Diarrhoea was found to be more prevalent among children who were stunted than those who were not [P = 9.1%, 95% CI: (8.6, 9.7)], among children who were not stunted [P = 9.5%, 95% CI: (8.9, 10.1), among children who were wasted than those who were not [P = 9.9%, 95% CI: (9.2, 10.6)] and among children who were underweight than those who were not [P = 11.9%, 95% CI: (10.9, 13.1)].

6.3 Prevalence of ARI

Prevalence of ARI by the various independent variables of the respondents is presented in Table 6.3. Prevalence of ARI was higher among rural children than among their urban counterparts [P = 54.6%, 95% CI: (52.4, 56.7)]. The highest percentage of childhood diarrhoea occurred in the East region [P = 60. 5%, 95% CI: (56.9, 64.0)].

The highest percentage of ARI occurred in poor households [P = 56.3%, 95% CI: (53.6, 58.9)]; among mothers who were educated up to primary level [P = 55.9%, 95% CI: (52.3, 59.5)], among children whose fathers had no education [P = 56.7%, 95% CI: (53.6, 59.8)], among children of the youngest mothers (aged 15- 19 years) [P = 54.2%, 95% CI: (51.6, 56.7)], and among children whose mothers were currently married [P = 52.4%, 95% CI: (50.6, 54.2)].

Table 6.3: Prevalence of ARI - India, 2005-06 (n=52868)

INDEPENDENT VARIABLE	**%**	95% Confidence Interval
Residence		
Urban	45.7	[42.8, 48.7]
Rural	54.6	[52.4, 56.7]
Geographical region		
North	54.6	[50.8, 58.5]
Central	50.7	[47.6, 53.8]
East	60.5	[56.9, 64.0]
Northeast	52.0	[46.5, 57.5]
West	47.0	[42.1, 51.9]
South	37.9	[33.8, 42.1]
Socioeconomic factors		

Wealth index		
Poor	56.3	[53.6, 58.9]
Middle	51.0	[48.6, 53.3]
Rich	42.6	[38.9, 46.5]
Mother working status in the previous 12 months		
Not working	52.2	[50.2, 54.2]
Working	52.5	[49.5, 55.5]
Maternal Education		
No education	54.4	[51.8, 57.1]
Primary	55.9	[52.3, 59.5]
Secondary	48.4	[46.0, 50.8]
Partner education		
No education	56.7	[53.6, 59.8]
Primary	51.9	[49.8, 54.0]
Secondary	44.6	[40.1, 49.1]
Mother's age (years)		
15-24	54.2	[51.6, 56.7]
25-34	50.6	[48.3, 52.9]
35-49	51.5	[45.9, 57.0]
Maternal marital status		
Currently married	52.4	[50.6, 54.2]
Formerly married	45.3	[33.5, 57.7]
Child factors		
Child's age (months)		
48-59	56.0	[53.1, 58.9]
36-47	54.1	[51.2, 57.1]
24-35	50.5	[47.3, 53.7]
12-23	49.9	[46.4, 53.5]
0-11	49.2	[45.4, 52.9]
Sex of the baby		
Female	53.0	[50.8, 55.2]
Male	51.5	[49.3, 53.7]
Perceived size of the baby		
Large	56.4	[53.4, 59.3]
Average	50.2	[48.0, 52.5]
Small	53.9	[50.5,57.4]
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	53.7	[51.1, 56.3]
1st birth rank	49.6	[47.0, 52.2]
2nd/3rd birth rank, ≤ 2 years interval	52.8	[49.1, 56.4]
4th birth rank, >2 years interval	54.4	[49.6, 59.1]
4th birth rank, ≤2 years interval	54.2	[46.5, 61.7]
Exposure to media factors		
Mother Read newspaper/magazine		

No	54.6	[52.6, 56.7]
Yes*	46.3	[43.6, 49.1]
Mother Listened to the radio		
No	53.8	[51.7, 55.9]
Yes*	50.1	[47.4, 52.8]
Mother Watched television		
No	56.1	[53.3, 58.9]
Yes*	49.2	[47.2, 51.2]
Environmental factors		
Sources of drinking water		
Improved	51.6	[49.6, 53.6]
Unimproved	55.1	[51.9, 58.3]
Type of toilet facilities		
Improved	47.7	[45.1,50.4]
Unimproved	54.3	[52.1, 56.4]
Nutrition factors		
Stunting		
Not stunted	53.0	[50.8, 55.2]
Stunted	52.3	[49.7, 54.9]
Wasting		
Not Wasted	52.2	[50.2, 54.2]
Wasted	54.5	[51.2, 57.8]
Underweight		
Not underweight	51.8	[49.7, 53.9]
Underweight	53.9	[51.2, 56.6]

*less than once a week/At least once a week/ almost everyday

The oldest children (aged 48-59 months) had the highest percentage of ARI [P = 56.0%, 95% CI: (53.1, 58.9)]; more female children suffered diarrhoea than their male counterparts [P = 53.0%, 95% CI: (50.8, 55.2)]. Children whose mothers perceived them to be of a large size at birth [P = 56.4%, 95% CI: (53.4, 59.3)], and those who were fourth-born with a birth interval of more than two years [P = 54.4%, 95% CI: (49.6, 59.1)] had the highest percentage of ARI.

Acute respiratory infection was found to be more prevalent among children whose mothers did not read newspapers/magazines than those whose mothers did [P = 54.6%, 95% CI: (52.6, 56.7)], among children whose mothers did not listen to the radio

then those whose mothers did [P = 53.8%, 95% CI: (51.7, 55.9)], and among children whose mothers did not watch television than those whose mothers did [P = 46.7%, 95% CI: (42.4, 51.0)].

Prevalence of ARI was found to be higher in households with unimproved source of drinking water than those with improved drinking water sources [P = 55.1%, 95% CI: (51.9, 58.3)], and in households with unimproved toilet facilities than those with improved ones [P = 54.3%, 95% CI: (52.1, 56.4)].

Acute respiratory infection was found to be more prevalent among children who were stunted than those who were not [P = 52.3%, 95% CI: (49.7, 54.9)], among children who were wasted than those who were not [P = 54.5%, 95% CI: (51.2, 57.8)] and among children who were underweight than those who were not [P = 53.9%, 95% CI: (51.2, 56.6)].

6.4 Factors Associated with Childhood Diarrhoea

Unadjusted and adjusted odds ratios were calculated to estimate the strength of association between independent variables and childhood diarrhoea. As shown in Table 6.4, the likelihood of childhood diarrhoea was higher among rural children compared with their urban counterparts [UOR = 1.04, 95% CI: (0.94, 1.17)]. Children from the South region were found to be least likely to contract childhood diarrhoea [UOR = 0.62, 95% CI: (0.52, 0.74)]. When the other covariates were adjusted for, a similar pattern of result was found [OR = 0.58, 95% CI: (0.47, 0.70)]. Children from households which were neither rich nor poor were more predisposed to diarrhoea compared with those from poor households [UOR = 1.07, 95% CI: (0.99, 1.16)].

Table 6.4: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with childhood diarrhoea - India 2005-06 (n=9466)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Community level factors		
Residence		
Urban	1	
Rural	1.04 (0.94, 1.17)	
Geographical region		
North	1	1
Central	0.86 (0.74, 1.02)	0.85 (0.71, 1.02)
East	0.99 (0.84, 1.17)	0.93 (0.78, 1.12)
Northeast	0.86 (0.67, 1.11)	0.87 (0.66, 1.14)
West	1.00 (0.83, 1.21)	0.99 (0.81, 1.21)
South	0.62 (0.52, 0.74)	0.58 (0.47, 0.70)
Socioeconomic factors		
Wealth index		
Poor	1	
Middle	1.07 (0.99, 1.16)	
Rich	1.00 (0.89, 1.12)	
Mother working status		
Not working	1	
Working	0.91 (0.85, 0.99)	
Maternal Education		
Higher	1	1
Secondary	1.25 (1.05, 1.50)	1.32 (1.08, 1.61)
Primary	1.34 (1.13, 1.58)	1.29 (1.07, 1.55)
No education	1.10 (0.93, 1.30)	1.14 (0.94, 1.37)
Partner education		
Higher	1	
Secondary	0.96 (0.84, 1.10)	
Primary	1.03 (0.92, 1.15)	
No education	0.91 (0.81, 1.03)	
Mother's age (years)		
15-24	1	
25-34	0.77 (0.73, 0.83)	
35-49	0.63 (0.55, 0.71)	
Maternal marital status		
Currently married	1	
Formerly married	0.97 (0.73, 1.29)	
Child factors		
Child's age (months)		
48-59	1	1

36-47	1.26 (1.10, 1.44)	2.34 (2.04, 2.69)
24-35	2.30 (1.03, 2.60)	1.36 (1.17, 1.58)
12-23	4.30 (3.82, 4.83)	4.06 (3.55, 4.65)
0-11	4.44 (3.95, 4.99)	5.21 (4.53, 5.99)
Sex of the baby		
Female	1	1
Male	1.16 (1.09, 1.24)	1.18 (1.10, 1.26)
Perceived size of the baby		
Large	1	1
Average	0.91 (0.83, 0.99)	0.88 (0.80, 0.97)
Small	1.31 (1.19, 1.45)	1.15 (1.03, 1.28)
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank	1.04 (0.96, 1.13)	
2nd/3rd birth rank, ≤ 2 years interval	0.99 (0.91, 1.09)	
4th birth rank, >2 years interval	1.05 (0.94, 1.17)	
4th birth rank, ≤2 years interval	0.91 (0.78, 1.07)	
Exposure to media factors		
Mother Read newspaper/magazine		
No	1	
Yes*	1.11 (1.03, 1.19)	
Mother Listened to the radio		
No	1	
Yes*	1.01 (0.94, 1.08)	
Mother Watched television		
No	1	
Yes*	1.01 (0.94, 1.08)	
Environmental factors		
Sources of drinking water		
Improved	1	
Unimproved	1.00 (0.99, 1.12)	
Type of toilet facilities		
improved	1	
Unimproved	1.01 (0.92, 1.09)	
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	0.94 (0.88, 1.01)	
Wasting		
Not Wasted	1	
Wasted	1.09 (1.02, 1.17)	
Underweight		
Not underweight	1	1
Underweight	1.42 (1.31, 1.54)	1.18 (1.08, 1.28)

*less than once a week/At least once a week/ almost everyday

The likelihood of childhood diarrhoea was less among children of mothers who were in paid employment compared with those whose mothers were unemployed [UOR = 0.91, 95% CI: (0.85, 0.99)]. Compared with children whose mothers had higher education, those whose mothers had primary education only were more likely to contract diarrhoea [UOR = 1.34, 95% CI: (1.13, 1.58)]. After adjusting for other covariates, the likelihood of diarrhoea was higher among children whose mothers had secondary education [OR = 1.32, 95% CI: (1.08, 1.61)]. In addition, the likelihood of diarrhoea was higher among children whose fathers had only primary education compared with those whose fathers had higher education [UOR = 1.03, 95% CI: (0.92, 1.15)]. Children whose mothers belonged to the oldest age bracket (35-49 years) were less likely to contract diarrhoea compared to those of mothers belonging to the youngest age bracket (15-19 years) [UOR = 0.63, 95% CI: (0.55, 0.71)]. The likelihood of diarrhoea was higher among children of formally married mothers [UOR = 0.97, 95% CI: (0.73, 1.19)].

Children of the youngest age bracket (0-11 months) were more associated with the contraction diarrhoea compared with those mothers belonged to the oldest age bracket [UOR = 4.44, 95% CI: (3.95, 4.99)]. When all covariates were adjusted for, the same pattern of results were obtained [OR = 5.21, 95% CI: (4.53, 5.99)]. Male children were more predisposed to diarrhoea than their female counterparts [UOR = 1.16, 95% CI: (1.09, 1.24)], and when all covariates were adjusted for, similar results were found [OR = 1.18, 95% CI: (1.10, 1.26)]. Children who were perceived by their mothers to be small at birth were more likely to contract diarrhoea compared with those who were

perceived to be large [UOR = 1.31, 95% CI: (1.19, 1.45)]. A similar finding was made when all covariates were adjusted for [OR = 1.15, 95% CI: (1.03, 1.28)]. Fourth-born children with birth intervals of more than two years were most likely to contract diarrhoea [UOR = 1.05, 95% CI: (0.94, 1.17)].

The likelihood of diarrhoea was higher among children whose mothers read newspapers/magazines [UOR = 1.11, 95% CI: (1.03, 1.19)], among children whose mothers listened to the radio [UOR = 1.01, 95% CI: (0.94, 1.08)] and among children whose mothers watched television [UOR = 1.01, 95% CI: (0.94, 1.08)] compared with those whose mothers did not read newspapers/magazines, did not listen to the radio and did not watch television. The likelihood of diarrhoea was higher among children in households with unimproved sources of drinking water [UOR = 1.00, 95% CI: (0.99, 1.12)], and among those from households with unimproved toilet facilities [UOR = 1.01, 95% CI: (0.92, 1.09)]. Stunted children were less predisposed to diarrhoea than those who were not stunted [UOR = 0.94, 95% CI: (0.88, 1.01)]. Furthermore, the likelihood of diarrhoea was higher among wasted children [UOR = 1.09, 95% CI: (1.02, 1.17)] and underweight children [UOR = 1.42, 95% CI: (1.31, 1.54)] than children who were not wasted and not underweight. When all covariates were adjusted for, the likelihood of diarrhoea was still higher among underweight children compared with children who were not underweight [OR = 1.18, 95% CI: (1.08, 1.20)].

6.5 Factors Associated with Acute Respiratory Infection

Table 6.5 shows the unadjusted and adjusted odds ratios for factors associated with ARI among Indian children aged 0-59 months. The likelihood of ARI was higher among rural children compared with their urban counterparts [UOR = 1.55, 95% CI: (1.30, 1.86)]. Children from the East region were found to be most likely to contract ARI

compared with those from the North region [UOR = 1.37, 95% CI: (1.07, 1.76)]. Children from rich households were less predisposed to ARI compared with those from poor households [UOR = 0.60, 95% CI: (0.50, 0.73)]. A similar result was obtained when all covariates were adjusted for [OR = 0.75, 95% CI: (0.61, 0.92)].

Table 6.5: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with acute respiratory infection (ARI) - India 2005-06 (n=9466)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Residence		
Urban	1	
Rural	1.55 (1.30, 1.86)	
Geographical region		
North	1	1
Central	0.86 (0.65, 1.08)	0.78 (0.60, 1.01)
East	1.37 (1.07, 1.76)	1.21 (0.93, 1.56)
Northeast	0.89 (0.61, 1.31)	0.80 (0.54, 1.19)
West	0.75 (0.55, 1.02)	0.75 (0.54, 1.03)
South	0.48 (0.36, 0.64)	0.45 (0.34, 0.61)
Socioeconomic factors		
Wealth index		
Poor	1	1
Middle	0.91 (0.81, 1.03)	1.01 (0.88, 1.16)
Rich	0.60 (0.50, 0.73)	0.75 (0.61, 0.92)
Mother working status in the previous 12 months		
Not working	1	
Working	1.06 (0.93, 1.20)	
Maternal Education		
No education	1	
Primary	0.96 (0.82, 1.13)	
Secondary	0.82 (0.73, 0.94)	
Partner education		
No education	1	
Primary	0.89 (0.79, 1.01)	
Secondary	0.64 (0.52, 0.79)	
Mother's age (years)		
15-24	1	
25-34	0.93 (0.83, 1.04)	
35-49	0.91 (0.74, 1.13)	
Maternal marital status		

Currently married	1	
Formerly married	0.72 (0.46, 1.14)	
Child factors		
Child's age (months)		
48-59	1	1
36-47	0.84 (0.73, 0.98)	0.88 (0.75, 1.03)
24-35	0.74 (0.63, 0.86)	0.75 (0.64, 0.88)
12-23	0.75 (0.64, 0.88)	0.77 (0.65, 0.91)
0-11	0.71 (0.60, 0.85)	0.70 (0.59, 0.83)
Sex of the baby		
Female	1	1
Male	0.89 (0.81, 0.99)	0.89 (0.80, 0.99)
Perceived size of the baby		
Large	1	1
Average	0.76 (0.67, 0.87)	0.80 (0.70, 0.91)
Small	0.91 (0.78, 1.08)	0.96 (0.82, 1.14)
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank	0.78 (0.69, 0.89)	
2nd/3rd birth rank, ≤ 2 years interval	0.98 (0.84, 1.14)	
4th birth rank, >2 years interval	0.91 (0.76, 1.10)	
4th birth rank, ≤2 years interval	1.02 (0.78, 1.34)	
Exposure to media factors		
Mother Read newspaper/magazine		
No	1	1
Yes*	0.76 (0.67, 0.86)	0.85 (0.74, 0.98)
Mother Listened to the radio		
No	1	
Yes*	0.89 (0.80, 0.99)	
Mother Watched television		
No	1	
Yes*	0.81 (0.72, 0.91)	
Environmental factors		
Sources of drinking water		
Improved	1	1
Unimproved	1.23 (1.07, 1.42)	1.24 (1.07, 1.44)
Type of toilet facilities		
Improved	1	
Unimproved	1.26 (1.11, 1.44)	
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	0.94 (0.84, 1.05)	
Wasting		
Not Wasted	1	

Wasted	1.12 (0.98, 1.29)	
Underweight		
Not underweight	1	1
Underweight	1.05 (0.94, 1.18)	1.18 (1.08, 1.28)

*less than once a week/At least once a week/ almost everyday

The likelihood of childhood ARI was higher among children of mothers who were in paid employment compared with those whose mothers were unemployed [UOR = 1.06, 95% CI: (0.93, 1.20)]. Compared with children whose mothers had no formal education, those whose mothers had secondary education or higher were less likely to contract ARI [UOR = 0.82, 95% CI: (0.73, 0.94)]. Similarly, the likelihood of ARI was less among children whose fathers had no secondary education compared with those whose fathers had no formal education [UOR = 0.64, 95% CI: (0.52, 0.79)]. Children whose mothers belonged to the oldest age bracket (35-49 years) were less likely to contract ARI compared to those of mothers belonging to the youngest age bracket (15-19 years) [UOR = 0.91, 95% CI: (0.74, 1.13)]. The likelihood of ARI was less among children of formally married mothers [UOR = 0.72, 95% CI: (0.46, 1.14)].

Male children were less predisposed to ARI than their female counterparts [UOR = 0.89, 95% CI: (0.81, 0.99)]. A similar result was obtained when all covariates were adjusted for [OR = 0.89, 95% CI: (0.80, 0.99)]. Children who were perceived by their mothers to be of average size at birth were less likely to contract ARI compared with those who were perceived to be large [UOR = 0.76, 95% CI: (0.67, 0.87)]. This finding was true after controlling for confounders [OR = 0.96, 95% CI: (0.82, 1.14)]. Fourth-born children with birth intervals of two years or less were most likely to contract ARI [UOR = 1.02, 95% CI: (0.78, 1.34)].

The likelihood of ARI was less among children whose mothers read newspapers/magazines compared with those whose mothers did not [UOR = 0.76, 95% CI: (0.67, 0.86)]. The result remained similar after controlling for confounders [OR = 0.85, 95% CI: (0.74, 0.98)]. The likelihood of ARI was less among children whose mothers listened to the radio [UOR = 0.89, 95% CI: (0.80, 0.99)] and among those whose mothers watched television [UOR = 0.81, 95% CI: (0.72, 0.91)] compared with those whose mothers did not listen to the radio, and did not watch television. The likelihood of ARI was higher among children in households with unimproved sources of drinking water [UOR = 1.23, 95% CI: (1.07, 1.42)]. This was true even after controlling for confounders [OR = 1.24, 95% CI: (1.07, 1.44)]. The likelihood of ARI was also less among those from households with unimproved toilet facilities [UOR = 1.26, 95% CI: (1.11, 1.44)]. Stunted children were less predisposed to ARI than those who were not stunted [UOR = 0.94, 95% CI: (0.84, 1.05)]. Furthermore, the likelihood of ARI was higher among wasted children [UOR = 1.12, 95% CI: (0.98, 1.29)]. Underweight children were more likely to contract ARI compared to children who were not underweight [UOR = 1.05, 95% CI: (0.94, 1.18)]. The result remained the same after controlling for confounders [OR = 1.18, 95% CI: (1.08, 1.28)].

6.6 Summary

This chapter presented characteristics of the study variables and the prevalence of both childhood diarrhoea and ARI among Indian children aged 0-59 months. The chapter also featured factors associated with childhood diarrhoea and ARI among this group of children. The prevalence of childhood diarrhoea and ARI as well as factors associated with diarrhoea and ARI among Indian children aged 0-59 months were also

presented in the chapter. Prevalence of, and factors associated with childhood diarrhoea and ARI among Pakistani children aged 0-59 months are examined in the next chapter.

CHAPTER 7

FACTORS ASSOCIATED WITH CHILDHOOD DIARRHOEA AND ACUTE RESPIRATORY INFECTION - PAKISTAN

7.0 Introduction

This chapter presents results of the first and second research questions for Pakistan. The community, socio-economic, child, exposure to media, environmental as well as nutrition factors significantly associated with childhood diarrhoea and ARI in Pakistan are assessed. The rest of the chapter is organised as follows: The rest of the chapter is organised as follows: Section 7.1 describes the characteristics of the study participants. Section 7.2 presents the prevalence of childhood diarrhoea by various independent variables, while section 7.3 presents the prevalence of ARI by the various independent variables. Factors associated with childhood diarrhoea are examined in section 7.4 and section 7.5 presents the factors associated with ARI. The chapter ends with a summary.

7.1 Characteristics of the Sample

The distribution of the community, socio-economic, child, exposure to the media, environmental and nutrition factors of the respondents is shown in Table 7.1. Nearly three-quarters of the sample (70%) were rural dwellers. In terms of geographical residence, most people lived in the Punjab region (57%) with the smallest proportion residing in the Islamabad region.

The majority of mothers (44%) lived in poor households, and three-quarters of them were not in paid employment in the 12 months preceding the survey. Only 27% of them had secondary education or higher, and more than half of them did not have any

formal education. However, the majority of their partners (50%) had secondary education, whilst one-third of them did not have any formal education.

Table 7.1: Characteristics of the sample - Pakistan, 2012-13 (n=11040)

INDEPENDENT VARIABLE	n (%)
Community level factors	
Residence	
Urban	3281 (29.7)
Rural	7759 (70.3)
Geographical region	
Punjab	6307 (57.1)
Sindh	2510 (22.7)
North West Frontier	1560 (14.1)
Baluchistan	536 (4.9)
Gilgit Baltistan	81 (0.7)
Islamabad	45 (0.4)
Socioeconomic factors	
Wealth index	
Poor	4875 (44.2)
Middle	4361 (39.5)
Rich	1804 (16.3)
Mother working status in the previous 12 months	
Not working	8288 (75.1)
Working	2752 (24.9)
Maternal Education	
No education	6226 (56.4)
Primary	1870 (16.9)
Secondary or higher	2944 (26.7)
Partner education	
No education	3693 (33.5)
Primary	1850 (16.8)
Secondary or higher	5478 (49.7)
Mother's age (years)	
35-49	2154 (19.5)
25-34	6359 (57.6)
15-24	2527 (22.9)
Maternal marital status	
Currently married	10926 (99)
Formerly married	114 (1.0)
Child factors	
Child's age (months)	
0-11	2187 (19.8)

12-23	2074 (18.8)
24-35	2277 (20.6)
36-47	2286 (20.7)
48-59	2216 (20.1)
Sex of the baby	
Male	5625 (50.9)
Female	5415 (49.1)
Perceived size of the baby	
Large	719 (6.5)
Average	8225 (74.8)
Small	2051 (18.7)
Birth rank and birth interval	
2nd/3rd birth rank, >2 years interval	3275 (29.7)
1st birth rank	2568 (23.3)
2nd/3rd birth rank, ≤ 2 years interval	2197 (19.9)
4th birth rank, >2 years interval	2005 (18.2)
4th birth rank, ≤2 years interval	995 (9)
Exposure to media factors	
Mother Read newspaper/magazine	
No	8455 (76.8)
Yes*	2555 (23.2)
Mother Listened to the radio	
No	9341 (84.6)
Yes*	1696 (15.4)
Mother Watched television	
No	3862 (35)
Yes*	7175 (65)
Environmental factors	
Sources of drinking water	
Improved	5996 (57.8)
Unimproved	4383 (42.2)
Type of toilet facilities	
Improved	6928 (66.5)
Unimproved	3498 (33.5)
Nutrition factors	
Stunting	
Not stunted	1889 (55.6)
Stunted	1508 (44.4)
Wasting	
Not Wasted	2398 (70.6)
Wasted	998 (29.4)
Underweight	
Not underweight	3033 (89.3)
Underweight	363 (10.7)

*less than once a week/At least once a week/ almost everyday

More than half of the mothers (58%) belonged to the middle age bracket (25-34 years), and a vast majority of them (99%) were married at the time of the survey.

The majority of the children were aged between 36 and 47 months, and there were slightly more males than females. According to the mothers' perception of birth size, which has been shown to be a good population-level indicator of birth weight [247, 248], three-quarters of the children were of average size at birth. Most of the children (30%) were second or third-born, with a birth interval of more than two years.

More than three-quarters (77%) of mothers did not read newspapers or magazines, and the majority of them (85%) did not listen to the radio. However, almost two-thirds of them (65%) did watch television. More than half of households (58%) had access to improved source of drinking water, and more than two-thirds of those households also had access to improved toilet facilities.

Less than half of the children (44%) were stunted; the majority of them were not wasted (71%), and 89% of them were not underweight (89%).

7.2 Prevalence of Childhood Diarrhoea

The prevalence of childhood diarrhoea by the various independent variables is presented in Table 7.2. Prevalence of diarrhoea was higher among rural children than among their urban counterparts [P = 21.7%, 95% CI: (20.8, 24.7)]. The highest percentage of childhood diarrhoea occurred in the North West Frontier region [P = 27.9%, 95% CI: (23.6, 32.6)].

The highest proportion of children who contracted diarrhoea came from households which were neither rich nor poor [P = 23.6%, 95% CI: (21.5, 25.9)], and the lowest proportion came from rich households [P = 17.1%, 95% CI: (14.7, 19.8)]. Prevalence of

diarrhoea was higher among children whose mothers were employed than among those whose mothers were unemployed [P = 24.0%, 95% CI: (21.6, 26.7)].

Table 7.2: Prevalence of childhood diarrhoea - Pakistan, 2012-13 (n=52858)

INDEPENDENT VARIABLE	%	95% Confidence Interval
Community level factors		
Residence		
Urban	21.9	(19.8,24.1)
Rural	22.7	(20.8,24.7)
Geographical region		
Punjab	21.9	(19.9,24.1)
Sindh	23.1	(20.8,25.5)
North West Frontier	27.9	(23.6,32.6)
Baluchistan	12.1	(9.0,16.0)
Gilgit Baltistan	16.7	(12.6,21.8)
Islamabad	20.5	(17.0,24.5)
Socioeconomic factors		
Wealth index		
Poor	23.5	(21.2,25.9)
Middle	23.6	(21.5,25.9)
Rich	17.1	(14.7,19.8)
Mother working status		
Not working	22.0	(20.3,23.7)
Working	24.0	(21.6,26.7)
Maternal Education		
No education	22.9	(21.0,24.9)
Primary	25.0	(22.2,28.1)
Secondary or higher	20.0	(17.9,22.4)
Partner education		
No education	23.7	(21.2,26.4)
Primary	23.1	(20.6,25.9)
Secondary or higher	21.4	(19.8,23.1)
Mother's age (years)		
35-49	18.9	(16.7,21.2)
25-34	21.8	(20.1,23.7)
15-24	27.3	(24.5,30.2)
Maternal marital status		
Currently married	22.5	(21.0,24.1)
Formerly married	19.1	(10.9,31.3)
Child factors		
Child's age (months)		
0-11	30.2	(27.5,33.1)

12-23	32.9	(29.9,35.9)
24-35	22.0	(19.4,24.8)
36-47	16.3	(14.4,18.5)
48-59	12.0	(9.9,14.4)
Sex of the baby		
Male	22.7	(20.7,24.7)
Female	22.3	(20.6,24.1)
Perceived size of the baby		
Large	17.1	(13.9,20.9)
Average	21.2	(19.5,23.1)
Small	29.6	(26.8,32.6)
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	24.3	(22.2,26.5)
1st birth rank"	21.3	(19.2,23.5)
2nd/3rd birth rank, ≤ 2 years interval	22.6	(20.1,25.2)
4th birth rank, >2 years interval	21.5	(18.6,24.7)
4th birth rank, ≤2 years interval	21.5	(18.2,25.3)
Exposure to media factors		
Mother Read newspaper/magazine		
No	22.6	(20.9,24.3)
Yes*	22.0	(19.4,24.9)
Mother Listened to the radio		
No	22.4	(20.9,23.9)
Yes*	22.9	(19.3,27.0)
Mother Watched television		
No	23.6	(21.0,26.3)
Yes*	21.9	(20.3,23.6)
Environmental factors		
Sources of drinking water		
Improved	21.6	(19.9,23.4)
unimproved	23.6	(21.3,26.2)
Type of toilet facilities		
improved	22.1	(20.5,23.8)
unimproved	23.4	(21.0,25.9)
Nutrition factors		
Stunting		
Not stunted	21.5	(19.0,24.3)
Stunted	24.0	(20.6,27.7)
Wasting		
Not Wasted	21.4	(19.0,23.9)
Wasted	25.7	(21.6,30.2)
Underweight		
Not underweight	21.9	(19.6,24.4)
Underweight	29.0	(22.9,35.8)

*less than once a week/At least once a week/ almost everyday

Diarrhoea was most prevalent among children whose mothers had primary education only [P = 25.0%, 95% CI: (22.2, 28.1)], and among children whose fathers had no formal education [P = 23.7%, 95% CI: (21.2, 26.4)]. The majority of children who had diarrhoea belonged to mothers of the youngest age group (15-19 years) [P = 27.3%, 95% CI: (24.5, 30.2)]; the minority of those who had the disease were from mothers of the oldest age bracket (35-49 years) [P = 18.9%, 95% CI: (16.7, 21.2)]. Diarrhoea was found to be more prevalent among children whose mothers were married than among those whose mothers were single at the time of the survey [P = 22.5%, 95% CI: (21.0, 24.1)].

Whilst the prevalence of diarrhoea was least prevalent among children aged between 48 and 59 months [P = 12.0%, 95% CI: (9.9, 14.4)], it was found to be most prevalent among those who were aged between 12 and 23 months [P = 32.9%, 95% CI: (29.9, 35.9)]. Slightly more male children had diarrhoea than their female counterparts [P = 22.7%, 95% CI: (20.7, 24.7)]. The majority of children who had diarrhoea were the ones who were perceived by their mothers to be small when they were born [P = 29.6, 95% CI: (26.8, 32.6)]. Most of the children who had diarrhoea were second or third born, with more than two years birth interval [P = 24.3%, 95% CI: (22.2, 26.5)], whilst diarrhoea was least prevalent among first-born children [P = 21.3%, 95% CI: (19.2, 23.5)].

Diarrhoea was found to be more prevalent among children whose mothers did not read newspapers/magazines than those whose mothers did [P = 22.6%, 95% CI: (20.9, 24.3)], among children whose mothers did listen to the radio than those whose

mothers did not [P = 22.9%, 95% CI: (19.3, 27.0)], and among children whose mothers did not watch television than those whose mothers did [P = 23.6%, 95% CI: (21.0, 26.3)].

Prevalence of diarrhoea was found to be higher in households with unimproved source of drinking water than those with improved drinking water sources [P = 23.6%, 95% CI: (21.3, 26.2)], and in households with unimproved toilet facilities than those with improved ones [P = 23.4%, 95% CI: (21.0, 25.9)].

Prevalence of diarrhoea was found to be higher among children who were stunted than those who were not [P = 24.0%, 95% CI: (20.6, 27.7)], among children who were wasted than those who were not wasted [P = 25.7%, 95% CI: (21.6, 30.2)] and among children who were underweight than those who were not [P = 29.0%, 95% CI: (22.9, 35.8)].

7.3 Prevalence of Acute Respiratory Infection

Table 7.3 presents the prevalence of childhood diarrhoea by the various independent variables of the respondents. Prevalence of childhood diarrhoea was higher among rural children than among their urban counterparts [P = 66.5%, 95% CI: (63.1, 69.7)]. The highest percentage of childhood diarrhoea occurred in the North West Frontier region [P = 69. 1%, 95% CI: (56.9, 64.0)].

The highest percentage of diarrhoea occurred in poor households [P = 67.0%, 95% CI: (62.4, 71.4)]; among children whose mothers were in paid employment [P = 65.2%, 95% CI: (58.9, 71.0)] and among children whose mothers were educated up to primary level [P = 68.9%, 95% CI: (63.3, 74.0)], among children whose fathers had no education [P = 68.3%, 95% CI: (63.4, 72.9)], among children of middle-age mothers (aged 25- 34

years) [P = 65.0%, 95% CI: (61.0, 68.9)], and among children whose mothers were formerly married [P = 66.4%, 95% CI: (43.2, 83.7)].

Table 7.3: Prevalence of Acute Respiratory Infection - Pakistan, 2012-13 (n=11040)

INDEPENDENT VARIABLE	%	95% Confidence Interval
Community level factors		
Residence		
Urban	60.7	[54.3, 66.8]
Rural	66.5	[63.1, 69.7]
Geographical region		
Punjab	66.8	[62.4, 70.9]
Sindh	55.0	[49.3, 60.6]
North West Frontier	69.1	[64.1, 73.7]
Balochis	67.6	[59.5, 74.8]
Socioeconomic factors		
Wealth index		
Poor	67.0	[62.4, 71.4]
Middle	65.4	[60.7, 69.8]
Rich	57.6	[51.4, 63.6]
Mother working status in the previous 12 months		
Not working	64.5	[61.2, 67.7]
Working	65.2	[58.9, 71.0]
Maternal Education		
No education	67.7	[63.9, 71.3]
Primary	68.9	[63.3, 74.0]
Secondary or higher	56.5	[52.1, 60.8]
Partner education		
No education	68.3	[63.4, 72.9]
Primary	64.7	[57.4, 71.4]
Secondary or higher	62.3	[59.0, 65.5]
Mother's age (years)		
35-49	64.5	[59.6, 69.1]
25-34	65.0	[61.0, 68.9]
15-24	63.8	[58.2, 69.0]
Maternal marital status		
Currently married	64.7	[61.6, 67.6]
Formerly married	66.4	[43.2, 83.7]
Child factors		
Child's age (months)		
0-11	71.5	[66.8, 75.7]

12-23	69.3	[64.1, 74.1]
24-35	60.2	[55.1, 65.2]
36-47	60.8	[55.3, 66.0]
48-59	60.5	[55.5, 65.3]
Sex of the baby		
Male	64.3	[60.9, 67.5]
Female	65.1	[61.1, 68.9]
Perceived size of the baby		
Large	67.7	[62.3, 72.7]
Average	64.9	[61.5, 68.1]
Small	53.9	[45.4, 62.1]
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	65.0	[60.3, 69.5]
1st birth rank	65.0	[60.6, 69.2]
2nd/3rd birth rank, ≤ 2 years interval	61.1	[55.7, 66.2]
4th birth rank, >2 years interval	66.3	[60.9, 71.3]
4th birth rank, ≤2 years interval	67.7	[60.1, 74.4]
Exposure to media factors		
Mother Read newspaper/magazine		
No	66.5	[63.1, 69.7]
Yes*	59.8	[54.4, 65.0]
Mother Listened to the radio		
No	64.7	[61.5, 67.7]
Yes*	64.7	[58.1, 70.8]
Mother Watched television		
No	67.4	[62.7, 71.8]
Yes*	63.3	[59.7, 66.8]
Environmental factors		
Sources of drinking water		
Improved	62.0	[58.0, 65.9]
Unimproved	67.4	[63.4, 71.2]
Type of toilet facilities		
Improved	63.1	[58.4, 67.5]
Unimproved	66.1	[62.5, 69.5]
Nutrition factors		
Stunting		
Not stunted	59.7	[53.9, 65.3]
Stunted	69.0	[62.6, 74.8]
Wasting		
Not Wasted	64.1	[59.2, 68.8]
Wasted	58.6	[45.9, 70.3]
Underweight		
Not underweight	63.2	[57.9, 68.2]
Underweight	64.4	[57.0, 71.2]

*less than once a week/At least once a week/ almost everyday

The youngest children (aged 0-11 months) had the highest percentage of diarrhoea [P = 71.5%, 95% CI: (66.8, 75.7)]; more female children suffered diarrhoea than their male counterparts [P = 65.1%, 95% CI: (61.1, 68.9)]. Children whose mothers perceived them to be of a large size at birth [P = 67.7%, 95% CI: (62.3, 72.7)], and those who were fourth-born with a birth interval of less than or equal to two years [P = 67.7%, 95% CI: (60.1, 74.4)] had the highest percentage of diarrhoea.

Diarrhoea was found to be more prevalent among children whose mothers did not read newspapers/magazines than those whose mothers did [P = 66.5%, 95% CI: (63.1, 69.7)], and among children whose mothers did not watch television than those whose mothers did [P = 67.4%, 95% CI: (62.7, 71.8)].

Prevalence of childhood diarrhoea was found to be higher in households with unimproved source of drinking water than those with improved drinking water sources [P = 67.4%, 95% CI: (63.4, 71.2)], and in households with unimproved toilet facilities than those with improved ones [P = 66.1%, 95% CI: (62.5, 69.5)].

Diarrhoea was found to be more prevalent among children who were stunted than those who were not [P = 69.0%, 95% CI: (62.6, 74.8)], among children who were not wasted than those who were not [P = 64.1%, 95% CI: (59.2, 68.8)] and among children who were underweight than those who were not [P = 64.4%, 95% CI: (57.0, 71.2)].

7.4 Factors Associated with Childhood Diarrhoea

Unadjusted and adjusted odds ratios were calculated to estimate the strength of association between independent variables and childhood diarrhoea. As shown in Table 7.4, the likelihood of childhood diarrhoea was higher among rural children compared with their urban counterparts [UOR = 1.03, 95% CI: (0.86, 1.25)]. Children from the North West Frontier region were found to be more likely to contract

diarrhoea compared with those from the Punjab region [UOR = 1.21, 95% CI: (0.97, 1.52). Children from the middle class households were more predisposed to diarrhoea compared with those from poor households [UOR = 1.01, 95% CI: (0.89, 1.14)].

Table 7.4: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with childhood diarrhoea - Pakistan, 2012-13 (n=11040)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Community level factors		
Residence		
Urban	1	
Rural	1.03 (0.86, 1.25)	
Geographical region		
Punjab	1	
Sindh	1.02 (0.84,1.24)	
North West Frontier	1.21 (0.97, 1.520	
Baluchistan	0.45 (0.32, 0.65)	
Gilgit Baltistan	0.71 (0.37, 1.35)	
Islamabad	0.92 (0.43, 2.00)	
Socioeconomic factors		
Wealth index		
Poor	1	
Middle	1.01 (0.89, 1.14)	
Rich	0.63 (0.53, 0.75)	
Mother working status		
Not working	1	
Working	1.13 (1.01, 1.27)	
Maternal Education		
No education	1	
Primary	1.11 (0.97, 1.27)	
Secondary or higher	0.88 (0.77, 0.99)	
Partner education		
No education	1	
Primary	0.97 (0.84, 1.12)	
Secondary or higher	0.88 (0.79, 0.99)	
Mother's age (years)		
35-49		1
25-34		1.31 (1.02, 1.68)
15-24		1.62 (1.22, 2.15)
Maternal marital status		
Currently married	1	
Formerly married	0.96 (0.58, 1.58)	

Child factors		
Child's age (months)		
0-11	1	
12-23	1.16 (1.01, 1.33)	
24-35	0.62 (0.54, 0.71)	
36-47	0.42 (0.36, 0.49)	
48-59	0.30 (0.25, 0.35)	
Sex of the baby		
Male	1	
Female	0.97 (0.88, 1.06)	
Perceived size of the baby		
Large		1
Average		1.91 (1.31, 2.80)
Small		2.82 (1.85, 4.28)
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank"	0.84 (0.74, 0.96)	
2nd/3rd birth rank, ≤ 2 years interval	0.91 (0.80, 1.05)	
4th birth rank, >2 years interval	0.83 (0.72, 0.96)	
4th birth rank, ≤2 years interval	0.86 (0.72, 1.03)	
Exposure to media factors		
Mother Read newspaper/magazine		
No	1	
Yes*	1.01 (0.89, 1.14)	
Mother Listened to the radio		
No	1	
Yes*	1.09 (0.96, 1.25)	
Mother Watched television		
No	1	
Yes*	0.96 (0.86, 1.07)	
Environmental factors		
Sources of drinking water		
Improved	1	
unimproved	1.06 (0.94, 1.20)	
Type of toilet facilities		
improved	1	
unimproved	1.02 (0.91, 1.15)	
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	1.14 (0.95, 1.37)	
Wasting		
Not Wasted	1	
Wasted	1.33 (1.10, 1.62)	
Underweight		

Not underweight	1	1
Underweight	1.53 (1.17, 2.02)	1.44 (1.10, 1.91)

*less than once a week/At least once a week/ almost everyday

The likelihood of diarrhoea was more among children of mothers who were in paid employment compared with those whose mothers were unemployed [UOR = 1.13, 95% CI: (1.01, 1.27)]. Compared with children whose mothers had no formal education, those whose mothers had secondary education or higher were less likely to contract diarrhoea [UOR = 0.88, 95% CI: (0.77, 0.99)]. Similarly, the likelihood of diarrhoea was less among children whose fathers had secondary education or higher compared with those whose fathers had no education [UOR = 0.88, 95% CI: (0.79, 1.99)]. Children whose mothers belonged to the youngest age bracket (15-24 years) were significantly more likely to contract diarrhoea compared with those of mothers belonging to the oldest age bracket (35-49 years) after all covariates were adjusted for [OR = 1.62, 95% CI: (1.22, 2.15)]. The likelihood of diarrhoea was less among children of formally married mothers compared with those of mothers who were married [UOR = 0.96, 95% CI: (0.58, 1.58)]. Children who were aged between 48 and 59 months were less likely to contract diarrhoea compared with those aged 0-11 months [UOR = 0.30, 95% CI: (0.25, 0.35)]. Female children were less predisposed to diarrhoea than their male counterparts [UOR = 0.97, 95% CI: (0.88, 1.06)], and, after adjusting for all covariates, children who were perceived by their mothers to be of small size at birth were significantly more likely to contract diarrhoea compared with those who were perceived to be large [UOR = 2.82, 95% CI: (1.85, 4.28)]. Fourth-born children with birth intervals of more than two years were less likely to contract diarrhoea compared

with second/third-born children with more than two years birth interval [UOR = 0.83, 95% CI: (0.72, 0.96)].

The likelihood of diarrhoea was more among children whose mothers read newspapers/magazines [UOR = 1.01, 95% CI: (0.89, 1.14)] and among children whose mothers listened to the radio [UOR = 1.09, 95% CI: (0.96, 1.25)] compared with those whose mothers did not read newspapers/magazines and did not listen to the radio. However, children whose mothers watched television were found to be less likely to contract diarrhoea than those whose mothers did not watch television [UOR = 0.96, 95% CI: (0.86, 1.07)].

The likelihood of diarrhoea was more among children in households with unimproved sources of drinking water [UOR = 1.06, 95% CI: (0.94, 1.20)], and among those from households with unimproved toilet facilities [UOR = 1.02, 95% CI: (0.91, 1.15)] compared with those from households with improved sources of drinking water and improved toilet facilities respectively.

Stunted children were more predisposed to diarrhoea than those who were not stunted [UOR = 1.14, 95% CI: (0.95, 1.37)]. Furthermore, the likelihood of diarrhoea was more among wasted children [UOR = 1.33, 95% CI: (1.10, 1.62)] and underweight children [UOR = 1.53, 95% CI: (1.17, 2.02)] than children who were not wasted and not underweight respectively. After adjusting for covariates, wasted children were more indisposed to diarrhoea compared with their counterparts who were not waster [OR = 1.44, 95% CI: (1.10, 1.91)].

7.5 Factors Associated with Acute Respiratory Infection

Table 7.5 presents the unadjusted and adjusted odds ratios for factors associated with ARI among Pakistani children aged 0-59 months. The likelihood of ARI was more among rural children compared with their urban counterparts [UOR = 1.48, 95% CI: (1.11, 1.97)]. Children from the Sindh region were found to be less likely to contract ARI compared with those from the Punjab region [UOR = 0.62, 95% CI: (0.44, 0.87)]. The same result was obtained when all covariates were adjusted for [OR = 0.60, 95% CI: (0.44, 0.83)]. Children from rich households were less predisposed to ARI compared with those from poor households [UOR = 0.62, 95% CI: (0.47, 0.81)].

Table 7.5: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with acute respiratory infection - Pakistan, 2012-13 (n=52858)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Community level factors		
Residence		
Urban	1	
Rural	1.48 (1.11, 1.97)	
Geographical region		
Punjab	1	1
Sindh	0.62 (0.44,0.87)	0.60 (0.44,0.83)
North West Frontier	1.38 (0.98, 1.94)	1.23 (0.89, 1.70)
Balochis	1.32 (0.69, 2.53)	1.12 (0.58, 2.15)
Socioeconomic factors		
Wealth index		
Poor	1	
Middle	0.77 (0.63, 0.94)	
Rich	0.62 (0.47, 0.81)	
Mother working status in the previous 12 months		
Not working	1	
Working	1.16 (0.95, 1.41)	
Maternal Education		
No education	1	1
Primary	0.93 (0.75, 1.17)	0.92 (0.74, 1.16)
Secondary or higher	0.51 (0.41, 0.62)	0.54 (0.43, 0.67)
Partner education		
No education	1	

Primary	0.80 (0.80, 1.02)	
Secondary or higher	0.74 (0.61, 0.89)	
Mother's age (years)		
35-49	1	
25-34	1.00 (0.83, 1.20)	
15-24	1.16 (0.91, 1.46)	
Maternal marital status		
Currently married	1	
Formerly married	1.18 (0.57, 2.45)	
Child factors		
Child's age (months)		
0-11	1	1
12-23	0.96 (0.75, 1.22)	0.93 (0.72, 1.19)
24-35	0.63 (0.49, 0.80)	0.63 (0.49, 0.80)
36-47	0.64 (0.50, 0.82)	0.63 (0.49, 0.81)
48-59	0.60 (0.46, 0.77)	0.61 (0.47, 0.78)
Sex of the baby		
Male	1	
Female	1.00 (0.85, 1.16)	
Perceived size of the baby		
Large	1	1
Average	0.79 (0.64, 0.97)	0.85 (0.69, 1.04)
Small	0.50 (0.36, 0.70)	0.60 (0.42, 0.84)
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank	1.02 (0.83, 1.26)	
2nd/3rd birth rank, ≤ 2 years interval	0.86 (0.69, 1.07)	
4th birth rank, >2 years interval	1.14 (0.90, 1.44)	
4th birth rank, ≤2 years interval	1.25 (0.91, 1.72)	
Exposure to media factors		
Mother Read newspaper/magazine		
No	1	
Yes*	0.66 (0.55, 0.79)	
Mother Listened to the radio		
No	1	
Yes*	0.96 (0.76, 1.19)	
Mother Watched television		
No	1	
Yes*	0.80 (0.66, 0.97)	
Environmental factors		
Sources of drinking water		
Improved	1	1
Unimproved	1.37 (1.14, 1.65)	1.27 (1.06, 1.53)
Type of toilet facilities		
Improved	1	

Unimproved	1.34 (1.11, 1.62)	
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	2.07 (1.48, 2.90)	
Wasting		
Not Wasted	1	
Wasted	0.63 (0.39, 1.02)	
Underweight		
Not underweight	1	
Underweight	1.12 (0.80, 1.59)	

*less than once a week/At least once a week/ almost everyday

The likelihood of childhood ARI was more among children of mothers who were in paid employment compared with those whose mothers were unemployed [UOR = 1.16, 95% CI: (0.95, 1.41)]. Compared with children whose mothers had no formal education, those whose mothers had secondary education or higher were less likely to contract ARI [UOR = 0.51, 95% CI: (0.41, 0.62)]. This result was still true after adjusting for all other covariates [UOR = 0.54, 95% CI: (0.43, 0.67)]. In addition, the likelihood of ARI was less among children whose fathers had secondary education or higher compared with those whose fathers had no education [UOR = 0.74, 95% CI: (0.61, 0.89)]. The likelihood of ARI was more among children of formally married mothers [UOR = 1.18, 95% CI: (0.57, 2.45)].

The oldest children were less indisposed to ARI compared with their youngest counterparts [UOR = 0.60, 95% CI: (0.46, 0.77)]. Children who were perceived by their mothers to be small at birth were less likely to contract ARI compared with those who were perceived to be large [UOR = 0.50, 95% CI: (0.36, 0.70)]. Second/third-born children with birth intervals of two years or less were less likely to contract ARI compared with second/third-born children with birth interval of more than two years [UOR = 0.86, 95% CI: (0.69, 1.07)].

The likelihood of ARI was less among children whose mothers read newspapers/magazines [UOR = 0.66, 95% CI: (0.55, 0.79)], among children whose mothers listened to the radio [UOR = 0.96, 95% CI: (0.76, 1.19)] and among those whose mothers watched television [UOR = 0.80, 95% CI: (0.66, 0.97)] compared with those whose mothers did not read newspapers/magazines, did not read newspapers/magazines and did not watch television.

The likelihood of ARI was more among children in households with unimproved sources of drinking water [UOR = 1.37, 95% CI: (1.14, 1.65)], and among those from households with unimproved toilet facilities [UOR = 1.34, 95% CI: (1.11, 1.62)] compared with those from households with improved sources of drinking water and toilet facilities respectively. When all covariates were adjusted for, the likelihood of ARI was still more among children from households with unimproved sources of drinking water [UOR = 1.27, 95% CI: (1.06, 1.53)].

Stunted children were more predisposed to ARI than those who were not stunted [UOR = 2.07, 95% CI: (1.48, 2.90)]. However, the likelihood of ARI was less among wasted children compared with those children who were not wasted [UOR = 0.63, 95% CI: (0.39, 1.02)] and the likelihood of ARI was more among underweight children compared with children who were not underweight [UOR = 1.12, 95% CI: (0.80, 1.59)].

7.6 Summary

This chapter presented the characteristics of the study variables and also presented the prevalence of both childhood diarrhoea and ARI among Pakistani children aged 0-59 months. Factors associated with childhood diarrhoea and ARI among this group of children were also presented in the chapter. The next chapter presents the factors

associated with diarrhoea and ARI in Nepalese children aged 0-59 months. Prevalence of both childhood diarrhoea and ARI in those Nepalese children is also presented.

CHAPTER 8

FACTORS ASSOCIATED WITH CHILDHOOD DIARRHOEA AND ACUTE RESPIRATORY INFECTION - NEPAL

8.0 Introduction

This chapter presents results of the first and second research questions for Nepal. Community-level factors, socio-economic and child determinants, as well as media factors that were significantly associated with childhood diarrhoea and ARI in Nepal are examined. The rest of the chapter is organised as follows: Section 8.1 describes the characteristics of the sample. Section 8.2 presents the prevalence of childhood diarrhoea while section 8.3 presents the prevalence of acute respiratory infection (ARI) by the various independent variables. The next section presents the factors associated with childhood diarrhoea, and the section that follows examines the factors associated with ARI. Section 8.6 presents a summary to conclude the chapter and to signpost the proceeding chapters.

8.1 Characteristics of the Sample

Table 8.1 presents the distribution of the community level, socio-economic, child, exposure to media, environmental and nutrition factors of 4837 (weighted total) children aged 0-59 months. The majority of the sample (54%) resided in urban areas, with most of them (37%) living in the Central region. More than half of the surveyed mothers (55%) lived in the Terai ecological zone.

Only a small proportion of mothers (15%) lived in rich households. More than half of the mothers (51%) belonged to the working class in the 12 months preceding the survey. The majority of mothers (46%) had secondary education or higher. Similarly, the majority of fathers (61%) had secondary education or higher. Most of the mothers

(51%) were middle-aged (25-34 years), and a vast majority of them (99%) were married at the time of the survey.

The majority of the children (21%) were aged between 12 and 23 months, and there were more males than females (52% and 48% respectively). According to the mothers' perception of birth size, which has been shown to be a good population-level indicator of birth weight [247, 248]. More than two-thirds of the children (67%) were of average size at birth. Most of the children (40%) were second or third-born, with a birth interval of more than two years.

Table 8.1: Characteristics of the sample - Nepal, 2016 (n=4837)

INDEPENDENT VARIABLE	n (%)
Community level factors	
Residence	
Urban	2616 (54.1)
Rural	2220 (45.9)
Geographical region	
Eastern	1094 (22.6)
Central	1767 (36.5)
Western	895 (18.5)
Mid-west	663 (13.7)
Far-west	418 (8.6)
Ecological zones	
Mountain	338 (7.0)
Hill	1834 (37.9)
Terai	2664 (55.1)
Socioeconomic factors	
Wealth index	
Poor	2051 (42.4)
Middle	2062 (42.6)
Rich	725 (15.0)
Mother working status in the previous 12 months	
Working	2460 (50.9)
Not working	2377 (49.1)
Maternal Education	
No education	1639 (33.9)

Primary	973 (20.1)
Secondary or higher	2225 (46.0)
Partner education	
No education	711 (14.8)
Primary	1095 (22.9)
Secondary or higher	2986 (62.3)
Mother's age (years)	
15-24	1968 (40.7)
25-34	2484 (51.4)
35-49	385 (7.9)
Maternal marital status	
Currently married	4802 (99.3)
Formerly married	34 (0.7)
Child factors	
Child's age (months)	
0-11	899 (18.6)
12-23	1029 (21.3)
24-35	928 (19.2)
36-47	970 (20.1)
48-59	1010 (20.9)
Sex of the baby	
Female	2301 (47.6)
Male	2536 (52.4)
Perceived size of the baby	
Small	814 (16.8)
Average	3246 (67.2)
Large	771 (16.0)
Birth rank and birth interval	
2nd/3rd birth rank, >2 years interval	1943 (40.2)
1st birth rank	1903 (39.4)
2nd/3rd birth rank, ≤ 2 years interval	588 (12.2)
4th birth rank, >2 years interval	291 (6.0)
4th birth rank, ≤2 years interval	112 (2.3)
Exposure to media factors	
Mother Read newspaper/magazine	
Yes*	3785 (78.3)
Not at all	1052 (21.7)
Mother Listened to the radio	
Not at all	2398 (49.6)
Yes*	2438 (50.4)
Mother Watched television	
Not at all	1837 (38.0)
Yes*	3000 (62.0)
Environmental factors	
Sources of drinking water	

Improved	3400 (70.3)
unimproved	1437 (28.7)
Type of toilet facilities	
improved	3027 (62.6)
unimproved	1810 (37.4)
Nutrition factors	
Stunting	
Not stunted	1503 (64.6)
Stunted	826 (35.4)
Wasting	
Not Wasted	2096 (90.2)
Wasted	229 (9.8)
Underweight	
Not underweight	1705 (73.0)
Underweight	631 (27.0)

*less than once a week/At least once a week/ almost everyday

More than three-quarters (78%) of mothers did read newspapers/magazines. Further, half of them did listen to the radio (50%) and 62% of them did watch television. The majority of households (70%) had access to improved sources of drinking water; and about 63% of those households did have access to improved toilet facilities.

Less than half of the children (35%) were stunted; the majority of them were not wasted (90%) and 73% were not underweight.

8.2 Prevalence of Childhood Diarrhoea

Table 8.2 presents the prevalence of childhood diarrhoea by the various independent variables. Prevalence of diarrhoea was higher among urban children than among their rural counterparts [P = 7.9%, 95% CI: (6.2, 10.0)]. The highest percentage of childhood diarrhoea occurred in the Central region [P = 9.7%, 95% CI: (7.2, 12.9)].

The lowest proportion of children with diarrhoea lived in households which were neither poor nor rich [P = 8.5%, 95% CI: (6.8, 10.4)]; and the highest proportion of children with diarrhoea were those whose mothers were employed [P = 8.7%, 95% CI: (7.1, 10.5), and had no formal education [P = 14.4%, 95% CI: (12.5, 16.5)], whose

fathers had no formal education [P = 9.8%, 95% CI: (7.3, 13.1)], whose mothers belonged to the oldest age bracket (35- 49 years) [P = 8.1%, 95% CI: (5.7, 11.5)], and whose mothers were formerly married at the time of the survey [P = 19.9%, 95% CI: (8.8, 38.9)].

Table 8.2: Prevalence of childhood diarrhoea - Nepal 2016 (n=4837)

INDEPENDENT VARIABLE	%	95% Confidence Interval
Community level factors		
Residence		
Urban	7.9	[6.2,10.0]
Rural	7.4	[6.0,9.2]
Geographical region		
Eastern	6.3	[4.8,8.2]
Central	9.7	[7.2,12.9]
Western	5.4	[4.0,7.1]
Mid-west	8.6	[6.2,11.8]
Far-west	6.2	[4.6,8.4]
Ecological zones		
Mountain	5.3	[3.7,7.5]
Hill	6.5	[4.4,9.5]
Terai	8.8	[7.4,10.5]
Socioeconomic factors		
Wealth index		
Poor	7.0	[5.8,8.4]
Middle	8.5	[6.8,10.4]
Rich	7.4	[4.5,11.9]
Mother working status in the previous 12 months		
Working	8.7	[7.1,10.5]
Not working	6.7	[5.4,8.2]
Maternal Education		
No education	8.6	[7.1,10.5]
Primary	8.4	[6.6,10.8]
Secondary or higher	6.6	[5.0,8.7]
Partner education		
No education	9.8	[7.3,13.1]
Primary	7.6	[5.7,10.0]
Secondary or higher	7.0	[5.7,8.6]
Mother's age (years)		

15-24	7.6	[6.2,9.3]
25-34	7.7	[6.0,9.8]
35-49	8.1	[5.7,11.5]
Maternal marital status		
Currently married	7.6	[6.4,9.0]
Formerly married	19.9	[8.8,38.9]
Child factors		
Child's age (months)		
0-11	10.0	[7.8,12.8]
12-23	10.9	[8.3,14.2]
24-35	6.5	[4.9,8.4]
36-47	6.3	[4.5,8.9]
48-59	4.7	[3.4,6.6]
Sex of the baby		
Female	7.8	[6.5,9.2]
Male	7.6	[5.6,10.2]
Perceived size of the baby		
Small	8.2	[6.1,10.9]
Average	7.4	[6.3,8.7]
Large	8.4	[5.7,12.2]
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	8.2	[6.6,10.1]
1st birth rank"	6.3	[4.9,8.1]
2nd/3rd birth rank, ≤ 2 years interval	9.0	[6.2,12.9]
4th birth rank, >2 years interval	10.8	[7.1,15.9]
4th birth rank, ≤2 years interval	7.3	[2.6,19.2]
Exposure to media factors		
Mother Read newspaper/magazine		
Yes*	7.9	[6.8,9.3]
Not at all	6.7	[4.5,9.8]
Mother Listened to the radio		
Not at all	8.5	[6.9,10.3]
Yes*	6.9	[5.7,8.4]
Mother Watched television		
Not at all	9.1	[7.2,11.4]
Yes*	6.8	[5.2,8.9]
Environmental factors		
Sources of drinking water		
Improved	7.3	[6.2,8.6]
unimproved	8.5	[6.5,11.0]
Type of toilet facilities		
improved	6.6	[5.7,7.7]
unimproved	9.5	[7.1,12.5]
Nutrition factors		
Stunting		

Not stunted	8.1	[6.6,9.9]
Stunted	6.6	[4.8,9.0]
Wasting		
Not Wasted	7.3	[6.1,8.7]
Wasted	10.3	[6.5,16.1]
Underweight		
Not underweight	7.0	[5.8,8.5]
Underweight	9.0	[6.4,12.6]

*less than once a week/At least once a week/ almost everyday

Diarrhoea was most prevalent among children aged 12-23 months [P = 10.9%, 95% CI: (8.3, 14.2)]; more female children suffered diarrhoea than their male counterparts [P = 7.8%, 95% CI: (6.5, 9.2)]. The majority of children who had diarrhoea were those whose mothers perceived them to be of large size at birth [P = 8.4%, 95% CI: (5.7, 12.2)], and those who were fourth-born with a birth interval of more than two years [P = 10.8%, 95% CI: (7.1, 15.9)].

Diarrhoea was found to be more prevalent among children whose mothers did not read newspapers/magazines than those whose mothers did [P = 7.9%, 95% CI: (6.8, 9.3)], among children whose mothers did not listen to the radio than those whose mothers did [P = 8.5%, 95% CI: (6.9, 10.3)], and among children whose mothers did not watch television than those whose mothers did [P = 9.1%, 95% CI: (7.2, 11.4)].

Prevalence of diarrhoea was found to be higher in households with unimproved source of drinking water than in households with improved source of drinking water [P = 8.5%, 95% CI: (6.5, 11.0)]. Diarrhoea was more prevalent in households with unimproved toilet facilities than in those with improved ones [P = 9.5%, 95% CI: (7.1, 12.5)].

Diarrhoea was found to be more prevalent among children who were not stunted than those who were stunted [P = 8.1%, 95% CI: (6.6, 9.9)], among children who were

wasted than those who were not [P = 10.3%, 95% CI: (6.5, 16.1)] and among children who were underweight than those who were not [P = 9.0%, 95% CI: (6.4, 12.6)].

8.3 Prevalence of ARI

Table 8.3 shows the prevalence of ARI by the various independent variables of the respondents. Prevalence of ARI was higher among rural children than among their urban counterparts [P = 7.3%, 95% CI: (6.0, 8.9)]. The highest percentage of ARI occurred in the Central region [P = 7.3%, 95% CI: (5.6, 9.4)]; and in the Hill Ecological zone [P = 6.7%, 95% CI: (5.3, 8.4)].

The highest percentage of ARI occurred in poor households [P = 7.4%, 95% CI: (6.1, 8.9)]; among children whose mothers were not in paid employment [P = 6.5%, 95% CI: (5.4, 7.8)] and among children whose mothers had primary education only [P = 7.6%, 95% CI: (5.7, 10.0)], among children whose fathers also had primary education only [P = 7.2%, 95% CI: (5.5, 9.5)], among children of the youngest mothers (aged 15- 24 years) [P = 7.4%, 95% CI: (6.2, 8.8)], and among children whose mothers were married as at time of the survey [P = 6.3%, 95% CI: (5.5, 7.3)].

Table 8.3: Prevalence of acute respiratory infection (ARI) - Nepal, 2016 (n=4837)

INDEPENDENT VARIABLE	%	95% Confidence Interval
Community level factors		
Residence		
Urban	5.5	[4.5,6.8]
Rural	7.3	[6.0,8.9]
Geographical region		
Eastern	6.4	[4.6,8.8]
Central	7.3	[5.6,9.4]
Western	5.9	[4.5,7.9]
Mid-west	5.0	[3.8,6.5]
Far-west	5.1	[3.5,7.4]
Ecological zones		
Mountain	6.30	[4.1,9.5]

Hill	6.70	[5.3,8.4]
Terai	6.1	[4.9,7.5]
Socioeconomic factors		
Wealth index		
Poor	7.4	[6.1,8.9]
Middle	6.2	[4.9,7.8]
Rich	3.6	[2.2,5.8]
Mother working status in the previous 12 months		
Working	6.5	[5.4,7.8]
Not working	6.2	[5.0,7.6]
Maternal Education		
No education	5.6	[4.5,7.1]
Primary	7.6	[5.7,10.0]
Secondary or higher	6.3	[5.1,7.7]
Partner education		
No education	5.9	[4.2,8.4]
Primary	7.2	[5.5,9.5]
Secondary or higher	6.1	[5.1,7.3]
Mother's age (years)		
15-24	7.4	[6.2,8.8]
25-34	5.5	[4.4,6.8]
35-49	6.4	[4.2,9.8]
Maternal marital status		
Currently married	6.3	[5.5,7.3]
Formerly married	4.9	[0.8,25.7]
Child factors		
Child's age (months)		
0-11	9.4	[7.6,11.5]
12-23	8.0	[6.3,10.6]
24-35	5.3	[3.8,7.3]
36-47	4.3	[3.0,6.0]
48-59	4.6	[3.3,6.4]
Sex of the baby		
Female	6.9	[5.8,8.4]
Male	5.7	[4.6,7.0]
Perceived size of the baby		
Small	7.2	[5.5,9.5]
Average	6.0	[5.0,7.2]
Large	6.8	[5.0,9.2]
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	6.10	[4.8,7.7]
1st birth rank	6.30	[5.1,7.7]
2nd/3rd birth rank, ≤ 2 years interval	6.90	[4.8,9.6]
4th birth rank, >2 years interval	6.40	[3.9,10.3]

4th birth rank, ≤2 years interval	8.3	[2.9,21.4]
Exposure to media factors		
Mother Read newspaper/magazine		
Yes*	6.8	[5.7,7.9]
Not at all	4.8	[3.5,6.5]
Mother Listened to the radio		
Not at all	5.9	[4.6,7.4]
Yes*	6.8	[5.6,8.2]
Mother Watched television		
Not at all	8.1	[6.6,9.8]
Yes*	5.30	[4.3,6.4]
Environmental factors		
Sources of drinking water		
Improved	6.4	[5.4,7.6]
Unimproved	6.2	[4.8,7.9]
Type of toilet facilities		
Improved	6.3	[5.3,7.4]
Unimproved	6.4	[4.9,8.3]
Nutrition factors		
Stunting		
Not stunted	5.5	[4.4,6.9]
Stunted	6.8	[5.0,9.2]
Wasting		
Not Wasted	5.7	[4.7,6.9]
Wasted	8.7	[5.4,13.5]
Underweight		
Not underweight	5.6	[4.5,7.0]
Underweight	7.1	[5.1,9.9]

*less than once a week/At least once a week/ almost everyday

The youngest children (aged 0-11 months) had the highest percentage of ARI [P = 9.4%, 95% CI: (7.6, 11.5)]; more female children suffered diarrhoea than their male counterparts [P = 6.9%, 95% CI: (5.8, 8.4)]. Children whose mothers perceived them to be of a small size at birth [P = 7.2%, 95% CI: (5.5, 9.5)], and those who were fourth-born with a birth interval of two years or less [P = 8.3%, 95% CI: (2.9, 21.4)] had the highest percentage of ARI.

Acute respiratory infection was found to be more prevalent among children whose mothers did read newspapers/magazines than those whose mothers did not [P = 6.8%,

95% CI: (5.7, 7.9)], among children whose mothers did listen to the radio than those whose mothers did not [P = 6.8%, 95% CI: (5.6, 8.2)] and among children whose mothers did not watch television than those whose mothers did [P = 8.1%, 95% CI: (6.6, 9.8)].

Prevalence of ARI was found to be higher in households with improved source of drinking water than those with unimproved drinking water sources [P = 6.4%, 95% CI: (5.4, 7.6)], and in households with unimproved toilet facilities than those with improved ones [P = 6.4%, 95% CI: (4.8, 7.9)].

Acute respiratory infection was found to be more prevalent among children who were stunted than those who were not [P = 6.8%, 95% CI: (5.0, 9.2)], among children who were wasted than those who were not [P = 8.7%, 95% CI: (5.4, 13.5)] and among children who were underweight than those who were not [P = 7.1%, 95% CI: (5.1, 9.9)].

8.4 Factors Associated with Childhood Diarrhoea

Unadjusted and adjusted odds ratios were calculated to estimate the strength of association between independent variables and childhood diarrhoea. As shown in Table 8.4, the likelihood of childhood diarrhoea was lower among rural children compared with their urban counterparts [UOR = 0.97, 95% CI: (0.73, 1.28)]. Children from the Mid-west region were found to be most likely to contract childhood diarrhoea [UOR = 1.32, 95% CI: (0.84, 2.08)]. The likelihood of diarrhoea was higher among children from the Terai ecological region compared with those from the Mountain ecological zone [UOR = 1.62, 95% CI: (0.90, 2.90)]. Children from households which were neither rich nor poor were more predisposed to diarrhoea compared with those from poor households [UOR = 1.12, 95% CI: (0.87, 1.45)].

Table 8.4: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with childhood diarrhoea - Nepal 2016 (n=4837)

INDEPENDENT VARIABLE	UOR (95% confidence interval)	OR (95% confidence interval)
Community level factors		
Residence		
Urban	1	
Rural	0.97 (0.73, 1.28)	
Geographical region		
Eastern	1	
Central	1.29 (0.89, 1.88)	
Western	0.78 (0.49, 1.22)	
Mid-west	1.32 (0.84, 2.05)	
Far-west	1.02 (0.59, 1.74)	
Ecological zones		
Mountain	1	
Hill	1.06 (0.58, 1.94)	
Terai	1.62 (0.90, 2.90)	
Socioeconomic factors		
Wealth index		
Poor	1	
Middle	1.12 (0.87, 1.45)	
Rich	0.96 (0.66, 1.38)	
Mother working status in the previous 12 months		
Working	1	
Not working	0.80 (0.63, 1.00)	
Maternal Education		
No education	1	
Primary	0.99 (0.73, 1.35)	
Secondary or higher	0.79 (0.60, 1.02)	
Partner education		
No education	1	
Primary	0.76 (0.53, 1.07)	
Secondary or higher	0.71 (0.52, 0.96)	
Mother's age (years)		
15-24	1	
25-34	0.94 (0.74, 1.18)	
35-49	1.09 (0.72, 1.66)	
Maternal marital status		
Currently married	1	1
Formerly married	3.50 (1.37, 8.92)	4.74 (1.80, 12.49)
Child factors		
Child's age (months)		
0-11	1	1

12-23	1.04 (0.76, 1.41)	1.03 (0.76, 1.40)
24-35	0.56 (0.39, 0.79)	0.57 (0.40, 0.81)
36-47	0.57 (0.40, 0.81)	0.56 (0.39, 0.79)
48-59	0.39 (0.27, 0.57)	0.39 (0.26, 0.56)
Sex of the baby		
Female	1	
Male	0.92 (0.7, 1.15)	
Perceived size of the baby		
Small	1	
Average	0.93 (0.69, 1.25)	
Large	0.94 (0.64, 1.37)	
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank"	0.76 (0.59, 0.99)	
2nd/3rd birth rank, ≤ 2 years interval	1.05 (0.75, 1.48)	
4th birth rank, >2 years interval	1.54 (1.01, 2.36)	
4th birth rank, ≤2 years interval	0.77 (0.36, 1.66)	
Exposure to media factors		
Mother Read newspaper/magazine		
Yes*	1	
Not at all	0.89 (0.66, 1.18)	
Mother Listened to the radio		
Not at all	1	
Yes*	0.97 (0.77, 1.23)	
Mother Watched television		
Not at all	1	1
Yes*	0.70 (0.56, 0.89)	0.73 (0.57, 0.93)
Environmental factors		
Sources of drinking water		
Improved	1	
unimproved	1.05 (0.81, 1.35)	
Type of toilet facilities		
improved	1	1
unimproved	1.39 (1.09, 1.77)	1.30 (1.01, 1.66)
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	0.77 (0.54, 1.09)	
Wasting		
Not Wasted	1	
Wasted	1.54 (0.96, 2.49)	
Underweight		
Not underweight	1	
Underweight	1.35 (0.96, 1.90)	

*less than once a week/At least once a week/ almost everyday

The likelihood of childhood diarrhoea was less among children of unemployed mothers compared with those whose mothers were employed [UOR = 0.80, 95% CI: (0.63, 1.00)]. Compared with children whose mothers had no formal education, those whose mothers had secondary education or higher were less likely to contract diarrhoea [UOR = 0.79, 95% CI: (0.60, 1.02)]. Similarly, the likelihood of diarrhoea was less among children whose fathers had secondary education or higher compared with those whose fathers had no education [UOR = 0.71, 95% CI: (0.52, 0.96)]. Children whose mothers belonged to the oldest age bracket (35-49 years) were more likely to contract diarrhoea compared to those of mothers belonging to the youngest age bracket (15-19 years) [UOR = 1.09, 95% CI: (0.76, 1.66)]. The likelihood of diarrhoea was higher among children of formally married mothers [UOR = 3.50, 95% CI: (1.37, 8.92)]. This result remained true after adjusting for all confounding variables [OR = 4.74, 95% CI: (1.80, 12.49)]. Children aged between 12 and 23 months were more likely to contract diarrhoea [UOR = 1.04, 95% CI: (0.76, 1.41)]. When all covariates were adjusted for, this result remained true [OR = 1.03, 95% CI: (0.76, 1.40)]. Male children were less predisposed to diarrhoea than their female counterparts [UOR = 0.92, 95% CI: (0.70, 1.15)], and also children who were perceived by their mothers to be of a large size at birth were less likely to contract diarrhoea compared with those who were perceived to be small [UOR = 0.94, 95% CI: (0.64, 1.37)]. Fourth-born children with birth intervals of more than two years were more likely to contract diarrhoea compared with $2^{nd}/3^{rd}$-born children with a birth interval of more than two years [UOR = 1.54, 95% CI: (1.01, 2.36)].

The likelihood of diarrhoea was less among children whose mothers did not read newspapers/magazines compared to children whose mothers did [UOR = 0.89, 95% CI: (0.66, 1.18)]. Children whose mothers listened to the radio were less predisposed to contracting diarrhoea compared with those whose mothers did not [UOR = 0.97, 95% CI: (0.77, 1.23)]. Compared with children whose mothers did not watch television, those whose mothers watched were less likely to contract diarrhoea [UOR = 0.70, 95% CI: (0.56, 0.89)]. This result was true after controlling for all confounders.

The likelihood of diarrhoea was higher among children in households with unimproved sources of drinking water [UOR = 1.05, 95% CI: (0.81, 1.35)], and among those from households with unimproved toilet facilities [UOR = 1.39, 95% CI: (1.09, 1.77)]. After controlling for confounders, the likelihood of diarrhoea was still higher among children from households with unimproved toilet facilities than among those children who came from households with improved toilet facilities [OR = 1.30, 95% CI: (1.01, 1.66)].

Stunted children were less predisposed to diarrhoea than those who were not stunted [UOR = 0.77, 95% CI: (0.54, 1.09)]. Furthermore, the likelihood of diarrhoea was higher among wasted children than children who were not wasted [UOR = 1.54, 95% CI: (0.96, 2.49)], and among underweight children than those who were not underweight [UOR = 1.35, 95% CI: (0.96, 1.90)].

8.5 Factors Associated with Acute Respiratory Infection

Table 8.5 presents the unadjusted and adjusted odds ratios for factors associated with ARI among Nepalese children aged 0-59 months. The likelihood of ARI was higher among rural children compared with their urban counterparts [UOR = 1.20, 95% CI: (0.79, 1.83)]. Children from the Far West region were found to be more likely to contract ARI compared with those from the Eastern region [UOR = 2.49, 95% CI: (1.42,

4.37)]. Additionally, the likelihood of ARI was less among children from the Terai ecological region compared with those from the Mountain ecological zone [UOR = 0.81, 95% CI: (0.43, 1.52)]. Children from rich households were less predisposed to ARI compared with those from poor households [UOR = 0.41, 95% CI: (0.28, 0.62)]. A similar result was obtained when all covariates were adjusted for [OR = 0.56, 95% CI: (0.35, 0.87)].

Table 8.5: Unadjusted odds ratios (UOR) and adjusted odds ratios (OR) for factors associated with acute respiratory infection - Nepal 2016 (n=4837)

INDEPENDENT VARIABLE	UOR (95% confidence interval	OR (95% confidence interval
Community level factors		
Residence		
Urban	1	
Rural	1.20 (0.79, 1.83)	
Geographical region		
Eastern	1	1
Central	1.33 (0.87, 2.03)	1.34 (0.88, 2.03)
Western	1.27 (0.80, 2.01)	1.25 (0.79, 1.96)
Mid-west	1.62 (0.96, 2.73)	1.43 (0.85, 2.42)
Far-west	2.49 (1.42, 4.37)	2.40 (1.37, 4.22)
Ecological zones		
Mountain	1	
Hill	0.91 (0.48, 1.73)	
Terai	0.81 (0.43, 1.52)	
Socioeconomic factors		
Wealth index		
Poor	1	1
Middle	0.91 (0.69, 1.21)	1.04 (0.77, 1.40)
Rich	0.41 (0.28, 0.62)	0.56 (0.35, 0.87)
Mother working status in the previous 12 months		
Working	1	
Not working	1.09 (0.84, 1.43)	
Maternal Education		
No education	1	
Primary	0.85 (0.59, 1.22)	
Secondary or higher	0.60 (0.45, 0.81)	
Partner education		

No education	1	
Primary	0.94 (0.63, 1.40)	
Secondary or higher	0.66 (0.48, 0.96)	
Mother's age (years)		
15-24	1	
25-34	0.87 (0.67, 1.13)	
35-49	1.44 (0.88, 2.38)	
Maternal marital status		
Currently married	1	
Formerly married	0.95 (0.19, 4.69)	
Child factors		
Child's age (months)		
0-11	1	
12-23	1.11 (0.78, 1.58)	
24-35	0.72 (0.50, 1.05)	
36-47	0.90 (0.61, 1.32)	
48-59	0.65 (0.41, 1.03)	
Sex of the baby		
Female	1	
Male	1.05 (0.82, 1.35)	
Perceived size of the baby		
Small	1	
Average	0.79 (0.56, 1.11)	
Large	0.94 (0.61, 1.44)	
Birth rank and birth interval		
2nd/3rd birth rank, >2 years interval	1	
1st birth rank	0.87 (0.66, 1.15)	
2nd/3rd birth rank, ≤ 2 years interval	1.30 (0.86, 1.96)	
4th birth rank, >2 years interval	1.55 (0.93, 2.57)	
4th birth rank, ≤2 years interval	0.34 (0.12, 1.02)	
Exposure to media factors		
Mother Read newspaper/magazine		
Yes*	1	
Not at all	0.56 (0.41, 0.74)	
Mother Listened to the radio		
Not at all	1	
Yes*	0.84 (0.62, 1.13)	
Mother Watched television		
Not at all	1	1
Yes*	0.74 (0.55, 0.98)	0.66 (0.47, 0.91)
Environmental factors		
Sources of drinking water		
Improved	1	
Unimproved	1.05 (0.74, 1.50)	
Type of toilet facilities		

Improved	1	
Unimproved	1.39 (1.06, 1.84)	
Nutrition factors		
Stunting		
Not stunted	1	
Stunted	1.37 (0.93, 2.03)	
Wasting		
Not Wasted	1	
Wasted	1.48 (0.82, 2.65)	
Underweight		
Not underweight	1	
Underweight	1.52 (0.99, 2.33)	

*less than once a week/At least once a week/ almost everyday

The likelihood of ARI was higher among children of unemployed mothers compared with those whose mothers were unemployed [UOR = 1.09, 95% CI: (0.84, 1.43)]. Compared with children whose mothers had no formal education, those whose mothers had secondary education or higher were less likely to contract ARI [UOR = 0.60, 95% CI: (0.45, 0.81)]. Similarly, the likelihood of ARI was less among children whose fathers had secondary education or higher compared with those whose fathers had no formal education [UOR = 0.66, 95% CI: (0.48, 0.96)]. Children whose mothers belonged to the oldest age bracket (35-49 years) were more likely to contract ARI compared to those of mothers belonging to the youngest age bracket (15-19 years) [UOR = 1.44, 95% CI: (0.88, 2.38)]. The likelihood of ARI was less among children of formally married mothers compared with children whose mothers were marries at the time of the survey [UOR = 0.95, 95% CI: (0.19, 4.69)].

Children aged 12-23 months were more predisposed to ARI compared with those aged 0-11 months [UOR = 1.11, 95% CI: (0.78, 1.58)]. Male children were more predisposed to ARI than their female counterparts [UOR = 1.05, 95% CI: (0.82, 1.35)]. Children who were perceived by their mothers to be of average size at birth were less likely to

contract ARI compared with those who were perceived to be small [UOR = 0.79, 95% CI: (0.56, 1.11)]. Fourth-born children with birth intervals of more than two year were more likely to contract ARI compared with second/third-born children with a birth interval of more than two years [UOR = 1.55, 95% CI: (0.93, 2.57)].

The likelihood of ARI was less among children whose mothers read newspapers/magazines compared with those whose mothers did not [UOR = 0.56, 95% CI: (0.41, 0.74)]. The likelihood of ARI was less among children whose mothers listened to the radio compared with those whose mothers did not listen [UOR = 0.84, 95% CI: (0.62, 1.13)] and among those whose mothers watched television compared with those whose mothers did not [UOR = 0.74, 95% CI: (0.55, 0.98)]. This result remained valid after controlling for confounding variables [UOR = 0.66, 95% CI: (0.47, 0.91)].

The likelihood of ARI was more among children in households with unimproved sources of drinking water [UOR = 1.05, 95% CI: (0.74, 1.50)]. The likelihood of ARI was also more among children from households with unimproved toilet facilities compared to those from households with improved toilet facilities [UOR = 1.39, 95% CI: (1.06, 1.84)].

Stunted children were more predisposed to ARI than those who were not stunted [UOR = 1.37, 95% CI: (0.93, 2.03)]. Furthermore, the likelihood of ARI was more among wasted children compared with those who were not wasted [UOR = 1.48, 95% CI: (0.82, 2.65)]. Underweight children were more likely to contract ARI compared to children who were not underweight [UOR = 1.52, 95% CI: (0.99, 2.33)].

8.6 Summary

This chapter presented characteristics of the study variables and the prevalence of both childhood diarrhoea and ARI among Nepalese children aged 0-59 months. The chapter also assessed factors associated with childhood diarrhoea and ARI among this group of children. The prevalence of childhood diarrhoea and ARI as well as factors associated with diarrhoea and ARI among Nepalese children aged 0-59 months were also examined in the chapter. The next chapters following this chapter will present trends in childhood diarrhoea and ARI among children aged 0-59 months in Bangladesh and Nepal. This would not be done for Pakistan and India due to limited data.

CHAPTER 9

Cross-Country Comparisons of Diarrhoea and Acute Respiratory Infection and Associated Factors

9.0 Introduction

A comparison of the prevalence of diarrhoea and acute respiratory infection between the four countries are presented in **Error! Reference source not found.** to 2. Factors associated with diarrhoea and acute respiratory infection across the 4 countries are shown in **Error! Reference source not found.** to 10-2.

9.1 Cross-country comparison of Diarrhoea among children aged 0-59 months in four South Asian countries

The prevalence of childhood diarrhoea was 6% in Bangladesh, 7.7% in Nepal, 22.5% in Pakistan and 9% in India (Figure 8). Data from Bangladesh showed that the prevalence of diarrhoea is much lower than other three countries.

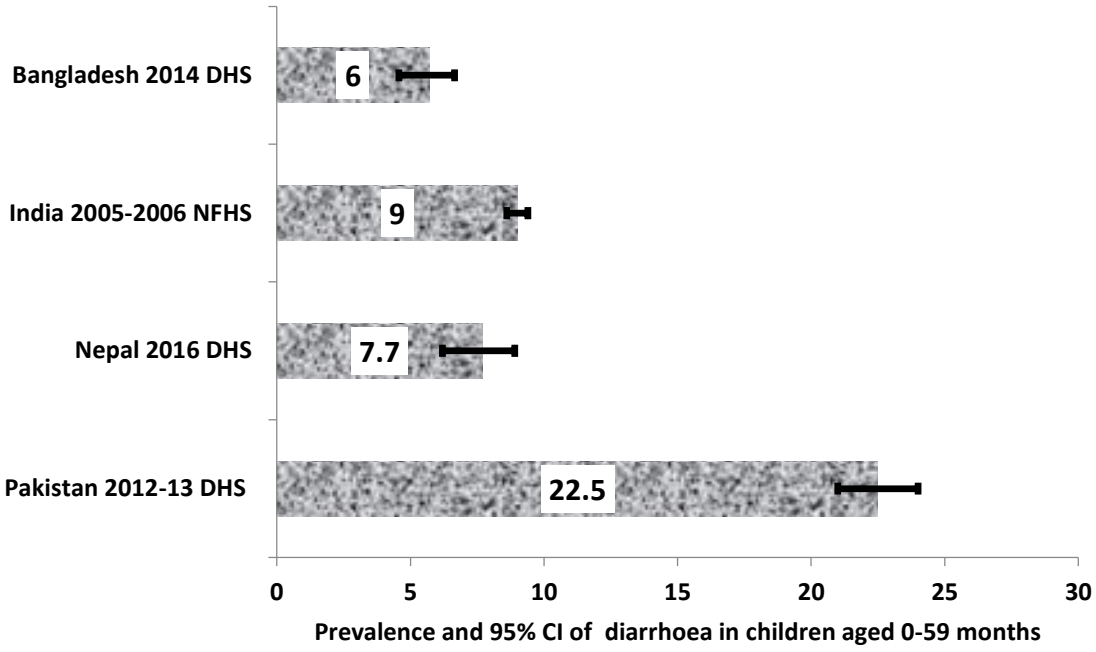
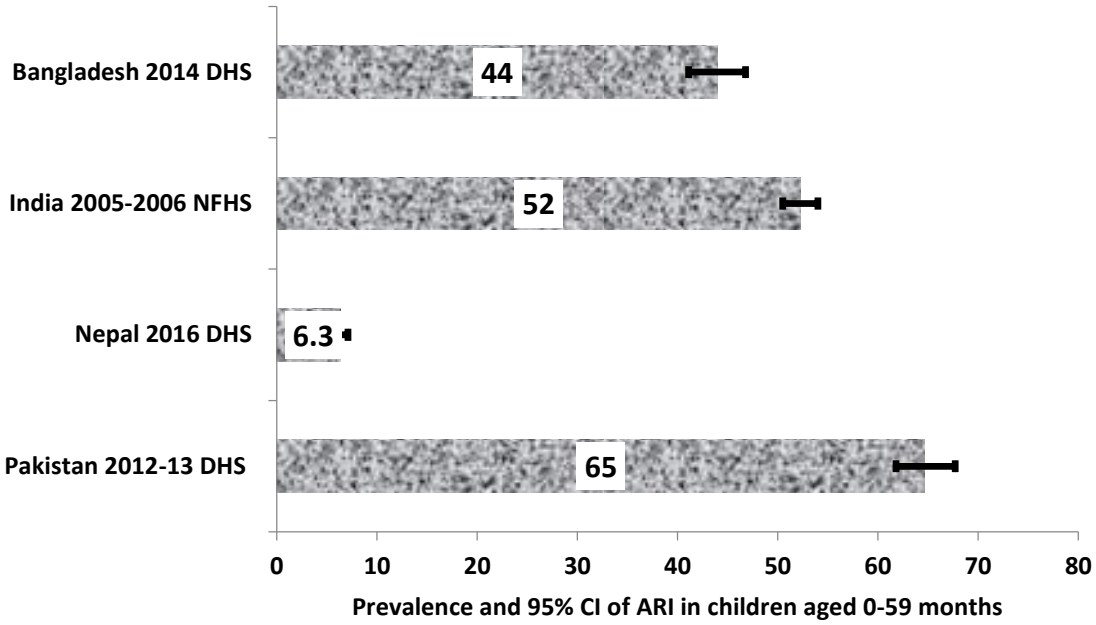


Figure 8: Cross country comparison of diarrhoea in South Asian countries, 2012-16

9.2 Cross-country comparison of ARI among children aged 0-59 months in four South Asian countries

The prevalence of ARI varied from 6.3% to 65% across the countries. The data from Bangladesh shows that 44% of children aged 0-59 months had ARI. The figure was 52% in India and 65% in Pakistan. The prevalence of ARI in Nepal was very low (6.3%) (Figure 9).

Figure 9: Cross-country comparison of ARI in South Asian countries, 2012-16


Bangladesh 2014 DHS
44
India 2005-2006 NFHS
52
Nepal 2016 DHS
6.3
Pakistan 2012-13 DHS
65
0
10
20
30
40
50
60
70
80
Prevalence and 95% CI of ARI in children aged 0-59 months

9.3 Cross-country comparison of selected factors associated with ARI and Diarrhoea

Multivariate analyses revealed some un-confounded associations between ARI, diarrhoea and individual, household and community characteristics in individual countries. The following Tables (Table 10.1 to Table 10.2) summarize the significant factors that were associated with higher or lower rates according to the country.

9.3.1 Factors associated with diarrhoea

Child aged 36-47 months and Mothers who completed primary and secondary education was found to be consistent positive in Bangladesh and India, Child perceived to small by their mother and underweight were common in India and Pakistan. In Nepal, Child aged 36-47 months reported lower odds.

Higher maternal education, Mothers age, stunting, unimproved sanitation and Maternal marital status was associated with significantly higher odds.

Table 9.1: Factors associated with diarrhoea in South Asian countries, 2012-16

Country	Factors associated with	
	Higher odds	Lower odds
Bangladesh, 2014	• Higher maternal education (Primary and secondary and above) • Child age (36-47 months and 48-59 months) • Stunted (-2 SD)	
India, 2005/06	• Maternal education (secondary and primary) • Child's age (0-11, 12-23, 24-35 & 36-47 months) • Male baby • Perceived size of baby (Small) • Underweight (-2 SD)	• Geographical region (south) • Perceived size of baby (Average)
Nepal, 2016	• Maternal marital status (formerly married) • Unimproved sanitation	• Child's age (24-35, 36-47 & 48-59 months) • Mother who watched TV

Pakistan, 2012-13	• Mothers age (15-24 & 25-34 years) • Perceived size of baby (Small and average) • Underweight (-2 SD)	

9.3.2 Factors associated with ARI

Unimproved water sources reported significantly higher odds in India and Pakistan. Child age in months was found to report consistent lower odds in Bangladesh, India and Pakistan. Rich household were less likely to reported ARI in Nepal, Bangladesh and India. Mothers who completed secondary or more level of education also reported lower odds in Bangladesh and Pakistan.

Geographical region, male child, mass media and mother perceived size of the baby and Higher maternal education was associated with significantly lower odds while wasted and underweight children reported higher odds in Bangladesh and India, respectively.

Table 9.2: Factors associated with ARI in South Asian countries, 2012-16

Country	Factors associated with	
	Higher odds	**Lower odds**
Bangladesh, 2014	• Maternal marital status (formerly married) • Wasted (-2 SD)	• Household wealth (Middle and Rich) • Maternal education (Primary and no education) • Child's age (12-23 months and 0-12 months).
India, 2005/06	• More antenatal visits • Unimproved water sources • Underweight (-2 SD)	• Geographical region (South) • Household wealth (Rich) • Child's age (0-11, 12-23 & 24-35 months) • Male child • Perceived size of baby (Average) • Read newspapers
Nepal, 2006	• Geographical region (farWest)	• Household wealth (Rich)

		• Mother who watched TV
Pakistan, 2012-13	• Unimproved water sources	• Geographical region (Singh) • Maternal education (Secondary or more) • Child's age (24-35, 36-47 & 48-59 months) • Perceived size of baby (small)

9.4 Summary

This chapter presented the comparison of prevalence and factors associated with childhood diarrhoea and ARI in four South Asian countries (Nepal, Bangladesh, India and Pakistan). The next chapters following this chapter will present trends in childhood diarrhoea and ARI among children aged 0-59 months in Bangladesh and Nepal. This would not be done for Pakistan and India due to limited data.

CHAPTER 10

TRENDS AND PREDICTORS IN CHILDHOOD DIARRHOEA AND ACUTE RESPIRATORY INFECTION – BANGLADESH

10.0 Introduction

This chapter examines the trends in childhood diarrhoea and acute respiratory infection (ARI) against selected socio-economic factors among children aged 0-59 months in Bangladesh. The magnitudes of childhood diarrhoea and ARI were estimated through concentration indices, and the inequalities were decomposed to ascertain the contribution of socioeconomic factors to childhood diarrhoea and ARI over time. The socioeconomic variables which were analysed in this study were based on the income, education, and occupation of the respondents from the 2004 and 2014 Bangladesh Demographic and Health Surveys (BDHS). The socio-economic variables featured included: work status of mothers, maternal education, household wealth index, geographical region and residence type. Insight into the regional clustering of poor–rich disparities in Bangladesh was provided by the inclusion of geographical region and type of residence. The rest of the chapter is organised as follows: Prevalence of childhood diarrhoea and ARI is presented in section 10.1. Section 10.2 presents the socio-economic factors associated with two-week childhood diarrhoea, any treatment of diarrhoea and ORT treatment of the disease among Bangladeshi children aged 0-59 months. This is followed by section 10.3 which presents the concentration indices for two-week diarrhoea, any treatment and ORT treatment among Bangladeshi children aged 0-59 months. Section 10.4 presents the decomposition of socio-economic inequality for

diarrhoea, any treatment and ORT treatment among Bangladeshi children aged 0-59 months. Section 10.5 presents the socio-economic factors associated with ARI, while section 10.6 presents the concentration indices for ARI among Bangladeshi children aged 0-59 months. This is followed by section 10.7 which presents the decomposition of socio-economic inequality for ARI among Bangladeshi children aged 0-59 months. A summary concludes the chapter.

10.1 Prevalence of Childhood Diarrhoea and Acute Respiratory Infection among Children aged 0 - 59 Months by Wealth Index, Bangladesh

Table 10.1 presents the prevalence of childhood diarrhoea and ARI among Bangladeshi children aged 0-59 months by wealth index. The Table also reports the trend in childhood diarrhoea between 2004 and 2014. In the *poorest* households, Childhood diarrhoea significantly decreased. Such a decrease also occurred in *middle* class households and in the *richer* households. The decrease in diarrhoea was even more drastic among children in the *poorer* and *richer* households. There was a general decrease in any treatments for diarrhoea among children across the different classes of household wealth index. Regarding Oral Rehydration Therapy (ORT) treatment, there were appreciable increases among the *poorest*, *poorer*, *middle* and *richest* categories of household wealth index. However, there was a slight decrease in ORT treatment among children from the *richer* category.

Table 10.1: Prevalence of two-week diarrhoea, any diarrhoea treatment¸ ORT treatment among children aged 0-59 months by wealth index, Bangladesh DHS 2004 and 2014

	Poorest	Poorer	Middle	Richer	Richest
Diarrhoea					
Year 2004	8.8 [7.2,10.7]	8.3 [6.6,10.4]	7.2 [5.9,8.9]	6.9 [5.5,8.6]	6.0 [4.4,8.1]
Year 2014	7.4 [4.9,11.1]	4.6 [3.5,6.0]	5.9 [4.1,8.4]	4.7 [3.3,6.6]	5.3 [4.3,6.6]
Diff-1 [CI]	0.01 [-0.02,0.05]	0.03 [0.01,0.06]	0.01 [-0.01,0.04]	0.02 [00, 0.05]	0.01 [-0.01, 0.03]
Any treatment					
Year 2004	75.7 [64.0,84.5]	77.6 [67.0,85.6]	91.4 [83.0,95.8]	91.5 [83.4,95.9]	94.2 [83.6,98.1]
Year 2014	34.2 [12.9,64.6]	21.3 [12.4,34.0]	26.7 [14.0,44.8]	36.4 [23.3,52.0]	54.6 [41.8,66.9]
Diff-1 [CI]	40.1 [11.6, 71.4]	56.0 [44.3,70.4]	64.7 [47.8, 81.7]	33.1 [39.8, 70.4]	39.6 [25.2, 53.9]
ORT treatment					
Year 2004	56.0 [44.2,67.1]	59.0 [47.8,69.4]	70.7 [60.4,79.3]	80.8 [70.2,88.3]	78.5 [63.6,88.4]
Year 2014	76.8 [59.2,88.3]	67.1 [50.7,80.1]	77.1 [60.4,88.1]	79.0 [60.6,90.2]	85.0 [74.8,91.5]
Diff-1 [CI]	-20.8 [-38.9,-2.7]	-8.1 [-26.2, 10.1]	-6.3 [-22.9, 10.3]	1.7 [-15.8, 19.4]	-6.4 [-21.4, 8.5]
Acute respiratory infections (ARI)					
Year 2004	50.9[45.8,56.0]	50.7 [45.1,56.2]	49.3 [44.6,54.1]	42.1 [37.5,47.0]	32.8 [27.6,38.4]
Year 2014	48.1 [42.7,53.5]	53.5[46.7,60.2]	40.6[32.9,48.9]	42.1[36.7,47.7]	36.7[31.5,42.2]
Diff-1 [CI]	2.8 [-4.6,10.4]	-2.8 [-11.8, 6.1]	8.7 [-0.2, 17.6]	0.01[-7.1, 7.17]	-3.4 [-11.6, 3.7]

10.2 Socio-economic Factors Associated with Two-week Diarrhoea, any Diarrhoea Treatment¸ ORT Treatment among Bangladeshi Children aged 0 -59 months

The socio-economic factors associated with two-week diarrhoea, any treatment of diarrhoea and oral rehydration therapy (ORT) among children aged 0-59 months are presented in Table 9.2. Compared with 2004, the likelihood of childhood diarrhoea was significantly lower in 2014 [AOR = 0.63, 95% CI: (0.53, 0.75)]. The likelihood of any treatment for diarrhoea was significantly less in 2014 compared with that in 2004 [AOR = 0.04, 95% CI: (0.02, 0.08)]; and ORT treatment for diarrhoea was significantly more likely in 2014 compared with that in 2004 [AOR = 1.46, 95% CI: (0.93, 2.30)].

Female children were less predisposed to diarrhoea compared with their male counterparts [AOR = 0.92, 95% CI: (0.80, 1.06)]. Any treatment for diarrhoea was less likely among female children compared with male children [AOR = 0.95, 95% CI: (0.66, 1.39)]. Additionally, the likelihood of ORT treatment was significantly less among female children compared with males [AOR = 0.81, 95% CI: (0.57, 1.15)].

Table 10.2: Socioeconomic factors associated with two-week diarrhoea, any diarrhoea treatment¸ ORT treatment among children 0 -59 months, BDHS 2004 and 2014

Characteristics	Diarrhoea		Any Treatment		ORT Treatment	
	AOR	[95% CI]	**AOR**	[95% CI]	**AOR**	**[95% CI]**
Year						
2004	1.00		1.00		1.00	
2014	0.63	[0.53, 0.75]	0.04	[0.02, 0.08]	1.46	[0.93, 2.30]
Child's age (Months)	0.98	[0.98, 0.99]	0.99	[0.97, 1.00]	1.01	[1.00, 1.03]
Sex of child						
Male	1.00		1.00		1.00	
Female	0.92	[0.80, 1.06]	0.95	[0.66, 1.39]	0.81	[0.57, 1.15]
Maternal working status						
Non-working	1.00		1.00		1.00	

Working (past 12 months)	0.95	[0.79, 1.14]	0.66	[0.41, 1.07]	0.83	[0.53, 1.31]
Maternal education						
No education	1.00		1.00		1.00	
Primary	1.14	[0.94, 1.38]	0.86	[0.52, 1.2]	0.71	[0.45, 1.11]
Secondary and above	0.91	[0.73, 1.13]	1.15	[0.63, 2.09]	0.99	[0.57, 1.71]
Paternal education						
No education		1	1.00		1.00	
Primary	0.98	[0.82, 1.17]	1.31	[0.82, 2.08]	1.18	[0.78, 1.79]
Secondary and above	0.90	[0.70, 1.16]	1.67	[0.87, 3.22]	1.27	[0.67, 2.39]
Household wealth index						
Poorest	1.00		1.00		1.00	
Poorer	0.94	[0.75, 1.17]	0.95	[0.54, 1.67]	1.20	[0.72, 2.00]
Middle	0.76	[0.61, 0.95]	1.76	[0.96, 3.20]	1.50	[0.87, 2.56]
Richer	0.73	[0.57, 0.92]	1.64	[0.87, 3.09]	2.33	[1.27, 4.29]
Richest	0.75	[0.57, 0.99]	2.74	[1.28, 5.89]	1.72	[0.83, 3.55]
Type of residence						
Urban	1.00		1.00		1.00	
Rural	0.93	[0.78, 1.22]	0.65	[0.39, 1.06]	0.72	[0.45, 1.16]

Children whose mothers were employed in the last 12 months preceding the survey were less predisposed to contracting diarrhoea compared with those whose mothers were unemployed [AOR = 0.95, 95% CI: (0.79, 1.14)]. The likelihood of any treatment for diarrhoea was significantly less among children whose mothers were employed compared with those whose mothers were unemployed [AOR = 0.66, 95% CI: (0.41, 1.07)]. Additionally, children whose mothers were unemployed were significantly less likely to receive ORT treatment compared with their counterparts whose mothers were unemployed [AOR = 0.83, 95% CI: (0.53, 1.31)]. Compared with children whose mothers had no education, the likelihood of contracting diarrhoea was significantly more among those whose mothers had primary education only [AOR = 1.14, 95% CI: (0.94, 1.38)]. The likelihood of receiving any treatment for diarrhoea for children whose mothers had secondary education of higher was more compared with those who mothers had no education [AOR = 1.15,

95% CI: (0.63, 2.09)]. Additionally, children whose mothers had primary education only were significantly less likely to receive ORT treatment compared with those whose mothers had no education [AOR = 0.71, 95% CI: (0.45, 1.11)]. The pattern was the same for fathers of the children. Children from the *richer* households were significantly less likely to contract diarrhoea compared with those from the *poorest* households [AOR = 0.73, 95% CI: (0.57, 0.92)]. Any treatment for diarrhoea was significantly more likely among children from the *richest* households compared with those from the *poorest* households [AOR = 2.74, 95% CI: (1.28, 5.89)], and the likelihood of ORT treatment was significantly more among children from the *richer* households compared with those from the *poorest* households [AOR = 2.33, 95% CI: (1.27, 4.29)]. Contraction of diarrhoea was significantly less likely among rural children than their urban counterparts [AOR = 0.93, 95% CI: (0.78, 1.22)]. The likelihood of receiving any treatment for diarrhoea was significantly less among rural children compared with their urban counterparts [AOR = 0.65, 95% CI: (0.39, 1.06)].; and rural children were significantly less likely to receive ORT treatment than their urban counterparts [AOR = 0.72, 95% CI: (0.45, 1.16)].

10.3 Concentration Indices (CI) of Two-week Diarrhoea, Any diarrhoea Treatment Oral Rehydration Therapy Treatment among Children 0 - 59 Months, BDHS 2004 and 2014

Table 10.3 shows the concentration index (CI) of diarrhoea among Bangladeshi children aged 0-59 months. The CI of childhood diarrhoea was negative for both 2004 and 2014, indicating that in both years, concentration of the disease was among the poor households. The CI was slightly greater in 2014 than in 2004, which showed that there was a slight decline in the concentration of childhood diarrhoea

in poor households. The CI of children receiving any treatment for diarrhoea was positive in both 2004 and 2014; this showed that in both years, a child treated for diarrhoea was common in rich households. Further, the result shows an increase in any treatment in those rich households. The use of OTR treatment was also common in rich households, and this practice showed a decline from 2004 to 2014.

Table 10.3: Concentration indices (CI) of two-week diarrhoea, any diarrhoea treatment¸ ORT treatment among children 0 - 59 months, BDHS 2004 and 2014

Year	Diarrhoea		Any Treatment		ORT Treatment	
	CI [SE]	P	CI [SE]	P	CI [SE]	P
2004	-0.068 [0.029]	0.0203	0.0477 [0.013]	<0.001	0.080 [0.021]	<0.001
2014	-0.07 [0.06]	0.226	0.108 [0.101]	0.288	0.0023 [0.024]	0.3405
Diff	-0.001 [0.06]	0.9782	0.060 [0.102]	0.5566	-0.056 [0.032]	0.0761

Note: A zero value of the CI reflects no inequality in child diarrhoea, any diarrhoea treatment or ORT treatment. If the CI is negative, it indicates that inequality is concentrated among the relatively poor, whereas if CI is positive it indicates that the concentration of childhood diarrhoea, any diarrhoea treatment or ORT treatment is higher among the relatively rich.

10.4 Decomposition of Socio-economic Inequality for Two-week Childhood Diarrhoea, Any Treatment, Oral Rehydration Therapy Treatment

Table 10.4 shows the unadjusted and adjusted estimates for the contribution of each socio-economic variable to overall CIs of childhood diarrhoea, any treatment and ORT treatment in Bangladeshi children aged 0-59 months.

In both 2004 and 2014, diarrhoea prevalence was higher among children whose mothers were employed compared to those whose mothers were unemployed. However, there was an increase in this effect in 2014 compared with 2004. In both 2004 and 2014, prevalence of diarrhoea was highest among children whose

mothers had only primary education. There was an increase in this effect between the two years. In 2004, the prevalence of diarrhoea was higher among children from the poorest households whilst in 2004 prevalence of the disease was highest among children from the richer households.

Table 10.4: Decomposition of Concentration indices (CI) for two-week diarrhoea, Any diarrhoea Treatment¸ ORT Treatment among children 0 - 59 months, BDHS 2004 and 2014

Characteristics	Diarrhoea				Any Treatment				ORT Treatment			
	2004		2014		2004		2014		2004		2014	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	%	%	%	%	%	%	%	%	%	%	%	%
Child's age (Months)	-	-47.95	-	443.75	-	92.06	-	9.14	-	-934.15	-	-45.66
Sex of child												
Female	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref
Male	-	3.83	-	-188.16	-	24.30	-	0.13	-	-188.15	-	-43.38
Maternal working status												
Non-working	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref
Working (past 12 months)	-	9.51	-	545.06	-	-85.76	-	24.19	-	516.38	-	53.19
Maternal education												
No education	24.87	14.23	-2.71	-50.27	57.26	-375.16	47.70	12.23	41.81	1308.02	-451.00	-72.05
Primary	75.13	42.95	102.71	13.11	42.74	-279.49	52.30	13.36	58.19	1822.98	551.00	86.92
Secondary and above	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Paternal education												
No education	109.22	36.61	29.54	-499.11	435.91	-639.00	50.00	13.57	233.40	2713.44	64.78	63.39
Primary	-9.22	-3.10	70.46	-85.50	-335.91	488.29	50.00	13.57	-133.40	-1545.08	35.22	34.46
Secondary and above	Ref	Ref	Ref	Ref	ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Household wealth index												
Poorest	90.69	74.72	-220.10	-434.61	10448.36	-1012.65	43.93	19.08	-1540.91	4816.20	56.89	66.66
Poorer	65.14	53.69	-100.94	-199.38	6269.40	-606.96	47.48	20.54	-772.36	2416.73	26.50	31.04
Middle	-16.86	-13.91	151.76	299.93	-8946.80	861.57	14.19	6.34	302.95	-949.24	49.40	57.88
Richer	-38.97	-32.16	269.28	532.31	-7670.95	739.09	-5.60	-2.55	2110.32	-6624.95	-32.79	-38.37
Richest	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Type of residence												
Urban	-	-23.31	-	-204.02	-	667.43	-	-26.36	-	-3170.69	-	-85.34
Rural	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref

The practice of applying any method to treat diarrhoea was higher among male children in both 2004 and 2014. This approach, however, declined between the two years. In 2014, practice of applying any method to treat diarrhoea was higher among children whose mothers had only primary education, among children from the middle class households and children residing in urban areas. In 2014, the practice of applying any method to treat diarrhoea was highest among children from the poorest households.

ORT treatment for diarrhoea was higher among children whose mothers were employed, compared with those mothers were unemployed. There was however a decrease in the use of this method of treatment between the two years. ORT treatment was higher among children whose mothers had only primary education, and this method of treatment decreased between the two years. In both 2004 and 2014, ORT treatment was highest among children from the poorest households. Furthermore, this method of treatment decreased between the two years.

10.5 Socio-economic Factors Associated with ARI among Children aged 0-59 months

The socio-economic factors associated with ARI among children aged 0-59 months are presented in Table 10.5. Compared with 2004, the likelihood of ARI was significantly higher in 2014 [AOR = 1.08, 95% CI: (0.94, 1.23)]. Female children were less predisposed to ARI compared with their male counterparts [AOR = 0.91, 95% CI: (0.81, 1.02)].

Children whose mothers were employed in the last 12 months preceding the survey were less predisposed to contracting ARI compared with those whose mothers

were unemployed [AOR = 0.91, 95% CI: (0.79, 1.05)]. Compared with children whose mothers had no education, the likelihood of contracting ARI was significantly more among those whose mothers had primary education only [AOR = 1.05, 95% CI: (0.89, 1.22)]. The pattern was different for fathers of the children. Children whose fathers had secondary education or higher were significantly less likely to contract ARI compared with those whose fathers had no education. Children from the *poorer* households were significantly more likely to contract diarrhoea compared with those from the *poorest* households [AOR = 1.05, 95% CI: (0.87, 1.26)]. Contraction of diarrhoea was significantly less likely among rural children than their urban counterparts [AOR = 0.99, 95% CI: (0.85, 1.16)].

Table 10.5: Socioeconomic factors associated with acute respiratory infections (ARI) among children aged 0 -59 months, BDHS 2004 and 2014

Characteristics	Acute Respiratory Infection	
	Adjusted odds ratio	[95% confidence interval]
Year		
2004	1.00	
2014	1.08	[0.94, 1.23]
Child's age (Months)	0.99	[0.98, 0.99]
Sex of child		
Male	1.00	
Female	0.91	[0.81, 1.02]
Maternal working status		
Non-working	1.00	
Working (past 12 months)	0.91	[0.79, 1.05]
Maternal education		
No education	1.00	
Primary	1.05	[0.89, 1.22]
Secondary and above	0.91	[0.76, 1.08]
Paternal education		
No education		1
Primary	0.94	[0.81, 1.08]
Secondary and above	0.68	[0.56, 0.83]
Household wealth index		

Poorest	1.00	
Poorer	1.05	[0.87, 1.26]
Middle	0.97	[0.81, 1.16]
Richer	0.82	[0.67, 0.99]
Richest	0.71	[0.56, 0.88]
Type of residence		
Urban	1.00	
Rural	0.99	[0.85, 1.16]

10.6 Concentration Indices (CI) of ARI among Children 0 - 59 Months, BDHS 2004 and 2014

Table 10.6 shows the concentration index (CI) of ARI among Bangladeshi children aged 0-59 months. The CI of ARI was negative for both 2004 and 2014, indicating that in both years, concentration of the disease was among the relatively poor households. The CI was slightly greater in 2014 than in 2004, which showed that there was a slight decline in the concentration of ARI within poor households.

Table 10.6: Concentration indices (CI) of acute respiratory infections (ARI) among Nepalese children 0 - 59 months, NDHS 2006 and 2016

Year of survey	Acute Respiratory Infection	
	CI [SE]	*P*
2006	-0.11 [0.040]	0.0099
2016	-0.03 [0.07]	0.6206
Diff	0.07 [0.08]	0.3818

Note: A zero value of the CI reflects no inequality in child ARI. If the CI is negative, it indicates that inequality is concentrated among the relatively poor, whereas if CI is positive it indicates that the concentration of child ARI is higher among the relatively rich.

10.7 Decomposition of Socio-economic Inequality for ARI

Table 10.7 shows the unadjusted and adjusted estimates for the contribution of each socio-economic variable to overall CIs of ARI in Bangladeshi children aged 0-59 months.

In both 2004 and 2014, ARI prevalence was higher among male children compared with their female counterparts. However, there was a decline in this effect in 2014 compared with 2004. In both 2004 and 2014, prevalence of ARI was highest among children whose mothers had only primary education. There was a decrease in this effect between the two years. There was a similar pattern for fathers of children. In 2004, the prevalence of ARI was higher among children from the poorest households whilst in 2014 prevalence of the disease was highest among children from the poorer households.

Table 10.7: Decomposition of Concentration indices (CI) for acute respiratory infections (ARI) among children aged 0-59 months, BDHS 2004 and 2014

Characteristics	Acute Respiratory Infection			
	2004		2014	
	Unadjusted	Adjusted	Unadjusted	Adjusted
	%	%	%	%
Child's age (Months)	-	-25.73	-	-10.13
Sex of child				
Female	-	Ref	-	Ref
Male	-	13.08	-	5.02
Maternal working status				
Non-working	-	Ref	-	Ref
Working (past 12 months)	-	-40.07	-	5.28
Maternal education				
No education	58.54	38.26	31.00	9.36
Primary	41.46	27.12	69.00	20.75
Secondary and above	Ref	Ref	Ref	Ref
Paternal education				
No education	134.26	42.98	46.89	22.35

Primary	-34.26	-11.02	53.11	25.29
Secondary and above	Ref	Ref	Ref	Ref
Household wealth index				
Poorest	56.42	57.97	52.75	17.43
Poorer	35.73	36.71	97.77	32.13
Middle	43.68	44.88	-19.27	-6.42
Richer	-35.83	-36.8	-31.25	-10.43
Richest	Ref	Ref	Ref	Ref
Type of residence				
Urban	-	-47.37	-	-10.61
Rural	-	Ref	-	Ref

10.8 Summary

In this chapter, the prevalence of childhood diarrhoea and ARI was presented. The next section presented the socio-economic factors associated with two-week childhood diarrhoea, any treatment of diarrhoea and ORT treatment of the disease among Bangladeshi children aged 0-59 months. This was followed by section 9.3, which presented the concentration indices for two-week diarrhoea, any treatment and ORT treatment among Bangladeshi children aged 0-59 months. The section that followed presented the decomposition of socio-economic inequality for diarrhoea, any treatment and ORT treatment among Bangladeshi children aged 0-59 months. The next section presented the socio-economic factors associated with ARI; followed by concentration indices for ARI among Bangladeshi children aged 0-59 months. This was followed by section 9.7 which presented the decomposition of socio-economic inequality for ARI among Bangladeshi children aged 0-59 months. In the next chapter, trends in childhood diarrhoea and ARI among Nepalese children aged 0-59 months are assessed in a fashion similar to that presented in this chapter.

CHAPTER 11

TRENDS AND PREDICTORS IN CHILDHOOD DIARRHOEA AND ACUTE RESPIRATORY INFECTION - NEPAL

11.0 Introduction

Examination of the trends in childhood diarrhoea and acute respiratory infection (ARI) against selected socio-economic factors among children aged 0-59 months in Nepal are presented in this chapter. The magnitudes of childhood diarrhoea and ARI were estimated through concentration indices, and the inequalities were decomposed to ascertain the contribution of socioeconomic factors to childhood diarrhoea and ARI over time. The socioeconomic variables which were analysed in this study were based on the income, education, and occupation of the respondents from the 2006 and 2016 Nepal Demographic and Health Surveys. The socio-economic variables featured included: work status of mothers, maternal education, household wealth index, geographical region and residence type. Insight into the regional clustering of poor–rich disparities in Bangladesh was provided by the inclusion of geographical region and type of residence. The rest of the chapter is organised as follows: Prevalence of childhood diarrhoea and ARI is presented in section 10.1. Section 10.2 presents the socio-economic factors associated with two-week childhood diarrhoea, any treatment of diarrhoea and ORT treatment of the disease among Nepalese children aged 0-59 months. This is followed by section 10.3 which presents the concentration indices for two-week diarrhoea, any treatment and ORT treatment among Nepalese children aged 0-59 months. Section 10.4 presents the decomposition of socio-economic inequality for diarrhoea, any

treatment and ORT treatment among Nepalese children aged 0-59 months. Section 10.5 presents the socio-economic factors associated with ARI, while section 10.6 presents the concentration indices for ARI among Nepalese children aged 0-59 months. This is followed by section 10.7 which presents the decomposition of socio-economic inequality for ARI among Nepalese children aged 0-59 months. The chapter concludes with a summary.

11.1 Prevalence of Childhood Diarrhoea and Acute Respiratory Infection among Children aged 0 - 59 Months by Wealth Index, Nepal

Table 11.1 presents the prevalence of childhood diarrhoea and ARI among Nepalese children aged 0-59 months by wealth index. The Table also reports the trend in childhood diarrhoea between 2006 and 2016. There was a general decline in diarrhoea among children of the different categories of household wealth index. The declines were most drastic among children from the poorest and poorer households. There was a general increase in any method of treating diarrhoea among children across the different categories of household wealth index.

Regarding Oral Rehydration Therapy (ORT) treatment, there were appreciable increases among the *poorest*, *poorer*, *middle* and *richer* categories of household wealth index. The increase was most drastic among children from the *poorest* households. However, there was a slight decrease in ORT treatment among children from the *richest* households. There were drastic declines in ORT among children in all the categories of household wealth index.

Table 11.1: Prevalence of two-week diarrhoea, any diarrhoea treatment¸ ORT treatment among children aged 0-59 months by wealth index, Nepal DHS 2006 and 2016

	Poorest	Poorer	Middle	Richer	Richest
Diarrhoea					
Year 2006	12.3 [9.2,16.4]	12.8 [10.5,15.6]	11.4 [9.6,13.4]	11.6 [9.514.2]	12.0 [9.115.7]
Year 2016	5.8 [4,5,7.4]	7.4 [5.1,10.6]	8.4 [6.1,11.5]	8.7 [6.4,11.6]	7.7 [5.5,10.7]
Diff-1 [CI]	-6.5 [-10.4,-2.7]	-5.4 [-9.2,-1.7]	-2.9 [-6.2,0.02]	-2.9 [-6.4, 0.01]	-4.3 [-8.4, -0.01]
Any treatment					
Year 2006	32.8 [16.9,54.0]	46.6 [37.8,55.5]	74.8 [65.6,82.3]	72.4 [60.9,81.6]	73.3 [58.6,84.0]
Year 2016	73.5 [60.1,83.6]	80.0 [62.1,90.7]	75.4 [52.7,89.4]	88.9 [79.2,94.4]	87.4 [75.0,94.1]
Diff-1 [CI]	40.6 [18.1,63.2]	33.4 [16.7,50.2]	0.1 [-19.9,21.1]	16.5 [3.8, 29.2]	14.1 [-1.6,29.8]
ORT treatment					
Year 2006	15.1 [6.0,32.9]	21.9 [15.3,30.0]	29.4 [22.4,37.6]	37.4 [26.5,49.9]	38.9 [26.9,52.3]
Year 2016	35.2 [23.3,49.3]	37.6 [21.2,57.4]	41.7 [26.4,58.8]	29.3 [21.0,39.2]	43.0 [33.4,53.1]
Diff-1 [CI]	20.1 [1.6,38.6]	15.7 [-4.9,35.9]	12.3 [-6.1,30.6]	8.2 [-23.1, 6.8]	4.1 [-12.2, 20.4]

ARI	**Poorest**	**Poorer**	**Middle**	**Richer**	**Richest**
2006	46.2 [34.1,58.8]	53.7 [46.4,60.9]	43.7[36.5,51.2]	46.2[37.3,55.3]	38.9[30.2,48.3]
2014	7.2[5.5,9.3]	7.9[5.8,10.8]	7.0 [4.8,10.0]	7.0 [5.4,9.1]	4.1[3.0,5.6]
Diff-1 [CI]	39.1 [26.3,51.8]	45.8 [38.2, 53.4]	36.7[29.0, 44.4]	39.1[29.9, 48.4]	34.7 [25.5, 43.9]

11.2 Socio-economic Factors Associated with Two-week Diarrhoea, any Diarrhoea Treatment, ORT Treatment among Children aged 0 -59 months, Nepal

Table 10.2 shows the socio-economic factors associated with two-week diarrhoea, any treatment of diarrhoea and oral rehydration therapy (ORT) among Nepalese children aged 0-59 months. Compared with 2006, the likelihood of childhood diarrhoea was significantly lower in 2016 [AOR = 0.62, 95% CI: (0.50, 0.80)]. The likelihood of any treatment for diarrhoea was significantly more in 2016 compared with that in 2006 [AOR = 2.61, 95% CI: (1.54, 4.42)]; and ORT treatment for diarrhoea was significantly more likely in 2016 compared with that in 2006 [AOR = 1.06, 95% CI: (0.67, 1.66)].

Female children were less predisposed to diarrhoea compared with their male counterparts [AOR = 0.85, 95% CI: (0.74, 0.97)]. Any treatment for diarrhoea was less likely among female children compared with male children [AOR = 0.76, 95% CI: (0.55, 1.05)]. Additionally, the likelihood of ORT treatment was significantly less among female children compared with males [AOR = 0.85, 95% CI: (0.53, 1.15)].

Table 11.2: Socioeconomic factors associated with two-week diarrhoea, Any diarrhoea Treatment¸ ORT Treatment among children 0 -59 months, NDHS 2006 and 2016

Characteristics	Diarrhoea		Any Treatment		ORT Treatment	
	AOR	[95% CI]	**AOR**	[95% CI]	**AOR**	[95% CI]
Year						
2006	1.00		1.00		1.00	
2016	0.62	[0.50, 0.80]	2.61	[1.54, 4.42]	1.06	[0.67, 1.66]
Child's age (Months)	0.97	[0.97, 0.99]	1.01	[0.99, 1.02]	1.02	[1.00, 1.03]
Sex of child						
Male	1.00		1.00		1.00	
Female	0.85	[0.74, 0.97]	0.76	[0.55, 1.05]	0.85	[0.53, 1.15]
Maternal working status						
Non-working	1.00		1.00		1.00	
Working (past 12 months)	1.15	[0.97, 1.36]	0.98	[1.41, 3.50]	0.85	[0.58, 1.22]

Maternal education						
No education	1.00		1.00		1.00	
Primary	1.03	[0.84, 1.25]	2.22	[1.41, 3.50]	1.42	[0.94, 2.6]
Secondary and above	0.91	[0.74, 1.11]	2.48	[1.51, 4.08]	2.04	[1.32, 3.13]
Paternal education						
No education	1.00		1.00		1.00	
Primary	1.00	[0.83, 1.21]	1.04	[0.67, 1.57]	1.10	[0.71, 1.69]
Secondary and above	0.86	[0.66, 1.12]	1.72	[0.89, 3.30]	1.80	[1.03, 3.15]
Household wealth index						
Poorest	1.00		1.00		1.00	
Poorer	1.29	[0.98, 1.69]	1.48	[0.82, 2.69]	0.86	[0.71, 1.69]
Middle	1.24	[0.93, 1,64]	3.59	[1.91, 6.73]	1.70	[0.92, 3.12]
Richer	1.19	[0.88, 1.59]	4.10	[2.06, 8.16]	1.55	[0.83, 2.91]
Richest	1.24	[0.89, 1.73]	2.40	[1.10, 5.21]	1.28	[0.63, 2.58]
Type of residence						
Urban	1.00		1.00		1.00	
Rural	1.03	[0.84, 1.26]	1.06	[0.68, 1.66]	1.21	[0.82, 1.80]

Children whose mothers were employed in the last 12 months preceding the survey were more predisposed to contracting diarrhoea compared with those whose mothers were unemployed [AOR = 1.15, 95% CI: (0.97, 1.36)]. The likelihood of any treatment for diarrhoea was significantly less among children whose mothers were employed compared with those whose mothers were unemployed [AOR = 0.98, 95% CI: (1.41, 3.50)]. Additionally, children whose mothers were unemployed were significantly less likely to receive ORT treatment compared with their counterparts whose mothers were unemployed [AOR = 0.85, 95% CI: (0.58, 1.22)]. Compared with children whose mothers had no education, the likelihood of contracting diarrhoea was significantly more among those whose mothers had primary education only [AOR = 1.03, 95% CI: (0.84, 1.25)]. The likelihood of receiving any treatment for diarrhoea for children whose mothers had secondary education or higher was more, compared with those who mothers had no education [AOR =

2.48, 95% CI: (1.51, 4.08)]. Additionally, children whose mothers had secondary education or higher, were significantly more likely to receive ORT treatment compared with those whose mothers had no education [AOR = 2.04, 95% CI: (1.32, 3.13)]. The pattern was the same for fathers of the children.

Children from the *poorer* households were significantly more likely to contract diarrhoea compared with those from the *poorest* households [AOR = 1.29, 95% CI: (0.98, 1.69)]. Any treatment for diarrhoea was significantly more likely among children from the *richer* households compared with those from the *poorest* households [AOR = 4.10, 95% CI: (2.06, 8.16)], and the likelihood of ORT treatment was significantly more among children from the *middle class* households compared with those from the *poorest* households [AOR = 1.70, 95% CI: (0.93, 3.12)]. Contraction of diarrhoea was significantly more likely among rural children than their urban counterparts [AOR = 1.03, 95% CI: (0.84, 1.26)]. The likelihood of receiving any treatment for diarrhoea was significantly more among rural children compared with their urban counterparts [AOR = 1.06, 95% CI: (0.68, 1.66)].; and rural children were significantly more likely to receive ORT treatment than their urban counterparts [AOR = 1.21, 95% CI: (0.82, 1.80)].

11.3 Concentration Indices (CI) of Two-week Diarrhoea, Any diarrhoea Treatment Oral Rehydration Therapy Treatment among Nepalese Children 0 - 59 Months

Table 10.3 shows the concentration index (CI) of diarrhoea among Nepalese children aged 0-59 months. The CI of childhood diarrhoea was negative for 2006 and positive for 2016, indicating that in 2006, concentration of the disease was among the poor households, whilst in 2016, the concentration of the disease was

among the rich households. The CI of children receiving any treatment for diarrhoea was positive in both 2006 and 2016; this showed that in both years, a child treated by any method for diarrhoea was likely to reside in a rich household. Further, the result shows a decrease in any treatment method in those rich households. The use of OTR treatment was also common in rich households, and this practice showed a decline from 2006 to 2016.

Table 11.3: Concentration indices (CI) of two-week diarrhoea, Any diarrhoea Treatment¸ ORT Treatment among children 0 - 59 months, NDHS 2006 and 2016

Year	Diarrhoea		Any Treatment		ORT Treatment	
	CI [SE]	*P*	CI [SE]	*P*	CI [SE]	*P*
2006	-0.016 [0.03]	0.596	0.11 [0.024]	<0.001	0.14 [0.047]	0.0038
2016	0.04 [0.04]	0.2438	0.035 [0.013]	0.008	0.023 [0.04]	0.558
Diff	0.059 [0.05]	0.2147	-0.073 [0.028]	0.008	-0.12 [0.062]	0.064

Note: A zero value of the CI reflects no inequality in child diarrhoea, any diarrhoea treatment or ORT treatment. If the CI is negative, it indicates that inequality is concentrated among the relatively poor, whereas if CI is positive it indicates that the concentration of child diarrhoea, any diarrhoea treatment or ORT treatment is higher among the relatively rich.

11.4 Decomposition of Socio-economic Inequality for Two-week Childhood Diarrhoea, Any Treatment, Oral Rehydration Therapy Treatment

Table 10.4 shows the unadjusted and adjusted estimates for the contribution of each socio-economic variable to overall CIs of childhood diarrhoea, any treatment and ORT treatment in Nepalese children aged 0-59 months.

In both 2006 and 2016, prevalence of diarrhoea was higher among male children, compared with females. Additionally, in both 2006 and 2016, diarrhoea prevalence was higher among children whose mothers had primary education only, compared with those whose mothers had secondary education or higher. In both years,

prevalence of diarrhoea was higher among children whose fathers had no formal education compared with those whose fathers had secondary education or higher. There was an increase in this effect between the two years. In both 2006 and 2016, the prevalence of diarrhoea was higher among children from the richer households compared with those from the richest households; and also, prevalence of diarrhoea was higher among urban children compared with their rural counterparts.

Table 11.4: Decomposition of Concentration indices (CI) for two-week diarrhoea, Any diarrhoea Treatment¸ ORT Treatment among children 0 - 59 months, NDHS 2006 and 2016

Characteristics	Diarrhoea				Any Treatment				ORT Treatment			
	2006		2016		2006		2016		2006		2016	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	%	%	%	%	%	%	%	%	%	%	%	%
Child's age (Months)	-	101.87	-	-92.94	-	11.63	-	-40.12	-	-2.82	-	-30.88
Sex of child												
Female	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref
Male	-	3.83	-	35.28	-	-33.61	-	2.48	-	-17.15	-	7.7
Maternal working status												
Non-working	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref
Working (past 12 months)	-	-17.77	-	-51.48	-	33.98	-	-50.18	-	11.51	-	-12.93
Maternal education												
No education	-20.62	-0.12	46.96	42.18	-251.31	75.65	84.34	41.93	209.47	38.86	70.44	7.61
Primary	120.62	0.68	53.04	47.63	351.31	-111.97	15.66	7.85	-109.47	-21.03	29.56	35.64
Secondary and above	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Paternal education												
No education	241.44	11.69	91.74	114.55	108.11	83.06	0.72	0.44	103.75	49.65	39.26	15.04
Primary	-141.44	-6.86	8.26	10.3	-8.11	-6.28	99.28	60.28	-3.75	-1.83	60.74	32.48
Secondary and above	Ref	Ref	Ref	Ref	ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Household wealth index												
Poorest	102.12	-26.76	844.88	-127.05	229.540	234.14	96.06	87.44	126.48	98.09	351.93	-14.13
Poorer	220.22	-57.85	-96.27	14.38	96.290	98.57	57.14	52.11	60.4	47.3	-167.42	6.64
Middle	-19.92	5.2	-274.28	40.92	-81.150	-83.18	17.08	15.61	-12.71	-10.05	569.1	-22.97
Richer	-202.43	52.66	-374.33	55.81	-144.680	-148.24	-70.28	-64.44	-74.17	-59.05	-653.6	25.65
Richest	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Type of residence												
Urban	-	62.51	-	10.43	-	-53.76	-	-13.42	-	-33.48	-	50.15
Rural	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref	-	Ref

The practice of applying any method to treat diarrhoea was higher among children whose mothers had no education compared with those whose mothers had secondary education or higher in both 2006 and 2016. This approach, however, declined between the two years. In 2006, the practice of applying any method to treat diarrhoea was highest among children whose fathers had no education compared with those whose fathers had secondary education or higher. However, in 2016, the practice of applying any method to treat diarrhoea was higher among children whose fathers had primary education only. In both 2006 and 2016, the practice of treating diarrhoea with any method was higher in the poorest households compared with those from the richest households.

In 2006, ORT treatment was higher among children whose mothers had no education compared with those whose mothers had secondary education or higher, and in 2016, ORT treatment was higher among children whose mothers had primary education only compared with those whose mothers had secondary education or higher. The same pattern was true for children's fathers. In 2006, ORT treatment was higher in poorest households compared with children in the richest households, and in 2016, ORT treatment was higher in richer households compared with the richest households.

11.5 Socio-economic Factors Associated with ARI among Children aged 0 -59 months

The socio-economic factors associated with ARI among children aged 0-59 months are presented in Table 10.5. Compared with 2006, the likelihood of ARI was significantly lower in 2016 [AOR = 0.06, 95% CI: (0.05, 0.09)]. Female children were less predisposed to ARI compared with their male counterparts [AOR = 0.86, 95% CI: (0.71, 1.00)].

Children whose mothers were employed in the last 12 months preceding the survey were less predisposed to contracting ARI compared with those whose mothers

were unemployed [AOR = 0.91, 95% CI: (0.79, 1.05)]. Compared with children of unemployed children, the likelihood of ARI was more among those whose mothers were employed [AOR = 1.31, 95% CI: (1.02, 1.62)]. Compared with children whose mothers had no education, the likelihood of contracting ARI was significantly more among those whose mothers had primary education only [AOR = 1.21, 95% CI: (0.92, 1.57)]. Children whose fathers had primary education only were significantly less likely to contract ARI compared with those whose fathers had no education [AOR = 0.85, 95% CI: (0.64, 1.12)]. Children from the *poorer* households were significantly more likely to contract ARI compared with those from the *poorest* households [AOR = 1.22, 95% CI: (0.87, 1.71)]. Contraction of ARI was significantly more likely among rural children than their urban counterparts [AOR = 1.19, 95% CI: (0.93, 1.52)].

Table 11.5: Socioeconomic factors associated with acute respiratory infections (ARI) among children 0 -59 months, NDHS 2006 and 2016

Characteristics	Acute Respiratory Infection	
	AOR	[95% CI]
Year		
2006	1.00	
2016	0.06	[0.05, 0.09]
Child's age (Months)	0.98	[0.98, 0.99]
Sex of child		
Male	1.00	
Female	0.86	[0.71, 1.0]
Maternal working status		
Non-working	1.00	
Working (past 12 months)	1.31	[1.06, 1.62]
Maternal education		
No education	1.00	
Primary	1.21	[0.92, 1.57]
Secondary and above	1.12	[0.86, 1.44]

Paternal education		
No education	1.00	
Primary	0.85	[0.64, 1.12]
Secondary and above	0.91	[0.65, 1.28]
Household wealth index		
Poorest	1.00	
Poorer	1.22	[0.87, 1.71]
Middle	0.96	[0.68, 1.35]
Richer	1.03	[0.74, 1.44]
Richest	0.75	[0.51, 1.11]
Type of residence		
Urban	1.00	
Rural	1.19	[0.93, 1.52]

11.6 Concentration Indices (CI) of ARI among Children 0 - 59 Months, BDHS 2004 and 2014

Table 11.6 shows the concentration index (CI) of ARI among Nepalese children aged 0-59 months. The CI of ARI was negative for both 2006 and 2016, indicating that in both years, concentration of the disease was among the relatively poor households. The CI was greater in 2016 than in 2006, which showed that there was an increase in the concentration of ARI within poor households.

Table 11.6: Concentration indices (CI) of acute respiratory infections (ARI) among Nepalese children 0 - 59 months, NDHS 2006 and 2016

Year of survey	Acute Respiratory Infection	
	CI [SE]	*P*
2006	-0.11 [0.040]	0.0099
2016	-0.03 [0.07]	0.6206
Diff	0.07 [0.08]	0.3818

Note: A zero value of the CI reflects no inequality in child ARI. If the CI is negative, it indicates that inequality is concentrated among the relatively poor, whereas if CI is positive it indicates that the concentration of child ARI is higher among the relatively rich.

11.7 Decomposition of Socio-economic Inequality for ARI

Table 11.7 shows the unadjusted and adjusted estimates for the contribution of each socio-economic variable to overall CIs of ARI in Nepalese children aged 0-59 months.

In both 2006 and 2016, ARI prevalence was higher among male children compared with their female counterparts. However, there was an increase in this effect in 2016 compared with 2006. In both 2006 and 2016, prevalence of ARI was higher among children whose mothers had only primary education compared with those whose mothers had secondary education or higher. There was an increase in this effect between the two years. In both 2006 and 2016, the prevalence of ARI was higher among children from the poorer households compared with those from the richest households.

Table 11.7: Decomposition of Concentration indices (CI) for acute respiratory infections (ARI) among Nepalese children 0 - 59 months

Characteristics	Acute Respiratory Infection			
	2006		2016	
	Unadjusted	Adjusted	Unadjusted	Adjusted
	%	%	%	%
Child's age (Months)	-	-19.64	-	-60.65
Sex of child				
Female	-	Ref	-	Ref
Male	-	11.04	-	19.74
Maternal working status				
Non-working	-	Ref	-	Ref
Working (past 12 months)	-	33.27	-	7.13
Maternal education				
No education	32.34	6.43	-82.85	-22.67
Primary	67.66	13.42	182.85	49.73

Secondary and above	Ref	Ref	Ref	Ref
Paternal education				
No education	12.7	43.09	-42.99	-8.55
Primary	-26.8	-9.18	142.99	28.35
Secondary and above	Ref	Ref	Ref	Ref
Household wealth index				
Poorest	26.33	17.25	24.22	28.15
Poorer	90.25	58.93	46.04	53.54
Middle	-0.77	-0.51	12.34	14.35
Richer	-15.8	-10.38	17.39	20.21
Richest	Ref	Ref	Ref	Ref
Type of residence				
Urban	-	-43.72	-	-29.33
Rural	-	Ref	-	Ref

11.8 Summary

In this chapter, the prevalence of childhood diarrhoea and ARI by household wealth index among Nepalese children aged 0-59 months was presented. The section that followed presented the socio-economic factors associated with two-week childhood diarrhoea, any treatment of diarrhoea and ORT treatment of the disease among Nepalese children aged 0-59 months. This was followed by section 10.3, which presented the concentration indices for two-week diarrhoea, any treatment and ORT treatment among Nepalese children aged 0-59 months. The section that followed presented the decomposition of socio-economic inequality for two-week childhood diarrhoea, any treatment and ORT treatment among Nepalese children aged 0-59 months. This was followed by a section which presented the socio-economic factors associated with ARI; followed by a presentation of the concentration indices for ARI among Nepalese children aged 0-59 months. Section 11.7 presented the decomposition of socio-economic inequality for ARI among Bangladeshi children aged 0-59 months. In the next chapter, association of

childhood diarrhoea with infant and young child feeding practices is South Asia is examined.

CHAPTER 12

ASSOCIATION OF CHILDHOOD DIARRHOEA WITH INFANT AND YOUNG CHILD FEEDING PRACTICES – SOUTH ASIA

12.0 Introduction

Examination of the association between childhood diarrhoea and Infant and Young Child Feeding (IYCF) practices among children aged 0-59 months in Bangladesh, India, Pakistan and Nepal is presented in this chapter. The impact of diarrhoea-related diseases and deaths on survival of children is most pronounced in children from low-income countries due to inadequate infant feeding practices, unimproved water and sanitation, a lack of access to vaccination, and inadequate treatment of diarrhoea [249, 250]. This chapter assesses the association of childhood diarrhoea with infant and young child feeding practices in the countries surveyed. Previous analysis did not find any association between acute respiratory infection and infant and young child feeding practices. The rest of the chapter is organised as follows: Section 11.1 presented prevalence of infant and young child feeding indicators among children aged 0-59 months in the four south Asian countries surveyed in this research. This is followed by assessing the association of infant and young child feeding practices with childhood diarrhoea and those countries. Section 11.3 examines the prevalence and modifying effect of sources of drinking water on infant and young child feeding indicators associated with diarrhoea. The next section (section 11.4) examines the prevalence and modifying effect of sanitation type on infant and young child feeding indicators associated with diarrhoea. A summary concludes the chapter.

12.1 Prevalence of Infant and Young Child Feeding Practices

Table 12.1 presents the prevalence of IYCF practices among children aged 0-59 months in the four countries surveyed. In general, the majority of children (aged under 24 months) were not exposed to early initiation of breastfeeding. Additionally, among children (aged under 24 months) who had diarrhoea in the two weeks prior to the survey, more than three-quarters of them were not exposed to early initiation of breastfeeding [Prevalence (P) = 78.5%, 95% confidence interval (CI): (76.7, 80.1)]. Whilst more than half of infants (aged under 6 months) were not exclusively breastfed, more than sixty percent of those who had diarrhoea were not exclusively breastfed [P = 62.3%, 95% CI: (57.7, 66.6)]. In general, more than three-quarters of infants (aged under 6 months) were not exposed to predominant breastfeeding. However, among those who had diarrhoea in the two weeks prior to the survey, more than 7 out of every 10 of them were predominantly breastfed [P = 73.3%, 95% CI: (69.2, 77.0)].

Table 12.1: Prevalence of infant and young child feeding (IYCF) indicators and IYCF who had diarrhoea among children aged 0–23 months in 4 South Asian countries (N = 27181)

Infant and Young Child Feeding (IYCF) Indicator	Prevalence of IYCF (95% confidence interval)			
	N	General	N	Children with diarrhoea[t]
Early initiation of breastfeeding[a]				
Yes	7094	26.1 [25.1, 27.1]	935	21.6 [19.9, 23.2]
No	20087	73.9 [72.9, 74.9]	3403	78.5 [76.7, 80.1]
Exclusive breastfeeding[b]				
Yes	3153	45.8 [44.0, 47.6]	540	37.8 [33.4, 42.3]
No	3728	54.2 [52.4, 56.0]	327	62.3 [57.7, 66.6]
Predominant breastfeeding[b]				
Yes	1681	24.4 [22.5, 26.0]	232	73.3 [69.2, 77.0]
No	5200	75.6 [74.0, 77.1]	635	26.7 [23.0, 30.8]
Continued breastfeeding (1 year)[d]				

Yes	4200	88.7 [87.5, 89.9]	759	86.2 [82.9, 88.9]
No	534	11.3 [10.1, 12.5]	122	13.9 [11.2, 17.1]
Continued breastfeeding (2 years)[e]				
Yes	2778	73.4 [71.4, 75.3]	759	74.7 [72.9, 76.5]
No	1007	26.5 [24.7, 28.6]	122	25.3 [23.6, 27.1]
Bottle-feeding[a]				
Yes	4889	18.0[17.2, 18.8]	941	21.7 [19.9, 23.6]
No	22292	82.0 [81.2, 82.8]	3397	78.3 [76.4, 80.1]
Introduction of solid, semi-solid or soft foods[e]				
Yes	2077	55.2 [52.9, 57.4]	415	56.5 [51.5, 61.3]
No	1689	44.9 [42.7, 47.1]	320	43.5 [38.7, 48.5]

N* = weighted count

a - children aged under 24 months

b - infants aged below 6 months

c - children aged 12-15 months

d- children aged 20-23 months

e - infants aged 6-8 months

ɨ - in the 2 weeks prior to the DHS survey of each country

Mothers of a vast majority of children (aged 20-23 months) practised continued breastfeeding (one year), and among those of them who had diarrhoea, more than 86% of their mothers practised continued breastfeeding (one year) [P = 86.2%, 95% CI: (82.9, 88.9)]. For infants aged 6-8 months who had diarrhoea, approximately three-quarters of their mothers practised continued breastfeeding (2 years) [P = 74.7%, 95% CI: (72.9, 76.5)]. In general, mothers of more than 8 out of every 10 children (aged under 24 months) did not practise bottle feeding; and among the children (aged under 24 months) who had diarrhoea, more than three-quarters of their mothers did not practise bottle feeding [P = 78.3%, 95% CI: (76.4, 80.1)]. Mothers of more than half of infants aged 6-8 months practised early introduction of solid, semi-solid or soft foods [P = 56.5%, 95% CI: (51.5, 61.3)].

12.2 Association between Infant and Young Child Feeding Indicators and Childhood Diarrhoea

The association of childhood diarrhoea with infant and young child feeding indicators is presented in Table 12.2. Infants aged under 24 months who were put to the breast within the first hour after birth were significantly less likely to contract diarrhoea compared with those who were not put to the breast within the first hour after birth [P = 0.79, 95% CI: (0.73, 0.86); p < 0.001]. Infants aged less than six months who were exclusively breastfed were significantly less predisposed to contracting diarrhoea than those who were not exclusively breastfed [P = 0.65, 95% CI: (0.55, 0.77); p < 0.001]. The likelihood of diarrhoea was significantly more among infants aged less than years whose mothers practised predominant breastfeeding compared with those whose mothers did not practise predominant breastfeeding [P = 1.29, 95% CI: (1.07, 1.55); p = 0.009].

Table 12.2: Association between infant and young child feeding (IYCF) indicators and diarrhoea in 4 South Asian countries

Infant and Young Child Feeding (IYCF) Indicator	Unadjusted Odd ratios	P value	Adjusted Odd ratios†	P value
Early initiation of breastfeeding[a]				
No	1.00		1.00	
Yes	0.80 (0.73, 0.86)	<0.001	0.79 (0.73, 0.86)	<0.001
Exclusive breastfeeding[b]				
No	1.00		1.00	
Yes	0.66 (0.56, 0.78)	<0.001	0.65 (0.55, 0.77)	<0.001
Predominant breastfeeding[b]				
No	1.00		1.00	
Yes	1.27 (1.05, 1.53)	0.012	1.29 (1.07, 1.55)	0.009
Continued breastfeeding (1 year)[d]				
No	1.00		1.00	
Yes	1.03 (0.82, 1.31)	0.781	1.01 (0.79, 1.28)	0.964
Continued breastfeeding (2 year)[e]				

No	1.00		1.00	
Yes	1.28 (1.01, 1.61)	0.039	1.20 (0.95, 1.53)	0.130
Bottle-feeding[a]				
No	1.00		1.00	
Yes	1.08 (0.99, 1.18)	0.084	1.13 (1.03, 1.23)	0.013
Introduction of solid, semi-solid or soft foods[e]				
No	1.00		1.00	
Yes	1.03 (0.85, 1.24)	0.771	1.03 (0.85, 1.25)	0.758

a - children aged under 24 months

b - infants aged below 6 months

c - children aged 12-15 months

d- children aged 20-23 months

e - infants aged 6-8 months

Children aged 12-15 months whose mothers practised continued breastfeeding for one year were more likely to contract diarrhoea, compared with those whose mothers did not practise continued breastfeeding. The finding, however, was not statistically significant. Similarly, the likelihood of children aged 12-15 months whose mothers practised continued breastfeeding for two years to contract diarrhoea, was more than that of children aged 12-15 months whose mothers did not practise continued breastfeeding for two years. This finding was also not statistically significant. Children aged less than 24 months who were bottle-fed were significantly more predisposed to diarrhoea compared with those who were not bottle-fed [P = 1.13, 95% CI: (1.03, 1.23); p = 0.013]. Furthermore, the likelihood of diarrhoea was significantly more among infants aged 6-8 months whose mothers introduced them to solid, semi-solid or soft foods. However, the finding was not statistically significant.

12.3 Prevalence and modifying effect of sources of drinking water on infant and young child feeding indicators associated with diarrhoea

Table 12.3 shows the prevalence and modifying effects of the quality of sources of drinking water on infant and young child feeding indicators associated with diarrhoea in the four countries surveyed. There were less than 30% of infants whose mothers practised early initiation of breastfeeding and lived in households with improved sources of drinking water. There were more than three-quarters of infants whose mothers did not practise early initiation of breastfeeding and lived in households with unimproved sources of drinking water. Approximately 45% of children who were exclusively breastfed lived in households with improved sources of drinking water, whilst more than half of children who were not exclusively breastfed lived in households with unimproved sources of drinking water.

Infants who were put to the breast within the first hour after birth and lived in households with improved sources of drinking water were significantly less likely to contract diarrhoea compared with their counterparts who were not put to the breast within one hour after birth. Infants who were exclusively breastfed and lived in households with improved sources of drinking water were significantly less likely to contract diarrhoea compared with those who were not exclusively breastfed and lived in households with unimproved sources of drinking water.

Table 12.3: Prevalence and modifying effect of sources of drinking water on infant and young child feeding indicators associated with diarrhoea in 4 south Asian countries.

	Quality of source of drinking water							
Infant and Young Child Feeding (IYCF) Indicator	Improved				Unimproved			
	N*	**%***	Adjusted Odd ratios	P value	**N***	**%***	Adjusted Odd ratios†	P value
Early initiation of breast feeding[a]								
No	14397	72.6	1.00		5673	77.4	1.00	

Yes	5437	27.4	0.82 (0.74, 90)	<0.001	1656	22.6	0.70 (0.60, 0.82)	<0.001
Exclusive breastfeeding[b]								
No	2526	55.2	1.00		1202	52.2	1.00	
Yes	2049	44.8	0.69 (0.57, 0.85)	<0.001	1102	47.8	0.62 (0.47, 0.83)	0.001
Predominant breastfeeding[b]								
No	3461	75.7	1.00		1737	75.4	1.00	
Yes	1114	24.4	1.25 (0.99, 1.56)	0.057	567	24.6	1.29 (0.93, 1.78)	0.126
Continued breastfeeding (1 year)[d]								
No	396	11.3	1.00		138	11.2	1.00	
Yes	3102	88.7	0.94 (0.71, 1.23)	0.638	1088	88.8	1.28 (0.73, 2.23)	0.39
Continued breastfeeding (2 year)[e]								
No	797	26.8	1.00		210	26.0	1.00	
Yes	2180	73.2	1.12 (0.85, 1.49)	0.422	598	74.0	1.55 (0.86, 2.76)	0.138
Bottle-feeding[a]								
No	16329	82.3	1.00		5945	81.1	1.00	
Yes	3505	17.7	1.14 (1.02, 1.27)	0.022	1384	18.9	1.13 (0.96, 1.35)	0.149
Introduction of solid, semi-solid or soft foods[e]								
No	1245	44.1	1.00		439	46.8	1.00	
Yes	1578	55.9	1.09 (0.87, 1.36)	0.459	499	53.2	0.90 (0.63, 1.28)	0.548

Models adjusted for socio-economic factors (maternal education, household wealth and maternal employment); health service factors (antenatal care visit); individual factors (maternal age, child's age and gender) and household factors (place of residence, type of toilet facility and sources of drinking water). N* = weighted count, %* weighted percent

12.4 Prevalence and modifying effect of sanitation type on infant and young child feeding indicators associated with diarrhoea

The prevalence and modifying effects of type of sanitation on infant and young child feeding practices associated with diarrhoea are presented in Table 12.4. There were approximately one-third of infants whose mothers practised early initiation of breastfeeding and lived in households with improved sanitation.

Table 712.4: Prevalence and modifying effect of sanitation on infant and young child feeding indicators associated with diarrhoea in 4 south Asian countries.

	Improved sanitation				Unimproved Sanitation			
Infant and Young Child Feeding (IYCF) Indicator	**N***	**%***	Adjusted Odd ratios	P value	**N***	**%***	Adjusted Odd ratios†	P value
Early initiation of breast feeding[a]								
No	6201	67.4	1.00		13885	77.3	1.00	

Yes	3006	32.7	0.78 (0.70, 89)	<0.001	4088	22.7	0.80 (0.71, 0.89)	<0.001
Exclusive breastfeeding[b]								
No	1198	58.9	1.00		2530	52.2	1.00	
Yes	837	41.1	0.57 (0.43, 0.75)	<0.001	2316	47.8	0.70 (0.56, 0.86)	0.001
Predominant breastfeeding[b]								
No	1609	79.0	1.00		3591	74.1	1.00	
Yes	427	21.0	1.40 (1.02, 1.92)	0.038	1255	25.9	1.25 (0.98, 1.59)	0.072
Continued breastfeeding (1 year)[d]								
No	259	15.2	1.00		275	9.1	1.00	
Yes	1443	84.8	0.87 (0.64, 1.19)	0.390	2757	90.9	1.21 (0.83, 1.77)	0.331
Continued breastfeeding (2 year)[e]								
No	474	33.5	1.00		533	22.5	1.00	
Yes	942	66.5	1.06 (0.76, 1.50)	0.720	1836	77.5	1.34 (0.96, 1.87)	0.088
Bottle-feeding[a]								
No	6656	72.3	1.00		1223	49.3	1.00	
Yes	2551	27.7	1.18 (1.04, 1.34)	0.010	1257	50.7	1.06 (0.93, 1.22)	0.375
Introduction of solid, semi-solid or soft foods[e]								
No	467	36.3	1.00		15635	87.0	1.00	
Yes	820	63.7	1.06 (0.77, 1.45)	0.715	2338	13.0	0.90 (0.63, 1.28)	0.548

Models adjusted for socio-economic factors (maternal education, household wealth and maternal employment); health service factors (antenatal care visit); individual factors (maternal age, child's age and gender) and household factors (place of residence, type of toilet facility and sources of drinking water). N* = weighted count, %* weighted percent

There were more than three-quarters of infants whose mothers did not practise early initiation of breastfeeding and lived in households with unimproved sanitation. About two- fifths of children who were exclusively breastfed lived in households with improved sanitation, whilst more than half of children who were not exclusively breastfed lived in households with unimproved sanitation. A little over one-fifth of infants whose mothers practised predominant breastfeeding lived in households with improved sanitation; and close to three-quarters of infants whose mothers did not practice predominant breastfeeding lived in households with unimproved sanitation. More than two-thirds of infants aged 6-8 months whose mothers practised continued breastfeeding up to two years lived in households with improved sanitation whilst approximately 23% of those whose

mothers did not practise continued breastfeeding up to two years lived in households with unimproved sanitation. Less than one-third of children who were bottle-fed lived in households with improved sanitation; and slightly less than half of breast-fed children lived in households with unimproved sanitation. Additionally, almost 64% of infants aged 6-8 months whose mothers introduced them to solid, semi-solid or soft foods lived in households with improved sanitation, whilst 87% of infants aged 6-8 months whose mothers did not introduce them to solid, semi-solid or soft foods lived in households with unimproved sanitation.

Infants who were put to the breast within the first hour after birth and lived in households with improved sanitation were significantly less likely to contract diarrhoea compared with their counterparts who were not put to the breast within one hour after birth. Infants who were exclusively breastfed and lived in households with improved sanitation were significantly less likely to contract diarrhoea compared with those who were not exclusively breastfed and lived in households with unimproved sanitation.

12.5 Summary

This chapter first examined the prevalence of infant and young child feeding indicators among children aged 0-59 months in the four south Asian countries surveyed in this research. In the section that followed, assessment of the association of infant and young child feeding practices with childhood diarrhoea and those countries was carried out. This was followed by examining the prevalence and modifying effect of sources of drinking water on infant and young child feeding indicators associated with diarrhoea. This was followed by examining the prevalence and modifying effect of sanitation type on infant and young child

feeding indicators associated with diarrhoea. In the next chapter (Chapter 13), a discussion of the results of the entire thesis is presented.

CHAPTER 13

Discussion

13.0 Introduction

This chapter presents discussions of the results of the various research questions. It assesses factors that were significantly associated with childhood diarrhoea and acute respiratory infection (ARI) among children aged 0-59 months in Bangladesh, India, Pakistan and Nepal. It also discusses the trend in childhood diarrhoea and ARI in these four countries. Additionally, the association of childhood diarrhoea and ARI with infant and young child feeding practices are discussed in this chapter. The rest of the chapter is organised as follows: Section 13.1 presents characteristics of the study respondents. This is followed by the discussion of significant factors associated with childhood diarrhoea and ARI. The factors discussed include: household wealth index, age of the child, nutritional status, quality of source of drinking water, sanitation, parental level of education and regional differences. Section 13.3 presents a discussion on trends in socio-economic inequalities associated with, and predictors of childhood Diarrhoea. This is followed by an examination of the association between infant and young child feeding practices with childhood diarrhoea. The summary concludes with a summary.

13.1 Characteristics of the Study Respondents

In an attempt to tackle the research questions, the main characteristics of the study respondents were examined. With the exception of Nepal, the majority of children came from rural areas. This observation has been found to hold for other studies in some developing countries [251-260].

Previous studies have indicated the existence of various health disparities between urban and rural areas in some countries in health status, health access, and health utilization [261-263]. Children are expected to be more severely affected by disparities in urban–rural health care system, because they tend to be in the early stages of their body growth [264].

The lack of access to preventive and curative health services for children living in rural areas may lead to worse nutrition-related health outcomes as a result of high incidence and severity of illness [265-267]. Childhood disease has also been associated with reduced dietary intake, poor nutrient absorption, and high needs for nutrients for combatting disease, which may lead to depletion of nutritional stores, and consequently growth retardation, especially in young children [34–36].

Children in rural areas are prone to health and well-being risks [268, 269]. Some of the risks are associated with their demographic characteristics; rural children tend to be more likely to live in poverty than their urban counterparts [270]. Some relate to their physical environment; the risks of injury and of death from injury are greater among rural children [271].

It was also found that majority of children came from poor households (except in Nepal), which is consistent with findings from previous other studies [258, 259, 272].

In this study, it was found that the vast majority of mothers surveyed were married as at the time of each survey. This is also consistent with findings from past studies [258-260].

In the next section, factors which were significantly associated with childhood diarrhoea and/or acute respiratory infection are discussed. These factors were revealed by carrying out multivariate regression analysis, and employing a five-stage modelling technique.

13.2 Factors Associated with Childhood Diarrhoea and ARI

Multivariate regression methods were employed to identify factors which were significantly associated with childhood diarrhoea and/or ARI. The significant factors included: limited level of parental education, household poverty, small birth size of child, lack of access to the media, regional differences, unimproved source of drinking water and unimproved toilet facilities, age of the child and unmarried mothers.

Household Wealth Index

Analysis revealed that in Bangladesh, India and Nepal, the likelihood of ARI was less in children from rich households, indicating that the likelihood of ARI was more in children from poor households. Poverty has been related to unemployment, crowdedness, and poor interactions, which all reflect a family's health status [273]. Additionally, sufficient family income has been reported as a main factor that leads to better health outcomes [274].

Our findings are consistent with those of several studies which had found significant association between household economic status and diarrhoea in children [275, 276]. Generally, children living in poor households have higher rates of infection with diarrhoea than their wealthier counterparts, probably because of

inadequate access to sanitary facilities, unsanitary environments in the home, and poor hygiene of the child.

Inequalities in health have almost always been to the disadvantage of the poor. There is the tendency of the poor to die earlier and to have higher levels of morbidity than the rich. These inequalities tend to be more pronounced for objective indicators of ill-health, including anthropometric measures of malnutrition and mortality, than for subjective indicators. Subjective indicators sometimes produce perverse gradients in developing countries, with the rich reporting worse health than the poor [277]. In the developing world, longer-term illness indicators such as long-standing illness, limitation of a major activity, and self-assessed health tend to highlight inequalities to the disadvantage of the poor [278].

The extent of health inequalities across countries vary largely, although the variations themselves change with the indicators of health and socioeconomic status used. For instance, in Latin America, there are higher inequalities in child health between poor and non-poor than other parts of the developing world, no matter what health indicator is used. On the contrary, inequalities in child mortality and malnutrition are less pronounced in sub-Saharan Africa compared to North Africa, Asia, and the Near East. The opposite, however, is true of inequalities concerning diarrhoea and acute respiratory infections [279]. There is evidence to the effect that socioeconomic inequalities in health seem to be widening rather

than narrowing; both in the developing [280, 281]and industrialized world [282-284].

Child's Age

Children aged 12-23 months were found to be less prone to diarrhoea compared to their counterparts aged 0-11 months in Bangladesh. In India, children aged 0-11 months were more prone to diarrhoea compared with their older counterparts. This reveals that the likelihood of diarrhoea was highest in infants and decreased as the child grew older, consistent with results from previous studies [285, 286]. When adjustment for other covariates was done, the relative odds of diarrhoea in the older age groups were lower compared to the youngest age group [287]. With older ages, there can be development of immunity to certain pathogens, which may explain the significant protective effect seen for the older children [287].

A study in Sudan [175] found that children aged 6–35 months were more likely to have diarrhoea than those who were younger or older. This is in consonance with previous findings from other settings in sub-Saharan Africa [149, 288, 289]. Several mechanisms like maternal antibodies against enteric pathogens and current breastfeeding may be a natural protection against diarrhoea in children of the youngest age group. It is likely that this natural protection is lost after the age of 6 months, with the introduction of supplementary feeding and changing nutritional habits.

Nutritional status

Analysis of the Bangladeshi data revealed that stunted children were more predisposed to diarrhoea compared with those who were not stunted. Further,

children who were underweight in India were found to be more prone to diarrhoea than their counterparts who were not underweight. These findings are consistent with results from previous studies [224, 290, 291]. Additionally, the likelihood of ARI was more in Bangladeshi children who were underweight compared with those who were not underweight, consistent with a past study [224]. There is a possibility of a child who is stunted to have been poorly nourished, which could lead to diarrhoea morbidity. The malnutrition could be associated with inappropriate infant feeding practices, impaired uptake of nutrients due to infections and parasites, inadequate food and health security, poor environmental conditions and lack of proper child care [291]. Children who are malnourished have impaired immunological response, particularly at the cellular level. This predisposes them to development of more severe infections compared with children who are well nourished [292].

Source of drinking water (Unimproved)

Source of drinking-water is an important environmental determinant of diarrhoeal morbidity as reported in previously studies [144, 293]. Diarrhoea morbidity can reportedly be reduced by approximately 21 % through improved water supply [294]. In this current study, however, no association was found in any of the four countries between quality of source of drinking water and childhood diarrhoea. A past study in Nigeria [295] found that poor handling of drinking water was significantly associated with increased risk of childhood diarrhoea. This finding may be due to the fact that bacteriological quality of drinking water could be significantly deteriorated at the household level after collection and storage as a

result of poor handling [296]. Another previous study [297] observed that there are often multiple points between drinking water collection and use sequence where pollution could occur. Furthermore, Jagals et al [298] found that unhygienic domestic water handling practices could be possible sources of household drinking water contamination. Poor storage of drinking water has also been found in a past study [146] to be significantly associated with high incidence of childhood diarrhoea.

However, analyses of the data from Bangladesh and India indicated that children from these two countries who were from households with unimproved sources of drinking water were more prone to ARI compared with their counterparts who had access to water from improved sources.

Sanitation (Unimproved toilet facilities)

Acute diarrhoeal outbreaks have been commonly attributed to contaminated water worldwide and unimproved toilet facilities [299]. In this study, analysis of data from Nepal showed that children who lived in households with unimproved toilet facilities were more prone to diarrhoea compared with those who lived in households with improved toilet facilities, consistent with prior studies [300].

Simple hygiene practices, especially washing hands with soap, have been known to reduce the occurrence of water-washed infections. Past research has indicated that appropriate hand-washing practices of mothers before food preparation was associated with a lower risk of diarrhoea among children [168, 169, 301]. Availability of water for anal and hand cleaning after using the toilet, presence of

dirt and faeces on toilet floors, and foul smell around the toilet have been found to be significant factors that predispose children to diarrhoeal diseases [295]. Nonetheless, Knight et al [302] in a case-control study carried out in rural Malaysia found no association between household latrine facility and diarrhoea, whilst non-use of water for washing the anus and hand in those households which had latrine facility was significantly associated with diarrhoea. Foul smell often emanate from most toilets due to the fact that these facilities were not always flushed or washed immediately after use. This condition attracts houseflies and suggests poor hygiene practices. The presence of these flies and faecal matter on the toilet floor are potential risk factors for diarrhoea and other faecal-oral disease transmission [303].

Parental level of education (Limited education)

The likelihood of having diarrhoea was more in children whose mothers had limited formal education. This is consistent with findings by Dikassa et al. [304] in Congo and Ekanem et al [303] in Nigeria. Parental education plays a vital role in the enlightenment of mothers towards their practice of healthcare [154, 218, 305, 306]. This knowledge is said to affect their behaviour, especially as it relates to child rearing and healthcare practices.

Well educated and wealthy parents may be unable to reduce the predisposition to exposure due to factors beyond their control, such as contaminated community environments or lack of water [307]. However, their knowledge and wealth allow them to recognise symptoms and use health services more effectively than their less educated and low wealth counterparts.

Overall, it is clear that higher parental education protects children from the risk of diarrhoea, even when other exposure-related risk factors are controlled for; education does not merely proxy for higher economic status [276]. In Bangladesh, the likelihood of diarrhoea was higher in children whose fathers had primary education only, although past studies did not find any association between association between parental education and ARI. However, Cesar and colleagues [308] found that the risk of ARI declined with education of parents. Generally, in public health issues, fathers' education typically receives less attention than mothers' education due to the fact that mothers are perceived to play a greater role in children's upbringing. However, despite the fact that fathers may not be the primary childcare providers in many third world households, their education has a direct payoff for their children's health, irrespective of how wealthy they are [276]. The importance of encouraging both women and men to achieve more than a primary education also stands out. The greatest reductions in children's risk of morbidity tend to be associated with advanced levels of parental education.

Unexpectedly, the likelihood of ARI increased with mother's level of education in Bangladesh. This counterintuitive finding contrasts sharply with previous literature on the role of maternal education in child health. It is suspected that this may be an artefact of reporting bias related to the broad definition of ''acute respiratory infection'' in the surveys. Due to the fact that the term includes many disparate conditions, which ranges from colds to severe pneumonia, mothers who are better educated may be more likely to recognise and categorise their children's respiratory symptoms as ''illness.'' Reported ARI could also include asthma, which seems to be more prevalent among children of highly educated mothers [309]. This

finding highlights the difficulty of analysing self-reported morbidity through standard national household surveys with broad illness categories; cultural and socioeconomic patterns of disease recognition can confound true morbidity patterns. For future analysis of acute respiratory infections, survey planners might consider including additional questions to distinguish colds and asthma from more severe illnesses.

Regional Differences

The likelihood of childhood diarrhoea in India was found to be more in the North region compared with the other regions. Additionally the likelihood of ARI was more in children from the East region than in the other regions of the country. In India, The high likelihood of childhood morbidity in certain regions is an indication of underlying safety problems related mainly to behavioural factors peculiar to that specific region. Analysis of data from Pakistan indicated that children from the North West were more prone to ARI than children from the other regions of the country. Furthermore, analysis of data from Nepal revealed that the likelihood of ARI was more in children from the Far West region compared with those from other regions of the country. These findings are consistent with results of past studies [233].

Gender

In India, male children were found to be more predisposed to diarrhoea compared with their female counterparts. This finding is consistent with a previous study [286]. Additionally, analysis of data from India revealed that male children were

less prone to ARI, which is contrary to results from past studies which found male children to be more predisposed to ARI [231, 310-312]. In a study of under-5 children in north Sudan [313], it was found that there was positive association between a male child and diarrhoea. This finding is in contradiction to findings of a study by el Samani et al [288] that the risk of diarrhoea was higher for females compared to males in a rural community of Sudanese. The el Samani study is consistent with previous reports from Guinea Bissau [290] and Republic of Congo [155]. The notion that boys are more affected than girls deserves further exploration and attention in terms of interventions. A plausible explanation may be that boys are likely to wander off in unsanitary surroundings compared to girls. Boys might also be more vulnerable to diseases than females. In a study of paediatric hospital admissions in Hong Kong [314], it was reported that males had a consistent excess in admissions of females. Furthermore, another study by Siziya et al [315] found that, among children aged five years or younger in Iraq, males were more likely to have acute respiratory infection than females.

The plausible reason of male predominance in ARI contraction is not known; however, a possible reason may be gender bias in seeking medical care.

13.3 Trends in Socio-Economic Inequalities Associated with, and Predictors of Childhood Diarrhoea

This current study assessed the trends in socioeconomic inequalities associated with childhood diarrhoea. The factors that showed the largest contribution to socioeconomic inequalities in childhood diarrhoea and its treatment methods over time (Bangladesh and Nepal) were male children, children of unemployed mothers,

children whose parents had no formal education, children from the poorest households and children from urban areas. This study revealed that socioeconomic factors greatly influence childhood diarrhoea in Bangladesh and Nepal. The observed increase in childhood diarrhoea among poor households tends to widen the poor-rich divide and highlights further deterioration in the living conditions of families over the years in Bangladesh. This trend in disparity could be as a result of changes in income, education, lifestyle, and other factors that directly or indirectly affect health care delivery. The socioeconomic status of households affects their access to quality food, supply of clean water, improved sanitation facilities, and basic healthcare facilities [316-318].

The unavailability of safe drinking water and proper environmental sanitation experienced by poor households especially in rural areas is a major cause of diarrhoea, which has been shown to be a determinant of undernutrition [319].

13.4 Infant and Young Child Feeding Indicators and Childhood Diarrhoea

In this study, prevalence of diarrhoea was lower among children whose mothers practiced early initiation of breastfeeding, exclusive and predominant breastfeeding. Infants who were introduced to solid, semi-solid and soft foods and those who continued breastfeeding at one year had a higher prevalence of diarrhoea compared to their counterparts. Early initiation of breastfeeding and exclusive breastfeeding were protective against diarrhoea in the four South Asian countries, while introduction solid, semi-solid and soft foods and continued breastfeeding were risk factors for diarrhoea. In households with improved sanitary

conditions, the protective effect of early initiation of breastfeeding and exclusive breastfeeding against diarrhoea were stronger.

The mechanisms of appropriate infant feeding practices in reducing the prevalence of childhood diarrhoea are evident in the extant literature [320, 321]. The current study revealed that early *initiation of breastfeeding* and *exclusive breastfeeding* were protective against diarrhoea in the south Asian countries. This finding is consistent with prior studies [322-324]. Furthermore, optimally breastfed children and those from households with improved sources of drinking water were also found to be less likely to contract diarrhoea under improved sanitary conditions.

Breastfeeding

Breastfeeding has been well documented to prevent and reduce the severity of diarrheal diseases in developing countries. Breast milk contains protective antibodies and hormones that can promote proliferation of the gut mucosa and recovery from infection [325]. The very act of breastfeeding limits infant exposure to feeding utensils, bottles, and food items that are very often contaminated due to ignorance, poor hygiene, poverty, and a lack of clean, potable water for rinsing.

A 1989 study from Peru showed that infants who were not exclusively breastfed had significant elevated relative risks for diarrhoea compared with exclusively breastfed babies [326]. An investigation into the epidemiology of persistent diarrhoea in Brazilian children under age 3 y found that exclusively breastfed children had eightfold lower diarrhoea rates than did weaned children [327].

13.5 Summary

This chapter presented characteristics of the study respondents. This was followed by a discussion of significant factors associated with childhood diarrhoea and ARI.

The significant factors included household wealth index, age of the child, nutritional status, quality of source of drinking water, sanitation, parental level of education and regional differences. The section that followed presented a discussion on trends in socio-economic inequalities associated with, and predictors of childhood diarrhoea; and this was followed by an examination of the association between infant and young child feeding practices with childhood diarrhoea. The next section presents an overall summary, policy implications of the study and recommendations for future research.

CHAPTER 14

SUMMARY, POLICY IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

14.0 Introduction

An overview of key findings of the current study is presented in this final chapter. The significant factors associated with childhood diarrhoea and ARI, as well as the association of infant and young child feeding practices with childhood diarrhoea are summarised. Strengths and weaknesses of the study, implications for policy, recommendations and direction for future research are presented in that order. Finally, the last section concludes the study.

14.1 Overview of key findings

Factors associated with childhood diarrhoea and ARI

Multivariate modelling in chapters 5, 6, 7 and 8 revealed the significant factors associated with childhood diarrhoea in Bangladesh, India, Pakistan and Nepal respectively. In Bangladesh, analysis showed that significant factors with childhood diarrhoea were: paternal education, child's age and nutritional status of children. Children whose fathers had primary education and those who were stunted were prone to contracting diarrhoea. Analysis also showed that the significant factors associated with ARI in Bangladesh were: household wealth, maternal education, mother's marital status, age of the child and nutritional status of the child. It was found that children from rich households, children whose mothers had no education, and children aged 0-11 were less predisposed to ARI. Children of formerly married women and wasted children were more predisposed to ARI.

In India, Geographical region, maternal education, child's age, gender of the child, perceived size of the baby at birth and nutritional status of the child were significant factors associated with childhood diarrhoea. Children from the South region were less predisposed to diarrhoea, whilst children whose mothers had primary education only, children aged 0-11 months, male children, children perceived to be small at birth and underweight children were prone to diarrhoea. In India, geographical region, household wealth, child's age, gender of child, quality of source of drinking water and nutritional status of the child were the mail factors associated with diarrhoea. Children from the East region, those from households with unimproved sources of drinking water and those who were underweight were prone to ARI, whilst children from rich households, children aged 0-11 months and male children were predisposed to ARI.

In Pakistan, perceived size of the baby at birth and nutritional status of the child were associated with diarrhoea. Children who were perceived to be small at birth and those who were underweight were predisposed to diarrhoea. Geographical region, maternal education and quality of source of drinking water were the main factors associated with ARI in Pakistan. Children from the North West Frontier region and those from households with unimproved sources of drinking water were likely to contract ARI, whilst those whose mothers had secondary education or higher were not predisposed to ARI.

In Nepal, marital status of mothers, child's age and quality of toilet facility were the main factors associated with diarrhoea. Children of formerly married mothers and those living in households with unimproved toilet facilities were predisposed to

diarrhoea. In Nepal, children from the Far West region were likely to contract ARI, whilst children from rich households and those whose mothers watched television were not predisposed to ARI.

Trends and predictors in childhood diarrhoea

In Bangladesh, there was a decline in the likelihood of childhood diarrhoea between 2004 and 2014. Other significant predictors of childhood diarrhoea included: male children, children of unemployed mothers, children of parents who had no formal education, children from the poorest households and those living in urban areas. Additionally, in both 2004 and 2014, concentration of the childhood diarrhoea was in the poor households, and there was a slight decline in the concentration of childhood diarrhoea in those poor households. In both 2004 and 2014, the tendency to treat a child for diarrhoea was common in rich households. Further, there was an increase in any treatment of diarrhoea in those rich households. The use of OTR treatment was also common in rich households, and this practice showed a decline from 2004 to 2014.

In Nepal, there was a decline in the likelihood of childhood diarrhoea between 2006 and 2016. Other significant predictors of childhood diarrhoea included: male children, children of employed mothers, children of parents who had primary education only, children from the poorer households and those living in rural areas. Additionally, in both 2006, concentration of diarrhoea was among the poor households, and in 2016, concentration of the childhood diarrhoea was in the rich households. Further, a child treated by any method for diarrhoea was likely to reside in a rich household. Additionally, the result shows a decrease in any

treatment method in those rich households. The use of OTR treatment was also common in rich households, and this practice showed a decline from 2006 to 2016.

Trends and predictors in ARI

In Bangladesh, there was an increase in the likelihood of ARI between 2004 and 2014. Other significant predictors of ARI in Bangladesh were: male children, children of unemployed mothers, children of mothers with primary education only, children of fathers with no formal education, children from the poorer households and those who lived in urban areas. Additionally, in both 2004 and 2014, concentration of the ARI was among the relatively poor households, and there was a slight decline in the concentration of ARI within poor households between 2004 and 2014.

In Nepal, there was a decline in the likelihood of ARI between 2006 and 2016. Other significant predictors of ARI in Bangladesh were: male children, children of employed mothers, children of mothers with primary education only, children of fathers with no formal education, children from the poorer households and those who lived in rural areas. Additionally, in both 2004 and 2014, concentration of the ARI was among the relatively poor households, and there was an increase in the concentration of ARI within poor households between 2004 and 2014.

Association of infant and young child feeding practices with childhood diarrhoea

For the four countries surveyed, analysis revealed that children whose mothers practised early initiation of breastfeeding, children who were exclusively breastfed and children whose mothers did not practise bottle feeding were significantly associated with decreased likelihood of contraction of childhood diarrhoea.

14.2 Strengths and weaknesses of the study

As indicated in earlier chapters, this current study utilized the DHS data from the four countries surveyed; and being nationally-representative datasets, the use of such data offers some advantages. Firstly, DHS data allow for the generalization of findings across whole countries and consist of large sample sizes with high response rates. Secondly, the DHS programme often adopts similar sampling methodology and comparable survey instruments over time, so that results from analysis of two or more DHS data points across different countries are comparable over time.

Nonetheless, the study has some limitations. For assessing the association of socio-demographic factors on diarrhoea, the present study had adequate sample size, but there may be insufficient variation in the environmental conditions between households to permit the detection of significant associations between them and diarrheal occurrence. The data used in the analysis support the concept that, despite any differences between individual households of communities, external factors, such as inevitable exposure to highly contaminated water, are responsible for high rates of illness among all of them. Additionally, this study used self-reported outcome measures, which could be a source of measurement bias. Since the analyses in this study were based on cross-sectional data, the establishment of a causal relationship between the exposures (infant feeding outcomes) and diarrhoea could be difficult. Further, past studies have indicated that seasonal variations could influence the incidence of diarrhoea in [328], which may affect the observed findings, given that the DHS data were collected at different time points, geographical areas and climatic conditions. Information on the duration and

severity of diarrhoea was unavailable in the DHS datasets of the four countries surveyed.

14.3 Policy Implications

The findings of this study have important implications for policy in an effort to reduce the burden of diarrhoea in south Asia. Changes in the burden of childhood diarrhoea at the population level in south Asia would require initiatives in the health, environment and social sectors. During the period of the United Nations millennium developments goals (MDGs), significant improvements were made in providing improved sources of drinking water and improved sanitation to many communities [324]. Despite this, not much attention was paid to the promotion of infant feeding practices. Current interventions such as the sustainable development goals (SDG 3 and 4), advocating for improved nutrition and healthy lives for all [329], and Global Nutrition Target by 2025 [46] are initiatives needed on a large scale to reduce deaths due to diarrhoea in resource constraint settings. However, in order to maximise positive results, these initiatives must be streamlined with available in-country resources.

14.4 Recommendations

Future studies in south Asia should focus not only on water quality, but also on water quantity. The availability of water for cleaning and washing in the home depends partly on water storage capabilities. It would be useful to have additional information on water storage variables to evaluate the risk of diarrheal disease due to them, and to develop intervention strategies, as has been done in a few other studies [330, 331].

Since the majority of children in most of the countries reside in rural areas, and since such areas are often deprived in terms of health care delivery systems, governments of these countries should ensure that rural areas receive a fair share of infrastructure that would protect children from diseases such as ARI and diarrhoea.

In Bangladesh, since the risk factors for diarrhoea are limited paternal education, older children and stunting, there is the need to encourage male education, create interventions to tackle child stunting and encourage mothers to pay extra attention to their older children. Regarding ARI, government of Bangladesh and other stakeholders need to create jobs to improve the socio-economic status of parents.

In India, in order to minimise diarrhoeal diseases among children, male education should be encouraged. Additionally, older and male children should be looked after properly. Job creation to improve socio-economic status of households, improving quality of drinking water as well as instituting interventions to minimise underweight babies should be the watchwords for preventing the burden of ARI.

In Pakistan, there is the need to improve maternal healthcare delivery to prevent children being born with low birth weight; as underweight is a risk factor to diarrhoea in the country. Regarding ARI, the government and other stakeholders should establish interventions to improve the quality of drinking water in households.

In Nepal, there is the need to improve quality of toilet facilities to curb the occurrence of childhood diarrhoea. Additionally, particular attention should be given to children from the Far West geographical region to minimise ARI cases.

14.5 Future research directions

Future interventions to reduce diarrhoea should investigate the mechanism of action of the WASH interventions including promoting proper handwashing with soap and stop open defecation. Such intervention should target subpopulation with limited education, babies perceived to be small by their mothers, stunted or underweight children, male children, households with poor sanitation and younger infants in the south Asia region.

At the community level, intervention to reduce diarrhoea should include community-based promotion of breastfeeding, hygiene and sanitation and the provision of low-osmolarity ORS and zinc to children with diarrhoea. At the individual level, intervention to reduce diarrhoea should focus on promoting the use of soap for hand washing in order to protect microbial contamination in water and discouraged the use of open defecation by substantial public investment is needed to construct toilets, especially among the rural children.

14.6 Conclusions

This thesis has

- documented the factors associated with childhood diarrhoea and ARI in four south Asian countries, namely, Bangladesh, India, Pakistan and Nepal
- documented the trends and predictors in childhood diarrhoea and ARI in the four countries

- the association of childhood diarrhoea and infant and young child feeding practices in the four countries

From the findings it can be concluded that policies for the control of childhood diarrhoea should focus on the significant factors associated with the disease, such as parental education, gender of the child, household wealth and sanitation, to mention a few.

It is crucial to have an integrated, multi-agency strategic partnership at all levels within each country in the south Asia region to ensure that there is an improvement in optimal infant feeding practices, with resultant impact on diarrhoea-related morbidity and mortality as well as achievement of the SDGs.

CHAPTER 15

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