Neonatal Mortality in Low and Lower-Middle Income Countries: Which Areas Require Further Attention? Evidence from Bangladesh

Tasnima Akter
Faculty of Health
University of Technology Sydney

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Certificate of Original Authorship

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I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Statement of Contributions of Jointly Authored Works

The research works presented in this thesis have been submitted for publication in peer-reviewed journals through six articles (one literature review paper and five original articles), presented in Chapter 2 and Chapter 4 to Chapter 8. For each of these papers, I have been primarily responsible for determining the research question, undertaking the analysis and drafting the manuscript.

I have received support in all of these areas from Professor David Sibbritt and Associate Professor Angela Dawson.

I take full responsibility for the accuracy of the findings presented in these publications and in this thesis.

Published Works Incorporated into the Thesis

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Abbreviations

ANC	Antenatal Care
BDHS	Bangladesh Demographic and Health Survey
CBSV	Community-based Surveillance Volunteer
CHC	Community Health Committee
CHW	Community Health Worker
CI	Confidence Interval
CSBA	Community-based Skilled Birth Attendant
DGHS	Directorate General of Health Services
DHS	Demographic and Health Survey
ENC	Essential Newborn Care
HDI	Human Development Indicator
HPNSDP	Health, Population and Nutrition Sector Development Program
HRH	Human Resources for Health
HR	Hazard Ratio
LHW	Lady Health Worker
LMIC	Low and Lower-Middle Income Country
MCH	Maternal and Child Health
MNCH	Maternal, Newborn and Child Health
MDG	Millennium Development Goal
MOHFW	Ministry of Health and Family Welfare
NGO	Non-Governmental Organization
NIPORT	National Institute of Population Research and Training
NMR	Neonatal Mortality Rate
OR	Odds Ratio
PICOS	Population, Interventions, Comparators, Outcomes, Study design
PMNCH	Partnership for Maternal, Newborn and Child Health

PMR	Perinatal Mortality Rate
PNC	Postnatal Care
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	Randomized controlled trial
SBA	Skilled Birth Attendant
SD	Standard Deviation
SDG	Sustainable Development Goal
SES	Socioeconomic Status
TBA	Traditional Birth Attendant
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VHW	Village Health Worker
WHO	World Health Organization

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Abstract

Background

The global neonatal mortality rate (NMR) is still high, estimated at 19 deaths per 1,000 live births in 2015, which accounts for 45 percent of under-five deaths. Neonatal deaths are projected to increase to 52 percent of under-five deaths in 2030, with most deaths occurring in low and lower-middle income countries (LMICs). This research aimed to examine the key factors that affect the neonatal mortality in LMICs, with a focus on Bangladesh.

Methods

This study comprised a systematic review and statistical analyses. The systematic review, using a narrative synthesis methodology, first examined the impact of workforce interventions on neonatal outcomes in LMICs. Statistical analyses of the 2011 Bangladesh Demographic and Health Survey (DHS) data (n=17,842) investigated the key components of health care services, including facility-based delivery, skilled birth attendants (SBAs), essential newborn care (ENC), antenatal care (ANC) and postnatal care (PNC). In addition, statistical analyses of DHS data from Nepal (n=12,674) and Pakistan (n=13,558) were undertaken to compare the impact of facility-based delivery and/or SBAs in reducing NMR in those countries. A separate statistical analysis of the 2014 Bangladesh DHS data (n=17,863) investigated the changes over time in newborn health care practices, from 2011 to 2014. Statistical analyses used in this research included chi-square tests, multiple logistic regression models and Cox proportional hazards regression models.

Results

The systematic review found that competency assessment, the acquisition of appropriate skills and supervisory guidelines can improve health professional performance. An empirical investigation of Bangladesh DHS data revealed an improvement in health care practices over time for all socio-demographic groups in the country. A detailed investigation suggested that neonatal mortality significantly decreased for newborns whose mothers received ANC services (HR=0.52; 95% CI: 0.29, 0.96). The ENC practice of delayed bathing significantly contributed to reducing neonatal mortality in

Bangladesh (OR=0.14; 95% CI: 0.03, 0.68). However, other ENC practices including PNC and skilled assistance during delivery were not found to be significantly associated with neonate deaths. Furthermore, neonatal mortality was significantly higher for facility deliveries compared to home deliveries in Bangladesh (OR=2.43; 95% CI: 1.09, 5.41). Nepal and Pakistan DHS data also failed to confirm any significant effect of facility delivery and/or SBAs on neonatal mortality.

Conclusions

This is the first study to examine the impact of different components of health care practices on neonatal mortality in Bangladesh at a national level and provides important recommendations for saving newborn lives. First, guidelines related to the fabric used for the immediate drying and wrapping of newborns are required to improve hygiene at a baby's birth. Second, increased emphasis on parental education is required to improve the uptake of ENC services. Third, investment in promoting ANC is important to accelerate the reduction of neonatal deaths. Fourth, revisiting current health intervention programs related to PNC in Bangladesh are essential to better understand the impact of PNC on neonatal mortality. Finally, standardized workforce training and staff supervision are required to improve the performance of health providers. Nevertheless, more research is required to better understand neonatal mortality in LMICs, particularly the reasons why the risk of neonatal deaths increases for deliveries at health facilities and why some ENC practices do not have any impact on neonatal mortality.

Chapter 1 : Background

This chapter outlines the context of the topic and identifies newborn mortality in low and lower-middle income countries as a potential area of investigation. It then discusses the key interventions utilized in such countries to reduce neonatal mortality and sets the aim and scope of the research. This chapter also discusses key aspects of Bangladesh, the primary country of this research, followed by the research questions. The structure of the thesis is outlined at the end of the chapter.

1.1 Global Child Mortality in Last Two Decades

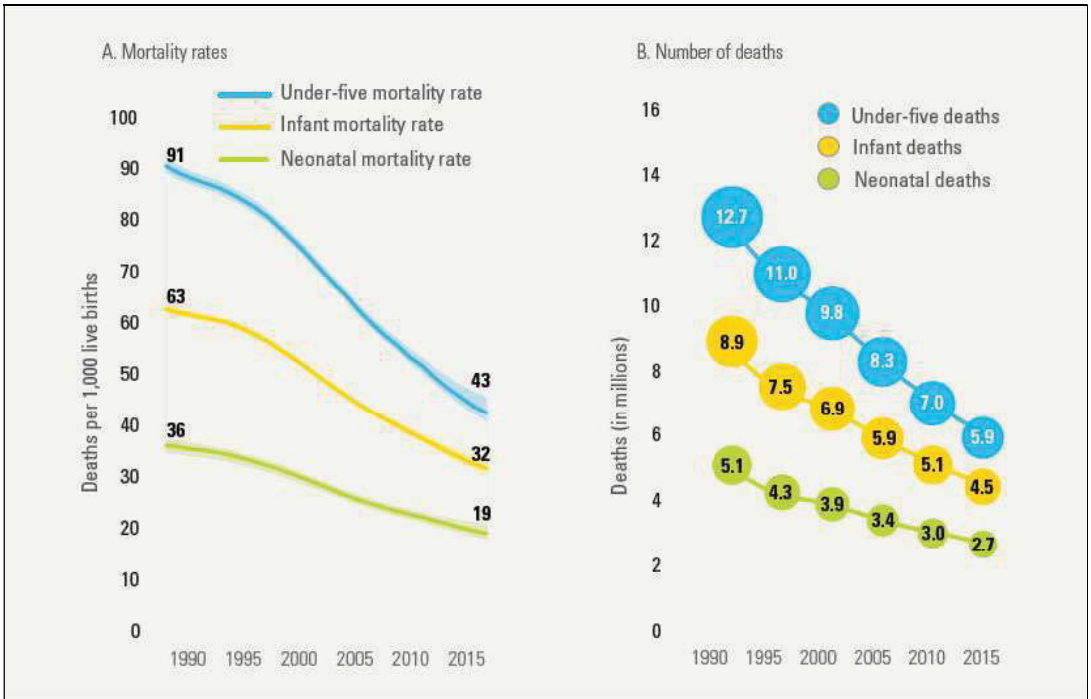
The world has made remarkable progress in improving important health indicators in the last two decades. Between 1990 and 2015, the global under-five mortality rate has declined from 91 deaths per 1,000 live births to 43 deaths per 1,000 live births (You et al., 2015). Despite these successes, newborn and child health is still a serious global issue. Each year, around 5.9 million children die before they reach their fifth birthday (WHO, 2015a; You et al., 2015). As a result, progress has remained insufficient to achieve the target of Millennium Development Goal (MDG) 4 – a two-thirds reduction in under-five mortality between 1990 and 2015. Only 62 of the 195 countries have met the target. Unfortunately, only 24 of 81 developing countries have achieved that target, indicating a lower rate of success compared to their developed counterparts (UNICEF, 2015a). Therefore, the Sustainable Development Goal (SDG) 3 targets include the reduction of the under-five mortality rate to 25 per 1,000 live births for all countries by 2030 (UNICEF, 2015a). The SDG 3 also aims to reduce the neonatal mortality rate (NMR) to 12 per 1,000 live births for all countries by 2030 (UNICEF, 2015a).

1.2 Neonatal Deaths Around the Globe

The neonatal period – the first 28 days of life – is the time when a child is most vulnerable to morbidity and mortality, and around 45% of under-five deaths occur during this period (UNICEF, 2016). The global NMR is still high – 19 per 1,000 live births in 2015 (UNICEF, 2016). Furthermore, between 1990 and 2015, the NMR declined by 47% which was slower than the post-neonatal under-five (1-59 months) mortality rate of 58% (Figure 1.1) (UNICEF, 2015a). Consequently, the global NMR as

a proportion of under-five mortality rate has been increasing (UNICEF, 2016; WHO, 2015a). If this trend continues, neonatal deaths are projected to increase to 52% of under-five deaths in 2030 (UNICEF, 2015a).

Figure 1.1: Global under-five, infant and neonatal mortality rates and number of deaths, 1990-2015



Note: The shaded bands in Figure 1A are the 90 per cent uncertainty intervals around the estimates of under-five mortality rates.

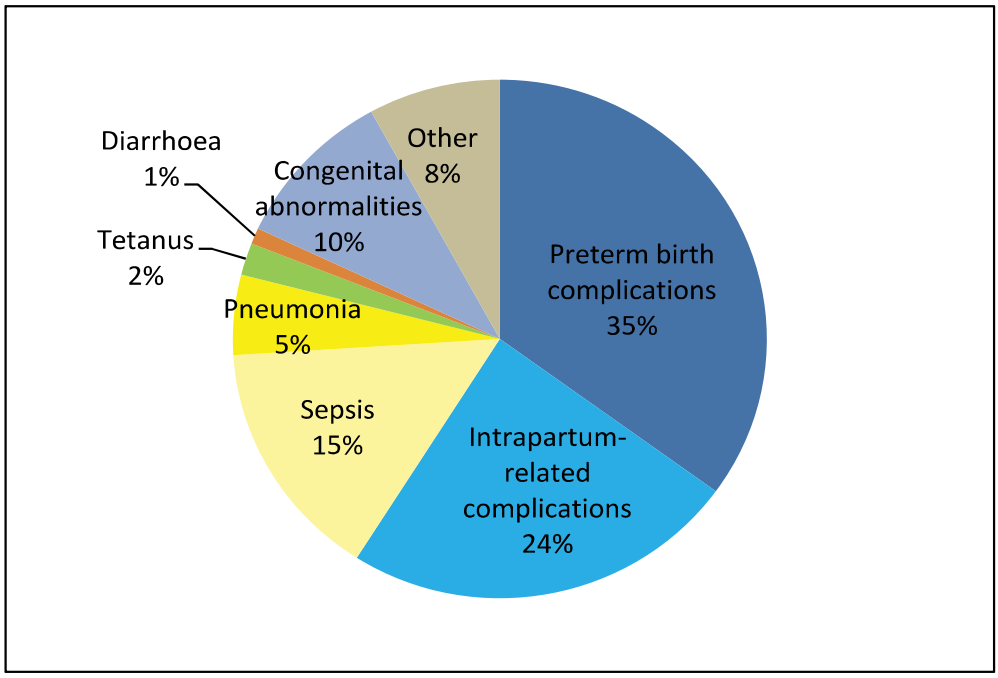
Source: UNICEF Data: Monitoring the Situation of Children and Women (UNICEF, 2016)

1.3 Neonatal Deaths in Low and Lower-Middle Income Countries

Wide variation in neonatal deaths is observed across regions around the world. A majority of these deaths occur in low-income countries, where NMRs are nearly seven times more likely compared with newborns living in high-income countries (UNICEF, 2015c). Specifically, more than 50% of all under-five deaths are concentrated in the neonatal period in South Asia, East Asia and the Pacific, Latin America and the Caribbean, and the Middle East and North Africa regions (Wardlaw et al., 2014). Almost all the countries in these regions belong to the group of low and lower-middle income countries (LMICs). Preterm births, intrapartum-related complications and sepsis are the major causes of these neonatal deaths (Figure 1.2) (UNICEF, 2016). Emerging evidence suggests that about two-thirds of these deaths can be prevented through

universal provision of evidence-based health interventions in low income countries (Jones et al., 2003; UNICEF, 2015c).

Figure 1.2: Causes of neonatal deaths around the world in 2015



Source: UNICEF Report: enormous progress in child survival but greater focus on newborns urgently needed (Wardlaw et al., 2014)

1.4 Key Determinants of Neonatal Deaths: Current Status

Health interventions needed to address the major causes of neonatal deaths generally differ from those needed to address other under-five deaths. Since many newborn deaths occur on the day of birth or within the first seven days of birth, the majority of neonatal deaths are preventable with quality care provided during antenatal, intrapartum and early postnatal periods (UNICEF, 2015a). Recent trends in child mortality and the coverage of key health care services indicate that too few mothers and newborns are benefitting from such interventions at this moment (UNICEF, 2015c).

1.4.1 Human Resources for Health

Factors preventing pregnant women from seeking care during pregnancy and childbirth include poverty, certain cultural beliefs and attitudes, limited information on available services and weak health systems, including shortage of a skilled health workforce

(Lawn, Cousens, & Zupan, 2005; WHO, 2006a; WHO & PMNCH, 2011). For example, a total of 57 countries were observed to experience critical shortages of skilled health workforce that were equivalent to a global deficit of 2.4 million doctors, nurses and midwives (WHO, 2006a). The lack of competency among the skilled workforce can further affect the health service delivery, for both mothers and neonates. An analyses on the 10 countries with high neonatal mortality – Pakistan, Lesotho, Sierra Leone, Guinea, Congo, Nigeria, Burundi, Niger, Côte d'Ivoire and Burkina Faso – indicated that only 10% of women who received services from skilled health care providers during pregnancy obtained key interventions, including emergency obstetric care, immediate care for newborn baby, newborn resuscitation and postnatal health checks for the mother within two days of delivery (UNICEF, 2014, 2015c; Wardlaw et al., 2014). Similarly, less than 10% of babies delivered by skilled health care providers have received essential interventions, including being weighed at birth, early initiation of breastfeeding, no pre-lacteal feed, BCG vaccination, polio vaccination and postnatal health check for the newborn within two days of delivery (UNICEF, 2014, 2015c; Wardlaw et al., 2014). Thus, in many LMICs, training and motivating new health care workers along with managing and retaining skilled and committed health care workers, are the primary challenges in the health system (WHO, 2016a). Consequently, important approaches to reducing NMR include enhancing the availability of an appropriately supported skilled and motivated health care workforce who are able to deliver quality care (Dawson et al., 2013; WHO, 2006a).

1.4.2 Health Care Services

Health care services encompass the delivery of quality health interventions so that people can receive diagnosis, treatment, disease management and prevention through the different levels and sites of care within the health system (WHO, 2016b). Previous studies observed that a large number of health care services related to maternal, newborn and child health (MNCH) have the potential to reduce deaths (Bhutta et al., 2008). Therefore, strengthening MNCH intervention is crucial to reach health-related goals for reducing maternal and child mortality.

1.4.2.1 Antenatal Care

Antenatal care (ANC) from skilled professionals provides an opportunity for women to receive health education and for professionals to monitor the health of mother and baby, and thus helps to reduce adverse pregnancy outcomes. The World Health Organization (WHO) recommends a minimum of four ANC visits during pregnancy (WHO, 2016a). Globally, about 58% of all pregnant women receive this recommended level of ANC services (UNICEF, 2016). Although a strong association is found between higher proportions of ANC visits and lower NMRs in general, the association has been found to be weaker in countries with relatively higher neonatal deaths (UNICEF, 2015c). For example, ANC coverage is lower in high child mortality regions like sub-Saharan Africa (49%) and South Asia (excluding India) (42%) (UNICEF, 2016). Disparities in ANC coverage are also observed between urban and rural areas and across household wealth quintiles, especially in LMICs. For example, in South Asia (excluding India), the gap in recommended ANC visits between the poorest and the richest quintile is 54 percentage points in favour of the richest quintile (UNICEF, 2016).

1.4.2.2 Facility-based Delivery and/or Skilled Birth Attendance

Essential and emergency health care services for women and their newborns that is provided by Skilled Birth Attendants (SBAs) (midwives, physicians, obstetricians, nurses or other health care professionals) during pregnancy, childbirth and the postpartum period, is crucial in preventing both maternal and newborn deaths (WHO, 2006a). Thus, health interventions, like the presence of SBAs at birth and emergency obstetric care with essential medicines and equipment, play a significant role during delivery (WHO, 2006b). Unfortunately, only 71% of births globally are assisted by midwives, doctors or trained nurses, with considerable heterogeneity across regions (UNICEF, 2015c). For example, only 50% of births are delivered with the help of SBAs in sub-Saharan Africa and South Asia, while Central and Eastern Europe, the Commonwealth of Independent States, Latin America and the Caribbean, and East Asia and the Pacific have a coverage of around 90% (UNICEF, 2015c). An inequitable coverage is also evident across wealth quintiles, where women from the bottom quintile are three times less likely to be assisted by skilled health care personnel compared to women from the top wealth quintile (UNICEF, 2015c).

1.4.2.3 Essential Newborn Care

Essential Newborn Care (ENC) is another approach to improve newborn health and supports mothers to care for their babies and plays an important role in decreasing the incidence of neonatal morbidity and mortality (Seward et al., 2012). ENC practices, as recommended by the WHO, include: drying (wiping) and wrapping the newborn immediately after birth; initiating skin-to-skin contact; dry cord care; immediate initiation of breastfeeding; and delayed bathing (WHO, 2006b). These ENC practices are instrumental in reducing neonatal infections/sepsis, asphyxia as well as hypothermia (body temperature below 36.5 degrees Celsius) and therefore reducing neonatal deaths (Hodgins et al., 2013; Khanal et al., 2014). The umbilical stump blood vessels are exposed during first few days after birth and the unhealed stump can be a route of entry for systemic infections in newborn babies (Arifeen et al., 2012). While newborns are vulnerable generally, low birth weight and premature babies have an even more limited capacity to maintain an optimal body temperature and are thus exposed to developing neonatal hypothermia (Khanal et al., 2014). A review article concludes that neonates born at home in LMICs experiencing hypothermia contribute significantly to neonatal deaths (Lunze et al., 2013). Further, many studies have observed a low coverage of ENC practices in LMICs, particularly for home deliveries (Khanal et al., 2014; Pagel et al., 2014; Shamba et al., 2014).

1.4.2.4 Postnatal Care

The postnatal period – the time following delivery until six weeks after birth – is a critical life stage when the majority of maternal and neonatal deaths occur (UNICEF, 2016; WHO, 2013). The WHO recommends postnatal care be received within 24 hours of birth, followed by at least three additional postnatal care visits by a skilled health professional on day 3 (48–72 hours), between days 7–14 and at six weeks after birth (WHO, 2013). Postnatal care provides an opportunity to check for key clinical signs of severe illness of newborns, such as low body temperature, insufficient feeding, severe chest in-drawing and jaundice. Postnatal care visits also allow mothers to receive advice on how to maintain lactation and how to respond to these symptoms, and thus help to reduce newborn mortality (UNICEF, 2016; WHO, 2013). Unfortunately, too few mothers and babies are benefitting from this intervention in LMICs – less than 40% of

mothers and just one in four babies receive a postnatal check-up within two days of delivery (UNICEF, 2015c).

1.5 Research Aim and Scope of this Research

1.5.1 Research Aim

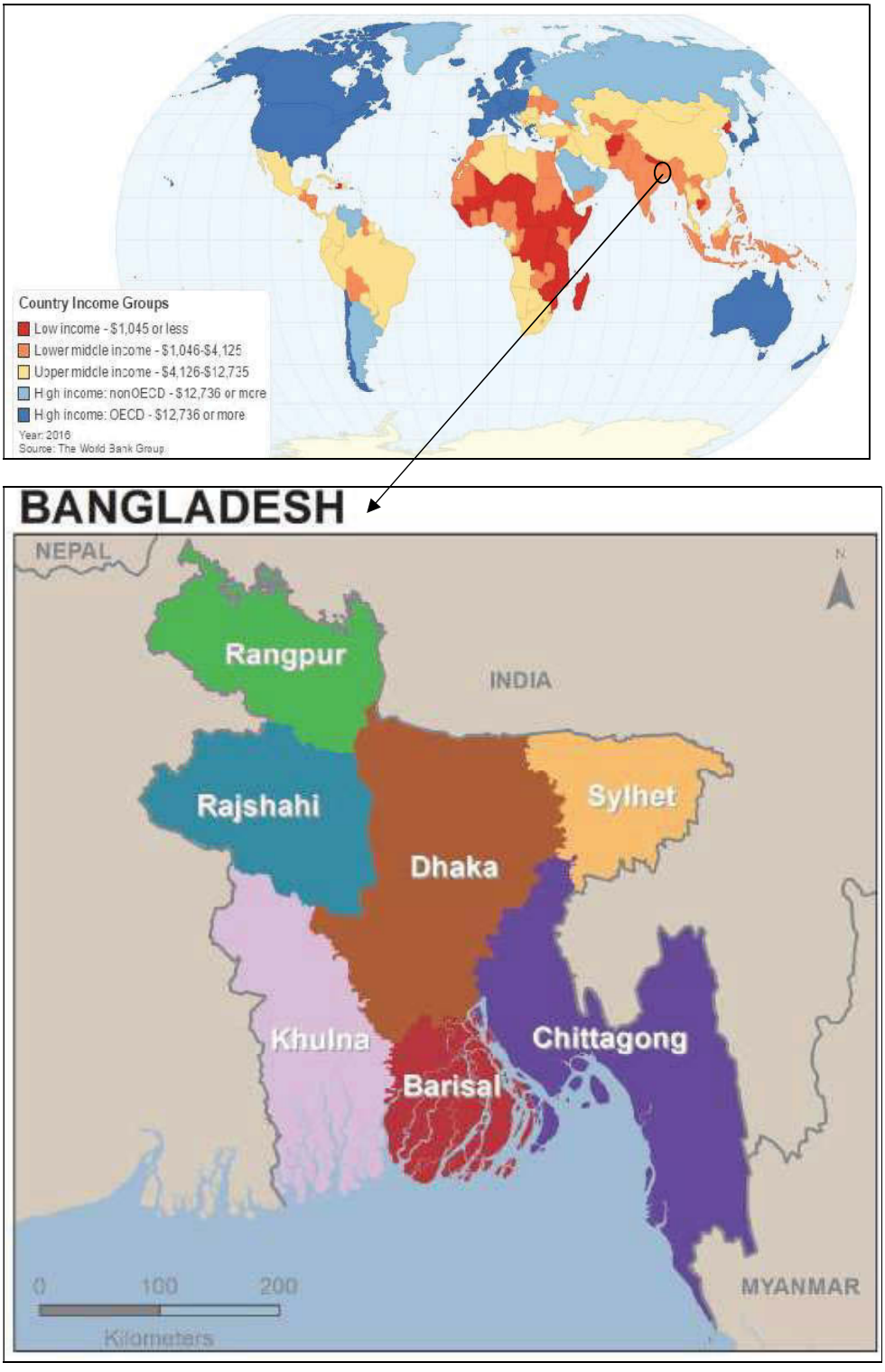
The aim of this research is to investigate the key factors that affect the delivery of health interventions to reduce the neonatal mortality in LMICs by providing evidence from Bangladesh. Using the information generated by the investigation, recommendations aimed at key stakeholders will be formulated.

1.5.2 Research area: Bangladesh

The focus of this project is on Bangladesh – a country located in South Asia (Figure 1.3). Bangladesh is the eighth most populous country in the world with a total population of about 158 million and a density of 1,070 persons/km^2 in 2011 (Chowdhury et al., 2013; NIPORT, Mitra and Associates, & ICF International, 2016). Bangladesh has achieved remarkable progress in reducing population growth through its extensive family planning programme. The estimated population growth rate between 2001 and 2011 censuses in Bangladesh is 1.4 percent as opposed to 2.5 percent in 1971, the year of its independence. The life expectancy at birth in the country is 71 years, with men having slightly shorter life spans than their counterpart (69 years versus 72 years) (NIPORT, Mitra and Associates, & ICF International, 2016; Planning Commission, 2015).

The majority of the population in the country live in rural areas and the agrarian sector dominates the country's economy (Ministry of Health and Family Welfare, 2015; WHO, 2015b). Over the last decade, poverty alleviation strategies have reduced the poverty head count ratio from 50% in 2000 to 31.5% in 2010 (NIPORT, Mitra and Associates, & ICF International, 2016; UNDP, 2016). The country has also made progress in key human development index (HDI), a composite index of life expectancy at birth, education and per capita income (UNDP, 2016). Bangladesh's HDI value belongs to the medium human development category, positioning the country at fifth out of eight South Asian countries, following Sri Lanka, Maldives, India, and Bhutan (UNDP, 2016).

Figure 1.3: Map of world by income group along with Bangladesh

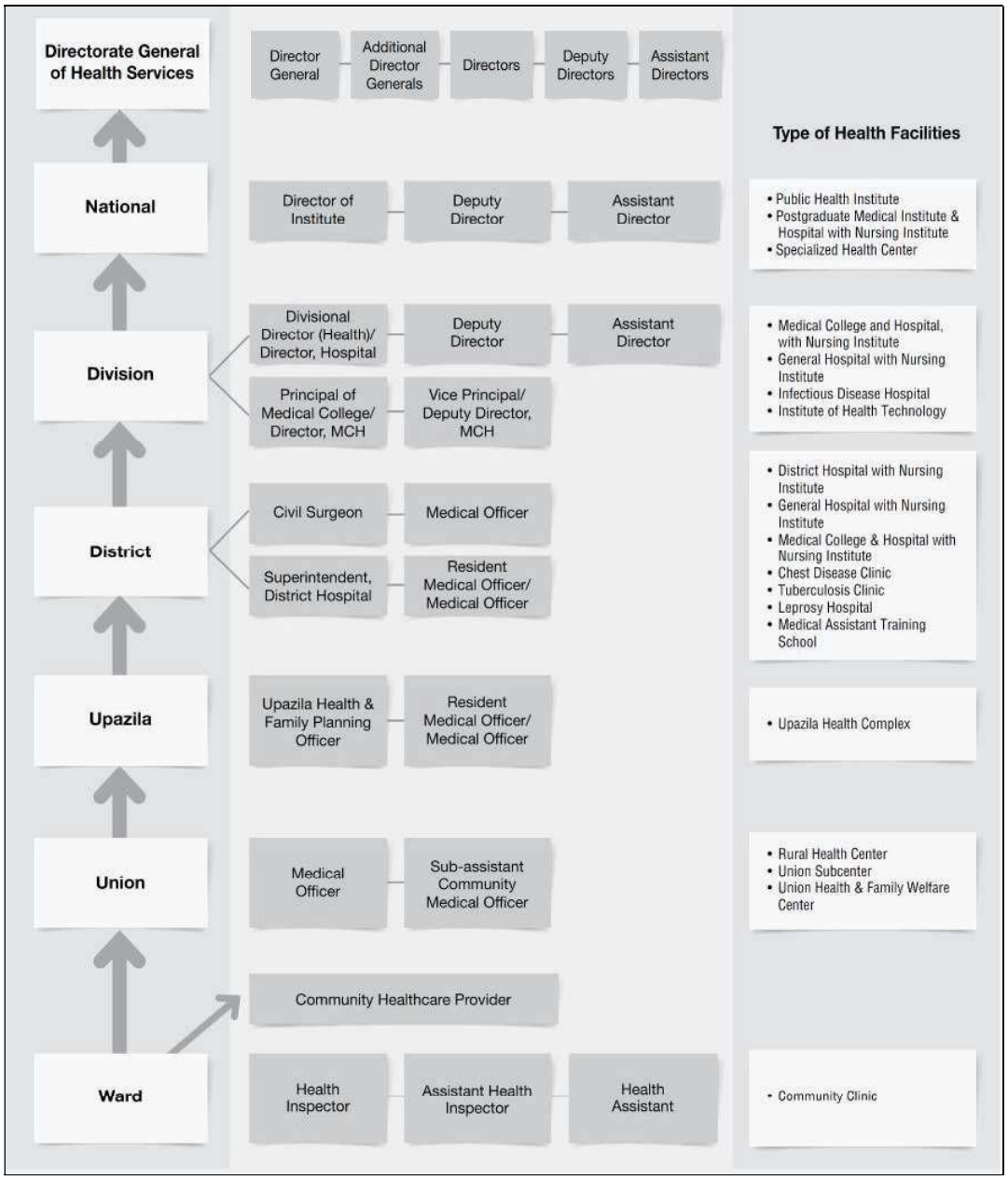


Source: Bangladesh Demographic and Health Survey 2014 (NIPORT, Mitra and Associates, & ICF International, 2016).

1.5.3 Health System in Bangladesh

The health system of Bangladesh is pluralistic, with four key components defining its structure and function: government, the private sector, non-governmental organizations (NGOs) and donor agencies (WHO, 2015b). Government or the public sector sets policy and regulations and provides comprehensive health services, including financing and employing health staff. The Ministry of Health and Family Welfare (MOHFW), with its two arms of Health and Family Planning, manages general health and family planning services through 53 district hospitals, 425 upazilla (or sub-district) health complexes, 1,469 union health and family welfare centres and 12,248 community clinics at the ward level (WHO, 2015b). The Directorate General of Health Services (DGHS), the largest implementing authority under the MOHFW, manages the delivery of health services from national to the community level. The health care infrastructure under the DGHS comprises six tiers: national, divisional, district, upazilla (subdistrict), union, and ward (Figure 1.4).

Figure 1.4: Types of facilities from national to the ward level, with managerial hierarchy in Bangladesh



Source: Health Bulletin 2015 (Ministry of Health and Family Welfare, 2015)

Bangladesh has an extensive primary health care infrastructure in the public sector (NIPORT, Mitra and Associates, & ICF International, 2016). MOHFW has also formulated the National Neonatal Health Strategy and Guidelines for Bangladesh to address the high burden of neonatal morbidity and mortality in the country (Ministry of Health and Family Welfare, 2009). The National Neonatal Health Strategy uses several approaches to improve maternal and neonatal service delivery. The strategy prioritizes

the following: 1) home and community practices to increase awareness of neonatal risks as well as improve behaviors and service delivery; 2) strengthening facility-based health care; 3) improving resources, logistics and supplies to provide adequate neonatal service delivery; 4) integrating multiple programs and partners involved in maternal and neonatal health; and 5) developing new interventions and quality service delivery to contribute to improve newborn health outcomes (Ministry of Health and Family Welfare, 2009).

As a result, the country has made remarkable progress in many areas of child and maternal health. Between the time period 1991 to 2014, under-five mortality has decreased from 133 deaths per 1,000 live births to 46 deaths per 1,000 live births and infant mortality decreased from 87 deaths per 1,000 live births to 38 deaths per 1,000 live births (NIPORT, Mitra and Associates, & ICF International, 2016). Bangladesh thus achieved the MDG 4 in time. However, a very slow pace of reduction in NMR poses considerable challenges to sustaining the achievements of the last decade and remaining on track to meet the country's targets under SDGs.

1.5.4 Significance and Scope of the Research

Like other LMICs, Bangladesh exhibits a high NMR with 28 deaths per 1,000 live births (NIPORT, Mitra and Associates, & ICF International, 2016). The NMR in the country is higher for births at home, where 63% of deliveries take place, with more than half of them assisted by traditional birth attendants (NIPORT, Mitra and Associates, & ICF International, 2016). Only 2% of newborns in Bangladesh who are delivered at home have been found to receive all six recommended elements of ENC practices, namely the use of instruments disinfected using boiling water to cut the umbilical cord, dry cord care, drying of the newborn within five minutes of birth, wrapping of the newborn within five minutes of birth, bathing of the newborn at least 72 hours after birth and the initiation of breastfeeding within one hour of delivery (NIPORT, Mitra and Associates, & ICF International, 2013). Furthermore, only 31% of newborns receive a postnatal check-up from medically trained providers within the first two days of birth and 5% of newborns within 3-41 days, while 63% either do not receive any postnatal check-up, or have received after 41 days of birth (NIPORT, Mitra and Associates, & ICF International, 2016).

One of the reasons for poor uptake of health care services is an insufficient number of skilled health personnel. Bangladesh is included in the list of 57 countries facing a critical shortage of human resources for health (HRH) (Chowdhury et al., 2013; WHO, 2015b). Therefore, examining the impact of different health care practices on neonatal mortality may provide key information for planning and implementing interventions that aim to improve newborn health outcomes in Bangladesh. Such knowledge may also provide useful insights to enhance health workers' practices, build supportive working environments and mobilise community support. Further, an understanding of the key determinants of neonatal mortality in Bangladesh may also be useful to other LMICs with similar health infrastructure.

1.5.5 Research Questions

To address the research aim, this project will address the following research questions:

1) How have the health care providers been trained and supported to deliver integrated packages of postnatal care that have led to improved neonatal outcomes in LMICs?
2) Is there any association between facility-based delivery or the presence of skilled birth attendants and neonatal mortality in Bangladesh? Is the association comparable with that of Nepal and Pakistan, countries with similar health infrastructure to Bangladesh?
3) Is there any association between essential newborn care practices and neonatal mortality in Bangladesh?
4) Is there any association between socio-demographic, antenatal and delivery care factors and the uptake of essential newborn care practices in Bangladesh?
5) Is there any association between antenatal and postnatal care and neonatal deaths in Bangladesh?
6) What is the trend in neonatal mortality and newborn health practices in Bangladesh?

1.6 Thesis Structure

The organisation of this thesis is as follows. In Chapter 1, the background information on global child health issues and determinants of neonatal deaths in LMICs is presented. The research aim, area and questions are also presented here.

In Chapter 2, Section 2.1 reviews the literature relating to HRH and, more specifically, reviews health workforce interventions that aim to reduce neonatal mortality in LMICs. This section investigates Research Question 1. The results of this work have been published in the *Asia Pacific Journal of Public Health*. Section 2.2 provides an overview of the literature review relating to health care and services, which addresses Research Questions 2 to 6, while a detailed review of each of the research questions is presented in the relevant chapters.

Chapter 3 outlines the methodology, data source, ethical considerations and statistical analysis employed in the research.

Chapter 4 to Chapter 8 are independent chapters, each addressing a specific research question. In Chapter 4, the association of facility-based deliveries and/or the presence of SBAs with neonatal deaths are examined for Bangladesh, Nepal and Pakistan. This work is under review for publication in the *International Journal of Evidence-Based Healthcare.*

Chapter 5 provides the association of ENC practices with the mortality of neonates delivered at home in Bangladesh. This work has been published in the *Journal of Perinatology.*

In Chapter 6, analyses are conducted to examine the determinants of ENC practices in Bangladesh; the findings have been published in the journal *Public Health*.

In Chapter 7, a comparison is made between antenatal and postnatal care in reducing neonatal deaths in Bangladesh. This study has been published in the journal *Health Care for Women International.*

In Chapter 8, the changes over time in NMR in Bangladesh and its association with health care practices are investigated. This work has been published in the *WHO South-East Asia Journal of Public Health.*

Chapter 9 discusses the implications of the findings of this research in the context of previous research, identifies limitations of the study, and highlights important issues relevant to the research objectives. Future research directions and recommendations are also highlighted.

1.7 Chapter Summary

This chapter provided detailed background information on newborn health and highlighted neonatal mortality in LMICs, and Bangladesh specifically, as a potential area of investigation. The research aims, area and scope were also outlined. The next chapter provides an extensive review of the literature in the context of the research.

Chapter 2 : Literature Review

This chapter provides a comprehensive overview of literature published over the previous twelve years on health workforce interventions aiming to reduce neonatal mortality in LMICs. Following this, the chapter identifies research gaps for further investigation and presents a framework for the remainder of this research.

2.1 Neonatal Deaths and the Health Workforce in LMICs

The health workforce – people engaged in different actions with the intention of enhancing health – plays an important role in reducing NMR (WHO, 2006a). Critical shortages of the health workforce, an inappropriate skill mix and an inequitable distribution of workers can be responsible for high NMR in LMICs (Ahmed et al., 2011; WHO, 2006a). The provision of universal access to health care services can also be constrained by the quality of care, particularly the skill level of the health workers delivering interventions. Research shows a positive association between the quality of health workers and different health outcomes, including immunization coverage, delivery of primary care, and neonatal, under-five and maternal survival (Ahmed et al., 2011; WHO, 2006a).

However, little is known about what workforce interventions best support health workers to appropriately care for newborns. A review of current literature on health workforce interventions was undertaken to provide insight into ways forward to improve the quality of health care services and information to reduce the NMR in LMICs.

2.1.1 Workforce Interventions to Deliver Postnatal Care to Improve Neonatal Outcomes in Low and Lower-Middle Income Countries: A Narrative Synthesis

A thorough review of the literature was conducted, focusing on workforce interventions that addressed Research Question 1, on how the health workforce have been trained and supported to deliver integrated packages of postnatal care to improve neonatal outcomes in LMICs. This review has been published in the *Asia Pacific Journal of Public Health* and is presented here in this section.

Akter T, Sibbritt D, & Dawson A. (2016). Workforce interventions to deliver postnatal care to improve neonatal outcomes in low-and lower-middle-income countries a narrative synthesis. *Asia Pacific Journal of Public Health*, 28(8), 659-681.

Abstract

Reducing neonatal mortality rates in low and lower-middle income countries (LMICs) requires postnatal interventions to be delivered through an appropriately prepared and supported workforce. This review examines health workforce interventions that deliver integrated packages of postnatal care to improve neonatal outcomes in LMICs. We conducted a structured search of peer-reviewed articles published during 2003–2014 that investigated the delivery of postnatal interventions by formal and lay health workers. We selected 13 studies and analysed them using a narrative synthesis methodology. This review observed a wide divergence among studies regarding the outcomes as well as the approaches and duration of workforce training and staff supervision. Except four, all studies observed a significant reduction in neonatal mortality. On the other hand, teams of lay health workers appear to be more effective in improving neonatal outcomes. Further improvement in the performance of health care providers may require emphasis on workforce interventions such as competency assessment, the acquisition of appropriate skills and supervisory guidelines. Nevertheless, the heterogeneity and limited number of studies do not allow us to arrive at definitive conclusions, and we recommend the need for the harmonization of future studies, with uniformity of outcome measures and cost analyses.

Introduction

Neonatal mortality – death within the first 28 days of life – is a serious global health issue with approximately 2.76 million deaths each year (Liu et al., 2015). Most of these deaths occur in low and lower-middle income countries (LMICs) where antenatal and postnatal care use is low and many women give birth without skilled attendants (WHO & PMNCH, 2011). Thus health interventions, delivered by competent, motivated and well supported health workers can lower the neonatal mortality rates in LMICs (Darmstadt et al., 2005; Haws et al., 2007).

Health interventions that play an essential role in reducing neonatal mortality include antenatal, intrapartum and postnatal care. Key antenatal interventions include tetanus toxoid immunization, syphilis screening and treatment, antibiotics for UTI/STD/asymptomatic bacteriuria, prevention and treatment of pre-eclampsia/eclampsia and malaria prevention (Darmstadt et al., 2005). Studies examining different components of antenatal care have observed a significant reduction in neonatal mortality of up to 69% (Dibley et al., 2012; Nisar & Dibley, 2014b; Nisar et al., 2015; Persson et al., 2012; Titaley et al., 2010; Zeng et al., 2008). Crucial intrapartum interventions include clean delivery practices, vaginal and newborn skin antisepsis, antibiotics for preterm premature rupture of membranes, corticosteroids for preterm labour and caesarean section (Darmstadt et al., 2005). One study has indicated that evidence-based intrapartum intervention packages (at 90% coverage) can prevent two to three times more neonatal deaths than those related to antenatal care (Darmstadt et al., 2005). Finally, important postnatal intervention packages include resuscitation of newborn baby, breastfeeding, prevention and management of hypothermia, kangaroo mother care and community-based pneumonia case management (Darmstadt et al., 2005). Studies indicate that home-based postnatal care interventions can prevent as many as 70% of newborn deaths (Bang et al., 2005c; Baqui et al., 2008a; Bhutta et al., 2011; Kumar et al., 2008).

The available information on the cost effectiveness of interventions at different phases of maternal and child health appear to be scarce in the literature. A study on the WHO Afro-D sub-region (Africa with high child and high adult mortality) showed that the average cost per neonatal and maternal years of life lost and years lived with disability

were USD47.12, USD19.00 and USD17.59 for antenatal, emergency obstetric and essential neonatal care, respectively (Darmstadt et al., 2005). Although, emergency obstetric care and essential neonatal care are only components of intrapartum and postnatal interventions, this indicates that postnatal interventions can be a cost-effective way to reduce neonatal mortality in LMICs.

Postnatal interventions in LMICs are delivered by a wide range of health workers, including community health workers, midwives, nurses and doctors. Increases in the density of such health workers can improve infant and child survival (Speybroeck et al., 2006). Again, health workers' performance can be improved through multifaceted interventions, including the provision of training, written guidelines, and supervision, which however, requires the assessment of training as well as identification of the contextual factors (Allen & Jeffery, 2006; Ariff et al., 2010; McClure et al., 2007; Rowe et al., 2005).

Previous systematic reviews have assessed the effectiveness of community health workers/lay health workers to deliver curative and preventative interventions for maternal and child health (MCH) (Christopher et al., 2011; Gilmore & McAuliffe, 2013; Lewin et al., 2010; Sousa & Mielke, 2015). However, there is no systematic review that examines workforce interventions to best support health workers in delivering postnatal interventions in LMICs. Against this background, this paper reports the findings of a narrative synthesis of peer-reviewed articles to understand the effectiveness of the health workforce. We specifically aim to identify health workforce interventions that deliver integrated packages of postnatal care to improve the neonatal outcomes in LMICs.

Methods

Due to the heterogeneous nature of the methodologies of selected studies, this review used a narrative synthesis approach (Sutherland, 2004). Thus, we report the characteristics, context, quality and findings of selected research papers according to a standard format. Unlike a descriptive review, a narrative synthesis methodology uses a systematic approach involving structured summaries where the extracted data are elaborated upon and then contextualised.

Search protocol

A Population, Interventions, Comparators, Outcomes, Study design (PICOS) question was formed to guide this review (CRD, 2009). The PICOS question was, "how have the health care providers been trained and supervised to deliver integrated packages of postnatal care that have led to improved neonatal outcomes in LMICs?" Health care providers in this review included both formal health workers (e.g. auxiliary nurses and midwives, registered nurses and midwives and doctors) and lay health workers (e.g. community health workers, village health workers and traditional birth attendants). Lay health workers had no formal professional or paraprofessional tertiary education and were usually provided on-the job training by formal health professionals (Lewin et al., 2010).

This study aimed to investigate health workforce interventions such as the provision of training, supervision and teamwork. We considered studies on neonates as participants who were born in LMICs. Relying on the WHO guidelines, an intervention was considered postnatal if it included any intervention listed in Table 2.1 (WHO & PMNCH, 2011). Studies considered in this review investigated the delivery of integrated packages of these interventions. Outcomes of interest included the neonatal mortality rate (NMR) and/or perinatal mortality rate (PMR) or morbidity. Randomized trials, quasi-experimental, observational and descriptive studies were eligible for inclusion.

Table 2.1: Postnatal interventions for newborns

Postnatal interventions (newborn)	Referral level	1st level	Community
Immediate thermal care (immediate drying, warming, skin to skin, delayed bathing)	X	X	X
Initiation of exclusive breastfeeding (within first hour)	X	X	X
Hygienic cord and skin care	X	X	X
Neonatal resuscitation with bag and mask (professional health worker)	X	X	-
Case management of neonatal sepsis, meningitis and pneumonia	X	X	-
Kangaroo mother care for preterm and for less than 2000g babies	X	X	-
Management of newborns with jaundice	X	X	-
Surfactant to prevent respiratory distress syndrome in preterm babies	X	-	-
Continuous positive airway pressure (CPAP) to manage babies with respiratory distress syndrome	X	-	-
Extra support for feeding small and preterm babies	X	X	-
Presumptive antibiotic therapy for newborns at risk of bacterial infection	X	-	-

Source: A global review of the key interventions related to reproductive, maternal, newborn and child health (RMNCH) (WHO & PMNCH, 2011)

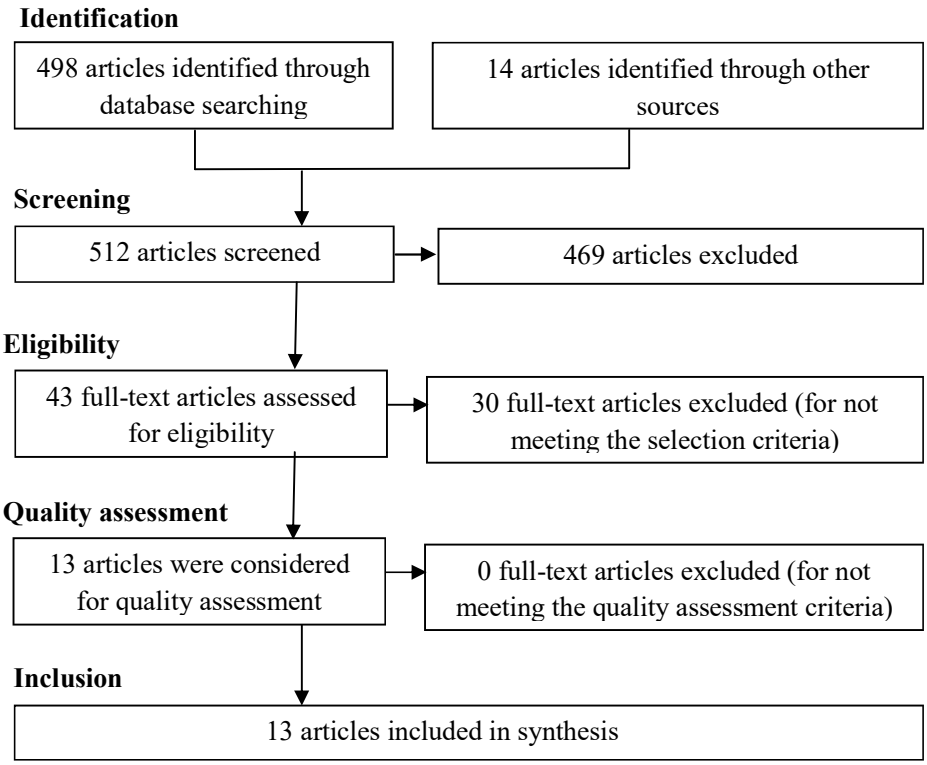
We concentrated only on recent health intervention programs and searched MEDLINE, PubMed, Scopus, ScienceDirect, Web of Science, CINAHL and Google Scholar for peer-reviewed articles in English (Table 2.2). We undertook this review in 2015 and, like other reviews, we selected a 12-year period (2003 to 2014) to ensure an analysis of the most contemporary research (Dawson et al., 2013; Weaver, Dy, & Rosen, 2014). The following Medline MeSH subject headings were used: *postnatal intervention* or *postnatal care* or *postnatal check-up* and *neonates* or *newborn* or *neonatal* and *Developing countries*, and augmented by the key words *health personnel* or *health care provider* or *health worker* or *lay health worker* or *community health worker*.

Table 2.2: Articles retrieved from the databases searched

Database	Articles retrieved
MEDLINE	59
PubMed	124
Scopus	173
ScienceDirect	87
Web of Science	35
CINAHL	20
Google Scholar	14
Total	512

We initially retrieved 512 articles and screened these articles as per the PICOS question. Following the screening process, 43 articles remained and were examined in more detail. At this stage, studies were excluded (listed in Appendix A) for not being an integrated interventions package (10 articles), not satisfying the outcome of interest (12 articles), not associated with the appropriate postnatal intervention (4 articles), no stated intervention (2 articles), being a pilot study (1 article for which the final study was included in this review) and being a study protocol (1 article). Thus, a total of 13 articles were selected for quality assessment. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline was used to report the review process (Figure 2.1) (Moher et al., 2009).

Figure 2.1: Literature review process



Quality assessment

The quality of the selected articles was assessed using the Effective Public Health Practice Project (EPHPP) tool for quantitative studies (EPHPP, 2009). The studies were scored as strong, moderate and weak with regard to the selection bias, study design, confounders, blinding, data collection methods, withdrawals/drop-outs, intervention integrity and analyses. All 13 articles in our analysis either had no (8 studies) or one (5 studies) weak rating in any of the components.

Data extraction and synthesis

Data was extracted systematically from the findings sections of all papers and directed by the PICOS question. The characteristics of all studies, including the context and method were examined. Tables were used to collate aspects of the studies and the contents of the cells discussed among authors. A textual narrative approach to the analysis of the study findings was undertaken as described by Lucas et al. (2007). This involved a commentary approach to the description and comparison of data that was grouped into various categories. These categories (type of health workers, workforce

interventions and postnatal interventions) were informed by the literature and examined in relation to postnatal outcomes (WHO, 2006a; WHO & PMNCH, 2011). Data was then synthesized by combining studies with similar types of health workers and patterns identified across and within articles. All the authors reviewed the selected articles.

Results

All 13 articles in this review are summarized in Table 2.3. Among these articles, nine focused on South Asia (Bang et al., 2005b; Bang et al., 2005c; Baqui et al., 2008a; Baqui et al., 2008b; Baqui et al., 2009c; Bhandari et al., 2012; Bhutta et al., 2011; Darmstadt et al., 2010a; Kumar et al., 2008), three on Africa (Carlo et al., 2010b; Gill et al., 2011; Kirkwood et al., 2013), and one on countries from Asia, Africa and Latin America (Carlo et al., 2010a). The majority of the studies (seven) were cluster randomized controlled trials (RCTs) (Baqui et al., 2008a; Bhandari et al., 2012; Bhutta et al., 2011; Darmstadt et al., 2010a; Gill et al., 2011; Kirkwood et al., 2013; Kumar et al., 2008). Other study designs include cluster controlled trial (not randomized), quasi-experimental and active baseline (an improvement over the before-after controlled study design) (Bang et al., 2005c; Baqui et al., 2008b; Carlo et al., 2010b). The remaining study had two parts; the first part involved a before-after intervention design and the other part relied on a cluster RCT design (Carlo et al., 2010a). In order to deliver the postnatal intervention packages, selected studies involved a range of health workers, including lay health workers (community health workers [CHWs], village health workers [VHWs], traditional birth attendants [TBAs], community mobilisers, unqualified medical practitioners, maternal and child health promotion workers, community-based surveillance volunteers [CBSVs], community health committees [CHCs], and volunteers) and formal health workers (lady health workers [LHWs], auxiliary nurses, midwives, and physicians). We categorized the health workers as individual lay health workers, teams of lay health workers, teams of lay and formal health workers, and formal health workers and then presented our group-wise findings according to workforce interventions, performance including contribution to neonatal health outcomes and cost effectiveness.

Training and supervision

Individual lay health workers

Studies by Gill et al. (2011) and Kirkwood et al. (2013) investigated the contribution of individual lay health workers who conducted home visits in improving neonatal outcomes. Gill et al. (2011) provided a one-week training to TBAs in the intervention area through interactive lectures, demonstrations and small group sessions. Before the final selection, TBAs had to successfully complete a one-on-one skill assessment. On the other hand, Kirkwood et al. (2013) provided a nine-day training including a two-day refresher course to the CBSVs. The CBSVs were supervised through individual monthly meetings and group supervision meetings held every two months.

Teams of lay health workers

Five articles (Bang et al., 2005b; Bang et al., 2005c; Baqui et al., 2008a; Baqui et al., 2009c; Darmstadt et al., 2010a) concentrated on workforce initiatives for teams of lay health workers in which VHWs/CHWs, together with the TBAs, contributed to the delivery of antenatal and postnatal care through home visits. VHWs in Bang et al. (2005c), who had 5 to 10 years of schooling, received a classroom-based 36-day training program that was spread over a year and practiced their skills in the community over the training period (Bang, Bang, & Reddy, 2005). Moreover, they attended a three-day workshop on the management of babies who did not cry/breathe at birth (Bang et al., 2005a). In contrast, TBAs in the study were trained on clean and safe home deliveries and mouth-to-mouth resuscitation of babies (Bang et al., 2005a). CHWs in Baqui et al. (2008a) received a six-week hands-on supervised training course in tertiary-care hospitals and in households. CHWs in Darmstadt et al. (2010a), who had at least 10 years of schooling, received a 36-day training course through didactic sessions, videos and practice on newborn babies in hospitals (Darmstadt et al., 2009a). Moreover, TBAs in these studies received a two-day orientation program on the aim of the study and newborn care practices. Baqui et al. (2008a) additionally employed community mobilisers who promoted birth and newborn-care messages through group meetings and provided refresher training to government health workers. Intensive supervision was provided to health workers in all these studies, which involved the provision of feedback and the evaluation of quality work performance.

Teams of lay and formal health workers

Five studies (Baqui et al., 2008b; Bhandari et al., 2012; Bhutta et al., 2011; Carlo et al., 2010a; Kumar et al., 2008) investigated the contribution of team work by lay and formal health workers in reducing neonatal mortality. Baqui et al. (2008b) investigated services of maternal and child health promotion (*anganwadi*) workers, auxiliary nurse-midwives and community volunteers, of which the first two were government-sponsored functionaries. All three groups in the intervention area that conducted home visits received six days of training on maternal and newborn care.

Bhandari et al. (2012) delivered the intervention through both home visits and health centre and employed CHWs, auxiliary nurse-midwives and government physicians; the former two groups received eight days of training, whereas the latter group received 11 days of training. Private health care providers and TBAs received six hours and four hours of orientation training, respectively. Supervisors, with training on the program and supervision skills, supervised CHWs and nurse-midwives (Bhandari et al., 2012).

The study by Bhutta et al. (2011) employed a team of LHWs, TBAs/*Dais* and CHCs and delivered intervention through home visits. Regular LHWs, who had at least eight years of schooling, received training on preventive newborn care for a period of 15 months, including a three-month didactic training and monthly refresher sessions. The LHWs in the intervention area received an extra six days of training on maternal and newborn care. The LHWs training was supervised by regular LHWs program supervisors and trainers. Community mobilisers from a local university helped LHWs to identify community volunteers, who were encouraged to form CHCs to assist the LHWs (Bhutta et al., 2011).

Birth attendants who made home visits in Carlo et al. (2010a) (TBAs, nurses, midwives, and physicians) received three days of training before the baseline period and three days of ENC training after the baseline period. In the other part of the study, birth attendants additionally received three days training on a modified version of the American Academy of Paediatrics Neonatal Resuscitation Program (Carlo et al., 2010a).

Kumar et al. (2008) employed CHWs, newborn stakeholders and community volunteers. CHWs, who had at least 12 years of schooling, were trained using seven days of classroom and apprenticeship-based field exercises on ENC. In addition to daily

and monthly program meetings, the performances of CHWs were assessed and monitored by supervisors through spot checks during their home visits (Kumar et al., 2008).

Formal health workers

The study by Carlo et al. (2010b) used a train-the-trainer model in which research nurses received a five-day training before the baseline period and a five-day training on ENC after the baseline period; they then trained the practicing midwives with three years of college degree in midwifery and worked in community health clinic. After the completion of the ENC training, research nurses again received five days training on neonatal resuscitation program and subsequently trained the practicing midwives.

Neonatal health outcomes

Individual lay health workers

Gill et al. (2011) reported that trained TBAs, in comparison with existing services, contributed to a 45% reduction in NMR with maximum reductions occurring for the first 24 hours after birth. On the other hand, trained CBSVs in the Kirkwood et al. (2013) contributed to reducing NMR by only 8%, compared with usual services.

Teams of lay health workers

Bang et al. (2005c) observed that VHWs played a significant role in the reduction of NMR by 70%, including early NMR (64%) and PMR (56%), compared to the usual care provided in the local health system. Further, Bang et al. (2005b) reported the contribution of VHWs in the reduction of neonatal morbidities through the delivery of intervention. The mean number of morbidities was found to decrease over the years (49.6%) alongside an increase in the delivery of multiple interventions, indicating a dose-response relationship.

Baqui et al. (2008a) observed a 34% reduction in NMR for the CHWs who worked through home visits but did not observe any contribution of community mobilisers. In a nested study from the same trial, Baqui et al. (2009c) found that case fatality rates were lower for CHW-treated cases (4.4%) compared with that for qualified medical providers (14.2%) and unqualified providers/no treatment (28.5%). Darmstadt et al. (2010a) found no contribution of CHWs (who worked with TBAs).

Teams of lay and formal health workers

Interventions in Baqui et al. (2008b) contributed to reduce NMR by 34% for the women who received at least one postnatal visit within 28 days, compared with the women who received no visit. In contrast, interventions in Carlo et al. (2010a) did not affect either the 7-day NMR or the perinatal death. The study by Bhandari et al. (2012) concluded that the intervention significantly reduced neonatal deaths beyond the first 24 hours after birth by 14%. Interventions in Bhutta et al. (2011) resulted in a significant reduction in NMR (15%) including early NMR (14%). ENC intervention in Kumar et al. (2008) significantly reduced both neonatal deaths (54%) and perinatal deaths (41%). The study also observed a significant reduction in NMR (52%) for the ENC plus ThermoSpot group.

Formal health workers

ENC-trained midwives contributed to reducing the 7-day NMR by 41%, compared to the regular trained midwives (Carlo et al., 2010b). Midwives trained on neonatal resuscitation program also contributed to reducing NMR.

Cost effectiveness

Individual lay health workers

Gill et al. (2011) did not report cost effectiveness of the program but referred to Sabin et al. (2012) which estimated the cost of avoiding each neonatal death as $1,866, $591, and $3,024 for the base, optimistic, and conservative scenario, respectively. Note that Kirkwood et al. (2013) did not report any cost effectiveness analysis.

Teams of lay health workers

An article, not included in this review, revealed that the cost of intervention package delivered by VHWs in Bang et al. (2005c) was US$5.30 per averted newborn death (Bang et al., 1999). Estimated cost of the home-care intervention delivered by CHWs in Baqui et al. (2008a) was US$2,995 (including health-systems strengthening costs) per averted neonatal death. Note that Darmstadt et al. (2010a) did not report any cost of averting neonatal deaths.

Teams of lay and formal health workers

No study in this group included a cost effectiveness analyses.

Formal health workers

The intervention costs of the study by Carlo et al. (2010b) were $208 per life saved (Manasyan et al., 2011).

Table 2.3: Summary of studies included in the synthesis

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
Individual lay health workers				
Reference: Gill et al. (2011) **Objective:** To determine whether training of TBAs to manage several common perinatal conditions could reduce neonatal mortality **Setting:** Lufwanyama, Zambia **Study design:** Cluster RCT	Traditional birth attendants (TBAs)	**Training:** TBAs in intervention area received one week of training on a modified version of the neonatal resuscitation protocol through interactive lectures, demonstrations, small group sessions, and skills practice by infant manikins. They had to complete a one on one skill assessment satisfactorily. Moreover, refresher workshops held in every three to four months throughout the study period in both intervention and control area. TBAs in intervention area needed to attend competency assessment in every workshop. Members of the study team trained TBAs. **Supervision:** Not discussed.	• Promoted a modified version of the neonatal resuscitation protocol • Provided antibiotics (single dose amoxicillin) with facilitated referral of infants to health centres, if needed	1. The NMR reduced by 45% among live born infants delivered by intervention birth attendants than control birth attendants (RR: 0.55; 95% CI: 0.33, 0.90) 2. The maximum reductions in mortality were in the first 24 hours after birth (RR: 0.40; 95%CI: 0.19, 0.83) 3. The NMR during the first week of life reduced by 44% (RR: 0.56; 95% CI: 0.32, 1.01) 4. Deaths due to birth asphyxia, delivered by intervention birth attendants, were reduced by • 63% (RR: 0.37; 95% CI: 0.17, 0.81) and • 81% (RR: 0.19; 95% CI: 0.07, 0.52) within the first two days after birth.
Reference: Kirkwood et al. (2013) **Objective:** To test home-visits strategy by assessing the effect on all-cause NMR and ENC practices **Setting:**	Community-based surveillance volunteers (CBSVs)	**Training:** CBSVs received a total of nine days training over eight months in three phases, including refresher training for two days. **Supervision:** Individual sessions held in each month with observation of home visit and supportive feedback. Group	1. Made two home visits during pregnancy 2. Made three postnatal visits in the first week of neonate's life (day 1,3 and 7) • to promote ENC practices • to weigh and assess babies for danger signs • to refer if required	1. The NMR reduced by 8% in intervention zones compared to control zones (RR: 0.92; 95% CI: 0.75, 1.12) 2. The post day 1 NMR reduced by 15% in intervention zones compared to control zones (RR: 0.85; 95% CI: 0.64,

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
BrongAhafo Region, Ghana **Study design:** Cluster RCT		supervision meetings held in every two months.		1.13)
		Teams of lay health workers		
Reference: Bang et al. (2005c) **Objectives:** To evaluate the effect of home-based neonatal care (HBNC) on neonatal and infant mortality **Settings:** Gadchiroli, India **Study design:** Clustered controlled trial (not randomized)	Female village health workers (VHWs) and trained traditional birth attendants (TBAs)	**Training:** VHWs, who had 5 to 10 years of schooling, received 36 days classroom-based training, spread over a period of one year (three days in each month), including practicum periods in the community (about two births in each month). VHWs also attended a three-day workshop on managing babies who did not cry or breathe at birth, followed by a review and assessment workshop held after two months. TBAs in the intervention villages were trained on clean and safe home delivery, and on mouth-to-mouth resuscitation of babies. **Supervision:** Intensive field supervision (twice in a month) was conducted as an extension of training and support. **Teamwork:** VHWs worked with the cooperation of TBAs.	• Attended delivery, along with the TBAs • Encouraged the family and the TBAs for referral when necessary • Assessed the baby immediately after birth • Managed birth asphyxia, used bag and mask if necessary • Initiated early and exclusive breast feeding • Injected vitamin K1 mg, on the day of birth • Provided thermal care of the neonate • Took extra care if the baby was in high-risk status • Conducted repeated home visits (8–12 times) during neonatal period to ensure breast-feeding, thermal care, hygiene, and to monitor the baby for any infection • Provided early diagnosis and treatment of neonates with sepsis, including administration of two antibiotics – co-trimoxazole and gentamicin • Offered home-based care of	1. The NMR in the intervention area declined from 62 (1993 to 1995) to 25 (2001 to 2003) per 1000 livebirths 2. The NMR increased in the control area from 58 (1993 to 1995) to 64 (2001 to 2003) per 1000 livebirths 3. The reduction in the intervention area compared to the control area was • NMR: 44 points (70%; 95% CI: 59, 81%) • Early NMR: 24 points (64%; 95% CI: 49, 79%) • Late NMR: 20 points (80%; 95% CI: 64, 95%). • Stillbirth rate: 16 points (49%; 95% CI: 31, 66%) • PMR: 38 points (56%; 95% CI: 44, 68%) 4. The cause-specific NMR (1995 to 1996 vs 2001 to 2003) decreased by • Sepsis: 89.8% (95% CI: 78.6, 101.0%) • Asphyxia:53.3% (95% CI: 23.8, 82.8%) • Prematurity: 38.0% (95% CI: 4.3, 71.6%)

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
			LBW or preterm neonates • Performed weekly weighing, problem solving, advising and helping mother • Provided referral service when necessary	
Reference: Bang et al. (2005b) **Objective:** To evaluate the effect of home-based neonatal care (HBNC) on neonatal morbidities by comparing the early period against the late period in the intervention arm of the trial **Settings:** Gadchiroli, India **Study design:** Clustered controlled trial (not randomized)	Female village health workers (VHWs) and trained traditional birth attendants (TBAs)	**Training:** VHWs, who had 5 to 10 years of schooling, received 36 days classroom-based training, spread over a period of one year (three days in each month), including practicum periods in the community (about two births in each month). VHWs also attended a three-day workshop on managing babies who did not cry or breathe at birth, followed by a review and assessment workshop held after two months. TBAs in the intervention villages were trained on clean and safe home delivery, and on mouth-to-mouth resuscitation of babies. **Supervision:** Intensive field supervision (twice in a month) was conducted as an extension of training and support. A physician made home visits (in every fortnight) to all neonates to ensure quality and recorded parallel observations on 119 consecutive neonates independently to evaluate the quality. **Teamwork:** VHWs worked in cooperation with the TBAs.	**In 1995-96,** • Attended home deliveries conducted by TBAs • Made eight home visits to observe the new born baby during the neonate period **In 1996-97** • VHWs advised and demonstrated mothers in neonatal care at home • Identified neonatal morbidities such as asphyxia, prematurity, birth weight <2000 g, sepsis, hypothermia, breast feeding problems, conjunctivitis, skin infections, umbilical sepsis and fever • Treated illnesses appropriately • Advised hospitalisation for serious illness **In 1997-1998** • Introduced intensive health education	1. The mean number of morbidities per 100 neonates in 1995-96, 1996-97 and 1997-98 was 228, 170 and 115 respectively (a reduction of 49.6%; p<0.001) and it showed a dose–response relationship with the multiple interventions in HBNC 2. The change in the incidence of morbidities was • **Infections**: from 61.6 to 27.5 (-55%; p<0.001) • **Care-related morbidities**: (asphyxia, hypothermia, feeding problems) from 48.2 to 26.3 (-45%; p<0.001) • **Low birth weight:** from 41.9 to 35.2 (-16%; p<0.05) • **Preterm birth and congenital anomalies**: remained unchanged

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
Reference: Baqui et al. (2008a) **Objective:** To promote neonatal health through two service-delivery strategies - a home-care model and a community-care model **Settings:** Sylhet, Bangladesh **Study design:** Cluster RCT	Female community health workers (CHWs), female and male community mobilisers and female volunteers (usually TBAs)	**Training:** CHWs received a six weeks hands-on training in a tertiary-care hospital and in households. They again attended a three-day refresher training in middle of the intervention. TBAs in homecare and community care arm had attended a two-day orientation program on cleanliness during delivery, maternal danger signs, and newborn care. Refreshers training were provided to government health workers in homecare, community care and comparison arm. **Supervision:** A group of six to eight CHWs were supervised by each field supervisor who, in every month, spent at least two days with each CHW to provide feedback on their work. In fortnightly group meetings, CHWs could also discuss the field problems with senior supervisors. **Teamwork:** CHWs and community mobilisers worked in homecare arm. Female volunteers were recruited in the community care arm and work with community mobilisers.	**Homecare arm:** **CHWs** • Made both antenatal and postnatal (1st, 3rd, and 7th days of birth) home visits to promote birth and newborn care preparedness • Assessed newborns and classified illnesses as very severe disease (VSD) or possible VSD • Referred to hospitals if required • Treated sick neonates at home if families were unable to comply with referral • Visited daily to complete the 10-day course of antibiotic therapy • Reinforced referral if neonates diagnosed with possible VSD with one sign **Community-care arm:** Female and male community mobilisers promoted birth and newborn-care messages through group meetings only	In the last 6 months of the 30-month intervention, 1. NMR 29.2 per 1000 live births (home-care arm) 2. NMR 45.2 per 1000 live births (community-care) 3. NMR 43.5 per 1000 live births (comparison arms) 4. NMR reduced by 34% in the home-care arm compared to comparison arm (adjusted RR: 0.66; 95% CI: 0.47, 0.93) 5. No mortality reduction was observed in the community-care arm (adjusted RR: 0.95; 95% CI: 0.69, 1.31)
Reference: Baqui et al. (2009c) **Objective:** To assess the relative	Community health workers (CHWs)and community mobilisers	**Training:** CHWs received six weeks hands-on training in a tertiary-care hospital and in households. They also received a three-day refresher training in middle	• Made both antenatal and postnatal (1st, 3rd, and 7th days of birth) home visits to promote birth and newborn care preparedness	1. Case fatality rate for VSD • 4.4% (95% CI: 2.0, 8.2%) if treated by CHWs • 14.2% (95% CI: 9.2, 20.5%) if treated by

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
effectiveness of neonatal infection management by CHWs, qualified medical providers, and other types of providers **Settings:** Sylhet, Bangladesh **Study design:** Nested in cluster RCT		of the intervention. TBAs in homecare and community care arm had received a two-day orientation program on cleanliness during delivery, maternal danger signs, and newborn care. Refreshers training were provided to government health workers. **Supervision:** A group of six to eight CHWs were supervised by each field supervisor who, in every month, spent at least two days with each CHW to provide feedback on their work. In fortnightly group meetings, CHWs could also discuss the field problems with senior supervisors. **Teamwork:** CHWs and community mobilisers worked in home-care arm.	• Assessed newborns and classified illnesses as very severe disease (VSD) or possible VSD • Referred to hospitals if required • Treated sick neonates at home if families were unable to comply with referral • Visited daily to complete the 10-day course of antibiotic therapy • Reinforced referral if neonates diagnosed with possible VSD with one sign	qualified medical providers • 32.0% (95% CI: 14.9, 53.5%) if treated by other unqualified providers • 27.6% (95% CI: 18.5, 38.2%) if no treatment outside home 2. Compared with newborns who received no treatment/treated by untrained providers, the adjusted HR of death during the neonatal period was • 0.22 (95% CI: 0.07, 0.71) if treated by CHWs • 0.61 (95% CI: 0.37, 0.99) if treated by qualified providers
Reference: Darmstadt et al. (2010a) **Objective:** To evaluate a delivery strategy for newborn interventions **Setting:** Mirzapur, Bangladesh **Study design:** Cluster RCT	Community health workers (CHWs) and traditional birth attendants (TBAs)	**Training:** CHWs, who had at least 10 years of schooling, received 36 days training (with six days of field practice) through didactic sessions, videos and practice on sick and healthy newborn babies. CHWs started field work after the evaluation of their assessment on five neonates. They also received refresher training in each fortnight. TBAs in intervention union attended a two-day orientation session on the aims of projects, ENC practices and indicators for referral of newborns and mothers.	• Promoted antenatal care • Promoted birth planning • Distributed clean delivery kit • Promoted new born care preparedness (drying and wrapping the baby, immediate breastfeed after birth, delaying bathing, cord care and monitoring the baby for signs of infection) • Made 3 postnatal home visits (on days 2,5 and 8 after birth) to negotiate preventive care practices • Assessed newborns for illness	Adjusted mortality hazard ratio in the intervention arm, compared to the comparison arm 1. Baseline 1.02 (95% CI: 0.80, 1.30) 2. Endline 0.87 (95% CI: 0.68, 1.12)

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
		Supervision: Field supervisors monitored CHWs through a standard checklist/guideline. In each union, one field supervisor met with six CHWs (about six hours in each fortnight) to review their work and to provide refresher training. **Teamwork:** Not discussed.	and referred to hospitals • Treated sick neonates at home if families refused to be referred	
Teams of lay and formal health workers				
Reference: Baqui et al. (2008b) **Objective:** To assess the impact of the newborn health component of a large-scale community-based integrated nutrition and health program **Settings:** Uttar Pradesh, Northern India **Study design:** Quasi-experimental design	Auxiliary nurse-midwives, maternal and child health promotion (*anganwadi*) workers and community volunteers (change agents)	**Training:** All three types of health workers received a six-day training on the care of mothers and newborn babies. **Supervision:** Not discussed. **Teamwork:** Auxiliary nurse-midwives worked in health centres as well as made home visits. *Anganwadi* workers promoted maternal, newborn and child health from fixed sites (*anganwadi* centre) and through home visits. Change agents worked with *anganwadi* workers.	**Prenatal** Home visit by all three types of health workers to provide counselling on preventive care, nutrition, preparedness for child birth, and health-care utilization for complications **Delivery** Encouraged families to call auxiliary nurse-midwife or trained TBA to attend delivery **Postnatal** Auxiliary nurse-midwife, *aganwadi* worker and change agent visited immediately after birth to provide counselling on breastfeeding, ENC (thermal care, hygiene, clean cord care), maternal and newborn danger signs and health-care utilization, and follow-up visits for sick, premature or LBW neonates	1. NMR decreased by 34% within the group of women who received a postnatal visit within 28 days of delivery (NMR: 35.7; 95% CI: 29.2, 42.1) compared with the group who received no visit (NMR: 53.8; 95% CI: 48.9, 58.8) 2. NMR decreased by 25% within the group of women who received a postnatal visit within 3 days of delivery (NMR: 40.2; 95% CI: 31.8, 48.6) compared with those who did not receive any visit (NMR: 53.8; 95% CI: 48.9, 58.8)

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
Reference: Bhutta et al. (2011) **Objective:** To evaluate the effectiveness of a community-based intervention package, principally delivered through LHWs working with TBAs and CHCs, for reduction of perinatal and neonatal mortality **Settings:** Hala and Matiari sub-districts, Pakistan **Study design:** Cluster RCT	Lady health workers (LHWs), traditional birth attendants (TBAs/Dais) and community health committees (CHCs)	**Training:** Regular LHWs, who had at least 8 years of schooling, received 15 months of training on preventive newborn care, including three months of didactic training and monthly refresher sessions. LHWs in intervention area received an extra six-day training. Dais had an optional three-day training program on basic newborn care. Dias could also attend the community education session led by LHWs. **Supervision:** Regular LHWs program supervisors and trainers supervised the LHWs training. Dias training program was developed with the assistance of Directorate of Health staff. Community mobilisers from Aga Khan University, Pakistan helped LHWs in identifying community volunteers to form CHCs. **Teamwork:** LHWs were encouraged to work with TBAs as a team. CHCs were also formed to work with LHWs to promote maternal and newborn care.	• LHWs visited mothers twice during pregnancy, within 24 hours of birth and on days 3, 7, 14, and 28 after birth • LHWs worked on promotion of antenatal care and maternal health education, use of clean delivery kits, facility births, immediate newborn care, identification of danger signs, and promotion of care seeking	1. NMR reduced by 15% in intervention clusters compared to control groups (RR: 0.85; 95% CI: 0.76, 0.96) 2. Early NMR reduced by 14% in intervention clusters compared to control groups (RR: 0.86; 95% CI: 0.75, 0.98) 3. Stillbirths reduced by 21% in intervention clusters compared to control clusters (RR: 0.79; 95% CI: 0.68, 0.92)
Reference: Bhandari et al. (2012) **Objective:** To evaluate the Indian Integrated Management of Neonatal and Childhood Illness (IMNCI) program,	CHWs (*anganwadi* workers and accredited social health activists), auxiliary nurse midwives and physicians	**Training:** CHWs (*anganwadi* workers and accredited social health activists) and auxiliary nurse midwives received eight days of IMNCI training and physicians from government health system received 11 days of IMNCI training. Private health care providers	1. Improved skills to promote newborn care practices • CHWs were trained to conduct postnatal home visits and women's group meetings 2. Improved case management skills • physicians, nurses and CHWs	1. NMR was lower in the intervention clusters than in control clusters (HR: 0.91; 95% CI: 0.80, 1.03) 2. NMR beyond the first 24 hours of birth was significantly lower in the intervention clusters than in

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
which integrates improved treatment of illness for children with home visits for newborn care, to inform its scale-up **Setting:** Haryana, India **Study design:** Cluster RCT		and TBAs received six hours and four hours of orientation training respectively. **Supervision:** Supervisors, trained in IMNCI and supervision skill, supervised CHWs and nurses. **Teamwork:** *Anganwadi* workers and accredited social health activists, auxiliary nurse midwives and physicians worked together.	were trained to treat or refer sick newborns and children 3. Strengthened health system to implement IMNCI • supply of drugs and supervision were strengthened	control clusters (HR: 0.86; 95% CI: 0.79, 0.95) 3. The perinatal mortality rate was significantly lower in the intervention clusters (HR: 0.89; 95% CI: 0.78, 1.00); the effect of the intervention was seen only for home births 4. A significant interaction found between the place of birth and the effect of the intervention for all mortality outcomes except post-NMR
Reference: Carlo et al. (2010a) **Objective:** To evaluate the community-based interventions design to reduce the number of neonatal/perinatal deaths **Setting:** Rural communities in six countries (Argentina, Democratic Republic of Congo, Guatemala, India, Pakistan, and Zambia) **Study design:** Before-and-after design (WHO ENC Course) Cluster RCT (Neonatal Resuscitation Program)	Birth attendants (traditional birth attendants, nurses, midwives, and physicians)	**Training:** **ENC course:** Used a train-the-trainer model, in which experienced trainers first trained master trainers who then trained community coordinators (physicians or nurses). Next, the community coordinators trained the birth attendants before the baseline period. After the baseline period, an experienced WHO trainer taught master trainers on ENC. The master trainers then taught the community coordinators who finally trained the birth attendants. Birth attendants received a three-day training on the differentiation between still birth and early neonatal death, clinical assessments like Apgar scores and adult education before the baseline period and a three-day training on ENC after the baseline data collection. **Neonatal Resuscitation Program:**	• WHO ENC promotion (focuses on routine neonatal care, resuscitation, thermoregulation, breast-feeding, skin-to-skin care, care of the small baby, and common illnesses) • Modified version of the American Academy of Paediatrics Neonatal Resuscitation Program (except in Argentina)	**1. ENC course:** • No significant reduction in 7-day NMR compared to the baseline period for all causes (RR: 0.99; 95% CI: 0.81, 1.22) or perinatal death • Significant reduction in the rate of stillbirth (RR: 0.69; 95% CI: 0.54, 0.88) **2. Neonatal Resuscitation Program:** • Compared with control clusters, no reduction in 7-day NMR, perinatal death and stillbirth

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
		An experienced trainer trained the birth attendants and they received three days of in-depth hand-on training on modified version of the American Academy of Paediatrics Neonatal Resuscitation Program. Refresher course was conducted six months later. **Supervision:** Not discussed. **Teamwork:** Not discussed.		
Reference: Kumar et al. (2008) **Objective:** To develop an intervention of behaviour change management, with a focus on prevention of hypothermia, aimed at modifying practices and reducing neonatal mortality **Setting:** Uttar Pradesh, India **Study design:** Cluster RCT	CHWs (*Saksham Sahayaks*), newborn stakeholders (traditional newborn care providers and birth attendants, unqualified medical practitioners, and health system workers) and community volunteers (*Saksham Karta*)	**Training:** CHWs, who had at least 12 years of schooling, received both classroom-based and apprenticeship-based field training over seven days on knowledge, attitudes, and practices related to ENC. Suitable CHWs were closely mentored by regional program supervisors for an additional week before the final selection. **Supervision:** Regional program supervisors, responsible for 6-7 CHWs, supervised their team through daily meetings. Moreover, CHWs performances were assessed and monitored by supervisors through spot checks during home visits. Besides these, all regional teams met on monthly program meetings to share their experiences. **Teamwork:**	**Intervention group-1:** Received preventive package of interventions for ENC, through two antenatal and two postnatal home visits, which included • birth preparedness • clean delivery • cord care and skin care • thermal care (STS) • breastfeeding promotion • danger sign recognition • care seeking from trained provider **Intervention group-2**: Received an ENC package similar to group-1 but additionally used a liquid crystal hypothermia indicator (ThermoSpot)	Compared with controls, 1. NMR was reduced by 54% in the ENC intervention only (RR: 0.46; 95% CI: 0.35, 0.60) 2. NMR was reduced by 52% in the ENC plus ThermoSpot intervention group (RR: 0.48; 95% CI: 0.35, 0.66) 3. Perinatal deaths was reduced by 41% in the ENC intervention only (RR: 0.59; 95% CI: 0.47, 0.74) 4. Perinatal deaths were reduced by 38% in the ENC plus ThermoSpot intervention group (RR: 0.62; 95% CI: 0.47, 0.81)

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
		Newborn-care stakeholders and community volunteers enhanced and supported the activities of the CHWs. Newborn-care stakeholders within the community had access to newborn babies during the first 4-9 days after delivery for working with families to ensure adherence with the intervention. Community volunteers played a role in program advocacy and to support families with knowledge, skills, and resources. CHWs met with newborn-care stakeholders and community volunteers to discuss experiences and strategies on separate monthly meetings.		
		Formal health workers		
Reference: Carlo et al. (2010b) **Objective:** To examine the effectiveness of two training programs on the incremental reduction of 7-day NMRs for low-risk institutional deliveries **Setting:** Community health clinics in Zambia (Lusaka and Ndola) **Study design:** The active baseline design (an improvement over the before/after controlled study	Midwives who performed deliveries in low-risk, first-level, urban, community health clinics	**Training:** **ENC course:** Used a train-the-trainer model, in which experienced researchers first trained midwives to become research nurses who then trained practicing midwives (with 3 years college degree in midwifery) before the baseline period. A WHO officer and two experienced trainers taught research nurses on ENC course after the baseline data collection. These research nurses then trained all practicing midwives. Research nurses received five days training on research concepts, differentiation between still birth and early neonatal death, clinical	• WHO ENC course (universal precautions and cleanliness, routine neonatal care, resuscitation, thermoregulation, breastfeeding, kangaroo care, care of small infants, and common illnesses) • American Academy of Paediatrics Neonatal Resuscitation Program (in-depth basic resuscitation)	1. All-cause, 7-day NMR decreased by 41% after ENC training (RR: 0.59; 95% CI: 0.48, 0.77); decreases in rates of deaths attributable to birth asphyxia and infection 2. The 7-day NMR was decreased further after NRP training, after correction for loss to follow-up monitoring.

Reference, objective, setting and study design	Types of health worker	Workforce interventions	Postnatal interventions	Findings
design)		assessments and Apgar scores before baseline period and five days training on ENC course after baseline data collection. Research nurses then trained practicing midwives (three years college degree in midwifery). **Neonatal Resuscitation Program (NRP):** After post ENC training data collection, an experienced instructor trained the research nurses on NRP and subsequently they trained all midwives. Research nurses received five days in-depth hand-on training on NRP and then they trained practicing midwives. **Supervision:** Not discussed.		

Discussion

Our systematic review revealed a range of workforce interventions to improve health workers' performance in delivering postnatal care to neonates. Key findings in this review demonstrated the differences among the studies with regard to the workforce interventions and associated neonatal outcomes (Table 2.4). For example, the duration of the training programs ranged from six days to six weeks, dispersed over a maximum period of 12 months. Differences in approaches to training, supervision and assessment as well as in the components of postnatal interventions also observed resulted in the heterogeneity in findings across studies. Four studies did not find any significant impact, while others observed a significant reduction in NMR, with the rates varying from 8% to 70%.

This review has investigated issues related to workforce intervention for different health cadres in LMICs which may have contributed to improved neonatal health. Such issues include training, supervisory mechanism, competency assessment, appropriate skills and workforce challenges. Below, in connection to the studies under review, we categorize these issues as workgroup specific and general and discuss each separately.

Table 2.4: Key findings of studies from this review

Reference	Types of health workers	Workforce intervention			Postnatal intervention					NMR reduction
		Training	Super-vision	Team work	A*	B*	C*	D*	E*	%
Gill et al. (2011)	TBAs	✓				✓				45
Kirkwood et al. (2013)	CBSVs	✓	✓		✓					8
Bang et al. (2005c)	VHWs & TBAs	✓	✓	✓	✓					70
Bang et al. (2005b)	VHWs & TBAs	✓	✓	✓	✓					50**
Baqui et al. (2008a)	CHWs, community mobilisers & volunteers	✓	✓	✓	✓					34
Baqui et al. (2009c)	CHWs & community mobilisers	✓	✓	✓	✓					4***
Darmstadt et al. (2010a)	CHWs & TBAs	✓	✓		✓					13
Baqui et al. (2008b)	Auxiliary nurse-midwives, *anganwadi* workers & volunteers	✓		✓	✓					34****
Bhutta et al. (2011)	LHWs, TBAs /Dais & CHCs	✓	✓	✓	✓					15
Bhandari et al. (2012)	CHWs, auxiliary nurse midwives & physicians	✓	✓	✓				✓		9
Carlo et al. (2010a)	Birth attendants	✓					✓			1
Kumar et al. (2008)	CHWs, newborn stakeholders & community volunteers	✓	✓	✓					✓	Group1: 54 Group 2: 52
Carlo et al. (2010b)	Midwives	✓					✓			41

Note: * A: Promoted a variety of ENC practices and referred newborn babies to health centres, if assessed danger sign; B: Promoted a modified version of neonatal resuscitation protocol and provided antibiotics with referral to health centres, if needed; C: Promoted WHO ENC practices and a modified version of the American Academy of Paediatrics Neonatal Resuscitation Protocol; D: Promoted newborn care practices, improved case management skills and strengthened health system; E: Intervention group 1: Promoted ENC practices, Intervention group 2: Promoted ENC plus ThermoSpot intervention

** Morbidity reduction

*** Case fatality rate - treated by CHWs

****Within the group of women who received a postnatal visit within 28 days of delivery

Workgroup-specific issues of health intervention

Individual lay health workers

Gill et al. (2011) employed a single-component intervention (training only), with competency assessment of TBAs and observed a significant reduction in NMR. In contrast, Kirkwood et al. (2013) employed a multifaceted intervention (training and supervision) without competency assessment and did not observe any significant

reduction in NMR. It indicates that, while individual lay health workers might play a role in the reduction of neonatal mortality, a better outcome might require competency assessment of the workforce. Nevertheless, the functions of the lay health workers and the delivered interventions were different between these two studies. Therefore, studies with more comparable interventions are essential to conclude about their effect on neonatal health.

Teams of lay health workers

All five articles in this group were supported by multifaceted workforce interventions, but only Darmstadt et al. (2010a) considered the assessment of health worker competencies and used standardized guideline-based supervisory monitoring. However, the study found no impact of intervention, which could be a result of a skill mismatch, where CHWs received training in the management of neonatal sepsis, while around 60% of deaths in the intervention area were attributed to birth asphyxia and prematurity. In contrast, Baqui et al. (2008a) found a significant reduction on NMR using a package of similar interventions. All other articles also observed a significant improvement in neonatal morbidity and mortality. Thus, the evidence supports the hypothesis that teams of lay health workers can contribute to preventing neonatal morbidity and mortality. This may be due to a shortage of adequately trained formal health workers in LMIC. However, studies identified here need to be examined carefully before designing any workforce intervention.

Teams of lay and formal health workers

Among the five studies in this group, three employed multifaceted interventions (Bhandari et al., 2012; Bhutta et al., 2011; Kumar et al., 2008) while two included a single-component intervention (Baqui et al., 2008b; Carlo et al., 2010a). None of these studies described the assessment of health worker competencies and guidelines for supervisory activities and only two studies observed a significant reduction in the overall NMR (Bhutta et al., 2011; Kumar et al., 2008). A lack of linkages between lay and formal health workers might be responsible for the weak performance of the team. Again, comparable studies are needed to make any conclusive remarks as the team composition and workforce interventions varied across the studies.

Formal health workers

Only Carlo et al. (2010b) employed formal health workers and used a single-component workforce intervention. It suggests that training may play a significant role in reducing NMR. Although the finding is consistent with a recent study on midwifery training, more comparable studies are required to conclude about the role of training (Manasyan et al., 2011).

General issues of health workers intervention

Multifaceted interventions are more effective in improving performance compared with single-component interventions (Rowe et al., 2005; Tran et al., 2014). With the exception of four studies, all studies included in this review employed multifaceted interventions. Supervision is also important to improve health workers' performance (Frimpong et al., 2011; Haines et al., 2007; Hill et al., 2014; Rowe et al., 2005). Quality supervision that involves support, feedback and monitoring can improve health workers' job satisfaction, motivation and professional development, which ultimately enhances their performances (Hill et al., 2014; Rowe et al., 2005). A majority of the studies in our review emphasized intensive supervision that included feedback and evaluation of work quality. Although guideline and staff participation can improve supervision, only the study by Darmstadt et al. (2010a) mentioned this (Haines et al., 2007).

Competency assessment was also an important component of training packages (Tran et al., 2014). In our review, only two studies (Darmstadt et al., 2010a; Gill et al., 2011) reported the use of competency assessment of health workers as part of CHWs and TBAs training. A recent review on training resources for CHWs found that nearly half of the training packages did not include competency assessment (Tran et al., 2014). Acquisition of appropriate knowledge and skills required to detect relevant clinical signs may enhance the performance of health workers. A mismatch between clinical skills training and health needs could have occurred in the study by Darmstadt et al. (2010a), which found no impact of intervention.

Workforce challenges in LMICs such as heavy workloads, night visits, travelling outside the local area, familial opposition and dissatisfaction with pay might affect the performance of health workers directly and indirectly through workforce turnover

(Rahman et al., 2010; Willis-Shattuck et al., 2008). For example, CHWs in Baqui et al. (2008a) only attended 5% of deliveries due to a lack of timely communication, long commuting distances and a high volume of work. Similar difficulties were also experienced by CHWs in Darmstadt et al. (2010a).

Limitations

We identified a number of limitations of this review. First, little information was available on how the workforce was managed in some studies included in this review. Some articles do not describe workforce interventions in detail and information concerning workforce components was sought from related papers that reported on other aspects of the same study. Second, most of the studies did not include an analysis of the cost of the interventions and programs that are required to identify what workforce interventions are cost effective in delivering postnatal care. As a result, we focused on neonatal health outcomes to draw conclusions about the effect of interventions. Third, selected studies may suffer from a publication bias because most of the published studies only report positive results. Finally, the results rely on a relatively small number of studies, which makes it difficult to draw definite conclusions.

Conclusions

This review examines a variety of health workforce interventions with a range of health workers, trained in delivering postnatal care for improving neonatal health in LMICs. We find that further improvements in the performance of health care providers require more emphasis on workforce intervention components such as competency assessment, acquisition of appropriate skills, quality supervision and workforce challenges. In our review, teams of lay health workers appear to be more effective in reducing neonatal mortality and morbidity compared with other groups. This indicates that employing lay health workers can be a good way to combat neonatal mortality in a weak health system. However, the heterogeneity and limited number of available studies do not allow definitive conclusions to be drawn regarding the impact of workforce interventions.

This review highlights the importance of training guidelines and points towards the need for developing standard training guidelines for the health workers. We also recommend including cost-benefit analyses in future studies, which are important to

evaluate and compare the effectiveness of the interventions. Harmonization of future studies, with uniformity of outcome measures and cost analyses, can be useful in comparing the impact of workforce interventions in reducing the neonatal mortality in LMICs. This would allow data from different sources to be combined and compared to facilitate a better understanding of appropriate intervention measures. A useful point is that most of the studies in this review rely on the Asia-Pacific region, which makes our study more relevant for designing workforce interventions in the area, where a vast number of neonatal mortality occurs.

Appendix A

Table A.1: Characteristics of excluded studies

Reference	Reasons for exclusion
1. Ahmed S, Mitra SN, Chowdhury AM, Camacho LL, Winikoff B, Sloan NL. Community Kangaroo Mother Care: implementation and potential for neonatal survival and health in very low-income settings. *J Perinatol*. 2011; 31:361-7. 2. Arifeen SE, Mullany LC, Shah R, et al. The effect of cord cleansing with chlorhexidine on neonatal mortality in rural Bangladesh: a community-based, cluster-randomised trial. *Lancet*. 2012; 379:1022-8. 3. Jokhio AH, Winter HR, Cheng KK. An intervention involving traditional birth attendants and perinatal and maternal mortality in Pakistan. *N Engl J Med*. 2005; 352:2091-9. 4. Lawn JE, Mwansa-Kambafwile J, Horta BL, Barros FC, Cousens S. 'Kangaroo mother care' to prevent neonatal deaths due to preterm birth complications. *Int J Epidemiol*. 2010; 39:i144-i54. 5. Mullany LC, Darmstadt GL, Khatry SK, et al. Topical applications of chlorhexidine to the umbilical cord for prevention of omphalitis and neonatal mortality in southern Nepal: a community-based, cluster-randomised trial. *Lancet*. 2006; 367:910-8. 6. Mullany LC, Katz J, Li YM, et al. Breast-feeding patterns, time to initiation, and mortality risk among newborns in southern Nepal. *J. Nutr*. 2008; 138:599-603. 7. Rao P, Udani R, Nanavati R. Kangaroo mother care for low birth weight infants: a randomized controlled trial. *Indian pediatrics*. 2008; 45. 8. Sharma D, Gathwala G. Impact of chlorhexidine cleansing of the umbilical cord on cord separation time and neonatal mortality in comparison to dry cord care-a nursery-based randomized controlled trial. *J Matern Fetal Neonatal Med*. 2013:1-4. 9. Soofi S, Cousens S, Imdad A, Bhutto N, Ali N, Bhutta ZA. Topical application of chlorhexidine to neonatal umbilical cords for prevention of omphalitis and neonatal mortality in a rural district of Pakistan: a community-based, cluster-randomised trial. *Lancet*. 2012; 379:1029-36. 10. Tielsch JM, Darmstadt GL, Mullany LC, et al. Impact of newborn skin-cleansing with chlorhexidine on neonatal mortality in southern Nepal: a community-based, cluster-randomized trial. *Pediatrics*. 2007; 119:e330-e40.	Not being an integrated interventions package
4. Azad K, Barnett S, Banerjee B, et al. Effect of scaling up women's groups on birth outcomes in three rural districts in Bangladesh: a cluster-randomised controlled trial. *Lancet*. 2010; 375:1193-202. 5. Darmstadt GL, Saha SK, Ahmed A, et al. Effect of topical treatment with skin barrier-enhancing emollients on nosocomial infections in preterm infants in Bangladesh: a randomised controlled trial. *Lancet*. 2005; 365:1039-45. 6. Darmstadt GL, Saha SK, Ahmed ANU, et al. Effect of skin barrier therapy on neonatal mortality rates in preterm infants in Bangladesh: a randomized, controlled, clinical trial. *Pediatrics*. 2008; 121:522-9. 7. Manandhar DS, Osrin D, Shrestha BP, et al. Effect of a participatory intervention with women's groups on birth outcomes in Nepal: cluster-randomised controlled trial. *Lancet*. 2004; 364:970-9.	Not associated with the appropriate postnatal intervention

Reference	Reasons for exclusion
1. Baqui A, Arifeen S, Darmstadt G, et al. Differentials in neonatal mortality in two adjacent rural areas of Bangladesh: lessons for neonatal health interventions. *Global Public Health*. 2008; 3:366-82. 2. Darmstadt GL, Hussein MH, Winch PJ, Haws RA, Gipson R, Santosham M. Practices of rural Egyptian birth attendants during the antenatal, intrapartum and early neonatal periods. *J Health Popul Nutr*. 2008; 26:36.	No stated intervention
1. Baqui AH, Rosecrans AM, Williams EK, et al. NGO facilitation of a government community-based maternal and neonatal health programme in rural India: improvements in equity. *Health Policy Plan*. 2008; 23:234-43. 2. Bari S, Mannan I, Rahman MA, et al. Trends in use of referral hospital services for care of sick newborns in a community-based intervention in Tangail District, Bangladesh. *J Health Popul Nutr*. 2006; 24:519 - 29. 3. Callaghan-Koru JA, Seifu A, Tholandi M, et al. Newborn care practices at home and in health facilities in 4 regions of Ethiopia. *BMC Pediatr*. 2013; 13:198. 4. Darmstadt G, Kumar V, Yadav R, et al. Introduction of community-based skin-to-skin care in rural Uttar Pradesh, India. *J Perinatol*. 2006; 26:597-604. 5. Darmstadt GL, El Arifeen S, Choi Y, et al. Household surveillance of severe neonatal illness by community health workers in Mirzapur, Bangladesh: coverage and compliance with referral. *Health Policy Plan*. 2010; 25:112-24. 6. Darmstadt GL, Saha SK, Choi Y, et al. Population-based incidence and etiology of community-acquired neonatal bacteremia in Mirzapur, Bangladesh: an observational study. *J Infect Dis*. 2009; 200:906-15. 7. Kumar V, Kumar A, Das V, et al. Community-driven impact of a newborn-focused behavioral intervention on maternal health in Shivgarh, India. *Int J Gynaecol Obstet*. 2012; 117:48-55. 8. McClure EM, Carlo WA, Wright LL, et al. Evaluation of the educational impact of the WHO Essential Newborn Care course in Zambia. *Acta Paediatr*. 2007; 96:1135-8. 9. Mannan I, Rahman SM, Sania A, et al. Can early postpartum home visits by trained community health workers improve breastfeeding of newborns? *J Perinatol*. 2008; 28:632-40. 10. Nalwadda CK, Waiswa P, Kiguli J, et al. High Compliance with Newborn Community-to-Facility Referral in Eastern Uganda:. An Opportunity to Improve Newborn Survival. *PloS One*. 2013; 8:e81610. 11. Opiyo N, Were F, Govedi F, Fegan G, Wasunna A, English M. Effect of newborn resuscitation training on health worker practices in Pumwani Hospital, Kenya. *PLoS One*. 2008; 3:e1599. 12. Syed U, Asiruddin S, Helal MS, Mannan II, Murray J. Immediate and early postnatal care for mothers and newborns in rural Bangladesh. *J Health Popul Nutr*. 2006; 24:508.	Not satisfying the outcome of interest
1. Bhutta ZA, Memon ZA, Soofi S, Salat MS, Cousens S, Martines J. Implementing community-based perinatal care: results from a pilot study in rural Pakistan. *Bull World Health Organ*. 2008; 86:452-9.	Pilot study for which the final study was included in this review
1. Mullany LC, El Arifeen S, Winch PJ, et al. Impact of 4.0% chlorhexidine cleansing of the umbilical cord on mortality and omphalitis among newborns of Sylhet, Bangladesh: design of a community-based cluster randomized trial. *BMC Pediatr*. 2009; 9:67.	Study protocol

2.2 Neonatal Deaths and the Health Care Services in LMICs

This section provides a summary of the literature reviewed for Research Questions 2 to 6, which are associated with delivery of health services related to newborn health. Detailed literature reviews addressing each of the research questions are presented in Chapters 4 to 8, respectively.

2.2.1 Neonatal Deaths and Facility Delivery and/or Skilled Birth Attendance in LMICs

Emergency obstetric care and the provision of SBAs are considered important in reducing neonatal mortality. In countries with high neonatal mortality, around 50% of all births are delivered without any skilled attendant and most early neonatal mortality (i.e. deaths during the first week of life) occurs as a result of intrapartum-related complications (Lawn et al., 2009; Lohela, Campbell, & Gabrysch, 2012). Therefore, facility-based delivery and the services of SBAs can be vital in managing complications such as preterm birth and neonatal sepsis, and thus improve early neonatal survival (Lawn et al., 2009; Lohela, Campbell, & Gabrysch, 2012). However, studies have observed a heterogeneous effect while comparing the impact of facility-based delivery on neonatal deaths in LMICs (Feng et al., 2011; Lohela, Campbell, & Gabrysch, 2012; Målqvist et al., 2010; Ronsmans et al., 2010; Titaley, Dibley, & Roberts, 2012; Tura, Fantahun, & Worku, 2013). A mixed finding is also reported when examining the impact of the services of SBAs on the mortality of home-born neonates in LMICs (Gill et al., 2011; Titaley, Dibley, & Roberts, 2012). Thus, it is important to examine how NMRs in LMICs are affected by facility-based delivery and by the assistance of SBAs.

2.2.2 Neonatal Deaths and Essential Newborn Care in LMICs

The first few hours and days of life are the most vulnerable time for newborns and provision of ENC can save many lives (UNICEF, 2016). This is particularly relevant for low-income countries, where most deliveries occur at home and usually in unhygienic conditions (Bhutta et al., 2014; Lawn et al., 2014). It has been estimated that around 40% of neonatal deaths can be averted through ENC interventions coupled with skilled attendance at birth (Bhutta et al., 2014; UNICEF, 2016). Information on ENC was not available in the previous rounds of the nationally representative Demographic and Health Surveys (DHS). Fortunately, the recent inclusion of such information in the DHS

has created opportunities to investigate the impact of ENC on child health. Surprisingly, no existing studies have investigated the contribution of different components of ENC interventions in reducing neonatal mortality.

2.2.3 The Determinants of ENC Practices in LMICs

Despite the known association between ENC practices and neonatal deaths, coverage of these practices is particularly low for babies born at LMICs (Khanal et al., 2014; Onalo, 2013; Pagel et al., 2014; Saaka & Iddrisu, 2014; Shamba et al., 2014). A recent study on Bangladesh, Nepal and India observes that the lowest coverage of ENC is at home deliveries with unskilled birth attendants (Pagel et al., 2014). Even for institutional deliveries, the coverage of some components of ENC practice, such as immediate breastfeeding and thermal care, is low (20% to 70%) (Pagel et al., 2014). Factors affecting the implementation of ENC vary across countries or even regions within a country (Baqui et al., 2007; Holman & Grimes, 2001; Khanal et al., 2014; Victor et al., 2013). Therefore, country-specific analysis can be useful in identifying the determinants of ENC practices. Such analysis may assist in improving the ENC coverage for home deliveries, which eventually can contribute to saving newborn lives.

2.2.4 Neonatal Deaths and the Impact of Antenatal and Postnatal Care in LMICs

Antenatal and postnatal care are instrumental in reducing the risk of maternal and neonatal deaths (Carroli et al., 2001; Chen et al., 2007; Raatikainen, Heiskanen, & Heinonen, 2007; WHO & UNICEF, 2009; WHO & PMNCH, 2011). Antenatal care services, which mothers receive during pregnancy, include the routine identification and management of obstetric complications, the provision of tetanus toxoid immunization and iron and folic acid supplements and health education and counselling on key intrapartum and postnatal issues (WHO, 2006b). Studies have observed a significantly positive association between iron and folic acid supplements and reduced maternal anaemia, which helps in reducing preterm delivery and increasing infant birth weight, thereby reducing neonatal deaths (Dibley et al., 2012; Nisar & Dibley, 2014b; Nisar et al., 2015; Pena-Rosas & Viteri, 2006; Titaley et al., 2010; Titaley & Dibley, 2012; Zeng et al., 2008). Antenatal tetanus toxoid immunization also plays a role in reducing deaths due to neonatal tetanus, which is particularly true for LMICs where deliveries are

conducted at home in unhygienic settings and non-sterile instruments are used to cut the umbilical cord (Blencowe et al., 2010). Different components of antenatal care have been observed to collectively reduce NMR by up to 69% (Dibley et al., 2012; Nisar & Dibley, 2014b; Nisar et al., 2015; Persson et al., 2012; Titaley et al., 2010; Zeng et al., 2008).

Postnatal care provides an opportunity to promote preventive and curative newborn care and thus reduce neonatal deaths (Baqui et al., 2008a; Baqui et al., 2009a; Blencowe et al., 2011; Darmstadt et al., 2005; Kumar et al., 2008). Since around three-quarters of all neonatal deaths occur during the first week of life, studies have observed that home-based early postnatal care interventions can prevent up to 61% of newborn deaths in high mortality settings (Bang et al., 1999; Baqui et al., 2008a; Bhutta et al., 2011; Kumar et al., 2008; WHO & UNICEF, 2009). However, none of the studies controlled for the impact of antenatal care while examining the contribution of postnatal care. This is important because the impact of antenatal care services may modify the impact of postnatal care (Titaley & Dibley, 2012).

2.2.5 Trends in Neonatal Mortality and Newborn Health Practices in Bangladesh

Bangladesh has made major improvements in health outcomes over the past two decades, with falls in maternal, infant and under-five mortality rates (WHO, 2015b). With regard to the MDG, Bangladesh has already achieved the target of reducing infant and under-five mortality (NIPORT, Mitra and Associates, & ICF International, 2016). These outcomes have been achieved by improvements in the coverage of key interventions such as delivery in a health facility, childhood immunization and uptake of oral rehydration therapy for diarrhoea (Chowdhury et al., 2013; El Arifeen et al., 2013; WHO, 2015b). Despite these improvements, NMR is still high in Bangladesh and the country is struggling to maintain its achievements thus far and is unlikely to achieve the SDG targets by 2030 (UNDP, 2016). An analysis of overall NMR, disaggregated by region and/or demographic and socioeconomic characteristics, can highlight the relative importance of different health care practices in reducing the NMR in Bangladesh.

2.3 Chapter summary

Chapter 2 reviewed literature relating to health workforce interventions when delivering postnatal care services to reduce neonatal deaths. This review observed a diversity of study outcomes as well as the approaches and duration of workforce training and staff supervision. This chapter also highlighted the research gaps that exist in the area of health care services related to antenatal, intrapartum and postnatal care in reducing NMR. The chapter summarized the importance of disaggregated analysis of changes over time in NMRs and health care practices in Bangladesh. In the next chapter, the methodology and data used to investigate the research questions are discussed.

Chapter 3 : Methodological Overview

This chapter provides an overview of the methodology used in this research while a detailed methodology that addresses each of the research questions (see Section 1.5.5) is presented in the relevant chapters that follow. This chapter also describes the data source, sample design, questionnaire items of the survey, statistical analyses employed and the ethical considerations applicable to this project.

3.1 The Data Source for Secondary Data Analyses

The secondary data analysed in this thesis was obtained from the Demographic and Health Surveys (DHS), funded by USAID and implemented by ICF International (DHS Program, 2017a). The objective of the DHS was to collect data required for policy formation, program planning, and monitoring and evaluation of the relevant country. DHS were conducted in over 90 countries to collect nationally representative household information on population, health, HIV and nutrition and were available in the public domain (DHS Program, 2017a). In this research, the DHS data for Bangladesh (2011 and 2014 rounds) is primarily utilized, but Chapter 4 also includes analyses of the Nepal (2011 round) and Pakistan (2012-13 round) DHS data (MOHP, New ERA, & ICF International, 2012; NIPORT, Mitra and Associates, & ICF International, 2013; NIPS & ICF International, 2013).

3.2 Sample Design and Survey Questionnaires

DHS were population-based surveys with large sample sizes (usually between 5,000 and 30,000 households) (DHS Program, 2017a). In general, all the surveys were cross-sectional and a two-stage stratified sampling design was used to collect information. The primary sampling unit for DHS was an enumeration area (EA), a group of adjacent households. In the first stage, EAs were sampled using probability proportional to the EA size followed by household listing. In the second stage, a fixed number of households were selected per EA using a systematic sampling technique. Eligible women aged 15–49 years and men aged 15–54 years were then identified from each selected household (DHS Program, 2017a).

There are three core questionnaires in DHS surveys: 1) households; 2) women; and 3) men. Details of the questionnaires are provided in Appendix 1, while some basic information regarding core questionnaires is presented below (DHS Program, 2017a).

3.2.1 Questionnaire for Household

The Household Questionnaire was used to list all the usual members of the household as well as visitors in the selected households. Some basic information was collected on the characteristics of each person listed, including the following:

Characteristics of the residents: age, sex, relationship to the head of the household and education.

Characteristics of the dwelling: source of drinking water, toilet facilities, cooking fuel and assets of the household.

3.2.2 Questionnaire for Women

The Woman's Questionnaire was used to collect the information for all ever-married women 15–49 years of age. Women were asked questions on the following topics:

Demographic characteristics: age, marital status, education, employment, media exposure, and place of residence.

Reproductive behaviour: 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.

Contraception: knowledge and use of specific contraceptive methods and source of contraceptive methods.

Antenatal care, delivery, and postnatal care: antenatal and postnatal care, place of delivery, type of attendance at the delivery, and the nature of complications during pregnancy for recent births.

Breastfeeding and nutrition: feeding practices, the length of breastfeeding, children's consumption of liquids and solid food, and micronutrient supplementation.

Children's health: immunization coverage, vitamin A supplementation, recent occurrences of diarrhoea, fever, and cough for young children and treatment of childhood diseases.

Husband's background: currently married women were asked about the age, education, and occupation of their husbands.

HIV and other sexually transmitted infections: knowledge of HIV and other sexually transmitted infections, the sources of their knowledge about HIV, knowledge about ways to avoid contracting HIV and high-risk sexual behaviour.

3.2.3 Questionnaire for Men

The Man's Questionnaire was used to collect information for ever-married men aged 15–54 years. Men were asked questions on the following topics:

Demographic characteristics: age, education, employment status, marital status, media exposure, and place of residence.

Knowledge and use of contraception: exposure to family planning messages through both the media and health professionals.

Participation in health care: knowledge about antenatal and delivery care.

HIV and other sexually transmitted infections: knowledge of HIV and other sexually transmitted infections, the sources of their knowledge about HIV, knowledge about ways to avoid contracting HIV and high-risk sexual behaviour.

3.3 Coverage of Samples

Table 3.1 shows the sample size of households, women and men, along with their response rates. In all selected households, ever-married women of age 15–49 years and a sub-sample of ever-married men of age 15–54 years were eligible to participate (DHS Program, 2017a). Response rates across Bangladesh, Nepal, and Pakistan vary from 96% to 99% for households, 93% to 98% for women and 79% to 92% for men (MOHP, New ERA, & ICF International, 2012; NIPORT, Mitra and Associates, & ICF International, 2013, 2016; NIPS & ICF International, 2013). All the information collected in the surveys was self-reported.

Table 3.1: Results of the household and individual interviews in DHS

	Bangladesh		Nepal	Pakistan
Round	**2011**	**2014**	**2011**	**2012-13**
Household interviews				
Household selected	17,964	17,989	11,353	13,944
Household interviewed	17,141	17,300	10,826	12,943
Response rate	97.9%	98.5%	99.4%	96.1%
Interviews with women age 15-49				
Number of eligible women	18,222	18,245	12,918	14,569
Number of eligible women interviewed	17,842	17,863	12,674	13,558
Response rate	97.9%	97.9%	98.1%	93.1%
Interviews with men age 15-54*				
Number of eligible men	4,343	-	4,323	3,991
Number of eligible men interviewed	3,997	-	4,121	3,134
Response rate	92.0%	-	95.3%	78.5%

Source: Bangladesh Demographic and Health Survey 2011 (NIPORT, Mitra and Associates, & ICF International, 2013), Bangladesh Demographic and Health Survey 2014 (NIPORT, Mitra and Associates, & ICF International, 2016), Nepal Demographic and Health Survey 2011 (MOHP, New ERA, & ICF International, 2012) and Pakistan Demographic and Health Survey 2012-13 (NIPS & ICF International, 2013).

* Questionnaire for men was available for the Bangladesh DHS 2014 round.

3.4 Study Participants, Outcome and Main Exposure Variables

Based on the availability of information related to perinatal health care services, the most recent live-births within five years or three years prior to the interview were considered as study participants for this research. For Research Questions 2, 4, 5 and 6, the primary outcome of interest is neonatal mortality while ENC practices are considered as the outcome variables for Research Question 3. Different health care services – place of delivery, type of assistance during the delivery, ENC practices, ANC and PNC – are the primary exposure variables in this research. Details of study participants, outcome and main exposure variables employed to answer each research question are discussed separately in the corresponding chapters.

3.5 Statistical Analyses

To address Research Question 2 (i.e. association of facility delivery and/or SBAs with neonatal mortality), in addition to an analysis on Bangladesh, a comparison is made among countries with similar health infrastructures – Nepal and Pakistan – by using the

DHS data of these countries. A logistic regression model is used to investigate this research question. A detailed discussion is presented in Chapter 4. Please note that no comparison is made with Nepal and Pakistan for other research questions because of the unavailability of required information.

Data from the 2011 Bangladesh DHS is analysed using logistic regression modelling to examine Research Questions 3 and 4 (i.e. association between ENC and neonatal mortality and determinants of ENC). Discussions of these two research questions are presented in Chapter 5 and 6, respectively.

Analyses of the 2011 Bangladesh DHS data is also used to address Research Question 5 (i.e. association of ANC and PNC with neonatal mortality), by utilising a Cox proportional hazards regression model. Details of the analytical technique and discussion of this research question are provided in Chapter 7.

Research Question 6 (i.e. trends in neonatal mortality and newborn health practices in Bangladesh) is addressed using the two most recent rounds (2011 and 2014) of the Bangladesh DHS and employing chi-square tests. Details of the analytical techniques and discussion of this research question are presented in Chapter 8. Please note that the use of 2014 Bangladesh DHS has not been possible for investigating other research questions due to the unavailability of the data at the time of study.

All statistical analyses in this research are performed using STATA version 11.2. The STATA survey commands were used to adjust for the sampling weights and design to ensure the actual representation of the survey results (NIPORT, Mitra and Associates, & ICF International, 2016).

It is important to mention that the DHS data sets have some limitations. The surveys rely on self-reported information in which recall bias can be an important issue, as interviewees are required to recollect events as far back as five years. The DHS excludes information of newborns whose mothers die before the survey and so data relating to their health care practices and neonatal survival are missing; information for these newborns can be different from those with alive mothers and have been included in the survey.

3.6 Ethical Approval

The DHS surveys have been approved by the Ethical Review Panels of each country's Ministry of Health and Family Welfare or equivalent. Informed verbal consents have been obtained from participants at the time of the interview. In addition, ethics approval for the research was obtained from the Human Research Ethics Committee at the University of Technology Sydney (#2015000228). A copy of the ethics approval letter is attached at Appendix 2.

3.7 Chapter Summary

This chapter has described the methodology used for the quantitative analyses component of this research. This research uses data from large and nationally-representative DHS from three countries – Bangladesh, Nepal and Pakistan. Statistical analyses including logistic regression models, Cox proportional hazards regression models and chi-square tests are applied to address the identified research questions and overall project aims. More methodological details are provided in the following chapters.

Chapter 4 : Does Delivery at Health Facilities and the Presence of Skilled Birth Attendants Reduce Neonatal Deaths? Evidence from Bangladesh, Nepal and Pakistan

This chapter investigates Research Question 2; the association of facility-based delivery and/or the presence of SBAs with neonatal deaths. A secondary data analysis was conducted to examine this research question. Since required data for this analysis were available for Bangladesh, Nepal and Pakistan, analyses were conducted on each of these countries separately. The findings have been submitted to the *International Journal of Evidence-Based Healthcare*.

Akter T, Dawson A, & Sibbritt D. Does delivery at health facilities and the presence of skilled birth attendants reduce neonatal deaths? Evidence from Bangladesh, Nepal and Pakistan. (under review at the *International Journal of Evidence-Based Healthcare*).

4.1 Abstract

Emergency obstetric care and the provision of skilled birth attendants (SBAs) are considered important in reducing neonatal deaths. This study examines whether facility-based deliveries reduce neonatal mortality and whether the presence of SBAs lowers the mortality rates of home-born neonates in three countries in South Asia – Bangladesh, Nepal and Pakistan. We examined cross-sectional data from the Demographic and Health Surveys of three countries – Bangladesh, Nepal and Pakistan – that included 7,314, 4,079 and 7,461 live-born infants respectively. Adjusted logistic regression models were used to examine the magnitude of the association of facility deliveries and SBAs with neonatal mortality. Neonatal deaths were significantly higher for facility deliveries compared to home deliveries in Bangladesh (OR=2.43; 95% CI: 1.09, 5.41). Data from the other two countries failed to confirm any significant effect of facility delivery on neonatal mortality. Furthermore, the contribution of SBAs was insignificant in reducing the mortality of home-delivered neonates. Programs aiming to enhance the clinical skills and experiences of SBAs may be useful in reducing the mortality of home-delivered neonates. Further research is required to determine the factors related to

neonatal deaths in health facilities, including whether these deaths are associated with severe complications.

4.2 Introduction

The neonatal period – the first 28 days of life – is the most vulnerable time for a child's survival, during which a significant number of children die in low and lower-middle income countries (LMICs) (UNICEF, 2015a). Premature birth, neonatal sepsis, as well as pregnancy and intrapartum-related complications are primarily responsible for these deaths (Tura, Fantahun, & Worku, 2013; UNICEF, 2015a). As suggested by World Health Organization (WHO), the majority of these deaths are largely preventable by ensuring delivery in health facilities with essential medicines, equipment and skilled health professionals (WHO, 2010).

Studies comparing the impact of facility delivery on neonatal and early neonatal (0–6 days after delivery) deaths in LMICs observed a heterogeneous effect (Feng et al., 2011; Lohela, Campbell, & Gabrysch, 2012; Målqvist et al., 2010; Ronsmans et al., 2010; Titaley, Dibley, & Roberts, 2012; Tura, Fantahun, & Worku, 2013). For example, neonatal mortality rates (NMRs) were found to be lower for hospital-based births compared to home births in China (Feng et al., 2011). In contrast, studies conducted in Bangladesh and Indonesia, observed higher mortality rates for neonates delivered in a health facility compared to neonates born at home (Ronsmans et al., 2010; Titaley, Dibley, & Roberts, 2012). A study in Zambia and Malawi observed no effect of institutional delivery on early neonatal mortality, even after controlling for proximity to the nearest facility (Lohela, Campbell, & Gabrysch, 2012).

Studies examining the effect of the services of skilled birth attendants (SBAs) on the mortality of home-born neonates in LMICs also observed mixed results (Gill et al., 2011; Titaley, Dibley, & Roberts, 2012). For example, trained traditional birth attendants significantly reduced neonatal mortality in rural Africa (Gill et al., 2011). In contrast, although relating to early neonatal deaths, a study in Indonesia observed no significant effect of services received from SBAs (Titaley, Dibley, & Roberts, 2012). Thus, it was unclear whether institutional deliveries or assistance by SBAs could reduce neonatal mortality in LMICs.

Against this background, our study investigated the contribution of facility-based deliveries and SBAs on neonatal mortality in three countries in South Asia – Bangladesh, Nepal and Pakistan. Such analysis can assist governments in the region to design policies and strategies to reduce the NMR, particularly where health infrastructure is poor, resources are limited and mortality rates are high.

South Asia has a large proportion of global neonatal mortality. A total of 1.1 million children die each year in the region during the neonatal period, which accounts for nearly 41% of global neonatal deaths (UNICEF, 2015a). Only 45% of deliveries in the region occur at institutions and 50% of all births are assisted by SBAs (UNICEF, 2015b). Our study, therefore, aims to examine the association of facility-based deliveries with neonatal mortality, as well as to investigate whether the services provided by SBAs during the delivery of home-born neonates are associated with neonatal mortality.

4.3 Methods

Data source

Data was obtained from the Demographic and Health Surveys (DHS) of Bangladesh, Nepal and Pakistan (MOHP, New ERA, & ICF International, 2012; NIPORT, Mitra and Associates, & ICF International, 2013; NIPS & ICF International, 2013). This analysis only considered data from the latest waves of the respective DHS, which were 2011 for Bangladesh and Nepal and 2012–13 for Pakistan. All the surveys were cross-sectional and employed a two-stage stratified random sampling design to collect information to monitor and evaluate maternal, child health and family planning programs, and to plan future interventions. The Bangladesh DHS collected information on 17,141 households, of which 17,842 ever-married women aged 12–49 years were interviewed with a response rate of 98 percent; on the other hand, 3,997 male respondents were selected from one-third of the surveyed households with a response rate of 92 percent (NIPORT, Mitra and Associates, & ICF International, 2013). In Nepal, the DHS collected information from 12,674 ever-married women aged 15–49 years from 10,826 selected households with a response rate of 98 percent. The number of male respondents, selected from every second surveyed household, was 4,121 with a response rate of 95 percent (MOHP, New ERA, & ICF International, 2012). Finally, the Pakistan DHS

collected information from 12,943 households where 13,558 ever-married women aged 15–49 years were interviewed with a response rate of 93 percent. The sample size of male respondents was 3,134, selected randomly with a response rate of 79 percent (NIPS & ICF International, 2013). All information obtained in these surveys was self-reported and collected by separate questionnaires for households, women and men. Informed verbal consents were obtained from participants at the time of the interview. Details of the sampling technique and data collection procedures used in these surveys have been described elsewhere (MOHP, New ERA, & ICF International, 2012; NIPORT, Mitra and Associates, & ICF International, 2013; NIPS & ICF International, 2013).

Study participants

The most recent live births in the five years prior to the interview were considered for this analysis since detailed information on perinatal health care services was available only for these newborns. Consequently, this study included 7,314, 4,079 and 7,461 infants from Bangladesh, Nepal and Pakistan, respectively. The corresponding numbers of neonatal deaths were 131 (1.79%), 71 (1.74%) and 272 (3.65%), of which 102 (1.39%), 67 (1.64%) and 225 (3.02%) were identified as early neonatal deaths.

Outcome and main exposure variables

The primary outcome of interest was neonatal mortality (deaths during 0–28 days of life) (WHO & PMNCH, 2011). Place of delivery and type of assistance during the delivery were the primary exposures in this study. Place of delivery was categorized as a binary variable indicating whether the delivery took place at home, or at a health facility which included both public and private hospitals, as well as health centres operated by non-government organizations. Assistance received during delivery was categorized as a binary variable indicating the presence or absence of an SBA. The definition of SBA in our data included medically-trained personnel who were able to manage childbirth (MOHP, New ERA, & ICF International, 2012; NIPORT, Mitra and Associates, & ICF International, 2013; NIPS & ICF International, 2013).

Potential confounding variables

Based on the literature and the availability of data for all three countries, a total of 13 potential confounders were identified from the datasets (Titaley, Dibley, & Roberts,

2012). These included whether the usual place of residence was urban/rural, household wealth, paternal and maternal years of schooling, maternal age at birth, antenatal care (ANC) visits, desire for pregnancy, child's sex, birth order, birth size as perceived by the mother and the timing of the first postnatal check-ups. The models that considered the place of delivery as the primary exposure included two additional variables, the mode of the delivery and the type of assistance received during delivery, in the list of confounders.

Household wealth was represented by an index constructed using the household asset information and the principal components analysis (MOHP, New ERA, & ICF International, 2012; NIPORT, Mitra and Associates, & ICF International, 2013; NIPS & ICF International, 2013; Rutstein, 1999). Parental years of schooling, maternal age at birth and ANC visit were considered as continuous variables. The birth order was grouped as first-born and higher (second-born or more). The size of a baby at birth, as perceived by its mother, was categorized as average, larger than average and smaller than average. While categorizing postnatal care, we used the recommendations by WHO and UNICEF and considered whether the newborn received postnatal care services from any type of provider within the first week of birth (WHO & UNICEF, 2009).

Statistical analyses

The differences in the exposure and other variables associated with the survival status of the newborns were initially examined using chi-square tests and t-tests. Then, separately for each country, an adjusted logistic regression model (that controlled for the confounding variables listed above) was used to examine the effect of the place of delivery on neonatal mortality. Among the home born neonates only, a similar analysis was conducted to observe the effect of the type of delivery assistance on neonatal mortality. All statistical analyses were performed using STATA version 11.2. The STATA survey commands were used to adjust for the sampling weights and design.

4.4 Results

The selected samples, for each of the countries, were predominantly from rural areas, with low wealth and low parental education. The average maternal age at birth ranged

from 23 to 28 years and average number of ANC visit varied from 2 to 4. In all the countries, a large proportion of the neonates were delivered at home (49% to 74%) and through natural birth (84% to 95%). Most of the deliveries in Pakistan (55%) were assisted by SBAs, which was not the case for Bangladesh (29%) or Nepal (39%).

The distribution of the variables related to demographic factors, socioeconomic status and perinatal health care services by newborn survival status and country are shown in Table 4.1. Statistically significant associations between neonatal mortality and place of birth were observed in Bangladesh ($p=0.002$) and Pakistan ($p=0.048$). A higher rate of neonatal mortality was observed for facility deliveries both for Bangladesh and Pakistan. There were also statistically significant associations between neonatal mortality and assistance during delivery in Bangladesh ($p=0.007$) and Pakistan ($p=0.032$). For both countries, a higher rate of neonatal mortality occurred when an SBA assisted the delivery.

Table 4.1: Frequency distribution of demographic, socioeconomic status and perinatal health care services for most recent birth by country and neonatal deaths

Variables	Bangladesh (2011)		Nepal (2011)		Pakistan (2012-13)	
	Alive n=7,183	Dead n=131	Alive n=4,008	Dead n=71	Alive n=7,189	Dead n=272
Place of delivery						
Home	5,132 (73.9)	83 (59.8)	2,420 (61.4)	44 (68.4)	3,372 (48.7)	131 (40.4)
Health facility	2,050 (26.1)	48 (40.3)	1,588 (38.6)	27 (31.6)	3,811 (51.3)	140 (59.6)
Assistance during delivery						
Unskilled	4,871 (71.0)	79 (58.2)	2,403 (60.7)	44 (68.4)	3,096 (45.0)	120 (36.0)
Skilled	2,303 (29.0)	51 (41.8)	1,605 (39.3)	27 (31.6)	4,073 (55.0)	151 (64.0)
Urban/rural						
Urban	2,283 (23.3)	43 (25.4)	883 (10.1)	14 (8.9)	3,182 (30.5)	96 (21.1)
Rural	4,900 (76.7)	88 (74.6)	3,125(89.9)	57 (91.1)	4,007 (69.5)	176 (78.9)
Household wealth index	-0.10±0.01[a]	-0.15±0.09 [a]	-0.19±0.02[a]	-0.27±0.10[a]	-0.19±0.01[a]	-0.43±0.07[a]
Paternal years of schooling	5.08± 0.06[a]	4.71 ± 0.50[a]	5.85±0.08[a]	4.65±0.59[a]	5.99±0.08[a]	4.84±0.35[a]
Maternal years of schooling	5.35±0.05[a]	5.18±0.41[a]	3.86±0.08[a]	3.11±0.59[a]	3.62±0.07[a]	2.38±0.31[a]
Mother's age at birth (years)	23.32±0.08[a]	23.26±0.62[a]	24.84±0.11[a]	24.01±0.73[a]	27.55±0.09[a]	28.63±0.61[a]
ANC visits (number)	2.18±0.04[a]	1.93±0.23[a]	3.59±0.05[a]	2.77±0.34[a]	3.28±0.05[a]	2.87±0.25[a]
Desire for pregnancy						
Wanted then	5,089 (70.6)	96 (77.1)	2,902 (72.6)	55 (81.1)	5,859 (81.1)	229 (82.9)
Wanted later	1,118 (15.4)	22 (15.3)	481 (12.2)	6 (5.3)	639 (9.2)	17 (8.6)
Wanted no more	976 (14.0)	13 (7.7)	625 (15.3)	10 (13.6)	679 (9.7)	25 (8.5)
Mode of delivery						
Non-caesarean section	6,029 (85.1)	106 (76.3)	3,796 (94.7)	69 (98.8)	6,196 (84.3)	237 (83.9)
Caesarean section	1,143 (14.9)	25 (23.7)	212 (5.3)	2 (1.2)	979 (15.7)	35 (16.1)
Sex of child						
Male	3,707 (51.5)	79 (60.3)	2,151 (52.9)	41 (56.8)	3,709 (51.9)	127 (51.3)
Female	3,476 (48.5)	52 (39.7)	1,857 (47.2)	30 (43.2)	3,480 (48.1)	145 (48.7)
Birth order						
First-born	2,423 (33.4)	42 (33.5)	1,223 (31.2)	25 (39.0)	1,342 (19.1)	47 (17.4)
Second-born or more	4,760 (66.6)	89 (66.5)	2,785 (68.8)	46 (61.0)	5,847 (80.9)	225 (82.6)
Size of baby						
Average	4,884 (68.4)	61 (46.5)	2,544 (65.9)	32 (49.2)	5,275 (73.5)	158 (63.6)
Larger than average	1,047 (14.2)	40 (33.9)	762 (18.6)	22 (28.4)	490 (6.4)	25 (7.8)
Smaller than average	1,249 (17.4)	30 (19.7)	699 (15.5)	16 (22.5)	1,402 (20.2)	86 (28.6)
Timing of first postnatal check-up						
No PNC/8days+ PNC	4,133 (59.8)	65 (45.1)	2,739 (69.1)	54 (74.4)	4,423 (55.3)	165 (47.0)
Days 1-7 PNC	3,023 (40.3)	66 (54.9)	1,261 (30.9)	17 (25.6)	2,684 (44.7)	102 (53.0)

Note: Weighted analysis. [a]: Mean±SE

For home births, the association of neonatal mortality with assistance received during delivery was observed as statistically insignificant for all three countries (Table 4.2).

Table 4.2: Frequency distribution of demographic, socioeconomic status and perinatal health care services for most recent home birth by country and neonatal deaths

Variables	Bangladesh (2011)		Nepal (2011)		Pakistan (2012-2013)	
	Alive n=5,132	Dead n=83	Alive n=2,420	Dead n=44	Alive n=3,372	Dead n=131
Assistance during delivery						
Unskilled	4,852 (95.7)	79 (97.8)	2,356 (97.0)	44 (100.0)	3,063 (91.6)	120 (89.2)
Skilled	271 (4.3)	3 (2.2)	64 (3.0)	0 (0.0)	299 (8.4)	11 (10.8)
Urban/rural						
Urban	1,229 (17.0)	22 (18.6)	274 (4.1)	6 (6.4)	1,056 (18.3)	35 (12.5)
Rural	3,903 (83.0)	61 (81.4)	2,146 (95.9)	38 (93.6)	2,316 (81.7)	96 (87.5)
Household wealth index	-0.34±0.01[a]	-0.44±0.08[a]	-0.52±0.02[a]	-0.45±0.09[a]	-0.57±0.02[a]	-0.69±0.08[a]
Paternal years of schooling	4.14±0.07[a]	3.29±0.53[a]	4.78±0.10[a]	4.31±0.71[a]	4.48±0.11[a]	3.65±0.46[a]
Maternal years of schooling	4.54±0.06[a]	3.86±0.42[a]	2.52±0.09[a]	2.45±0.69[a]	1.76±0.07[a]	1.11±0.33[a]
Mother's age at birth (years)	23.39±0.10[a]	23.24±0.80[a]	25.54±0.15[a]	24.60±0.96[a]	27.96±0.15[a]	28.40±0.81[a]
ANC visits (number)	1.54±0.03[a]	1.30±0.26[a]	2.71±0.05[a]	2.08±0.38[a]	1.71±0.05[a]	1.87±0.31[a]
Desire for pregnancy						
Wanted then	3,512 (68.2)	58 (73.6)	1,679 (69.8)	31 (75.9)	2,739 (80.0)	109 (83.5)
Wanted later	800 (15.5)	14 (16.3)	245 (10.3)	3 (4.2)	272 (8.4)	4 (2.5)
Wanted no more	820 (16.3)	11 (10.1)	496 (19.9)	10 (19.9)	357 (11.6)	18 (14.0)
Sex of child						
Male	2,635 (51.4)	50 (58.0)	1,303 (53.0)	28 (57.2)	1,683 (51.0)	59 (55.7)
Female	2,497 (48.6)	33 (42.0)	1,117 (47.0)	16 (42.8)	1,689 (49.0)	72 (44.3)
Birth order						
First-born	1,449 (28.0)	25 (33.3)	474 (20.1)	13 (33.3)	407 (12.7)	13 (8.8)
Second-born or more	3,683 (72.0)	58 (66.7)	1,946 (79.9)	31 (66.7)	2,965 (87.3)	118 (91.2)
Size of baby						
Average	3,502 (68.6)	48 (58.5)	1,494 (65.1)	20 (50.0)	2,483 (72.5)	72 (58.1)
Larger than average	700 (13.5)	17 (21.8)	444 (17.6)	14 (28.5)	157 (5.4)	11 (8.2)
Smaller than average	927 (17.9)	18 (19.8)	480 (17.3)	10 (21.5)	719 (22.1)	48 (33.7)
Timing of first postnatal check-up						
No PNC/8days+ PNC	3,969 (77.8)	59 (68.3)	2,151 (88.4)	40 (84.4)	2,634 (71.6)	101 (69.6)
Days 1-7 PNC	1,153 (22.2)	24 (31.7)	264 (11.6)	4 (15.6)	725 (28.4)	28 (30.4)

Note: Weighted analysis. [a]: Mean±SE

Results from the multiple logistic regression models, which adjust for potential confounders, showed associations between the place of delivery and neonatal deaths (Table 4.3). The odds of neonatal mortality was 2.4 times higher for those who were delivered at health facilities compared with those delivered at home in Bangladesh (OR=2.43; 95% CI: 1.09, 5.41; p=0.02). An increase in neonatal mortality was also observed for newborns who were delivered at health facilities in Nepal (OR=1.21; 95% CI: 0.73, 2.03; p=0.46) and Pakistan (OR=1.38; 95% CI: 0.68, 2.78; p=0.37) but were not statistically significant.

Table 4.3: Adjusted odds ratios of the associations between place of delivery and neonatal mortality for the most recent birth in the five years preceding the survey

Variable	Bangladesh (2011)			Nepal (2011)			Pakistan (2012-2013)		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Place of delivery									
Home	1.00			1.00			1.00		
Health facility	2.43	1.09, 5.41	0.02	1.21	0.73, 2.03	0.46	1.38	0.68, 2.78	0.37
Assistance during delivery									
Unskilled	1.00			1.00			1.00		
Skilled	0.68	0.32, 1.46	0.32	0.73	0.38, 1.38	0.33	1.48	0.73, 2.99	0.27
Urban/rural									
Urban	1.00			1.00			1.00		
Rural	0.79	0.48, 1.31	0.36	1.08	0.47, 2.47	0.85	1.29	0.80, 2.09	0.30
Household wealth index	0.89	0.67, 1.19	0.43	1.46	0.83, 2.57	0.18	0.85	0.61, 1.18	0.33
Paternal years of schooling	0.98	0.92, 1.04	0.50	0.92	0.85, 1.00	0.06	0.98	0.94, 1.02	0.29
Maternal years of schooling	0.99	0.91, 1.07	0.81	0.98	0.88, 1.10	0.77	0.96	0.91, 1.01	0.10
Mother's age at birth (years)	1.01	0.97, 1.06	0.57	0.98	0.92, 1.04	0.42	1.04	1.00, 1.07	0.04
ANC visits (number)	0.90	0.81, 0.99	0.03	0.86	0.72, 1.02	0.09	1.00	0.93, 1.07	0.91
Desire for pregnancy									
Wanted then	1.00			1.00			1.00		
Wanted later	0.87	0.50, 1.53	0.63	0.39	0.15, 1.00	0.05	1.00	0.50, 1.98	0.99
Wanted no more	0.37	0.19, 0.75	0.006	0.85	0.37, 1.94	0.69	0.68	0.37, 1.24	0.20
Mode of delivery									
Non-caesarean section	1.00			1.00			1.00		
Caesarean section	1.14	0.57, 2.29	0.71	0.27	0.06, 1.30	0.10	0.93	0.57, 1.53	0.77
Sex of child									
Male	1.00			1.00			1.00		
Female	0.74	0.49, 1.11	0.14	0.81	0.46, 1.43	0.47	1.05	0.75, 1.47	0.78
Birth order									
First-born	1.00			1.00			1.00		
Second-born or more	1.06	0.59, 1.90	0.84	0.55	0.27, 1.14	0.10	1.02	0.62, 1.68	0.93
Size of baby									
Average	1.00			1.00			1.00		
Larger than average	3.41	2.10, 5.55	<0.001	2.49	1.27, 4.86	0.008	1.57	0.89, 2.76	0.11
Smaller than average	1.73	1.02, 2.92	0.04	1.92	0.85, 4.30	0.11	1.64	1.11, 2.41	0.01
Timing of first postnatal check-up									
No PNC/8days+ PNC	1.00			1.00			1.00		
Days 1-7 PNC	1.69	0.95, 3.00	0.07	0.95	0.36, 2.47	0.91	1.38	0.98, 1.93	0.06

Note: weighted analysis

Table 4.4 presented the outputs of the multiple logistic regression model used to identify the association of type of delivery assistance with neonatal deaths for home-delivered neonates only. While the analysis could not be conducted for the Nepalese newborns due to the zero neonatal deaths for those who received services from SBAs, an insignificant association was observed between mortality and the SBAs assisted deliveries for both Bangladesh (OR=0.47; 95% CI: 0.13, 1.66; p=0.24) and Pakistan (OR=1.17; 95% CI: 0.51, 2.69; p=0.71).

Table 4.4: Adjusted odds ratios of the associations between type of delivery assistance and neonatal mortality for the most recent home-delivered neonates in the five years preceding the survey

Variable	Bangladesh (2011)			Nepal (2011)			Pakistan (2012-2013)		
	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Assistance during delivery									
Unskilled	1.00			1.00			1.00		
Skilled	0.47	0.13, 1.66	0.24	-	-	-	1.17	0.51, 2.69	0.71
Urban/rural									
Urban	1.00			1.00			1.00		
Rural	0.72	0.36, 1.42	0.34	0.79	0.27, 2.35	0.67	1.32	0.66, 2.62	0.43
Household wealth index	0.89	0.55, 1.42	0.61	1.58	0.79, 3.15	0.19	1.00	0.63, 1.59	0.99
Paternal years of schooling	0.97	0.88, 1.07	0.51	0.95	0.86, 1.05	0.34	0.98	0.92, 1.04	0.49
Maternal years of schooling	0.96	0.86, 1.06	0.41	0.99	0.86, 1.14	0.88	0.95	0.85, 1.05	0.30
Mother's age at birth (years)	1.02	0.97, 1.08	0.42	0.98	0.92, 1.05	0.57	1.00	0.95, 1.04	0.85
ANC visits (number)	0.93	0.80, 1.09	0.36	0.81	0.63, 1.04	0.09	1.09	0.97, 1.21	0.13
Desire for pregnancy									
Wanted then	1.00			1.00			1.00		
Wanted later	1.15	0.57, 2.31	0.69	0.33	0.08, 1.30	0.11	0.26	0.05, 1.32	0.10
Wanted no more	0.38	0.18, 0.80	0.01	1.11	0.44, 2.82	0.82	1.06	0.52, 2.16	0.87
Sex of child									
Male	1.00			1.00			1.00		
Female	0.78	0.47, 1.31	0.34	0.80	0.40, 1.62	0.53	0.78	0.47, 1.29	0.32
Birth order									
First-born	1.00			1.00			1.00		
Second-born or more	0.63	0.30, 1.34	0.23	0.43	0.19, 0.96	0.04	2.62	0.93, 7.32	0.06
Size of baby									
Average	1.00			1.00			1.00		
Larger than average	2.10	1.06, 4.18	0.03	2.37	1.02, 5.50	0.045	1.80	0.75, 4.33	0.18
Smaller than average	1.28	0.66, 2.48	0.45	1.56	0.57, 4.28	0.38	1.98	1.08, 3.64	0.02
Timing of first postnatal check-up									
No PNC/8days+ PNC	1.00			1.00			1.00		
Days 1-7 PNC	1.89	1.08, 3.31	0.02	1.65	0.52, 5.25	0.40	1.11	0.65, 1.90	0.70

Note: weighted analysis

4.5 Discussion

Using data obtained from nationally representative surveys of three South Asian countries, Bangladesh, Nepal and Pakistan, our study investigated the association of neonatal mortality with the place of delivery and the type of delivery assistance. We found that the risk of neonatal deaths was 2.4 times higher among Bangladeshi infants who were delivered at health facilities compared to those delivered at home. Results for the other two countries also failed to confirm any protective effect of facility delivery on neonatal mortality. Our analysis further observed no significant contribution of SBAs to reducing the mortality of home-delivered neonates.

The provision of SBAs and the availability of relevant medicines and equipment during delivery, including emergency obstetric care, were found to be important for neonatal survival (Lawn et al., 2009; WHO, 2010). Thus a number of studies observed a significantly lower mortality for facility deliveries (Feng et al., 2011; Målqvist et al., 2010). However, we observed higher odds of neonatal mortality for facility births in Bangladesh. This was consistent with a study in Indonesia, where deliveries at public hospitals were significantly associated with an increased risk of early neonatal death (Titaley, Dibley, & Roberts, 2012). Our findings for Pakistan and Nepal, which found no significant association between facility delivery and mortality, were also similar to some earlier studies (Lohela, Campbell, & Gabrysch, 2012). Thus, it was not surprising that a systematic review on the effect of health facility delivery on neonatal mortality, summarizing 19 studies conducted in Asia and Africa, observed heterogeneous results (Tura, Fantahun, & Worku, 2013).

The increased risk of neonatal deaths for facility deliveries in LMICs might be due to the fact that mothers were more likely to visit a health facility in the case of severe complications during labour (Titaley, Dibley, & Roberts, 2012; Tura, Fantahun, & Worku, 2013). A low density of health workers, as well as lack of essential medicines and equipment, might result in inadequate maternal and child health (MCH) services. As a consequence, pregnant mothers in LMICs could be more likely to present at the facilities when they experienced severe complications (WHO, 2006a). Without a measure of obstetric and neonatal complications, our data might not be suitable for a direct comparison of mortality between facility and home deliveries.

To address such a concern, we narrowed our focus to home births when examining the association between SBAs and neonatal mortality. While the zero neonatal deaths among those who received care from SBAs did not allow us to do an analysis for Nepalese newborns, we found a statistically insignificant associations of skilled and unskilled birth attendants in their contribution in affecting neonatal mortality in the other two countries. Earlier studies with similar results expressed concerns about weak referral systems in LMICs, including non-compliance with referral (Carlo et al., 2010a; Darmstadt et al., 2010b; Jokhio, Winter, & Cheng, 2005; Titaley, Dibley, & Roberts, 2012).

A lack of clinical skills and experience among SBAs might result in a weak referral practice (Titaley, Dibley, & Roberts, 2012). One study identified a gap between evidence-based standards and SBAs' competency to manage selected obstetric and neonatal complications across five LMICs (Harvey et al., 2007). For example, only 46% of SBAs were competent for active management of the third stage of labour, 71% for immediate newborn care and only 55% for neonatal resuscitation. A study on the evaluation of health workforce competence in maternal, newborn and child health issues in Pakistan also observed low competency levels for all cadres of health care providers (Ariff et al., 2010).

Financial and cultural factors could be responsible for poor compliance with referrals for emergency obstetrical care. A patient's incapacity to pay for travel and necessary medical costs might lead to lower compliance with referrals (Jokhio, Winter, & Cheng, 2005). Cultural norms and practices were also found to play a significant role in ensuring compliance with referral (Darmstadt et al., 2010b; Titaley, Dibley, & Roberts, 2012). A study in Bangladesh, which employed community health workers to identify and refer sick newborns at home and cover travel and hospital costs, observed significantly lower compliance in the first week of neonate's life. The authors attributed this to the cultural practice of isolating the mother and the newborn after delivery (Darmstadt et al., 2010b).

A major strength of this study is that data are obtained from a large and nationally-representative sample of newborns from three countries with similar health infrastructure. The similar timeframe of the surveys additionally allows us to compare

the findings for all three countries. However, this study is not free from potential limitations. First, due to data unavailability, some important variables – such as delivery complications, the timing of antenatal care and preterm birth – were not included in our models. Second, recall bias is an important issue as all the information came from interviews with mothers that required them to recollect events as far back as five years. Third, a relatively small sample size for home-birth neonates, and particularly for neonatal deaths, may have resulted in low statistical power.

4.6 Conclusion

Our analyses of the contribution of SBAs and the place of delivery in reducing neonatal mortality offers some important insights and may contribute to improving policy and programs related to MCH services in LMICs. An insignificant contribution of SBAs to reducing mortality among home-born neonates may indicate the importance of a well-developed referral system, including compliance. Programs aiming to enhance the clinical skills and experience of SBAs, as well as their supervision, may be particularly useful in improving referral systems in LMICs. Our analyses also suggest that the risk of neonatal mortality may increase if the delivery occurs in a health facility. This may occur if a larger proportion of mothers with severe complications deliver at a health facility; however, this cannot be confirmed with our data. Nevertheless, this is an unexpected finding and further research is required to identify the factors behind such outcomes.

4.7 Chapter Summary

This chapter investigated whether facility-based deliveries reduce neonatal mortality and whether the presence of SBAs lowers mortality rates among home-born neonates in three relatively comparable South Asian countries. It was observed that neonatal deaths were significantly higher for facility deliveries compared to home deliveries in Bangladesh. Data from other two countries – Nepal and Pakistan – also failed to confirm any significant effect of facility delivery on neonatal mortality. Furthermore, an insignificant contribution of SBAs in reducing the mortality of home-delivered neonates in Bangladesh and Pakistan was observed. In the following chapter, an investigation into the impact of ENC practices in Bangladesh is described.

Chapter 5 : What Impact do Essential Newborn Care Practices have on Neonatal Mortality in LMICs? Evidence from Bangladesh

This chapter investigates Research Question 3; the association between ENC practices and neonatal deaths in Bangladesh. A secondary data analysis was conducted and findings have been published in the *Journal of Perinatology*.

Akter T, Dawson A, & Sibbritt D. (2015). What impact do essential newborn care practices have on neonatal mortality in low and lower-middle income countries? Evidence from Bangladesh. *Journal of Perinatology*, 36(3), 225-230.

5.1 Abstract

Objective: To assess the impact of Essential Newborn Care (ENC) practices on the mortality of neonates delivered at home in Bangladesh.

Study design: This study used cross-sectional data from the 2011 Bangladesh Demographic and Health Survey. Adjusted logistic regression model was used to examine the effect of ENC practices on neonatal mortality based on 3,190 live-born infants.

Result: Delayed bathing (72 hours after delivery) significantly contributed to reducing neonatal mortality. A significant but counterintuitive relation was observed between the dry cord care and neonatal deaths.

Conclusion: Neonatal mortality may be reduced through emphasizing delayed bathing. Specific guidelines on the cleanliness of the fabric used to dry and wrap newborns as well as emphasizing the use of clean delivery kits and initiation of immediate and exclusive breastfeeding may improve neonatal outcomes. Further, the ENC guidelines in Bangladesh should include the application of topical antiseptics to the cord stump.

5.2 Introduction

Neonatal deaths and essential newborn care

Globally, approximately 3.1 million children die each year in their neonatal period (first 28 days of life) (WHO & PMNCH, 2011). Half of these neonatal deaths occur within the first 24 hours of delivery, while 75 percent occur in the early neonatal period (0-6 days after delivery) due to preterm births, severe infections and birth asphyxia (WHO & PMNCH, 2011). Essential Newborn Care (ENC) practices can contribute to decreasing the incidence of neonatal morbidity and mortality (Seward et al., 2012). Such ENC practices, as recommended by the World Health Organization (WHO), include drying (wiping) and wrapping the newborn immediately after birth, initiating skin-to-skin (STS) contact, dry cord care (not applying any potentially harmful substance to the umbilical cord), immediate initiation of breastfeeding and delayed bathing (for at least 6 hours) (WHO, 2006b).

ENC practice in low and lower-middle income countries

A low coverage of ENC practices has been reported particularly for home deliveries with an unskilled birth attendant in low and lower-middle income countries (LMICs) (Khanal et al., 2014; Pagel et al., 2014; Shamba et al., 2014). Based on home delivery data from Nepal, a study found that approximately 58 percent of newborns were immediately dried, 60 percent were immediately wrapped and 25 percent were bathed after the first 24 hours of birth while 64 percent were breastfed within one hour of birth (Khanal et al., 2014). A low uptake of ENC practices along with other socio-demographic factors has also been observed as a major cause of neonatal mortality in sub-Saharan Africa. For example, a study in rural southern Tanzania reported that approximately 41 percent of home-born babies were dried and 28 percent were wrapped within five minutes of birth while only 19 percent were bathed after six hours of birth (Shamba et al., 2014).

Rationale of this study

Examining the impact of specific ENC practices on neonatal mortality may provide key information for planning and implementing interventions that aim to improve newborn health outcomes in LMICs. However, no studies have analysed the extent to which each

of the individual interventions of ENC can reduce neonatal mortality. A review of literature also identified the limited availability of quality studies on the impact of ENC practices on maternal and newborn health outcomes in LMICs (Dettrick, Firth, & Soto, 2013). Against this background, this paper investigates the effect of ENC practices on neonatal mortality.

The focus of this study is on Bangladesh which, like other LMICs, exhibits a high neonatal mortality rate (32 per 1,000 live births). Approximately 71 percent of births in the country are delivered at home with more than half of the births assisted by traditional birth attendants who do not have any formal training (NIPORT, Mitra and Associates, & ICF International, 2013). Only two percent of these newborns have been found to receive all elements of ENC (NIPORT, Mitra and Associates, & ICF International, 2013). An incomplete or poor delivery of ENC interventions can contribute to high neonatal mortality in the country. Thus, this analysis may be useful in further embedding ENC in health workers' practice and mobilising community support. Such an analysis may also help to improve the design and implementation of ENC in Bangladesh that may transferrable to other LMICs. Therefore, this study aims to analyse the impact of ENC practices on the mortality of home-delivered neonates in Bangladesh.

5.3 Methods

Data source

Data was obtained from the 2011 Bangladesh Demographic and Health Survey (BDHS); a periodic cross-sectional survey (NIPORT, Mitra and Associates, & ICF International, 2013). Participants were recruited via a two-stage stratified sample design with the aim of collecting nationally representative demographic and health information. The BDHS was administered to a total of 17,141 households. In total, 17,842 ever-married women in these households aging from 12 to 49 years were interviewed. Male respondents were interviewed only from one-third of the households which included 3,997 male observations. The survey collected data using separate questionnaires for the household, for women and for men. All information obtained in the survey was self-reported and collected by face-to-face interviews. Informed verbal consent was taken from all surveys participants. Details of the design and data

collection procedures were described in NIPORT, Mitra and Associates, and ICF International (2013).

Study participants

Analyses were restricted to data on live-born infants who were delivered at home. Only the most recent birth by a mother within the preceding three years of the survey was considered because detailed information on ENC practices was available only for these births. A total of 3,190 live-born infants were included in the sample of which 60 (2%) cases experienced neonatal death.

Outcome variable

The primary outcome of interest in this analysis was neonatal mortality, defined as deaths occurring within the first 28 days of life (WHO & PMNCH, 2011). Neonatal mortality was identified from the complete birth history of mothers, which collected information on newborn's gender, date of birth, survival status and age at death (if dead).

Exposure variables

ENC practices were the primary exposures in our study. As a benchmark, we used the National Neonatal Health Strategy and Guidelines (NNHSG) for Bangladesh, which provided advice on the following six practices: 1) the use of instruments disinfected using boiling water to cut the umbilical cord; 2) cord care, which did not involve the application of any substances to the umbilical cord stump after being cut; 3) drying of the newborn within 5 minutes of birth; 4) wrapping of the newborn within 5 minutes of birth; 5) bathing of the newborn at least 72 hours after birth; and 6) the initiation of breastfeeding within 1 hour of delivery (Ministry of Health and Family Welfare, 2009). The information on the use of disinfected instruments and the umbilical cord care were collected in binary form (yes, no). The data on the timing of drying after delivery was categorized as a binary variable (<5 minutes, ≥5 minutes/not dried) in our models. Similarly, information on the timing of wrapping after delivery was categorized as a binary variable (<5 minutes, ≥5 minutes/not wrapped). The ENC practices of delayed bathing and immediate initiation of breastfed were also categorized as binary variables (yes, no).

Potential confounding variables

In identifying other factors that might potentially be associated with neonatal deaths, 12 factors were considered in this analysis. These included administrative divisions, urban/rural status of the interviewees usual place of residence, seasonal variation, socioeconomic status (SES) of the participants, mother's education, mother's age at birth, number of antenatal care visit, gender of the child, whether the selected child was first birth, size at birth perceived by mother, assistance received during delivery and the timing and the provider of a newborn's first postnatal check-up. The SES of participants was represented by a wealth index provided in the data which was constructed using the household asset data and the principal components analysis method (NIPORT, Mitra and Associates, & ICF International, 2013; Rutstein, 1999). The seasonal variation was generated from child's month of birth and, following previous literature, categorized as Winter (December-February), Summer (March-May), Rainy (June-August) and Autumn (September-November) (Ministry of Planning, 2005). Birth weights were usually unknown for babies born at home in LMICs. Therefore, following earlier studies, we considered a baby's size at birth perceived by mother as a proxy for birth weight (Ministry of Planning, 2005; NIPORT, Mitra and Associates, & ICF International, 2013; Titaley et al., 2008).

Statistical analysis

The differences in the exposure and other variables associated with the survival status of the newborns were examined using chi-square and t-tests. Then, an adjusted logistic regression model was used to examine the effect of the exposures after controlling for the confounding variables (listed above).

Code availability

All statistical analyses were performed using STATA version 11.2. The STATA survey commands were used to adjust for the sampling weights and design. All codes, employed for this analysis, are available from the corresponding author upon request.

5.4 Results

Descriptive statistics indicated statistically significant differences for dry cord care and delayed bathing between alive and deceased neonates (Table 5.1). Specifically, neonatal

mortality was higher if nothing was applied to the umbilical cord ($p<0.001$) and bathing was not delayed ($p=0.004$).

Table 5.1: Association between ENC practices and child survival, for most recent home deliveries in the three years preceding the survey

Variables	Survival status after 28 days of birth			
	Alive (n=3,130)	Dead (n=60)	Total (n=3,190)	p-value*
Instrument boiled before the umbilical cord was cut (%)				
No	343 (12.4)	9 (18.2)	352 (12.5)	0.278
Yes	2,657 (87.6)	42 (81.8)	2,699 (87.5)	
Nothing applied to umbilical cord (%)				
No	1,356 (43.4)	11 (17.2)	1,367 (43.0)	<0.001
Yes (Nothing applied)	1,653 (56.6)	43 (82.8)	1,696 (57.0)	
Dried <5 minutes of birth (%)				
No	1,498 (48.0)	25 (38.3)	1,523 (47.8)	0.193
Yes	1,589 (52.0)	33 (61.7)	1,622 (52.2)	
Wrapped <5 minutes of birth (%)				
No	2,104 (66.8)	36 (58.7)	2,140 (66.7)	0.272
Yes	984 (33.2)	22 (41.3)	1,006 (33.3)	
Delayed bathing (bathed 72+ hours after delivery) (%)				
No	2,151 (71.1)	57 (93.6)	2,208 (71.4)	0.004
Yes	958 (28.9)	3 (6.4)	961 (28.6)	
Initiation of breastfeeding (within 1 hour after birth) (%)				
No	1,508 (50.0)	38 (57.6)	1,546 (50.1)	0.324
Yes	1,614 (50.0)	22 (42.4)	1,636 (49.9)	

Weighted analysis
* - Pearson's chi-squared test for categorical variables

With the exception of two administrative divisions, mother's demographic characteristics were similarly distributed across the survival status (Table 5.2). Higher neonatal mortality was observed in Barisal and Sylhet divisions (p=0.006).

Table 5.2: Association between mother's demographic characteristics and child survival, for most recent home deliveries in the three years preceding survey

Variables	Survival status after 28 days of birth			
	Alive (n=3,130)	Dead (n=60)	Total (n=3,190)	p-value*
Rural/Urban (%)				
Rural	2,392 (83.6)	48 (89.5)	2,440 (83.7)	0.147
Urban	738 (16.4)	12 (10.5)	750 (16.3)	
Division (%)				
Dhaka	508 (30.1)	7 (27.2)	515 (30.0)	0.006
Barisal	368 (6.0)	15 (17.3)	383 (6.2)	
Chittagong	674 (24.7)	7 (13.2)	681 (24.5)	
Khulna	284 (7.3)	2 (3.8)	286 (7.3)	
Rajshahi	380 (13.1)	5 (10.5)	385 (13.1)	
Rangpur	400 (10.8)	7 (11.4)	407 (10.8)	
Sylhet	516 (8.0)	17 (16.6)	533 (8.1)	
Seasonal Variation (%)				
Winter (December-February)	796 (25.3)	16 (25.9)	812 (25.3)	0.965
Summer (March-May)	690 (22.2)	11 (22.9)	701 (22.2)	
Rainy (June-August)	744 (23.6)	15 (20.5)	759 (23.6)	
Autumn (September-November)	900 (28.9)	18 (30.8)	918 (28.9)	
SES (Wealth Index) (%)				
Poorest	873 (29.0)	12 (26.4)	885 (29.0)	0.864
Poorer	708 (23.2)	17 (25.3)	725 (23.2)	
Middle	642 (20.9)	14 (22.3)	656 (21.0)	
Richer	556 (16.6)	13 (19.9)	569 (16.6)	
Richest	351 (10.3)	4 (6.1)	355 (10.2)	
Mother's Education (%)				
No education	669 (21.9)	12 (24.0)	681 (22.0)	0.808
Primary incomplete	652 (21.7)	15 (21.3)	667 (21.7)	
Primary complete	429 (13.1)	8 (8.0)	437 (13.0)	
Secondary incomplete	1169 (37.2)	21 (38.4)	1190 (37.2)	
Secondary/higher	211 (6.0)	4 (8.4)	215 (6.0)	
Mean of mother's age (years) at birth (SD)	23.0 (5.6)	22.7 (6.8)	23.0 (5.7)	0.762

Weighted analysis
* - Pearson's chi-squared test for categorical variables and t-test for continuous variable

Table 5.3 provided details of the association between child's demographic characteristics and neonatal deaths. Only the timing of first postnatal check-ups for newborn showed a statistically significant difference between the alive and the deceased children. Specifically, neonatal mortality was more likely for the newborn who had postnatal check-ups within two days of delivery (p=0.002).

Table 5.3: Association between child's demographic characteristics and their survival, for most recent home deliveries in the three years preceding survey

Variables	Survival status after 28 days of birth			
	Alive (n=3,130)	Dead (n=60)	Total (n=3,190)	p-value*
Gender of child (%)				
Male	1,567 (50.2)	36 (55.4)	1,603 (50.3)	0.490
Female	1,563 (49.8)	24 (44.6)	1,587 (49.7)	
First birth (%)				
No	2,156 (69.7)	38 (59.2)	2,194 (69.6)	0.136
Yes	974 (30.3)	22 (40.8)	996 (30.4)	
Size at birth (%)				
Small/very small	594 (18.5)	13 (22.0)	607 (18.5)	
Average	2,128 (68.6)	36 (61.5)	2,164 (68.5)	0.595
Large/larger than average	408 (12.9)	11 (16.5)	419 (13.0)	
Assistance during delivery (%)				
Trained	174 (4.5)	2 (2.3)	176 (4.4)	
Untrained	2,934 (94.9)	56 (96.5)	2,990 (95.0)	0.512
No one	16 (0.6)	1 (1.2)	17 (0.6)	
Timing of first postnatal check-ups (Newborn) (%)				
Within 2 days of delivery	642 (20.1)	21 (40.0)	663 (20.4)	
3-28 days after delivery	256 (8.1)	1 (2.0)	257 (8.0)	0.002
29+ days after delivery/did not receive postnatal check-ups	2,227 (71.8)	38 (57.9)	2,265 (71.6)	
Type of provider for first postnatal check-ups (%)				
No postnatal check-ups	2,040 (66.3)	37 (57.4)	2,077 (66.1)	0.406
Untrained	696 (22.7)	13 (26.0)	709 (22.7)	
Trained	389 (11.1)	9 (16.5)	398 (11.2)	
Mean of antenatal care visit (SD)	1.7 (2.2)	1.7 (2.1)	1.7 (2.2)	0.952

Weighted analysis

* - Pearson's chi-squared test for categorical variables and t-test for continuous variable

The logistic regression model showing the association between ENC practices and neonatal death was presented in Table 5.4. Neonatal mortality was significantly lower for ENC practices related to the deferment of bathing for 72 hours after delivery. Specifically, the odds of neonatal deaths decreased by 86% for the children who had delayed bathing compared to the children either bathed before 72 hours of delivery or not bathed (OR=0.14; 95% CI: 0.03, 0.68; p=0.015).

With regard to the avoidance of applying any substances to the umbilical cord, the odds of neonatal mortality for those who applied nothing to the umbilical cord were nearly four times more likely compared with those who applied substances to the cord (OR=3.81; 95% CI: 1.75, 8.29; p= 0.001). Note that a detailed investigation revealed a

reduction in neonatal mortality for those who applied antiseptic to the umbilical cord though the relation was statistically insignificant (data not shown).

Table 5.4: Logistic regression model output showing the associations between neonatal mortality and the ENC practices

Variables	Odds Ratio*	95% Confidence Interval	p-value
Instrument boiled before the umbilical cord was cut			
No	1.00		
Yes	0.63	0.26, 1.55	0.319
Nothing applied to umbilical cord			
No	1.00		
Yes (Nothing applied)	3.81	1.75, 8.29	0.001
Dried <5 minutes of birth			
No	1.00		
Yes	1.64	0.75, 3.58	0.213
Wrapped <5 minutes of birth			
No	1.00		
Yes	0.96	0.44, 2.12	0.921
Delayed bathing (72+ hours after delivery)			
No	1.00		
Yes	0.14	0.03, 0.68	0.015
Initiation of breastfeeding (within 1 hour after birth)			
No	1.00		
Yes	0.86	0.41, 1.82	0.696

Weighted analysis

* Adjusted for residence, division, seasonal variation, wealth index, mother's education, mother's age at birth, antenatal care visit, gender of child, first birth, size at birth, assistance during delivery and timing and provider of first postnatal check-ups.

5.5 Discussion

Our study, which is the first to report the impact of different components of ENC practice on neonatal mortality, revealed a number of interesting and important findings. Specifically, the practice of deferment of bathing (for 72 hours after delivery) significantly contributed to reducing neonatal mortality, but a counterintuitive relation was observed between the avoidance of applying any substances to the umbilical cord and neonatal mortality. The remaining ENC practices did not show any statistically significant association with neonate deaths.

Impact of deferment of bathing

Delayed bathing is an essential component of thermal care practice that plays a crucial role in reducing neonatal hypothermia (body temperature below 36.5 degree Celsius)

(Kumar et al., 2009; WHO, 2006b). A review of recent research found that a significant proportion of neonates born at home in LMICs experienced hypothermia which contributed as a comorbidity to major causes of neonatal deaths such as infection, asphyxia and preterm birth (Lunze et al., 2013). Therefore, delayed bathing, by reducing the incidence of hypothermia, might significantly contribute in reducing neonatal mortality. The findings of our study on neonatal mortality in Bangladesh provided support to this hypothesis.

Impact of dry cord care

Sepsis or inflammation is a major cause of neonatal deaths in LMICs. Immediately after cutting the umbilical cord, traditional practices in some countries may dictate the application of substances such as ash, oil, mud, butter and spice pastes that can be harmful in causing omphalitis or infection of the cord stump and lead to newborn sepsis and therefore death (Hodgins et al., 2013; Neonatal Mortality Formative Research Working Group, 2008). However, our findings indicated that avoiding the application of any substances to the umbilical cord significantly increased neonatal mortality. Interestingly, this was consistent with the findings of another study in South Asia where dry cord care was significantly associated with increased odds of death (Seward et al., 2012).

On the other hand, applying chlorhexidine as an antiseptic to the umbilical cord stump in community and primary care settings in LMICs had been found to prevent sepsis and reduce neonatal mortality (Imdad et al., 2013). Thus, along with the recommendation of clean and dry cord care, WHO additionally recommends the application of topical antiseptics to the cord stump where the risk of infection is high (WHO, 1998). Until recently, sepsis was a major cause of neonatal deaths in Bangladesh (NIPORT, Mitra and Associates, & ICF International, 2013). Therefore, the application of antiseptic to the umbilical cord in the context of home births might be effective in reducing neonatal deaths compared to the application of no antiseptic.

Impact of immediate wrapping

As with delayed bathing, the ENC practice of immediate drying and wrapping the neonate is an important intervention to prevent hypothermia and thus reduce neonatal mortality (Khanal et al., 2014; Kumar et al., 2009). However, we observed an

insignificant impact of immediate wrapping on neonatal deaths in Bangladesh. An important point here was that while WHO emphasizes on the use of a soft dry clean cloth to wrap a newborn after birth, a number of studies reported that a significant proportion of newborns delivered at home were either not properly covered or wrapped with dirty fabric (Darmstadt et al., 2006; Iyengar et al., 2008). Such practices, either by a failure to prevent rapid heat loss or by increasing the risk of sepsis through contact with unhygienic cloth, might increase the likelihood of neonatal mortality. This could account for the insignificant result of immediate wrapping on neonatal deaths in our study.

Impact of immediate drying

We also observed an insignificant and counterintuitive relationship between neonatal mortality and the practice of the immediate drying of newborns. Studies on newborn skin-wiping indicated that wiping the newborn with chlorhexidine solution, thereby reducing the risk of early neonatal sepsis, reduced neonatal mortality for low birth weight babies (Tielsch et al., 2007). An unhygienic method of drying of newborns, in contrast, could be responsible for sepsis and thus neonatal mortality. The discussion in the review by Darmstadt et al. (2006), concerning the practice of wrapping neonates with dirty fabric in Bangladesh, could also indicate the possibility of improper drying of newborns in our study. Such an unhygienic practice might explain the increased mortality of children who were dried immediately compared to those who were not.

Impact of boiled instrument

Unlike our study, where we observed a statistically insignificant relationship between the use of boiled instruments to cut the cord and neonatal mortality, other research had noted a reduction in the risk of sepsis and neonatal deaths associated with use of a clean delivery kits that included a boiled blade to cut the cord (Seward et al., 2012). In contrast, Blencowe et al. (2011), reviewing four studies on Pakistan, Tanzania and Senegal, did not find any impact of the use of clean birth kits (including boiled/sterile/new blades) on neonatal sepsis or tetanus, and thus on neonatal deaths. However, the review could not provide any reasonable explanation for such findings.

A review of the NNHSG for Bangladesh reveals that the recommendation for clean cord-cutting (new/sterile blade or surgical blade) includes the use of sterile thread for

tying the cord (Ministry of Health and Family Welfare, 2009). However, the use of sterilized thread to tie the cord was less common in Bangladesh and other South Asian countries where dirty thread (cotton thread from used quilts or jute fibre) was often used to tie the cord (Darmstadt et al., 2006; Iyengar et al., 2008; Moran et al., 2009; Osrin et al., 2002). On the other hand, different components of the delivery kit (i.e. the use of a boiled blade to cut the cord, use of boiled thread to tie the cord and using a clean plastic sheet as the delivery surface) were all shown to be associated with significant relative reductions in mortality in South Asia (Seward et al., 2012). Unfortunately, such information was limited in our data, which being unaccounted for in our analysis could be responsible for a statistically insignificant effect of boiled instrument on neonatal mortality in our model.

Impact of breastfeeding within the first hour of birth

Earlier studies found that the risk of neonatal mortality increased with the delay in initiation of breastfeeding, indicating a dose-response relationship (Edmond et al., 2006). Studies in Bangladesh and other developing countries, on the other hand, observed a common practice of premature breast milk supplementation like honey and sweet water which might expose newborns to pathogens (Darmstadt et al., 2006; Moran et al., 2009; Thairu & Pelto, 2008). Newborns in our study, who started breastfeeding within first hour of birth, might have also consumed other supplements which could be responsible for the statistically insignificant result of the effect of breastfeeding (in the first hour) on neonatal mortality.

Some points are worth mentioning to contextualise our results. First, ENC practice is multi-factorial issue where different components may influence each other. Therefore, a comparison of the cases who reported providing all six ENC practices with those provided different five or no practices could be insightful. However, due to the size of our sample, such analysis was not possible. Second, our analysis showed a higher neonatal mortality for those who had early postnatal check-ups. This finding could be due to the higher likelihood of morbidity or disease. An earlier study on the utilization of postnatal care among rural women in Nepal observed a similar outcome (Dhakal et al., 2007). Finally, our analysis did not find any effect of birth size on mortality. This is counterintuitive, given that birth size is associated with birth weight and would therefore also be associated with mortality, as confirmed in earlier studies (Titaley et al.,

2008). A further review of previous studies indicates that this association may relate to intrauterine growth restriction and extents of prematurity (Baqui et al., 2013; Baschat et al., 2007). Unfortunately, these information were unavailable to us preventing an investigation of these factors.

Limitation

This study had several potential limitations. The data relies on self-reporting by the participants. Self-reported information can be biased in a certain direction, whereas recall bias questions the accuracy of information, particularly about the timing of drying and wrapping. The relatively small sample size, specifically the number of neonatal deaths, may have resulted in low statistical power. Nevertheless, like previous studies (Kabir et al., 2012; Khanal et al., 2014; Nisar & Dibley, 2014a), such limitations are outstripped by the insights gained through analysing data obtained from such a large, nationally representative sample of newborns.

5.6 Conclusion

We investigated the effect of ENC practices on reducing the mortality of neonates delivered at home in Bangladesh. Our analysis offers some important insights for the improvement of ENC policy and health worker practice. First, neonatal mortality may be reduced through emphasizing delayed bathing. Second, the ENC guidelines in Bangladesh should include the use of topical antiseptics such as chlorhexidine to the cord stump. Such a recommendation may also apply to LMICs where the incidence of sepsis is high. Third, the insignificant findings in our study associated with immediate drying and wrapping of newborns may be related to the reportedly common practice of using unclean cloth in Bangladesh. The NNHSG for Bangladesh do not include any instruction relating to the cleanliness of the cloth needed to dry and wrap newborns. Specific guidelines on these practices, as well as community-based interventions, are required to improve hygiene at baby's birth. Finally, more emphasis is required on the use of clean delivery kits and initiation of immediate and exclusive breastfeeding. However, we recommend such surveys to collect information on the different components of the delivery kit used at birth and premature breast milk supplementation, as such data may provide more precise insight into the impact of a boiled instrument (to cut the umbilical cord) and immediate initiation of breastfeeding on neonatal death.

5.7 Chapter Summary

This chapter examined the impact of ENC practices on the mortality of neonates delivered at home in Bangladesh. It was observed that delayed bathing significantly contributed to reducing neonatal mortality. However, a significant but counterintuitive relationship was also observed between the dry cord care and neonatal deaths. In the following chapter, the determinants of ENC practices in Bangladesh are examined.

Chapter 6 : The Determinants of Essential Newborn Care for Home Births in Bangladesh

This chapter studies Research Question 4; determinants of ENC in Bangladesh. A secondary analysis using Bangladesh DHS data was conducted and the findings have been published in the journal *Public Health*.

Akter T, Dawson A, & Sibbritt D. (2016). The determinants of essential newborn care for home births in Bangladesh. *Public Health*, 141(12), 7-16.

6.1 Abstract

Objectives: To examine the association of socio-demographic, antenatal and delivery care factors with the Essential Newborn Care (ENC) practices of neonates born at home in Bangladesh.

Study design: This study analysed data of a cross-sectional survey – the Bangladesh Demographic and Health Survey, 2011.

Methods: This analysis considered 3,190 most recent live-born infants who were delivered at home within three years of the survey. Logistic regression models were used to identify the factors affecting the implementation of six ENC practices, namely using disinfected instruments to cut the umbilical cord, avoidance of application of any substances to the umbilical cord stump, immediate drying and wrapping of newborns, delayed bathing of newborns, and immediate initiation of breastfeeding.

Results: Factors affecting ENC practices in Bangladesh are low parental education, low utilization of antenatal care services, the absence of skilled birth attendants, smaller size at birth, higher birth order and mother's age at birth. Regional factors also seem to considerably affect ENC practices.

Conclusion: There is ample scope to improve the coverage of ENC practices in Bangladesh. Health promotion programs that target parents with low education and older mothers may help to build awareness of ENC practices. This investigation provides insight into the key determinants of ENC practices, which require consideration when scaling up ENC practices in low and lower-middle income countries.

6.2 Introduction

The neonatal period – the first 28 days of life – is the time when a child is most vulnerable to illness, injury and death. Worldwide, approximately three million children die in their neonatal period (WHO & PMNCH, 2011). Around 99% of these deaths occur in the low and lower-middle income countries (LMICs) where health systems are weak and a large proportion of women give birth at home without any assistance from skilled birth attendants (SBAs) (Seward et al., 2012; WHO & PMNCH, 2011). The majority of these neonatal deaths can be prevented by evidence-based health interventions that are available, affordable and acceptable to women in LMICs (Jones et al., 2003).

Essential Newborn Care (ENC) is a strategy comprised of interventions designed to improve newborn health and support mothers to care for their babies. ENC includes immediate drying and wrapping of newborns after birth, initiating skin-to-skin (STS) contact, clean cord care, dry cord care, immediate initiation of breastfeeding and delayed bathing (WHO, 2006b). Despite the acknowledgement of the importance of ENC, its implementation remains low, particularly for home births in LMICs (Baqui et al., 2007; Khanal et al., 2014; Pagel et al., 2014; Saaka & Iddrisu, 2014; Shahjahan et al., 2012; Shamba et al., 2014).

Factors determining the implementation of individual components of ENC, although investigated widely, have not been consistently identified in earlier studies (Baqui et al., 2007; Holman & Grimes, 2001; Khanal et al., 2014; Victor et al., 2013). For example, mothers' education, antenatal care (ANC) and the presence of SBAs were found to positively influence the delivery of thermal care in Nepal (Khanal et al., 2014). In contrast, a study in India observed that ANC visits and the presence of SBAs were not significantly associated with thermal care but influenced the practice of dry cord care and early breastfeeding (Baqui et al., 2007). Again, a recent study in Tanzania found that the factors positively associated with immediate initiation of breastfeeding were mother's age, education, unemployment, living in urban areas, as well as the assistance of SBAs (Victor et al., 2013). In contrast, a study in Bangladesh reported a negative effect of a mother's age on the immediate initiation of breastfeeding (Holman & Grimes, 2001). Such findings suggest that factors affecting the implementation of ENC

may differ across countries or regions within a country. Therefore, country specific analysis of the determinants of specific ENC practices can inform policies and strategies to improve newborn care and mobilize resources to enhance the coverage and uptake of ENC for individual countries.

Like other LMICs, Bangladesh exhibits a high neonatal mortality rate (28 per 1,000 live births) in combination with low uptake of ENC (NIPORT, Mitra and Associates, & ICF International, 2016). The majority of women in the country give birth at home, with more than half assisted by unskilled birth attendants (NIPORT, Mitra and Associates, & ICF International, 2016). Hence, an understanding of the determinants of ENC will be useful in designing cost effective interventions to better support the delivery of services aiming to improve newborn care. In this context, this study aims to examine the association of important socio-demographic, antenatal and delivery care factors that may affect the delivery of ENC practices to babies born at home in Bangladesh.

6.3 Methods

Data source

This study analysed data from the 2011 Bangladesh Demographic and Health Survey (BDHS), a cross-sectional survey collecting nationally representative demographic and health information every three to four years (NIPORT, Mitra and Associates, & ICF International, 2013). The aim of this survey is to monitor and evaluate maternal, child health and family planning programs to support future interventions plans.

The primary sampling unit for 2011 BDHS was an enumeration area (EA), with an average of 120 households. In the first stage, 600 EAs were sampled using probability proportional to the EA size followed by household listing. In the second stage, an average of 30 households was selected per EA using systematic sampling technique. Based on a two-stage stratified sampling method, the survey collected information of 17,141 households. Of these households, 17,842 ever-married women aged 12-49 years were interviewed with a response rate of approximately 98 percent. The number of male respondents was 3,997, as they were interviewed only from one-third of the surveyed households and the response rate was around 92 percent. All information obtained in the survey was self-reported and collected by separate questionnaires for households,

women and men. The household questionnaire focused on economic aspects while questionnaires for men and women collected socio-demographic and health related information. The women's questionnaire additionally collected data on the use of antenatal, intrapartum and postnatal care services. Details of the design and data collection procedures have been described elsewhere (NIPORT, Mitra and Associates, & ICF International, 2013).

Study participants

The present analyses were restricted to all live-born home-delivered infants. Each mother's most recent birth that was within three years of the survey was considered for this study as detailed information on ENC practice were only available for these births.

Outcome variable

The primary outcomes of interest were the six individual components of ENC, as derived from the National Neonatal Health Strategy and Guidelines for Bangladesh, which recommended the following six practices: 1) the use of instruments, disinfected by boiling in water, to cut the umbilical cord; 2) umbilical cord care that did not involve the application of any substances to the cord stump after being cut; 3) drying the newborn within 5 minutes of birth; 4) wrapping the newborn within 5 minutes of birth; 5) bathing the newborn at least 72 hours after birth; and 6) the initiation of breastfeeding within one hour of delivery (Ministry of Health and Family Welfare, 2009).

Exposure variables

Based on previous literature, 11 independent variables were considered in the analyses including mother's age at birth; mother's education; father's education; socioeconomic status (SES) of the participant; sex of the child; birth order; size of a baby at birth; number of ANC visits; assistance received during delivery; urban/rural status of the interviewees usual place of residence and administrative divisions (Ezeh et al., 2014; Khanal et al., 2014; Nisar & Dibley, 2014a; Titaley et al., 2008). Mother's and father's educational levels were categorized as no education (up to 4 years of schooling including none), primary (5 to 9 years of schooling) and secondary (minimum 10 years of schooling). The definition of SES of a household relied on a wealth index provided in the data which was constructed using the household asset information and principal components analysis (NIPORT, Mitra and Associates, & ICF International, 2013; Rutstein, 1999). Mother's age at birth and number of ANC visits were considered as

continuous variables. The size of a baby at birth as perceived by mother was categorized as average, larger than average and smaller than average. Assistance received during delivery was categorized as a binary variable (presence or absence of SBAs), while the order of a baby's birth was grouped as first-born and higher (second-born or more).

Statistical analysis

We considered separate independent regression models for each of the six ENC practices. First, the differences in the exposure variables associated with each ENC practice were examined using unadjusted logistic regression models. The exposure variables with p-value < 0.3 were then further examined using multiple logistic regression models (Hosmer & Lemeshow, 2000). A backward stepwise elimination process was utilized to determine the most important exposures (with p-value < 0.05) on each outcome variable. All statistical analyses were performed using STATA version 11.2. The STATA survey commands were used to adjust the weights and sampling design.

6.4 Results

Among 3,190 newborns, disinfected (boiled in water) instruments were used in 88% of cases to cut the umbilical cord, while no substance was applied to the cord stump of 57% infants. Immediately after birth, 52% of newborns were dried, but only 33% were wrapped. The percentages of newborns that experienced delayed bathing and were breastfed within one hour of birth were 29% and 50%, respectively.

Table 6.1 shows the factors associated with the use of boiled instruments. The odds of using boiled instruments increased 4% for each additional year increase in mother's age (OR=1.04; 95% CI: 1.01, 1.07; p=0.002), while it decreased significantly for newborns whose mothers had low educational attainment (OR=0.45; 95% CI: 0.23, 0.89; p=0.021) or whose birth size was smaller than average (OR=0.68; 95% CI: 0.50, 0.92; p=0.013). For each extra ANC visit, the odds of using boiled instruments increased by 9% (OR=1.09; 95% CI: 1.01, 1.17; p=0.024). Furthermore, the use of boiled instruments were less likely in rural compared to urban areas (OR=0.54; 95% CI: 0.36, 0.79; p=0.002). Among divisions, newborns from Sylhet were more likely to have had their cords cut with boiled instrument compared to the reference category Dhaka (OR=1.80; 95% CI: 1.18, 2.76; p=0.007).

Table 6.1: Characteristics, unadjusted and adjusted odds ratios (ORs) for factors associated with utilization of boiled instruments before cut the umbilical cord for most recent home deliveries in Bangladesh

Variable		Unadjusted		Adjusted	
	n=3,051 (%)[a]	OR	95% CI	OR	95% CI
Mother's age at birth (years)	23.13 (5.68)[b]	1.02	[1.00, 1.05]	1.04	[1.01, 1.07]
Mother's education					
Secondary (Reference)	201 (6.0)	1.00		1.00	
Primary	1,551 (50.1)	0.64	[0.33, 1.24]	0.83	[0.42, 1.63]
No education	1,299 (43.9)	0.37	[0.19, 0.71]	0.45	[0.23, 0.89]
Father's education					
Secondary (Reference)	366 (11.6)	1.00			
Primary	1,097 (34.9)	0.53	[0.33, 0.86]		
No education	1,582 (53.5)	0.47	[0.29, 0.75]		
Wealth Index					
Rich (Reference)	681 (20.1)	1.00			
Middle	1,032 (34.1)	0.54	[0.36, 0.81]		
Poor	1,338 (45.8)	0.45	[0.31, 0.65]		
Sex of child					
Male (Reference)	1,530 (49.9)	1.00			
Female	1,521 (50.1)	0.93	[0.72, 1.19]		
Birth order					
First-born (Reference)	923 (29.5)	1.00			
Second-born or more	2,128 (70.5)	1.19	[0.92, 1.56]		
Size of baby					
Average (Reference)	2,074 (68.5)	1.00		1.00	
Large	395 (13.0)	1.43	[0.94, 2.17]	1.37	[0.90, 2.10]
Small	582 (18.5)	0.66	[0.49, 0.89]	0.68	[0.50, 0.92]
ANC visit (times)	1.68 (2.24)[b]	1.14	[1.07, 1.23]	1.09	[1.01, 1.17]
Assistance during delivery					
Skilled[c] (Reference)	164 (4.4)	1.00			
Unskilled[d]	2,880 (95.6)	0.66	[0.35, 1.24]		
Urban/ Rural					
Urban (Reference)	712 (16.2)	1.00		1.00	
Rural	2,339 (83.8)	0.50	[0.34, 0.73]	0.54	[0.36, 0.79]
Division					
Dhaka (Reference)	488 (29.8)	1.00		1.00	
Barisal	359 (6.0)	0.90	[0.60, 1.35]	0.86	[0.57, 1.29]
Chittagong	664 (25.0)	1.03	[0.73, 1.47]	1.04	[0.73, 1.48]
Khulna	270 (7.2)	1.20	[0.75, 1.93]	1.03	[0.64, 1.67]
Rajshahi	357 (12.7)	0.86	[0.57, 1.32]	0.87	[0.57, 1.33]
Rangpur	391 (10.9)	1.62	[1.03, 2.55]	1.54	[0.97, 2.44]
Sylhet	522 (8.4)	1.64	[1.08, 2.48]	1.80	[1.18, 2.76]

Note: Weighted analysis.
[a] Total number varies between categories because of missing values.
[b] Mean (SD in parenthesis).
[c] Skilled providers include doctor, nurse, midwife, paramedic, family welfare visitor (FWV) and CSBA.
[d] A total of 17 cases were included in this group who did not take any assistance during delivery.

Factors associated with the application of any substance to the cord stump are presented in Table 6.2. The odds of applying any substance to the cord stump were lower for newborns whose mothers were assisted by unskilled birth attendants compared to those supported by SBAs (OR=0.62; 95% CI: 0.42, 0.91; p=0.014). The likelihood of applying any substance to the cord stump were higher for newborns from Barisal (OR=2.04; 95% CI: 1.53, 2.71; p<0.001) and Khulna (OR=1.46; 95% CI: 1.07, 1.98; p=0.016) but lower for neonates of Rangpur (OR=0.62; 95% CI: 0.47, 0.83; p=0.001), compared to those from Dhaka division.

Table 6.2: Characteristics, unadjusted and adjusted odds ratios (ORs) for factors associated with applying a substance to the umbilical cord stump for most recent home deliveries in Bangladesh

Variable		Unadjusted		Adjusted	
	n=3,063 (%)[a]	OR	95% CI	OR	95% CI
Mother's age at birth (years)	23.12 (5.69)[b]	0.99	[0.98, 1.01]		
Mother's education					
Secondary (Reference)	203 (5.9)	1.00			
Primary	1,550 (49.8)	0.86	[0.62, 1.21]		
No education	1,310 (44.2)	0.84	[0.60, 1.18]		
Father's education					
Secondary (Reference)	366 (11.4)	1.00			
Primary	1,111 (35.2)	0.84	[0.64, 1.09]		
No education	1,581 (53.4)	0.78	[0.60, 1.01]		
Wealth Index					
Rich (Reference)	675 (19.7)	1.00			
Middle	1,039 (34.3)	0.94	[0.76, 1.18]		
Poor	1,349 (45.9)	0.78	[0.63, 0.97]		
Sex of child					
Male (Reference)	1,546 (50.5)	1.00			
Female	1,517 (49.5)	0.95	[0.80, 1.11]		
Birth order					
First-born (Reference)	922 (29.3)	1.00			
Second-born or more	2,141 (70.7)	0.92	[0.77, 1.09]		
Size of baby					
Average (Reference)	2,087 (68.6)	1.00			
Large	394 (12.9)	0.98	[0.77, 1.26]		
Small	582 (18.5)	0.98	[0.80, 1.21]		
ANC visit (times)	1.67 (2.23)[b]	1.02	[0.98, 1.06]		
Assistance during delivery					
Skilled[c] (Reference)	160 (4.3)	1.00		1.00	
Unskilled[d]	2,896 (95.7)	0.56	[0.39, 0.81]	0.62	[0.42, 0.91]
Urban/ Rural					
Urban (Reference)	716 (16.3)	1.00			
Rural	2,347 (83.7)	0.85	[0.69, 1.04]		
Division					
Dhaka (Reference)	498 (30.1)	1.00		1.00	
Barisal	372 (6.2)	2.10	[1.59, 2.79]	2.04	[1.53, 2.71]
Chittagong	659 (24.7)	1.02	[0.80, 1.30]	1.01	[0.79, 1.28]
Khulna	270 (7.1)	1.48	[1.09, 2.00]	1.46	[1.07, 1.98]
Rajshahi	362 (12.9)	0.79	[0.59, 1.06]	0.79	[0.59, 1.06]
Rangpur	389 (10.8)	0.60	[0.45, 0.80]	0.62	[0.47, 0.83]
Sylhet	513 (8.2)	1.02	[0.79, 1.31]	1.02	[0.79, 1.31]

Note: Weighted analysis.
[a] Total number varies between categories because of missing values.
[b] Mean (SD in parenthesis).
[c] Skilled providers include doctor, nurse, midwife, paramedic, family welfare visitor (FWV) and CSBA.
[d] A total of 17 cases were included in this group who did not take any assistance during delivery.

As evident from Table 6.3, which presents the factors associated with the practice of immediate drying of newborns, father's education and birth divisions were significantly associated with such practice. Specifically, newborns with less educated fathers were less likely to be dried immediately after birth (OR=0.76; 95% CI: 0.59, 0.99; p=0.041). Conversely, compared to the newborns from Dhaka, the odds of immediate drying were lower for the infants born in Sylhet division (OR=0.73; 95% CI: 0.57, 0.94; p=0.013).

Table 6.3: Characteristics, unadjusted and adjusted odds ratios (ORs) for factors associated with immediate drying of newborns for most recent home deliveries in Bangladesh

Variable		Unadjusted		Adjusted	
	n=3,145 (%)[a]	OR	95% CI	OR	95% CI
Mother's age at birth (years)	23.03 (5.67)[b]	0.99	[0.98, 1.00]		
Mother's education					
Secondary (Reference)	212 (6.0)	1.00			
Primary	1,602 (50.3)	0.90	[0.64, 1.25]		
No education	1,331 (43.7)	0.74	[0.53, 1.03]		
Father's education					
Secondary (Reference)	383 (11.6)	1.00		1.00	
Primary	1,146 (35.6)	0.82	[0.63, 1.07]	0.84	[0.64, 1.09]
No education	1,610 (52.8)	0.76	[0.59, 0.98]	0.76	[0.59, 0.99]
Wealth Index					
Rich (Reference)	706 (20.1)	1.00			
Middle	1,065 (34.2)	0.95	[0.76, 1.18]		
Poor	1,374 (45.7)	0.82	[0.67, 1.01]		
Sex of child					
Male (Reference)	1,580 (50.3)	1.00			
Female	1,565 (49.7)	1.00	[0.86, 1.18]		
Birth order					
First-born (Reference)	974 (30.2)	1.00			
Second-born or more	2,171 (69.8)	0.96	[0.81, 1.13]		
Size of baby					
Average (Reference)	2,135 (68.5)	1.00			
Large	411 (12.9)	0.96	[0.76, 1.22]		
Small	599 (18.6)	0.91	[0.74, 1.12]		
ANC visit (times)	1.69 (2.26)[b]	1.03	[0.99, 1.06]		
Assistance during delivery					
Skilled[c] (Reference)	174 (4.4)	1.00			
Unskilled[d]	2,964 (95.6)	0.81	[0.57, 1.16]		
Urban/ Rural					
Urban (Reference)	746 (16.5)	1.00			
Rural	2,399 (83.5)	1.06	[0.87, 1.30]		
Division					
Dhaka (Reference)	508 (30.0)	1.00		1.00	
Barisal	374 (6.1)	0.86	[0.65, 1.14]	0.85	[0.64, 1.12]
Chittagong	675 (24.6)	0.98	[0.78, 1.24]	0.98	[0.77, 1.24]
Khulna	280 (7.2)	0.95	[0.71, 1.29]	0.95	[0.70, 1.28]
Rajshahi	379 (13.0)	1.28	[0.97, 1.71]	1.27	[0.96, 1.70]
Rangpur	403 (10.9)	0.89	[0.68, 1.17]	0.90	[0.68, 1.17]
Sylhet	526 (8.1)	0.73	[0.56, 0.93]	0.73	[0.57, 0.94]

Note: Weighted analysis.
[a] Total number varies between categories because of missing values.
[b] Mean (SD in parenthesis).
[c] Skilled providers include doctor, nurse, midwife, paramedic, family welfare visitor (FWV) and CSBA.
[d] A total of 17 cases were included in this group who did not take any assistance during delivery.

Father's education and birth division were also significantly associated with immediate wrapping of newborns (Table 6.4). Lower odds of immediate wrapping was observed for newborns with less educated fathers (OR=0.71; 95% CI: 0.54, 0.93; p=0.013). Conversely, newborns were less likely to be wrapped immediately after birth in Sylhet (OR=0.49; 95% CI: 0.37, 0.65; p<0.001) but more likely in Rajshahi (OR=1.54; 95% CI: 1.15, 2.05; p=0.003) compared to the infants from Dhaka division.

Table 6.4: Characteristics, unadjusted and adjusted odds ratios (ORs) for factors associated with immediate wrapping of newborns for most recent home deliveries in Bangladesh

Variable		Unadjusted		Adjusted	
	n=3,146 (%)[a]	OR	95% CI	OR	95% CI
Mother's age at birth (years)	23.01 (5.66)[b]	0.99	[0.98, 1.01]		
Mother's education					
Secondary (Reference)	213 (6.0)	1.00			
Primary	1,602 (50.2)	1.00	[0.71, 1.42]		
No education	1,331 (43.7)	0.94	[0.66, 1.34]		
Father's education					
Secondary (Reference)	381 (11.5)	1.00		1.00	
Primary	1,145 (35.5)	0.77	[0.59, 1.01]	0.79	[0.60, 1.05]
No education	1,614 (53.0)	0.71	[0.55, 0.93]	0.71	[0.54, 0.93]
Wealth Index					
Rich (Reference)	707 (20.2)	1.00			
Middle	1,065 (34.2)	0.84	[0.67, 1.06]		
Poor	1,374 (45.6)	0.77	[0.61, 0.95]		
Sex of child					
Male (Reference)	1,580 (50.3)	1.00			
Female	1,566 (49.7)	1.01	[0.85, 1.19]		
Birth order					
First-born (Reference)	975 (30.3)	1.00			
Second-born or more	2,171 (69.7)	1.02	[0.85, 1.23]		
Size of baby					
Average (Reference)	2,135 (68.5)	1.00			
Large	413 (13.0)	0.94	[0.73, 1.22]		
Small	598 (18.5)	1.06	[0.85, 1.32]		
ANC visit (times)	1.68 (2.26)[b]	1.04	[1.00, 1.08]		
Assistance during delivery					
Skilled[c] (Reference)	174 (4.4)	1.00			
Unskilled[d]	2,965 (95.6)	0.88	[0.61, 1.28]		
Urban/ Rural					
Urban (Reference)	745 (16.5)	1.00			
Rural	2,401 (83.5)	0.86	[0.70, 1.06]		
Division					
Dhaka (Reference)	508 (30.0)	1.00		1.00	
Barisal	374 (6.1)	0.77	[0.57, 1.03]	0.75	[0.56, 1.02]
Chittagong	674 (24.6)	0.93	[0.73, 1.20]	0.92	[0.71, 1.18]
Khulna	281 (7.2)	0.74	[0.53, 1.03]	0.73	[0.53, 1.01]
Rajshahi	381 (13.1)	1.55	[1.17, 2.07]	1.54	[1.15, 2.05]
Rangpur	402 (10.8)	0.90	[0.68, 1.20]	0.91	[0.68, 1.21]
Sylhet	526 (8.1)	0.49	[0.36, 0.65]	0.49	[0.37, 0.65]

Note: Weighted analysis.
[a] Total number varies between categories because of missing values.
[b] Mean (SD in parenthesis).
[c] Skilled providers include doctor, nurse, midwife, paramedic, family welfare visitor (FWV) and CSBA.
[d] A total of 17 cases were included in this group who did not take any assistance during delivery.

Our analysis revealed that birth order, ANC visit and divisions were significantly associated with delayed bathing (Table 6.5). The odds of delayed bathing decreased by 24% for newborns with higher birth order compared to that of first-born (OR=0.76; 95% CI: 0.63, 0.92; p=0.004). An additional ANC visit increased the practice of delayed bathing by 9% (OR=1.09; 95% CI: 1.05, 1.14; p<0.001). Finally, compared to births from the Dhaka division, a significant and positive impact on delayed bathing was found for babies born in Barisal, Rajshahi, Rangpur and Sylhet divisions.

Table 6.5: Characteristics, unadjusted and adjusted odds ratios (ORs) for factors associated with delayed bathing of newborns for most recent home deliveries in Bangladesh

Variable		Unadjusted		Adjusted	
	n=3,169 (%)[a]	OR	95% CI	OR	95% CI
Mother's age at birth (years)	23.03 (5.68)[b]	0.99	[0.97, 1.00]		
Mother's education					
Secondary (Reference)	215 (6.1)	1.00			
Primary	1,615 (50.2)	0.89	[0.64, 1.25]		
No education	1,339 (43.7)	0.59	[0.42, 0.83]		
Father's education					
Secondary (Reference)	385 (11.6)	1.00			
Primary	1,157 (35.5)	0.96	[0.73, 1.27]		
No education	1,621 (52.9)	0.81	[0.62, 1.07]		
Wealth Index					
Rich (Reference)	710 (20.1)	1.00			
Middle	1,078 (34.4)	0.85	[0.67, 1.07]		
Poor	1,381 (45.5)	0.80	[0.64, 1.00]		
Sex of child					
Male (Reference)	1,586 (50.0)	1.00			
Female	1,583 (50.0)	0.93	[0.79, 1.11]		
Birth order					
First-born (Reference)	989 (30.4)	1.00		1.00	
Second-born or more	2,180 (69.6)	0.73	[0.61, 0.87]	0.76	[0.63, 0.92]
Size of baby					
Average (Reference)	2,150 (68.5)	1.00			
Large	414 (12.9)	0.91	[0.70, 1.18]		
Small	605 (18.6)	0.85	[0.68, 1.06]		
ANC visit (times)	1.68 (2.26)[b]	1.12	[1.08, 1.17]	1.09	[1.05, 1.14]
Assistance during delivery					
Skilled[c] (Reference)	176 (4.5)	1.00			
Unskilled[d]	2,986 (95.5)	0.82	[0.56, 1.19]		
Urban/ Rural					
Urban (Reference)	745 (16.4)	1.00			
Rural	2,424 (83.6)	1.00	[0.80, 1.24]		
Division					
Dhaka (Reference)	511 (30.0)	1.00		1.00	
Barisal	380 (6.2)	1.93	[1.44, 2.60]	1.86	[1.38, 2.51]
Chittagong	680 (24.6)	0.98	[0.74, 1.29]	1.01	[0.77, 1.34]
Khulna	283 (7.3)	1.03	[0.73, 1.45]	0.97	[0.68, 1.37]
Rajshahi	380 (13.0)	1.49	[1.09, 2.03]	1.50	[1.09, 2.05]
Rangpur	405 (10.8)	2.94	[2.20, 3.93]	2.72	[2.02, 3.65]
Sylhet	530 (8.1)	1.28	[0.96, 1.70]	1.36	[1.02, 1.81]

Note: Weighted analysis.
[a] Total number varies between categories because of missing values.
[b] Mean (SD in parenthesis).
[c] Skilled providers include doctor, nurse, midwife, paramedic, family welfare visitor (FWV) and CSBA.
[d] A total of 17 cases were included in this group who did not take any assistance during delivery.

Table 6.6 presents the factors associated with immediate initiation of breastfeeding. For every one year increase in a mother's age, the odds of immediate initiation of breastfeeding was lowered by 2% (OR=0.98; 95% CI: 0.97, 0.99; p=0.008). Furthermore, newborns from Rajshahi and Sylhet divisions were more likely to breastfeed within one hour of birth, compared to the newborns from Dhaka division.

Table 6.6: Characteristics, unadjusted and adjusted odds ratios (ORs) for factors associated with immediate initiation of breastfeeding for most recent home deliveries in Bangladesh

Variable		Unadjusted		Adjusted	
	n=3,182 (%)[a]	OR	95% CI	OR	95% CI
Mother's age at birth (years)	23.03 (5.68)[b]	0.98	[0.97, 1.00]	0.98	[0.97, 0.99]
Mother's education					
Secondary (Reference)	215 (6.1)	1.00			
Primary	1,621 (50.2)	0.88	[0.63, 1.22]		
No education	1,346 (43.7)	0.79	[0.57, 1.10]		
Father's education					
Secondary (Reference)	386 (11.6)	1.00			
Primary	1,162 (35.6)	0.97	[0.74, 1.26]		
No education	1,628 (52.8)	0.88	[0.68, 1.13]		
Wealth Index					
Rich (Reference)	712 (20.1)	1.00			
Middle	1,082 (34.4)	1.01	[0.81, 1.25]		
Poor	1,388 (45.5)	0.86	[0.70, 1.06]		
Sex of child					
Male (Reference)	1,598 (50.3)	1.00			
Female	1,584 (49.7)	0.92	[0.79, 1.08]		
Birth order					
First-born (Reference)	994 (30.4)	1.00			
Second-born or more	2,188 (69.6)	0.97	[0.82, 1.15]		
Size of baby					
Average (Reference)	2,157 (68.4)	1.00			
Large	419 (13.0)	1.15	[0.91, 1.45]		
Small	606 (18.6)	1.03	[0.84, 1.26]		
ANC visit (times)	1.68 (2.26)[b]	1.03	[1.00, 1.07]		
Assistance during delivery					
Skilled[c] (Reference)	173 (4.4)	1.00			
Unskilled[d]	3,002 (95.6)	1.07	[0.75, 1.52]		
Urban/ Rural					
Urban (Reference)	748 (16.4)	1.00			
Rural	2,434 (83.6)	0.92	[0.75, 1.12]		
Division					
Dhaka (Reference)	515 (30.1)	1.00		1.00	
Barisal	382 (6.2)	1.06	[0.81, 1.39]	1.06	[0.80, 1.39]
Chittagong	680 (24.5)	1.22	[0.96, 1.54]	1.23	[0.97, 1.55]
Khulna	284 (7.3)	1.22	[0.91, 1.64]	1.21	[0.90, 1.64]
Rajshahi	382 (13.0)	1.41	[1.07, 1.87]	1.42	[1.08, 1.88]
Rangpur	407 (10.8)	1.28	[0.98, 1.67]	1.26	[0.96, 1.65]
Sylhet	532 (8.1)	1.61	[1.26, 2.07]	1.68	[1.30, 2.16]

Note: Weighted analysis.
[a] Total number varies between categories because of missing values.
[b] Mean (SD in parenthesis).
[c] Skilled providers include doctor, nurse, midwife, paramedic, family welfare visitor (FWV) and CSBA.
[d] A total of 17 cases were included in this group who did not take any assistance during delivery.

6.5 Discussion

This study is the first to report the determinants of six ENC practices in Bangladesh. A number of factors were identified as being strongly associated with the components of ENC practices. Specifically, factors affecting the effective implementation of ENC practices were low parental education, low utilization of ANC services, absence of SBAs, smaller baby at birth, higher birth order, mother's age at birth, rural residency and division. The implications of each factor in improving ENC practices are discussed below.

Mothers' education was significantly associated with the utilization of boiled instruments. This finding was consistent with earlier research which also reported a positive relation between mothers' literacy and newborn health (Akter et al., 2015; Khanal et al., 2014; Seward et al., 2012; Titaley, Dibley, & Roberts, 2010). The reason for such relation is that educated mothers are expected to be more likely to have higher levels of health literacy including knowledge about disease prevention, management and treatment, as well as modern family planning methods (Akter et al., 2015; Khanal et al., 2014; Titaley, Dibley, & Roberts, 2009). Our study also found that fathers' education positively influenced the practice of immediate drying and wrapping of newborns. The protective effect of father's education on newborn health can be seen in increased household income, higher SES and health literacy (Akter et al., 2015; Kabir et al., 2012). Educated men may also play a key role in informed household decision making, which is particularly relevant in LMICs where women's empowerment is usually low (NIPORT, Mitra and Associates, & ICF International, 2013). Thus, our study confirms the role of parental education on neonatal health.

A negative association between higher birth order and delayed bathing was observed in our study. Earlier studies found that the second-born babies and their subsequent siblings received lower levels of maternal care and were significantly associated with neonatal mortality (Ezeh et al., 2014; Titaley et al., 2008). Furthermore, women more than one child were less likely to utilize ANC services, which might be due to their reliance on previous pregnancy experiences as well as competing time issues due to child caring responsibilities (Pallikadavath, Foss, & Stones, 2004; Titaley, Dibley, & Roberts, 2010). Thus, our result indicates that women who possess up-to-date maternal,

newborn and child health knowledge and have time available to attend ANC are more likely to have babies whose bathing are delayed.

We attempted to investigate the relation between low birth weight and ENC practices. However, birth weights are typically not known for babies born at home. Therefore, following earlier studies, we considered a baby's size at birth perceived by mother as a proxy for low birth weight (NIPORT, Mitra and Associates, & ICF International, 2013; Titaley et al., 2008). Our study observed decreased odds of using boiled instruments for smaller sized babies. This was consistent with other studies conducted in Bangladesh, India and Nepal, which identified term infants more likely to be delivered using a clean delivery kit than preterm infants (Seward et al., 2012). Although smaller babies did not always indicate preterm births, a study in Bangladesh reported that around 75 percent of neonatal deaths associated with low birth weights were preterm births (Titaley et al., 2008; Yasmin et al., 2001).

We found both the use of boiled instrument and the practice of delayed bathing positively associated with the utilization of ANC services (Baqui et al., 2007; Khanal et al., 2014). Antenatal care delivered by Community-based Skilled Birth Attendants (CSBAs) may assist in building mothers' awareness of ENC practices (Khanal et al., 2014; Ministry of Health and Family Welfare, 2009). The findings are in line with earlier studies and the National Neonatal Health Strategy and Guidelines for Bangladesh, which encourages ANC visits for pregnant mothers for better health outcomes (Ministry of Health and Family Welfare, 2009).

The National Neonatal Health Strategy and Guidelines for Bangladesh recommends avoiding the application of any substances to the umbilical cord stump after being cut (Ministry of Health and Family Welfare, 2009). Counter intuitively, we observed mothers assisted by unskilled birth attendants to be less likely to apply substances to the cord stump compared to those supported by SBAs. However, a detailed investigation revealed that the likelihood of applying antiseptics in the umbilical cord was higher for newborns whose mothers were assisted by SBAs, while the probability of applying potentially harmful substances like ash, oil, mud and spice pastes was lower for them (data not shown). This is consistent with the World Health Organization (WHO)

recommendation of applying topical antiseptics to the cord stump where the risk of infection is high (WHO, 1998).

Our findings of decreasing odds of immediate initiation of breastfeeding with the increase in mother's age was consistent with a study on rural Bangladesh (Holman & Grimes, 2001). Such finding might be attributed to the recent and intensified government and non-government efforts to promote immediate and exclusive breastfeeding in the country (BBF, 2012; Haider et al., 2010). Younger mothers might also be more receptive to the health initiatives (Holman & Grimes, 2001). However, a lack of experience about appropriate breastfeeding of first-time mothers may provide a contrasting result (Patel et al., 2010; Victor et al., 2013). Conversely, we found that the use of boiled instruments was positively associated with the increase in mother's age. A study in South Asia reported a similar relationship (Seward et al., 2012). Lower levels of knowledge about pregnancy among younger mothers could explain these findings. Thus, our study indicates that campaigns promoting immediate and exclusive breastfeeding coupled with encouraging young girls to delay motherhood can be effective in increasing the practice of ENC in Bangladesh.

In our study, neonates born to rural mothers had a lower likelihood of using boiled instruments to cut the umbilical cord compared with those living in urban areas. Previous studies found that women's use of health services depends on the proportion of facilities providing quality services (Ezeh et al., 2014; Titaley et al., 2008). Thus, a shortage of health services might result in rural mothers exhibiting lower odds of using of boiled instruments during delivery. Lower literacy rates in rural, compared to urban areas, may further negatively affect the use of ENC services (Ministry of Planning, 2013). Thus, our analysis highlights the importance of the equitable distribution of accessible ENC infrastructure between urban and rural areas.

Our study showed regional variation in ENC practices in Bangladesh. We observed that newborns from Sylhet were less likely to be dried and wrapped immediately after birth. Among all divisions, Sylhet has the lowest literacy rate and the highest proportion of the population in lowest wealth quintile (NIPORT, Mitra and Associates, & ICF International, 2013). The ENC practice of drying and wrapping of newborns might also be influenced by local culture and beliefs (Darmstadt et al., 2006; Winch et al., 2005).

In contrast, newborns from Sylhet were more likely to be delivered with boiled instruments, experience delayed bathing and be breastfed immediately by their mothers. This could be due to the success of the intervention programs, conducted in Sylhet between 2001 to 2013, that aimed to increase healthy maternal and neonatal behaviours (Baqui et al., 2008a; USAID & MCHIP, 2009). However, further research is required to conclude why ENC practices differ across divisions in Bangladesh.

This study has some potential limitations. First, as the study design is cross-sectional, we cannot determine any causal relationships but only associations between the exposures and the ENC practices. Second, recall bias was an important issue in this study, especially given that a large proportion of respondents had low literacy levels which may affect the respondents' ability to accurately report some information. Third, the selected exposure variables relied on the availability of information in the survey. For example, birth weights were not available in the data. As a result, following some earlier studies, size at birth perceived by mother was employed as a proxy to birth weight (Titaley, Dibley, & Roberts, 2010). Nevertheless, insights gained through analysing data obtained from such a large, nationally representative sample of newborns are expected to outstrip these limitations.

6.6 Conclusion

Our study findings offer valuable insights that may assist in improving the uptake of ENC practices in Bangladesh as well as in other LMICs where health systems are weak and have a critical shortage of skilled providers. In particular, SBAs and ANC visits can be effective in promoting ENC practices. An investigation into the relative scarcity of health services between urban and rural areas can also be beneficial in this regard. Health promotion programs, specifically designed to target parents with low education and older mothers, are required to build awareness of evidence-based antenatal, intrapartum and postnatal care practices. However, further research should examine in detail why the uptake of ENC practices differed among divisions.

6.7 Chapter Summary

This chapter investigated the association of socio-demographic, antenatal and delivery care factors with the ENC practices of neonates born at home in Bangladesh. It was observed that low parental education, low utilization of antenatal care services, the absence of SBAs, smaller size at birth, higher birth order and mother's age at birth were associated with the ENC practices in Bangladesh. In the next chapter, an examination of the impact of both ANC and PNC in Bangladesh is presented.

Chapter 7 : What Impact does Antenatal and Postnatal Care have on Neonatal Death in LMICs? Evidence from Bangladesh

This chapter investigates Research Question 5; the association of ANC and PNC with neonatal deaths in Bangladesh. A secondary data analysis was conducted to examine this research question and the findings have been published in the journal *Health Care for Women International*.

Akter T, Dawson A, & Sibbritt D. (2017). What impact does antenatal and postnatal care have on neonatal deaths in low- and lower-middle-income countries? Evidence from Bangladesh. *Health Care for Women International,* 38(8), 848-860.

7.1 Abstract

We investigated the contribution of antenatal and postnatal care in reducing the risk of neonatal deaths in Bangladesh. The effects of these services were examined using adjusted Cox regression models and secondary data with 7,314 live-born infants. We observed that neonatal mortality was significantly decreased for newborns whose mothers' attended antenatal care services but postnatal care did not show any effect. Health promotion programs offering antenatal care in Bangladesh and other low and lower-middle income countries may build awareness about these practices. Further research is required to examine the reasons for the lack of impact of postnatal care on mortality.

7.2 Introduction

Every year about three million newborns die in their first month of life (WHO & PMNCH, 2011). Low and lower-middle income countries (LMICs) experience most of these deaths due to their weak health systems where the usual practice for women is to give birth at home without any assistance from skilled birth attendants (WHO & PMNCH, 2011). Around two-thirds of these deaths can be prevented through promoting universal access to antenatal care, skilled birth attendance and early postnatal care services (Darmstadt et al., 2005).

Antenatal care, which mothers receive during pregnancy, plays an important role in reducing the risk of maternal and neonatal deaths (Carroli et al., 2001; Chen et al., 2007; Raatikainen, Heiskanen, & Heinonen, 2007). These services include the routine identification and management of obstetric complications, the screening and treatment of conditions such as anaemia, syphilis and HIV, the provision of tetanus toxoid immunization as well as iron and folic acid supplements and health education and counselling on key intrapartum and postnatal issues (Ministry of Health and Family Welfare, 2009). Researchers examining different components of antenatal care have observed a significant reduction in neonatal mortality, including early neonatal mortality, with the rates varying from 39% to 69% and 23% to 53%, respectively (Dibley et al., 2012; Nisar & Dibley, 2014b; Nisar et al., 2015; Persson et al., 2012; Titaley et al., 2010; Zeng et al., 2008).

Postnatal care practices, which include the initiation of early and exclusive breastfeeding, thermal care of the newborn and the provision of hygienic umbilical cord and skin care, have also been found to be effective in reducing neonatal mortality (WHO & UNICEF, 2009; WHO & PMNCH, 2011). Researchers indicated that home-based postnatal care interventions could prevent newborn deaths in South Asian countries by up to 61% (Bang et al., 1999; Baqui et al., 2008a; Bhutta et al., 2011; Kumar et al., 2008; WHO & UNICEF, 2009). Newborns in Bangladesh, who had had a postnatal visit on the day of their birth, experienced a two-third reduction in neonatal death compared to those who did not receive a postnatal visit (Baqui et al., 2009a). Against the same comparison group, the researchers also reported a reduced risk of neonatal mortality by more than half for those who received a postnatal visit on the second day after their birth (Baqui et al., 2009a).

From a statistical modelling point of view, controlling for both antenatal and postnatal care services in the model is required to identify the impact of postnatal care. This is important because the impact of antenatal care services may modify the impact of postnatal care (Titaley & Dibley, 2012). However, researchers examining the contribution of postnatal care rarely control for antenatal care in the statistical model. A recent investigation on Indonesia, which did control for antenatal care services in the model, found no protective effect of postnatal care on neonatal deaths (Titaley & Dibley, 2012). However, more empirical evidence is required to confirm such findings.

Against this background, we examine the impact of antenatal and postnatal care services on neonatal mortality in Bangladesh. Like other LMICs, neonatal mortality is high in Bangladesh (28 per 1000 live births) where approximately 62% of women give birth at home with the majority of them assisted by unskilled birth attendants (NIPORT, Mitra and Associates, & ICF International, 2016). Around 64% of women in Bangladesh receive antenatal care, while only 32% of children receive their first postnatal check-up from a trained provider within two days of delivery (NIPORT, Mitra and Associates, & ICF International, 2016). By providing evidence of the effect of these services, this study may help to modify the focus of antenatal and postnatal care interventions policies and programs which may improve newborn health outcomes in LMICs. Thus, this study aims to examine the contribution of antenatal care and postnatal care in reducing the risk of neonatal deaths in Bangladesh.

7.3 Methods

Data source

We analysed data from the 2011 Bangladesh Demographic and Health Survey (BDHS), a periodic cross-sectional survey (NIPORT, Mitra and Associates, & ICF International, 2013). The survey was based on a two-stage stratified sample design and the primary sampling unit was enumeration area (EA) with an average of 120 households. In the first stage, 600 EAs were sampled using probability proportional to the EA size followed by household listing. In the second stage, an average of 30 households were selected per EA using systematic sampling technique. The survey collected information from 17,141 households with an individual interview of 17,842 ever-married women aged 12-49 years. Male respondents from one-third of the surveyed households were interviewed comprising 3,997 observations. To collect information about causes of child death, the BDHS 2011 used separate questionnaires for mothers who reported the death of an under-five child in the five years preceding the survey. Details of the design and data collection procedures have been described elsewhere (NIPORT, Mitra and Associates, & ICF International, 2013).

Ethics

The BDHS was approved by the Ethical Review Panel of the Ministry of Health and Family Welfare, Government of the Peoples' Republic of Bangladesh. All survey information was self-reported, and no medical records were reviewed. Informed verbal consent was obtained from all survey participants.

Study participants

All live-born infants were considered for this analysis. Detailed information on perinatal health care services was only available for the most recent birth of women participants, which was within five years of the survey. As a result, this study included 7,314 infants, of which 131 died during their neonatal period and of these, 102 were categorized as early neonatal deaths.

Outcome variable

The primary outcome of interest was neonatal mortality (deaths during first 28 days of life) and early neonatal mortality (deaths during first week of life) (WHO & PMNCH, 2011). Neonatal mortality was identified from the birth history of mothers, which involved the collection of information on their newborn's date of birth, survival status and age at death (if deceased).

Exposure variables

Antenatal care and postnatal care were the primary exposures in this study. These variables were categorized according to the recommendations of WHO, UNICEF and the National Neonatal Health Strategy and Guidelines for Bangladesh (Ministry of Health and Family Welfare, 2009; WHO & UNICEF, 2009). Antenatal care by a mother during pregnancy was categorized as 0 visit, 1-3 visits and 4 or more visits. We considered two definitions for the postnatal care variable. In the first definition, we considered whether a newborn received any postnatal care services from any type of provider within the first week of its birth. The other definition considered whether any such services had been received on day 1, within 2-7 days, or after 7 days of birth, which also included no services received.

Potential confounding variables

Based on previous literature and the availability of data, we considered two groups of variables that might potentially be associated with neonatal deaths (Titaley & Dibley, 2012). The first group was comprised of variables related to perinatal health care services, which included mode and place of delivery, as well as the types of delivery attendant. Our models did not include any confounders related to delivery complications like preterm birth and preeclampsia due to the unavailability of such data. The second group of variables comprised demographic, socioeconomic and birthing characteristics and included variables related to administrative divisions, usual place of residence (urban/rural), paternal years of schooling, maternal years of schooling, household wealth index, maternal age at birth, child sex, combined birth rank and interval, desire for pregnancy and birth size perceived by the mother. Following earlier research, the information about birth size perceived by mothers were used as a proxy for birth weight in our models, as the latter variable was unknown for babies born at home (Akter, Dawson, & Sibbritt, 2015, 2016; Nisar & Dibley, 2014a).

A wealth index for each participant was constructed using the household asset information and the principal components analysis (NIPORT, Mitra and Associates, & ICF International, 2013; Rutstein, 1999). Parental years of schooling, household wealth index and maternal age at birth were considered as continuous variables. The variable related to infants birth rank and interval was created as first birth rank, second/third birth rank with previous birth interval of more than 2 years, second/third birth rank infants with previous birth interval of less than or equal to 2 years, and fourth birth rank. The size of a baby at birth was categorized as average, larger than average and smaller than average. Assistance received during delivery was categorized as a binary variable indicating the presence or absence of skilled birth attendants. The variable related to the place of delivery was used to indicate whether the delivery took place at a health facility or not.

Statistical analysis

The differences in the exposure and other variables associated with the survival status of the newborns were examined using chi-square and t-tests. We considered two independent Cox Proportional Hazards regression models to identify the potential

confounder from the two groups of variables. One model was related to perinatal health care services while the other model considered demographic, socioeconomic and birthing characteristics. A backward stepwise elimination process was utilized to identify the potential confounder in these two groups (those with a p-value < 0.05). Then, after controlling for the identified confounding variables, adjusted Cox Proportional Hazards regression models were used to examine the effect of the exposures – antenatal and postnatal care service – on the neonatal mortality. A similar analysis was conducted for early neonatal deaths. All statistical analyses were performed using STATA version 11.2. The STATA survey commands were used to adjust the weights and sampling design.

7.4 Results

The selected sample was predominantly from rural areas (77%) with average mother's schooling of five years and maternal age at birth of 23 years. On the other hand, out of the total 131 neonatal deaths in our sample, 50 cases (38%) died on the 1st day of birth and 52 (40%) died on 2nd to 7th days of life. The overall distribution of demographic, socioeconomic and birthing characteristics across neonatal death status are presented in Table 7.1. Statistically significant differences between alive and deceased neonates were observed among divisions and size of a baby at birth. Specifically, neonatal mortality was higher in the Dhaka, Barisal and Sylhet divisions ($p=0.018$) and for babies that were larger than average size at birth ($p<0.001$). Similarly, in the case of early neonatal deaths, statistically significant differences were observed for a child's sex, birth rank and interval and size at birth. The likelihood of early neonatal mortality was particularly higher for male newborns ($p=0.048$), infants with first birth rank and second/third rank with interval$\leq$2 years ($p=0.041$) and infants who were larger than average at birth ($p<0.001$).

Table 7.1: Frequency distribution of demographic, socioeconomic and birthing characteristics for most recent deliveries in Bangladesh

Variable	Neonatal death			Early neonatal death		
	Alive n=7,183 (%)	Dead n=131 (%)	p-value	Alive n=7,212 (%)	Dead n=102 (%)	p-value
Division						
Dhaka	1,202 (31.4)	24 (37.6)		1,205 (31.3)	21 (40.8)	
Barisal	834 (5.8)	21 (9.6)		839 (5.8)	16 (8.9)	
Chittagong	1,377 (21.8)	15 (11.6)		1,377 (21.7)	15 (14.5)	
Khulna	863 (9.7)	13 (9.5)	0.018	865 (9.7)	11 (9.7)	0.148
Rajshahi	932 (13.6)	14 (11.6)		935 (13.6)	11 (11.6)	
Rangpur	946 (11.0)	14 (8.6)		950 (11.0)	10 (6.5)	
Sylhet	1,029 (6.8)	30 (11.6)		1,041 (6.9)	18 (8.0)	
Urban/ Rural						
Urban	2,283 (23.3)	43 (25.4)	0.619	2,286 (23.3)	40 (30.8)	0.118
Rural	4,900 (76.7)	88 (74.6)		4,926 (76.7)	62 (69.2)	
Paternal years of schooling	5.08± 0.06[a]	4.71 ± 0.50[a]	0.465	5.07±0.06[a]	4.85±0.57[a]	0.693
Maternal years of schooling	5.35±0.05[a]	5.18±0.41[a]	0.672	5.35±0.05[a]	5.13±0.49[a]	0.643
Household wealth index	-0.10±0.01[a]	-0.15±0.09[a]	0.666	-0.11±0.01[a]	-0.07±0.11[a]	0.768
Mother's age at birth (years)	23.33±0.08[a]	23.26±0.62[a]	0.918	23.33±0.08[a]	23.05±0.71[a]	0.693
Sex of child						
Male	3,707 (51.5)	79 (60.3)	0.086	3,722 (51.5)	64 (62.9)	0.048
Female	3,476 (48.5)	52 (39.7)		3,490 (48.5)	38 (37.1)	
Birth rank and interval						
First rank	2,423 (33.5)	42 (34.1)		2,428 (33.5)	37 (37.5)	
Second/third rank, interval>2years	2,965 (41.8)	49 (39.2)	0.117	2,977 (41.8)	37 (38.2)	0.041
Second/third rank, interval≤2years	424 (5.8)	14 (11.5)		426 (5.8)	12 (12.6)	
≥4th rank	1,354 (18.9)	22 (15.2)		1,363 (18.9)	13 (11.7)	
Desire for pregnancy						
Wanted then	5,089 (70.6)	96 (77.1)		5,107 (70.6)	78 (78.2)	
Wanted later	1,118 (15.4)	22 (15.3)	0.134	1,123 (15.4)	17 (16.0)	0.096
Wanted no more	976 (14.0)	13 (7.7)		982 (14.0)	7 (5.9)	
Size of baby						
Average	4,884 (68.4)	61 (46.5)		4,900 (68.3)	45 (45.3)	
Larger than average	1,047 (14.2)	40 (33.9)	<0.001	1,052 (14.3)	35 (37.4)	<0.001
Smaller than average	1,249 (17.4)	30 (19.7)		1,257 (17.5)	22 (17.3)	

Note: Weighted analysis.
[a]=Mean±SE

Table 7.2 presents the distribution of perinatal health care service measures across neonatal death status. Statistically significant associations were observed for all probable confounders for both neonatal and early neonatal mortality (all p<0.05). Higher mortality was observed for those babies born by Caesarean section, attended by skilled birth attendants and delivered at a health facility.

Table 7.2: Frequency distribution of perinatal health care service characteristics for most recent deliveries in Bangladesh (confounding variables only)

Variable	Neonatal death			Early neonatal death		
	Alive n=7,183 (%)	Dead n=131 (%)	p-value	Alive n=7,212 (%)	Dead n=102 (%)	p-value
Mode of delivery						
Non-caesarean section	6,029 (85.1)	106 (76.3)	0.023	6,054 (85.1)	81 (72.8)	0.005
Caesarean section	1,143 (14.9)	25 (23.7)		1,147 (14.9)	21 (27.2)	
Delivery attendance						
Unskilled	4,871 (71.0)	79 (58.2)	0.007	4,890 (71.0)	60 (55.3)	0.003
Skilled	2,303 (29.0)	51 (41.8)		2,313 (29.1)	41 (44.7)	
Place of delivery						
Non-health facility	5,132 (73.9)	83 (59.8)	0.002	5,152 (73.9)	63 (56.6)	<0.001
Health facility	2,050 (26.1)	48 (40.3)		2,059 (26.1)	39 (43.4)	

Note: Weighted analysis.

Results of the Cox regression models, presented in Table 7.3, show the association of antenatal and postnatal care services with neonatal deaths, both unadjusted and adjusted for potential confounders. Unadjusted analyses indicated an insignificant association of antenatal care with neonatal mortality (HR=0.91; 95% CI: 0.54, 1.52; p=0.712). On the other hand, when we did control for confounding variables, neonatal mortality was nearly half and significant for those whose mothers' attended four or more antenatal care visits during pregnancy compared to those without any visit (HR=0.52; 95% CI: 0.29, 0.96; p=0.036). Neonatal mortality was also less likely for those who made 1–3 antenatal care visits (HR=0.61; 95% CI: 0.38, 0.97; p=0.038).

In contrast, an unadjusted analyses with the postnatal care showed a significant and an increased risk of neonatal mortality both for the first week of life (HR=1.80; 95% CI: 1.21, 2.67; p=0.004) and for those who received care in the first day of life (HR=2.03; 95% CI: 1.36, 3.05; p=0.001). Even after controlling for confounding variables, receiving postnatal care showed an increased risk of neonatal mortality both in the first week of life (HR=1.51; 95% CI: 0.85, 2.69; p=0.157), and in the first day of life

(HR=1.83; 95% CI: 0.98, 3.41; p=0.059), although these associations were not statistically significant.

Table 7.3: Hazard ratios showing the relative contribution of antenatal and postnatal care in reducing neonatal deaths in Bangladesh

Variable	Unadjusted			Adjusted (Model 1)[a]			Adjusted (Model 2)[a]		
	HR	95%CI	p-value	HR	95%CI	p-value	HR	95%CI	p-value
Use of antenatal service									
No ANC visit	1.00			1.00			1.00		
1-3 visits	0.77	0.49,1.22	0.271	0.61	0.38,0.97	0.038	0.62	0.39,0.98	0.043
4 or more visits	0.91	0.54,1.52	0.712	0.52	0.29,0.96	0.036	0.53	0.29,0.96	0.037
PNC on the first week of life									
No PNC or day 8+ PNC	1.00			1.00					
Days 1-7 PNC	1.80	1.21,2.67	0.004	1.51	0.85,2.69	0.157			
PNC on the first week of life by day									
No PNC or day 8+ PNC	1.00						1.00		
Day 1 PNC	2.03	1.36,3.05	0.001				1.83	0.98,3.41	0.059
Days 2-7 PNC	0.74	0.32,1.73	0.491				0.81	0.33,1.96	0.640

Note: Weighted analysis.
[a]=Data on 48 cases were missing and were excluded from the analyses.
ANC: Antenatal Care; PNC: Postnatal Care.
Model 1 examined the effects of ANC and days 1-7 PNC by any care provider and adjusted for division, desire for pregnancy, birth size perceived by mother and place of delivery.
Model 2 examined the effects of ANC and day 1 PNC by any care provider and adjusted for division, desire for pregnancy, birth size perceived by mother and place of delivery.
Potential confounders division, desire for pregnancy, birth size perceived by mother and place of delivery were identified from demographic, socioeconomic and birthing characteristics, and perinatal health care service characteristics through backward stepwise elimination process.

Table 7.4 presents results of the Cox regression model used to identify the contribution of antenatal and postnatal care for early neonatal deaths. Our findings in the unadjusted analysis of early neonatal deaths were largely similar to the findings in Table 7.3. On the other hand, in the adjusted analysis, a reduction in early neonatal mortality was observed for neonates whose mothers' received antenatal care during pregnancy (HR=0.61; 95% CI: 0.31, 1.21; p=0.160). In contrast, an increase in early neonatal mortality was observed in newborns who received postnatal care in the first week of life (HR=1.49; 95% CI: 0.77, 2.88; p=0.235). An increased HR was also observed for those

who received such care in the first day of life (HR=1.83; 95% CI: 0.90, 3.75; p=0.097). However, none of these associations were statistically significant.

Table 7.4: Hazard ratios showing the relative contribution of antenatal and postnatal care in reducing early neonatal deaths in Bangladesh

Variable	Unadjusted			Adjusted (Model 1)[a]			Adjusted (Model 2)[a]		
	HR	95%CI	p-value	HR	95%CI	p-value	HR	95%CI	p-value
Use of antenatal service									
No ANC visit	1.00			1.00			1.00		
1-3 visits	0.91	0.54,1.54	0.737	0.70	0.41,1.19	0.186	0.71	0.41,1.21	0.203
4 or more visits	1.12	0.62,2.00	0.708	0.61	0.31,1.21	0.160	0.62	0.31,1.22	0.166
PNC on the first week of life									
No PNC or day 8+ PNC	1.00			1.00					
Days 1-7 PNC	1.97	1.26,3.09	0.003	1.49	0.77,2.88	0.235			
PNC on the first week of life by day									
No PNC or day 8+ PNC	1.00						1.00		
Day 1 PNC	2.27	1.43,3.59	<0.001				1.83	0.90,3.75	0.097
Days 2-7 PNC	0.67	0.24,1.83	0.431				0.70	0.24,2.01	0.506

Note: Weighted analysis.
[a]=Data on 48 cases were missing and were excluded from the analyses.
ANC: Antenatal Care; PNC: Postnatal Care.
Model 1 examined the effects of ANC and days 1-7 PNC by any care provider and adjusted for division, desire for pregnancy, birth size perceived by mother and place of delivery.
Model 2 examined the effects of ANC and day 1 PNC by any care provider and adjusted for division, desire for pregnancy, birth size perceived by mother and place of delivery.
Potential confounders division, desire for pregnancy, birth size perceived by mother and place of delivery were identified from demographic, socioeconomic and birthing characteristics, and perinatal health care service characteristics through backward stepwise elimination process.

7.5 Discussion

Our study is the first to examine the impact of antenatal and postnatal care in reducing neonatal deaths in Bangladesh. The findings indicated a significant impact of antenatal care on neonatal deaths. In particular, we found that neonatal mortality was significantly decreased by 48% for those newborns whose mothers' attended at least four antenatal care visits. However, an insignificant effect was observed in the case of early neonatal deaths. Postnatal care did not exhibit a significant effect on the reduction of either neonatal or early neonatal deaths.

Earlier researchers reported a reduced risk of mortality for any form of antenatal care with a large effect observed for iron and folic acid supplementation (Dibley et al., 2012; Nisar & Dibley, 2014b; Nisar et al., 2015; Pena-Rosas & Viteri, 2006; Titaley et al., 2010; Titaley & Dibley, 2012). Antenatal iron and folic acid supplements significantly reduced maternal anaemia, which was associated with increased infant birth weight and reduced preterm delivery (Titaley et al., 2010; WHO & PMNCH, 2011; Zeng et al., 2008). Tetanus toxoid immunization, a component of antenatal care, also played a key role in reducing neonatal tetanus, which was associated with the use of non-sterile instruments to cut the umbilical cord (Blencowe et al., 2010; NIPORT, Mitra and Associates, & ICF International, 2013). This was particularly true for LMICs where many deliveries were conducted at home and in unhygienic conditions (Blencowe et al., 2010; NIPORT, Mitra and Associates, & ICF International, 2013).

Unfortunately, it was not possible to directly compare the estimates of our study with previous research as the data were inadequate to investigate the impact of individual components of antenatal care. However, researchers reported that nine out of ten mothers were protected against neonatal tetanus through immunization and consequently, tetanus was not a major cause of neonatal mortality in Bangladesh (Fottrell et al., 2015; NIPORT, Mitra and Associates, & ICF International, 2013). On the other hand, the 2007 BDHS indicated that around 60% of pregnant women in Bangladesh had received antenatal care (Fiedler, D'Agostino, & Sununtnasuk, 2014). Of these women, 74% took iron and folic acid supplements (Fiedler, D'Agostino, & Sununtnasuk, 2014). Thus, the effect of antenatal care might reveal the impact of iron and folic acid supplementation in our case.

The magnitude of the impact of antenatal care on neonatal mortality in our research was consistent with studies that focused on iron and folic acid supplementation (Dibley et al., 2012; Nisar et al., 2015; Titaley & Dibley, 2012; Zeng et al., 2008). For example, a reduction of 45% in early neonatal deaths and 42% in neonatal deaths were observed in Nepal, while a reduction of 53% in early neonatal deaths and 47% in neonatal deaths were observed in a cluster randomized trial in China as an impact of iron and folic acid supplementation (Nisar et al., 2015; Zeng et al., 2008). A 51% reduction in neonatal mortality was also observed in case of Indonesia (Titaley & Dibley, 2012). Thus, our

study provides additional support for the hypothesis that iron and folic acid supplementation is crucial in reducing neonatal mortality.

In contrast with earlier studies, we did not find any significant impact of antenatal care on early neonatal deaths. Researchers observed regional differences in the causes of neonatal deaths in low-income countries (Fottrell et al., 2015). They also reported sepsis as the major cause of neonatal deaths in Bangladesh. Traditional practices in cord care, as well as in other essential newborn care might lead to newborn sepsis in Bangladesh (Darmstadt et al., 2006). Around 30% to 40% of reported infection developed during the first 72 hours after birth leading to neonatal deaths from sepsis in the country (Blencowe et al., 2011; Darmstadt et al., 2009b). Such deaths were independent of iron and folic acid supplementation and might explain the difference of our finding with earlier studies.

Early postnatal care practices such as thermal care, umbilical cord care, skin care and breastfeeding were likely to be associated with the reduction in the risk of birth asphyxia, preterm birth, low birth weight, sepsis, tetanus or pneumonia, which were the major causes of neonatal deaths in LMICs (Baqui et al., 2008a; Baqui et al., 2009a; Blencowe et al., 2011; Darmstadt et al., 2005; Kumar et al., 2008). Researchers reported substantial improvements in neonatal survival as a result of postnatal care (Bang et al., 1999; Baqui et al., 2008a; Bhutta et al., 2011; Kumar et al., 2008; WHO & UNICEF, 2009). For example, neonatal mortality in Bangladesh, Pakistan and India was reduced by 34%, 15% and 54%, respectively (Baqui et al., 2008a; Bhutta et al., 2011; Kumar et al., 2008). While interventions in these research included both antenatal and postnatal visits to promote essential newborn care, they were not independent and the effect of antenatal care was not considered in those analyses.

The only study that included the effect of iron and folic acid supplementation in investigating the impact of postnatal care on neonatal deaths, like our findings, did not find any significant impact of postnatal care (Titaley & Dibley, 2012). Thus, our findings could indicate that iron and folic acid supplementation was more important in reducing neonatal mortality rather than postnatal care, as found in Titaley and Dibley (2012). A higher neonatal mortality for those who had early postnatal check-ups, particularly on the first day of life, could be due to a higher probability of illness or

morbidity. As reported by earlier researchers, families were more likely to visit medical professionals in case of severe complications (Akter, Dawson, & Sibbritt, 2015; Baqui et al., 2009c; Titaley & Dibley, 2012). This might reflect issues related to the referral system, delays in seeking care and poor compliance with recommended treatments, along with lack of competent health professionals to manage obstetric and neonatal complications (Akter, Sibbritt, & Dawson, 2016; Baqui et al., 2009c; Titaley & Dibley, 2012; Titaley, Dibley, & Roberts, 2012). These findings could also be linked with the fact that the provision of postnatal care limited to extremely ill infants in LMICs.

Some points are worth mentioning to contextualize our results. First, our analysis showed a higher neonatal mortality for larger than average-sized babies, contrasting with earlier research (Nisar & Dibley, 2014a; Titaley et al., 2008). A further review of previous research indicated that this association might relate to gestational diabetes mellitus (GDM) (Mahtab & Bhowmik, 2016; Mannan et al., 2012). Researchers reported that the prevalence of GDM in urban Bangladeshi population was about 7.5% in 2012, indicating that it might be responsible for our results (Mannan et al., 2012). Unfortunately, our data do not have information on GDM and therefore restrict any further investigation of the complications that could affect higher neonatal mortality for larger than average-sized babies. Second, we observed increased risk of neonatal deaths for those babies born by Caesarean section, attended by skilled birth attendants and delivered at a health facility. This might be due to the fact that mothers only came to the facility if they were medically in trouble (Titaley, Dibley, & Roberts, 2012; Tura, Fantahun, & Worku, 2013). Finally, another point is the importance of controlling for confounding variables in the model. The effect of antenatal care was not significant in the unadjusted models. However, when we controlled for the potential confounders, the effect was large and statistically significant. An opposite scenario was observed in case of postnatal care. Thus, our findings indicate that identification of impacts require a careful selection of confounders as some of them can be correlated with the exposure variables.

A major strength of this study is that data are obtained from a large and nationally-representative sample of newborns. However, this study is not free from potential limitations. First, we cannot determine causal relationship, but rather only associations, because of the cross-sectional survey design. Second, the selected variables in our study

relied on the availability of information in the survey. For example, due to the unavailability of information, some important variables such as delivery complications, GDM, timing of antenatal care and preterm birth were not considered in our study. Third, recall bias was an important issue in this study as all information came from interviews with mothers who were required to remember details over the previous five years. Nevertheless, these limitations were unlikely to have had an important influence on the consistency of our findings.

7.6 Conclusion

We investigated the impact of antenatal and postnatal care on the mortality of neonates born in Bangladesh. We found that the neonatal mortality in Bangladesh can be reduced significantly through emphasizing the antenatal care, probably through the intake of iron and folic acid during pregnancy. Health promotion programs, including the community-based interventions, may build awareness about these practices. Our analysis may assist in designing policies and programs related to antenatal and postnatal cares in LMICs. However, further research should examine the reasons for the lack of impact of postnatal care on neonatal mortality.

7.7 Chapter Summary

This chapter investigated the contribution of both antenatal and postnatal care to reduce the risk of neonatal deaths in Bangladesh. It was observed that neonatal mortality was significantly lower for newborns whose mothers attended antenatal care services, but postnatal care did not show any effect on neonatal mortality. In the following chapter, an investigation of the changes over time in NMR in Bangladesh and its association with health care practices is presented.

Chapter 8 : Trends in Neonatal Mortality and Newborn Health Practices: Evidence from Bangladesh Demographic and Health Survey 2011 and 2014

This chapter addresses Research Question 6; the trends in neonatal mortality and newborn health practices in Bangladesh. The availability of the 2014 round of Bangladesh DHS data, at the time of this study, has allowed for an analysis of the trends in neonatal mortality and newborn health practices in the country over a period of three years. The findings of these analyses have been published in the *WHO South-East Asia Journal of Public Health*.

Akter T, Dawson A, & Sibbritt D. (2018). Changes in neonatal mortality and newborn healthcare practices: descriptive data from the Bangladesh Demographic and Health Surveys 2011 and 2014. *WHO South-East Asia Journal of Public Health,* 7(1), 43-50.

8.1 Abstract

Background: Bangladesh has made major improvements in health outcomes over the past two decades, with falls in mortality rates in mothers and in infants and young children aged under 5 years. Despite these improvements, neonatal mortality rates (NMRs) are high in Bangladesh. This paper describes recent changes in NMRs and health-care practices, disaggregated by demographic and socioeconomic characteristics.

Methods: Summary statistics from the reports of the Bangladesh Demographic and Health Survey (BDHS) were examined. The BDHS is a nationally representative cross-sectional survey and the two most recent rounds of surveys, 2007–2011 and 2010–2014, were included in the analysis. The variables considered in this study were neonatal deaths and related health-care practices, including antenatal care visits, facility-based delivery, assistance from a medically trained provider during delivery, postnatal care from a trained provider and essential newborn care.

Results: Between the two survey periods, NMRs increased in Chittagong (average increase 4.5% per year) and Khulna (8.3% per year), remained unchanged in Rangpur, and decreased in Barisal (average decrease 19.8% per year), Dhaka (12.2% per year), Rajshahi (7.7% per year) and Sylhet (4.8% per year). A larger average annual reduction

in the NMR was observed in urban areas than in rural areas (14.0% versus 2.1%). There was also a large average reduction in NMR in the fourth and fifth richest quintiles for socioeconomic status (SES quintiles; 12.0% and 16.5% per year, respectively). Differences according to neonatal sex were also noted: the NMR for female neonates remained unchanged and that for male neonates reduced by an annual average of 7.7%. General improvements were observed in all health-care practices across all demographic and socioeconomic groups. However, the urban–rural gap in the uptake of antenatal care services, facility-based delivery, assistance from a medically trained provider during delivery, and postnatal care from a trained provider was roughly similar in both surveys. A similar unchanging gap was also seen between the poorest and richest SES quintiles.

Conclusion: The study analysis indicates that improvements in NMRs between the two survey periods are mixed. Further attention is required to improve the rate of reduction of neonatal mortality in some divisions in Bangladesh, and it may be useful to investigate whether the higher NMR in rural areas and for households with lower socioeconomic status can be reduced by strengthening the uptake of antenatal care services, facility-based delivery, assistance from a medically trained provider during delivery, and postnatal care from a trained provider. The static NMR for female neonates may encourage policy-makers to focus on ensuring standard essential newborn care practices for both sexes and ensuring adequate and appropriate care-seeking for illness in female neonates.

8.2 Introduction

Bangladesh is the eighth most populous country in the world, with a density of 1,070 persons/km^2 (Chowdhury et al., 2013; NIPORT, Mitra and Associates, & ICF International, 2016). Over the last 47 years since independence in 1971, the country has developed an extensive health infrastructure and made remarkable progress in providing important health-care and service inputs. These include antenatal care services, delivery in a health facility, assistance from a medically trained provider during delivery, childhood immunization, vitamin A supplementation, uptake of oral rehydration therapy for diarrhoea, and treatment success rates for tuberculosis (Chowdhury et al., 2013; El Arifeen et al., 2013). For example, between 1996–1997 and 2016, antenatal care from a medically trained provider and assistance from a medically trained provider during delivery increased from 26% to 64% and 8% to 42%, respectively (Mitra et al., 1997;

NIPORT, Mitra and Associates, & ICF International, 2016). These improvements may be attributed to the way Bangladesh has managed to deliver health services, specifically its widespread deployment of community-based strategies to serve every household in the country (Baqui et al., 2008a; Chowdhury et al., 2013; El Arifeen et al., 2013).

Improvements in health-care and service inputs have been translated into exceptional achievements across different health outcomes in Bangladesh. The total fertility rate has decreased from 6.3 births per women in 1975 to 2.3 births per woman in 2014, while between 2001 and 2016 the maternal mortality ratio declined from 322 to 196 per 100,000 live births (NIPORT, icddrb, & MEASURE Evaluation, 2017; WHO, 2015b). Bangladesh has also made important progress in child survival over the last two decades. Between 1989–1993 and 2010–2014, the mortality rate in children aged under 5 years declined from 133 to 46 per 1,000 live births (NIPORT, Mitra and Associates, & ICF International, 2016). Improvements in health-care services, together with community-based initiatives to tackle the demand-side of service use and other secular trends beyond the health sector, assisted Bangladesh to achieve the target of Millennium Development Goal 4 of an under-5 mortality rate of 48 per 1,000 live births (El Arifeen et al., 2013; NIPORT, Mitra and Associates, & ICF International, 2016).

Despite the considerable improvement in health outcomes in Bangladesh, the achievement remains vulnerable. For example, the risk of dying in the first month of life, which accounts for 61% of all deaths in children aged under 5 years, is still high (28 deaths per 1,000 live births in 2014) (NIPORT, Mitra and Associates, & ICF International, 2016). This may be related to the scarcity of skilled health personnel–Bangladeshis included in a list of 57 countries facing a critical shortage of human resources for health (WHO, 2006a, 2015b). The situation is further aggravated by the disproportionate distribution of human resources for health between rural and urban areas and skewing towards physicians. In 2007, the ratio of physicians to nurses in urban areas was 1:0.3 and 1:0.7 in rural areas (Ahmed et al., 2011). Such barriers may affect the country's ability to maintain momentum and achieve the target of Sustainable Development Goal (SDG) 3 of reducing the neonatal mortality rate (NMR) to 12 per 1,000 live births and under-5 mortality to 25 per 1,000 live births by 2030 (UN, 2016).

In this context, it may be helpful to look beyond aggregated data to examine recent changes and differences in NMRs and the uptake of related health-care practices among the socioeconomic groups in Bangladesh. This study therefore aims to examine recent changes in NMRs alongside health-care practices in the country, by demographic and socioeconomic characteristics.

8.3 Methods

Data source

Summary data from the Bangladesh Demographic and Health Survey (BDHS) 2011 and 2014 survey reports were used for this research. The BDHS is a cross-sectional survey and collects nationally representative demographic and health information every 3–4 years (NIPORT, Mitra and Associates, & ICF International, 2016). This study compared data from the latest two BDHS reports, 2011 and 2014 (NIPORT, Mitra and Associates, & ICF International, 2013, 2016). The reference periods for these surveys were 2007–2011 for the BDHS 2011 and 2010–2014 for the BDHS 2014. The surveys involved two-stage stratified random sampling and collected information by interviewing ever-married men (aged 15–54 years) and ever-married women of reproductive age (15–49 years). The sampling approach aimed to produce data that were representative for the country as a whole, for urban and rural areas separately, and for each of the seven administrative divisions (NIPORT, Mitra and Associates, & ICF International, 2013, 2016). All survey information was self-reported and was gathered using separate questionnaires for households, women and the community. An additional questionnaire for men was used for the 2011 round only. The design and data-collection procedures are described in detail elsewhere (NIPORT, Mitra and Associates, & ICF International, 2013, 2016).

Ethics

The ICF Institutional Review Board approves demographic and health surveys, (DHS Program, 2017b) and informed consent was obtained from participants at the time of the interviews conducted for the original surveys. This research involves human participants but is based on secondary data analyses and so no further consent was required. This study was also approved by the Human Research Ethics Committee of the University of Technology, Sydney, Australia.

Study participants

This analysis relied on statistics for live-born infants in the BDHS 2011 and 2014. The analysis was restricted to the most recent births in the last 3 years preceding the survey, as detailed information on perinatal health-care practice was available only for these births. Information on essential newborn care services was available for home births only. Mothers were the respondents for information collected on essential newborn care and health-care practices.

Neonatal mortality

The BDHS studies defined neonatal mortality as death of a baby within the first month of life (NIPORT, Mitra and Associates, & ICF International, 2013, 2016). The standard definition of neonatal mortality, as employed by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF), is deaths occurring within the first 28 days of life (WHO & PMNCH, 2011). As a result, the BDHS definition may show slightly higher NMRs compared with the standard definition. Neonatal deaths were determined from the complete birth history from mothers, which included information on the baby's sex, date of birth, survival status (alive/dead) and age at death (if dead). Methodology used to estimate NMRs in the BDHS relied on life-table approaches that estimated age-specific person–time and deaths in each estimation year (NIPORT, Mitra and Associates, & ICF International, 2013, 2016; Rutstein, 1984).

Health care practices

Previous research and the recommendations of WHO, UNICEF and the Government of Bangladesh were followed in selecting the health-care practices relevant to NMR (Akter, Dawson, & Sibbritt, 2015; Ministry of Health and Family Welfare, 2009; WHO & UNICEF, 2009). These practices included whether women received at least four antenatal care visits during the pregnancy preceding the most recent birth before the survey; whether delivery was at a health facility; whether there was assistance during delivery from a medically trained provider (defined as a qualified doctor, nurse, midwife, paramedic, family-welfare visitor or community skilled birth assistant); and whether postnatal check-ups were with a trained provider (which, in addition to the previous list, included medical assistants and sub-assistant community medical officers) and occurred within 2 days after birth (NIPORT, Mitra and Associates, & ICF

International, 2013, 2016). Four individual components of essential newborn care were also included in the list of health-care practices – the use of sterile/boiled instruments for cutting the umbilical cord; drying of the neonate after birth; delayed bathing (bathing the neonate at least 72 h after birth); and the initiation of breastfeeding within 1 h after delivery (Akter, Dawson, & Sibbritt, 2016; Ministry of Health and Family Welfare, 2009). The surveys collected information on the use of sterile/boiled instruments in binary form (yes, no), while the data on the timing of drying after birth were recorded as 0–4 min, 5–9 min, 10+ min or not dried; the category 0–4 min was used in this analysis. The data related to delayed bathing and immediate initiation of breastfeeding were collected as continuous variables. Two other recommended essential newborn care practices, umbilical cord care and immediate wrapping of neonate, were not included in the study analysis, as the related government guideline had been changed after 2011 (Ministry of Health and Family Welfare, 2009; NIPORT, Mitra and Associates, & ICF International, 2016).

Demographic and socioeconomic variables

Data on NMRs and related health-care practices were extracted for selected demographic and socioeconomic groups, including sex of the child, administrative division, urban/rural location, usual place of residence, and socioeconomic status of the participant. At the time of the two surveys, there were seven administrative divisions in Bangladesh: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet (NIPORT, Mitra and Associates, & ICF International, 2013, 2016). The quintiles for socioeconomic status (SES quintiles) in the BDHS data were created using household asset information and principal components analysis; the methods are described elsewhere (NIPORT, Mitra and Associates, & ICF International, 2013, 2016; Rutstein, 1999). The annual average rate of change by demographic and socioeconomic characteristics for the 3 years between the two BDHS surveys was calculated as the mean exponential growth rate (Perz, 2004).

8.4 Results

The BDHS 2011 collected information from 17,141 households, with an individual interview of 17,842 ever-married women aged 15–49 years and a response rate of 98%. The distribution of women respondents among divisions was 6%, 18%, 32%, 12%, 15%, 12% and 5% for Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur and Sylhet, respectively. The majority of women (74%) were residing in rural areas and 28% of women had received no education. The BDHS 2014 collected information from 17,300 households, with an individual interview of 17,863 ever-married women aged 15–49 years and a response rate of 98%. The distribution of women respondents across divisions was similar to the previous round of the survey. In the BDHS 2014, 72% of women respondents were from rural areas and around 25% of women had no education.

The NMR in Bangladesh was 32 per 1,000 live births in the 2011 round of the survey and 28 per 1,000 live births in the 2014 round. Thus, the NMR in the country had declined, with an annual average rate of reduction of 4.5% between the two survey periods (Table 8.1). A comparison of NMRs among divisions indicated a decreasing mortality rate for Barisal, Dhaka, Rajshahi and Sylhet, with an annual average rate of reduction of 19.8%, 12.2%, 7.7% and 4.8%, respectively. While the mortality rate remained unchanged in Rangpur, it increased in Chittagong and Khulna by 4.5% and 8.3% per year, respectively. A larger average annual reduction in the NMR was observed in urban areas than in rural areas (14.0% versus 2.1% per year). A considerable difference in the reduction of NMRs was also observed among neonates of mothers with different socioeconomic status, with a large reduction seen in the fourth and fifth richest SES quintiles (12.0% and 16.5% per year, respectively). Finally, the gap in NMR between male and female neonates narrowed between the two survey periods. However, the NMR reduced by 7.7% for male neonates, while that for female neonates remained unchanged.

Table 8.1: Neonatal mortality rates by demographic and socioeconomic characteristics in the Bangladesh Demographic and Health Surveys 2011 and 2014

Background characteristics	NMR (per 1000 live births)		Annual average change between BDHS 2011 and BDHS 2014[c]
	2007–2011[a,b]	2010–2014[a,b]	
Division			
Barisal	38.0	21.0	–19.8%
Chittagong	21.0	24.0	4.5%
Dhaka	36.0	25.0	–12.2%
Khulna	32.0	41.0	8.3%
Rajshahi	39.0	31.0	–7.7%
Rangpur	27.0	27.0	0.0%
Sylhet	45.0	39.0	–4.8%
Location			
Urban	32.0	21.0	–14.0%
Rural	33.0	31.0	–2.1%
Socioeconomic status			
Poorest	34.0	35.0	1.0%
Second	38.0	35.0	–2.7%
Middle	32.0	34.0	2.0%
Fourth	33.0	23.0	–12.0%
Richest	23.0	14.0	–16.5%
Sex			
Male	39.0	31.0	–7.7%
Female	26.0	26.0	0.0%
Total	**32.0**	**28.0**	**–4.5%**

BDHS: Bangladesh Demographic and Health Survey; NMR: neonatal mortality rate.

[a] Reference period.

[b] Data reported in the BDHS 2011 and 2014 (NIPORT, Mitra and Associates, & ICF International, 2013, 2016)

[c] Annual average rate of change by demographic and socioeconomic characteristics for the 3 years between the two BDHS surveys was calculated as the exponential growth rate (Perz, 2004):

$$\text{average annual rate of change} = \frac{\ln(NMR_{2014}/NMR_{2011})}{3}$$

Data on neonatal health-care practices by division are presented in Table 8.2. Three practices –facility-based delivery, assistance from a medically trained provider at delivery, and drying within 4 min of birth – were improved in the BDHS 2014 compared with the BDHS 2011 in all divisions. Improvements in receiving at least four antenatal care visits, as well as delayed bathing of neonates, was observed in all divisions except Barisal. No improvement in the use of sterile/boiled instruments for cutting the umbilical cord was observed in Barisal, Rajshahi, Rangpur or Sylhet. Initiation of breastfeeding within 1 h after delivery improved in all divisions except Chittagong.

Table 8.2: Neonatal health-care practices (%) in the Bangladesh Demographic and Health Surveys 2011 and 2014, by administrative division

Health practices	Divisions													
	Barisal		Chittagong		Dhaka		Khulna		Rajshahi		Rangpur		Sylhet	
	2011 (n=260)	2014 (n=268)	2011 (n=1,083)	2014 (n=1,011)	2011 (n=1,418)	2014 (n=1,634)	2011 (n=441)	2014 (n=371)	2011 (n=618)	2014 (n=464)	2011 (n=491)	2014 (n=450)	2011 (n=342)	2014 (n=428)
Received at least 4 ANC visit	27.0	24.6	20.3	25.5	26.6	35.5	33.3	38.8	21.4	26.5	38.4	41.3	15.9	19.8
Delivered in health facility	22.3	29.9	24.8	35.2	29.9	40.5	45.8	54.6	29.8	39.2	27.6	34.3	21.0	22.6
Assisted by a trained provider during delivery	28.4	36.7	29.7	43.9	31.5	43.5	49.0	58.2	30.9	41.6	28.7	37.9	24.4	27.1
Used sterile/boiled instruments for cutting cord[a]	80.0	78.5	84.9	85.6	82.1	83.1	84.2	88.9	78.7	69.6	88.0	84.6	89.8	87.9
Dried within 0–4 minutes after birth[a]	47.7	56.2	51.9	65.6	52.0	63.7	50.3	71.7	57.8	74.6	49.4	73.9	44.1	70.3
Delayed bathing (72+ hours after delivery)[a]	37.3	33.2	23.3	28.2	23.6	33.8	24.0	31.1	31.2	35.9	47.6	50.7	28.3	34.6
Breastfeeding (within 1 hour after birth)[a]	46.9	56.4	50.3	50.1	45.5	58.0	50.2	52.2	53.7	63.0	51.6	64.3	57.3	60.3
PNC within 2 days of birth from a trained provider	26.3	30.6	26.0	33.0	31.5	30.5	46.6	41.6	27.0	36.2	26.9	29.4	22.6	20.7

Note: Data reported in the BDHS 2011 and 2014 (NIPORT, Mitra and Associates, & ICF International, 2013, 2016); [a] sample excludes facility birth

An examination of the rural–urban dimension in the use of selected health-care practices for neonates indicated an improvement in all components except the use of sterile/boiled instruments for cutting the umbilical cord (Table 8.3). There was only a minor rural–urban gap in the use of health-care practices related to essential newborn care, in either 2011 or 2014. However, the lower use of other selected health-care services in rural areas – receipt of at least four antenatal care visits, facility-based delivery, assistance from a medically trained provider during delivery, and postnatal care services from a trained provider – remained roughly constant between the two surveys.

Table 8.3: Neonatal health-care practices (%) in the Bangladesh Demographic and Health Surveys 2011 and 2014, by urban/rural location

Health practices	Urban/rural			
	Urban		Rural	
	2011 (n=1,068)	2014 (n=1,209)	2011 (n=3,584)	2014 (n=3,418)
Received at least 4 ANC visit	44.7	45.5	19.8	26.1
Delivered in health facility	49.3	56.8	22.8	30.6
Assisted by a trained provider during delivery	53.7	60.5	25.2	35.6
Used sterile/boiled instruments for cutting cord[a]	87.8	84.9	82.8	82.7
Dried within 0–4 minutes after birth[a]	50.6	68.1	51.6	66.7
Delayed bathing (72+ hours after delivery)[a]	28.5	30.0	28.4	35.3
Breastfeeding (within 1 hour after birth)[a]	51.6	54.7	49.4	57.7
PNC within 2 days of birth from a trained provider	50.3	50.9	23.4	24.6

Note: Data reported in the BDHS 2011 and 2014 (NIPORT, Mitra and Associates, & ICF International, 2013, 2016); [a] sample excludes facility birth

Table 8.4 compares the changes in neonatal health-care practices by socioeconomic status. Except for the use of sterile/boiled instruments for cutting the umbilical cord, all selected practices improved between the BDHS 2011 and BDHS 2014 across all SES quintiles. However, a major gap between the poorest and the richest quintiles in the use of antenatal care, facility-based delivery, assistance from a medically trained provider at delivery, and postnatal care services from a trained provider were evident in both 2011 and 2014.

Table 8.4: Neonatal health-care health practices (%) in the Bangladesh Demographic and Health Surveys 2011 and 2014, by socioeconomic status

Health practices	Socioeconomic status									
	Poorest		Second		Middle		Fourth		Richest	
	2011 (n=1,062)	2014 (n=1,003)	2011 (n=920)	2014 (n=876)	2011 (n=919)	2014 (n=882)	2011 (n=911)	2014 (n=955)	2011 (n=841)	2014 (n=912)
Received at least 4 ANC visit	10.6	15.4	14.9	20.0	21.0	27.2	32.7	38.7	53.2	55.1
Delivered in health facility	9.9	14.9	17.5	24.1	24.1	34.0	39.4	46.3	59.8	70.2
Assisted by a trained provider during delivery	11.5	17.9	18.6	29.9	28.2	38.8	43.2	52.0	63.8	74.4
Used sterile/boiled instruments for cutting cord[a]	81.4	81.4	81.8	83.5	83.9	81.8	86.7	86.2	88.6	84.6
Dried within 0–4 minutes after birth[a]	48.4	66.3	51.8	65.4	54.1	61.3	49.4	72.5	56.9	75.1
Delayed bathing (72+ hours after delivery)[a]	26.3	28.7	28.6	35.7	26.3	38.9	33.2	37.0	30.0	34.4
Breastfeeding (within 1 hour after birth)[a]	47.5	60.8	47.8	53.0	54.1	55.2	52.1	59.4	48.6	56.0
PNC within 2 days of birth from a trained provider	11.4	13.1	16.1	17.2	24.9	26.7	39.9	38.1	61.4	63.1

Note: Data reported in the BDHS 2011 and 2014 (NIPORT, Mitra and Associates, & ICF International, 2013, 2016); [a] sample excludes facility birth

Table 8.5 presents data on selected neonatal health-care practice by sex. Between the 2011 and 2014 surveys, improvements were observed for all practices for both male and female neonates.

Table 8.5: Neonatal health-care practices in the Bangladesh Demographic and Health Surveys 2011 and 2014, by sex

Health practices	Sex			
	Male		Female	
	2011 (n=2,352)	2014 (n=2,439)	2011 (n=2,300)	2014 (n=2,188)
Received at least 4 ANC visit	26.5	32.1	24.5	30.2
Delivered in health facility	29.1	39.1	28.6	35.9
Assisted by a trained provider during delivery	32.2	43.7	31.1	40.2
Used sterile/boiled instruments for cutting cord[a]	83.5	82.2	83.8	84.0
Dried within 0–4 minutes after birth[a]	51.4	66.3	51.4	67.7
Delayed bathing (72+ hours after delivery)[a]	28.9	38.2	27.8	30.3
Breastfeeding (within 1 hour after birth)[a]	50.8	56.3	48.8	58.1
PNC within 2 days of birth from a trained provider	30.4	32.1	28.8	30.8

Note: Data reported in the BDHS 2011 and 2014 (NIPORT, Mitra and Associates, & ICF International, 2013, 2016); [a] sample excludes facility birth

8.5 Discussion

This study examined the changes over time in NMRs and health-care practices by demographic and socioeconomic groups between the 2011 and 2014 rounds of BDHS data. No reduction of NMR was observed for three divisions – Chittagong, Khulna and Rangpur. A minimal decline of NMR was observed for rural areas, with a large improvement in the two richest SES quintiles; no reduction in NMR was found for female neonates. Conversely, improvements were largely seen in health-care practices across all divisions. Improvements in all health-care services, except essential newborn care, were also observed in both urban and rural areas, while the urban–rural gap in the uptake of these services remained roughly similar over time. A similar situation was found across the SES quintiles. Considerable progress in all types of practice was observed for both sexes.

Neonatal mortality rate and health care practices by division

An unchanged NMR was observed in Rangpur and an increased NMR in Chittagong and Khulna, despite an improvement over time in the uptake of different neonatal health-care practices. The highest poverty rate in Bangladesh is observed in Rangpur, where famine-like situations (monga) are regularly experienced by the population (Bryan, Chowdhury, & Mobarak, 2014; Ministry of Planning, 2010). Research has also found an association between famine and child mortality (Kiros & Hogan, 2001). These may have contributed to the unchanged NMR in Rangpur (Lawn, Cousens, & Zupan, 2005; Ministry of Planning, 2010). A similar argument can be made for Chittagong, which is particularly vulnerable to cyclones because of its location and proximity to the Bay of Bengal (Haque et al., 2012). For example, Bangladesh experienced a severe cyclone in May 2013, when 1.1 million people were evacuated from the coastal area (Planning Commission, 2015). The geographical remoteness of Chittagong Hill Tracts, which is included in the Chittagong division, may also explain the increased NMR observed. Khulna, another division that has not experienced any improvement in mortality rate, has a poor connectivity with the capital city and other major centres and, as a coastal region, is vulnerable to cyclones that may affect the NMR in the division (Ministry of Planning, 2008; NIPORT, Mitra and Associates, & ICF International, 2013, 2016). Previous studies have also observed impacts of natural disasters on child health (Datar et al., 2013). However, a more detailed investigation is required to identify why improvement in NMRs varies across divisions in Bangladesh.

Neonatal mortality rate and health care practices by urban/rural areas

High-quality health care during pregnancy, delivered under the supervision of health professionals, is required to reduce the risk of complications and infections that can cause neonatal deaths. Postnatal check-ups are also essential for monitoring neonatal complications, especially during the first 2 days after delivery, when a large proportion of neonatal deaths occur from sepsis, birth asphyxia and low birth weight/prematurity (Baqui et al., 2009b; El Arifeen, 2008). The Bangladesh Government aimed to increase the proportion of pregnant women receiving at least four antenatal care visits, skilled assistance during delivery and neonates receiving at least one postnatal check-up to 50% by 2016 (Ministry of Health and Family Welfare, 2011). However, participants in both surveys from rural areas were receiving nearly half of the targeted services. Thus, a

lower rate of uptake of antenatal care, facility-based delivery, assistance from a medically trained provider at delivery, and postnatal care from a trained provider may explain the lower reduction in NMR over time in rural areas, compared with the urban areas. Nevertheless, a higher NMR may be related to a weak health system, including shortage of skilled health workers in rural areas (Titaley, Dibley, & Roberts, 2010). With respect to potential interventions, a systematic review and meta-analysis found that the use of women's groups practising participatory learning and action was a cost-effective strategy to improve maternal and neonatal survival in low-resource settings (Prost et al., 2013).

Neonatal mortality rate and health care practices by socioeconomic status

The sustained reduction in the NMR in Bangladesh has not occurred equitably, as can be seen by the differences across various socioeconomic groups. Like the rural versus urban case, the use of antenatal care services, facility-based delivery, assistance from a medically trained provider at delivery, and postnatal care from a trained provider were also observed to improve least for the poorest three quintiles. An important point in this connection is that the majority of the rural population exists in the bottom three SES quintiles, with only 9% in the highest wealth quintile (NIPORT, Mitra and Associates, & ICF International, 2016). The ratio of delivery in a health facility between women in the lowest and the highest quintiles was 1:6 in the 2011 which slightly improved to 1:5 in 2014. The reduction in this ratio did not reach the government target of 1:4 by 2016 (Ministry of Health and Family Welfare, 2011; NIPORT, Mitra and Associates, & ICF International, 2016).

Neonatal mortality rate and health care practices by neonates' sex

This study found a reduction in NMR for male neonates between the BDHS 2011 and BDHS 2014 but not for female neonates, despite considerable improvements in selected health-care practices. This may point towards a strong preference for male offspring, which is particularly common in South Asia and may influence women/carers care of a girl child (NIPORT, Mitra and Associates, & ICF International, 2016). This is in line with some previous studies that have observed gender biases in neonatal care or for seeking health care in sickness, in favour of male infants (Barcellos, Carvalho, & Lleras-Muney, 2014).

Overall challenges in the health system in Bangladesh

The density, skill mix and distribution of health professionals are closely associated with neonatal survival (Akter, Sibbritt, & Dawson, 2016; WHO, 2006a). Although the availability of health workers is increasing over time in Bangladesh, the density (per 10,000 population) of physicians and nurses in the country in 2014 was 3.8 and 1.2 respectively (Ministry of Health and Family Welfare, 2015). The health workforce is skewed towards doctors with a ratio of doctors to nurses of 1:0.4, compared with the WHO-recommended ratio of 1:3 (WHO, 2015b).

The inequitable distribution of the health workforce is another challenge in Bangladesh. One study observed a substantial variation in the ratios of physicians to nurses in 2007 among the divisions –Barisal (1:0.5), Chittagong (1:0.7), Dhaka (1:0.2), Khulna (1:1.4), Rajshahi (1:0.5) and Sylhet (1:0.1) (Ahmed et al., 2011). Note that Rangpur was part of Rajshahi at the time the study was conducted. In addition, although 70% of the population of Bangladesh lives in rural areas, the health workforce is mainly concentrated in urban areas. This may result in rural facilities becoming overburdened and insufficiently equipped to deal with demand (Ahmed et al., 2011; WHO, 2015b). Thus, not only the shortage of health workers but also the inappropriate skill mix and inequitable distribution of human resources for health in Bangladesh could be a major factor impeding the improvement of health outcomes, including neonatal mortality.

Limitation of this study

The present study cannot draw conclusions about the impact of health-care practices as well as demographic and socioeconomic variables on NMRs. However, the data presented are a useful starting point for further in-depth research on NMRs to achieve SDG 3 in Bangladesh (UN, 2016). It is important to note that previous studies have also attempted to carry out a similar investigation of achievement of health-related goals (El Arifeen, 2008). Also, the survey relies on self-reported information in which recall bias can be an important issue, as interviewees are required to recollect events as far back as 3 years. This may affect the responses of some demographic and socioeconomic groups differently and, consequently, responses for some groups may be more imprecise than for others. Furthermore, the surveys excluded women who died before the survey and so data relating to their birth practices are missing; data on essential newborn care and

neonatal survival for these women could be systematically different from those for women who survived and were therefore included in the surveys. In addition, it was not possible in this study to provide comprehensive information, as detailed statistics were unavailable in the BDHS reports. Importantly, the BDHS 2014 notes that the findings for the selected socioeconomic and demographic differentials must be interpreted with caution, given the low precision of mortality estimates due to sampling error (NIPORT, Mitra and Associates, & ICF International, 2016).

8.6 Conclusion

This study on differences between the BDHS 2011 and BDHS 2014 in NMRs and health-care practices across selected demographic and socioeconomic groups is a useful starting point for further in-depth research. The study analysis found three main issues that need to be investigated further to inform policy and programmes in Bangladesh. First, the analysis indicates that it can be useful to investigate whether the higher NMRs in rural areas and for households with lower socioeconomic status can be reduced by emphasizing the importance of uptake of antenatal care services, facility-based delivery, assistance from a medically trained provider during delivery, and postnatal care from a trained provider. Second, the findings of an unchanged NMR in female neonates may encourage policy-makers to focus on ensuring standard essential newborn care practices for both male and female neonates and ensuring adequate and appropriate care-seeking for illness for female neonates. Finally, no observed improvement in the NMR in some selected divisions may indicate that NMR-related programmes in these areas need to be given special attention. Such measures would also be useful for improving NMRs in low- and middle-income countries with similar health infrastructures.

8.7 Chapter Summary

This chapter presented an investigation of the changes over time in NMR and its association with health care practices, disaggregated by demographic and socioeconomic characteristics. A minimal decline in NMR was noted in rural areas and a reduction in NMR was not observed in all administrative divisions. In addition, the analysis did not find a change over time in NMR for female newborns. A significant improvement in the reduction of NMR was observed in the top two SES quintiles only.

Improvements in health care practices were generally observed across all socio-demographic characteristics.

Chapter 9 : Discussion

This chapter summarises the important insights for newborn care identified in the research presented in this thesis and offers recommendations for changes to policy and practice to reduce neonatal mortality in Bangladesh and other LMICs. This chapter also discusses the limitations of the research and provides suggestions for future research.

9.1 Findings of this Research

Using data obtained from nationally representative surveys, this research investigated the association between neonatal mortality and different health care practices. Five main findings of this research were identified. First, in terms of mortality, neonatal deaths were significantly higher for facility-based deliveries compared to home deliveries in Bangladesh. Further, the contribution of SBAs did not appear to reduce mortality among home-delivered neonates. Nepal and Pakistan DHS data also failed to confirm any significant effect of facility delivery and/or SBAs on neonatal mortality. Second, in relation to the impact of ENC practices on neonatal mortality, this research revealed a significant contribution of delayed bathing to reducing neonatal deaths but a counterintuitive association was observed between dry cord care and neonatal deaths. Third, factors affecting the uptake of ENC practices were low parental education, low utilization of ANC services, the absence of skilled birth attendants, higher birth order, mother's age at birth and regional variation. Fourth, neonatal mortality was significantly lower for newborns whose mothers attended at least four antenatal care visits. However, an insignificant effect was observed in the case of postnatal care services. Finally, regarding the changes in NMR over time in Bangladesh, this research showed no reduction in some divisions, a minimal decline in rural areas, a large improvement in the top two SES quintiles and no reduction for female newborns. However, general improvement in health care practices was observed across all divisions, areas, SES quintiles and for both sexes. These five key findings are discussed in detail in the following sections.

9.1.1 The Association between Facility-based Delivery and/or the Presence of SBAs and Neonatal Mortality in Bangladesh, Nepal and Pakistan

A meta-analysis, summarizing 19 studies conducted in LMICs, found facility-based delivery to reduce the risk of neonatal mortality by 29% and, as a result, recommended expanding health facilities and generating demand for their use through awareness-raising activities in LMICs where home delivery is a common practice (Tura, Fantahun, & Worku, 2013). However, the findings presented in Chapter 4 exhibit a heterogeneous effect of facility-based delivery on neonatal deaths. In particular, my research indicated significantly higher neonatal deaths for facility-based deliveries in Bangladesh, while the impact was non-significant for Nepal and Pakistan (see Section 4.3) and these findings concur with other studies (Feng et al., 2011; Lohela, Campbell, & Gabrysch, 2012; Målqvist et al., 2010; Ronsmans et al., 2010; Titaley, Dibley, & Roberts, 2012; Tura, Fantahun, & Worku, 2013). For example, a study in Zambia and Malawi observed non-significant association between institutional delivery and early neonatal mortality (Lohela, Campbell, & Gabrysch, 2012). On the other hand, a study in Indonesia observed higher newborn deaths for facility-based deliveries compared to neonates born at home (Titaley, Dibley, & Roberts, 2012). As discussed in Chapter 4, inadequate or low quality MCH services in LMICs may result in women being reluctant to visit health facilities or visit them only in the case of severe complications. This may explain the cause of higher neonatal deaths for facility deliveries, as has been noted in other research (Titaley, Dibley, & Roberts, 2012; Tura, Fantahun, & Worku, 2013).

In line with previous studies, my research found that the presence of SBAs did not appear (i.e. was non-significant) to reduce mortality among home-delivered neonates (Carlo et al., 2010a; Darmstadt et al., 2010b; Jokhio, Winter, & Cheng, 2005; Titaley, Dibley, & Roberts, 2012). The impact of any health care services can be influenced either by the skill level of the health care provider and/or by the quality of care. SBAs who are not competent in managing obstetric and neonatal complications may not refer women quickly and efficiently to other providers (Titaley, Dibley, & Roberts, 2012). My review of the literature on workforce interventions also emphasizes the importance of acquisition of appropriate skills, assessment of competencies and supervisory guidelines for improving the performance of health care providers (see Section 2.1.1).

The review also highlighted concerns about the approaches and duration of workforce training and staff supervision in LMICs and its impact on neonatal mortality.

Poor compliance with referral may also be responsible for the non-significant effect of presence of SBAs in reducing mortality of home-delivered neonates identified in my study. Maternal and newborn practices can be influenced by cultural belief systems and may result in poor compliance with evidence-based health practice. For example, cultural practices of isolating the mother and newborn after delivery are common in LMICs and may lead to a lower likelihood of interaction with skilled providers (Darmstadt et al., 2006; Khanal et al., 2014). A woman's inability to pay health care costs may also lead to lower compliance with referral and therefore the presence of an SBAs have a non-significant effect on mortality (Jokhio, Winter, & Cheng, 2005).

9.1.2 The Association between ENC Practices and Neonatal Mortality in Bangladesh

The association between ENC practices and mortality of neonates delivered at home in Bangladesh was examined in Section 5.3. Neonates born at home in LMICs may experience hypothermia, which contributes to major causes of neonatal deaths (Lunze et al., 2013). As a component of ENC, thermal care practices such as delayed bathing, immediate drying and wrapping, and immediate initiation of breastfeeding play a crucial role in reducing neonatal hypothermia (WHO, 2006b). The significant contribution of delayed bathing in my research provides support to this hypothesis. However, in my research a statistically non-significant association between neonatal deaths and immediate drying and wrapping of newborns was observed, as well as a non-significant association with immediate initiation of breastfeeding, and use of sterilized instruments to cut the umbilical cord. Studies in Bangladesh and other LMICs have observed traditional practices during or after birth, including the immediate wrapping of newborns in unclean cloths, premature breast milk supplementation and the use of unsterilized thread to tie the cord (Darmstadt et al., 2006; Khanal et al., 2014; Moran et al., 2009; Osrin et al., 2002; Thairu & Pelto, 2008). Unhygienic practices and inappropriate feeding might explain the increased risk of mortality despite using these ENC practices.

However, in my research a significant but counterintuitive association between dry cord care and neonatal deaths was observed. As observed in previous studies, the application

of topical antiseptics to the cord stump may be responsible for this counterintuitive result, as it can prevent sepsis and thus reduce neonatal deaths (Imdad et al., 2013; NIPORT, Mitra and Associates, & ICF International, 2013; Seward et al., 2012). Until now, sepsis is the major cause of neonatal deaths in Bangladesh (NIPORT, Mitra and Associates, & ICF International, 2013). It is worth mentioning that, following the WHO recommendation, the National Core Committee of Bangladesh has recently changed the ENC policy related to dry cord care and approved the practice of applying chlorhexidine to the umbilical cord (NIPORT, Mitra and Associates, & ICF International, 2016; WHO, 1998).

9.1.3 The Determinant of ENC Practices in Bangladesh

Understanding the impact of ENC provides us with an opportunity to improve the care received by women and/or newborns. Similarly, understanding what happens during the provision of ENC services could provide insights into how to improve the coverage of these practices. Some studies have observed a differential effect of the factors associated with the implementation of the individual components of ENC (Baqui et al., 2007; Holman & Grimes, 2001; Khanal et al., 2014; Victor et al., 2013). Therefore, it is important to use local data to guide program implementation (Lawn et al., 2010). Using BDHS 2011 data, my research investigated the determinants of ENC for home-delivered neonates in Bangladesh (see Section 6.3). As expected, the research demonstrated that both maternal and paternal education are important factors affecting the uptake of ENC services. Educated mothers are expected to have higher levels of health literacy and hence greater knowledge of disease prevention, management and treatment (Akter et al., 2015; Khanal et al., 2014). However, in LMICs where women's empowerment is low, paternal education is particularly important as it plays a key role in informed decision-making in households (NIPORT, Mitra and Associates, & ICF International, 2013).

My research findings confirm that, as reported in other studies, receiving ANC services and having skilled attendants during delivery are associated with the uptake of ENC services (Baqui et al., 2007; Khanal et al., 2014). This is probably because health workers who provide ANC and delivery services are trained to provide ENC. My research adds further weight to the National Neonatal Health Strategy of Bangladesh,

which encourages ANC visits for pregnant mothers and recommends births in the presence of trained health workers (Ministry of Health and Family Welfare, 2009).

My research also observed that an increasing mother's age is positively associated with the use of boiled instruments, but negatively associated with immediate initiation of breastfeeding. Previous studies that reported a significant impact of mother's age at birth on the immediate initiation of breastfeeding differed in the direction of the impact (Holman & Grimes, 2001; Patel et al., 2010; Victor et al., 2013). For example, a study in rural Bangladesh reported the mean time to the initiation of breastfeeding was about three times higher for older mothers than for younger mothers, which may be due to the promotion of early breastfeeding, together with the possibility that younger mothers could be more receptive to the latest public health initiatives (Holman & Grimes, 2001). In contrast, studies conducted in Tanzania and India observed the likelihood of initiation of breastfeeding within one hour after birth to be significantly lower among young mothers (Patel et al., 2010; Victor et al., 2013). Those studies pointed towards a lack of experience regarding appropriate breastfeeding, as most of the young mothers were first-time mothers. The finding in my research could be due to the success of government and non-government efforts to promote the immediate initiation of exclusive breastfeeding in Bangladesh (BBF, 2012; Haider et al., 2010). This is because the campaign for promoting breastfeeding, starting in 1989, had gained momentum and led to a gradual increase in the prevalence of immediate initiation of breastfeeding from 9% in BDHS 1993/94 to 51% in BDHS 2014 (Mitra et al., 1994; NIPORT, Mitra and Associates, & ICF International, 2016). Again, my findings of a positive association between the use of boiled instruments and increased mother's age may reflect the mother's experience of pregnancy, which is also reported in earlier studies (Seward et al., 2012).

As found in earlier studies, my research also observed an association between higher birth order and decreased use of ENC services (Ezeh et al., 2014; Titaley et al., 2008). This association could be explained by women relying on their previous positive pregnancy experiences, feeling confident without the need for health professional advice and therefore being less likely to use ANC services (Pallikadavath, Foss, & Stones, 2004; Titaley, Dibley, & Roberts, 2010). My research also shows urban versus rural differences in ENC practices in Bangladesh. Factors that may affect the uptake of

ENC services in rural areas include inadequate facilities and shortage of health workers (Ezeh et al., 2014; Titaley et al., 2008). Lower literacy rates in rural areas may also contribute to the lower uptake of ENC services, as formal education plays a significant role in access, as noted in my study (Ministry of Planning, 2013).

9.1.4 The Association between ANC and PNC and Neonatal Mortality in Bangladesh

In my research, I also examined the contribution of ANC and PNC services in reducing the risk of neonatal deaths in Bangladesh (see Section 7.3). I included both ANC and PNC services in the statistical model, as the impact of the former may modify the effect of the latter variable (Titaley & Dibley, 2012). Previous studies have found that ANC services, such as the provision of iron and folic acid supplements, tetanus toxoid immunization and health education, influence child survival (Dibley et al., 2012; Nisar & Dibley, 2014b; Nisar et al., 2015; Pena-Rosas & Viteri, 2006; Titaley et al., 2010; Titaley & Dibley, 2012). My research indicates that neonatal mortality is significantly decreased for those newborns whose mothers attended at least four antenatal care visits. Thus, my research findings suggest that the government's effort to promote the use of ANC services during pregnancy has been successful. However, such effect can be attributed to government's endeavour to comprehensive maternal and child health services including access to family planning services which may allow mothers to intensify the care for their children (Chowdhury et al., 2013; El Arifeen et al., 2014).

My research did not find any significant protective effect of postnatal care. In support of these findings, another study conducted in Indonesia found that PNC did not have a significant impact on neonatal mortality when ANC services were included in the same statistical model (Titaley & Dibley, 2012). The high mortality for newborns receiving PNC can partly be due to the limited capacity of health care services (Titaley & Dibley, 2012). It is also worth mentioning that higher mortality rates among those who have early postnatal check-ups could be due to other factors, as discussed in Section 9.1.1 in explaining the impact of facility delivery and/or the presence of SBAs on neonatal mortality.

9.1.5 Trends in Neonatal Mortality and Newborn Health Practices in Bangladesh

The changes in the NMR over time and its association with health care practices in Bangladesh, were investigated in Section 8.3. In terms of the change in NMR over time, my research findings did not demonstrate any reduction in NMR for some divisions despite improvement over time in the uptake of different health care practices. This could be due to high poverty and/or the proximity of divisions to the Bay of Bengal, which is prone to natural disasters (Haque et al., 2012; Ministry of Planning, 2010). For example, Bangladesh experienced a severe cyclone in May 2013, when 1.1 million people were evacuated from the coastal area (Planning Commission, 2015). Nevertheless, in collaboration with the WHO, MOHFW has already introduced a voucher scheme to improve access to and use of quality health services in that area (Ministry of Health and Family Welfare, 2015). My disaggregated analyses also showed a minimal decline in NMR in rural areas compared to urban areas. This research demonstrates that there is much work to be done to improve the outcomes for newborns from rural areas, as they are receiving only about half the health care services that newborns from urban areas receive. The inequitable distribution of the health workforce in Bangladesh, with lower numbers of health professionals in rural areas, is another challenge that needs to be addressed by government (Ahmed et al., 2011).

My research findings also demonstrated an inequitable coverage of health care services across wealth quintiles, with women from the bottom three quintiles were less likely to receive health care services compared to women from the top two quintiles. In this context, the Bangladesh government, under the Health, Population and Nutrition Sector Development Program (HPNSDP), set a target of the ratio of delivery in a health facility between women in the lowest and the highest quintiles as 1 to 4 (Ministry of Health and Family Welfare, 2011; NIPORT, Mitra and Associates, & ICF International, 2016). The ratio, while having improved from 1 to 6 in 2011 to 1 to 5 in 2014, is still below the target. It is worth mentioning that the majority of the population in the bottom three quintiles live in rural areas (NIPORT, Mitra and Associates, & ICF International, 2016).

Despite considerable improvements in receiving health care services in Bangladesh, the findings of my study on trends in neonatal mortality exhibit a stagnant female NMR between the two survey periods. Gender bias could be the underlying reason for the

unchanged female NMR, as a strong preference for a son is particularly common in South Asia (NIPORT, Mitra and Associates, & ICF International, 2016). Gellatly and Petrie (2016) have shown that prenatal sex selection and female infant mortality can increase with presence of older female siblings. Previous studies have also observed gender biases in breastfeeding and childcare, favouring male infants (Barcellos, Carvalho, & Lleras-Muney, 2014; Chakravarty, 2015).

9.2 Significance of the Research Findings

My research provides an overview of the relationship between NMR and the health care services in Bangladesh and identifies the determinants on ENC in the country. I have also reviewed the impact of health workforce interventions on the NMR in Bangladesh. Together, these findings can assist the government in developing public health strategies to improve maternal and child health services, which will contribute to achieving the SDG 3 targets.

The first findings reveal that ensuring births in health facilities or the presence of SBAs during delivery at home are not necessarily associated with a reduction in neonatal mortality. Limited access to and availability of quality health services, especially in rural areas, may result in fewer women seeking care, except in the case of severe complications. My research findings also indicate the need for SBAs to have up-to-date clinical skills and experience to ensure the effective and efficient referral of women, especially in the case of obstetric emergencies and particularly where the health services are scarce.

My research findings also reveal that some ENC practices do not have a statistically significant association with neonatal deaths, which may be due to the inappropriate delivery and/or practice of these services. As discussed, cultural norms and values may shape maternal and newborn care practices in the community. In summary, the findings point to a need for awareness among facilitators, carers and mothers regarding carrying out ENC practices along with regular training, proficiency assessment and supervision of health professionals to ensure quality ENC care in LMICs.

Another finding of my study indicates that parental education, utilization of ANC services and the presence of SBAs are instrumental to enhancing the coverage of ENC

services in Bangladesh, which is currently very low. The positive association between parental education and the uptake of ENC services draws attention to the need for formal education. Educated mothers are particularly important in LMICs, not only for women's empowerment but also for reducing the role of harmful traditional beliefs that negatively influence ENC practices. In addition, there is a need for health promotion programs that target parents with low levels of education and older mothers to build awareness of the importance of antenatal, intrapartum and postnatal care for every pregnancy.

The research confirms the importance of antenatal care in reducing neonatal mortality. Adjusting for the effects of ANC services in the model reveals that postnatal care does not have any significant protective effect on neonatal and early neonatal deaths. These findings are particularly important for designing policies and programs aimed at reducing newborn deaths in Bangladesh and in other LMICs. To demonstrate the causal impact of postnatal care on child survival, my research findings suggest that future research is needed on examining the differences in health outcomes between newborns who receive PNC services compared to those who do not.

A good understanding of newborn care practices at different socio-demographic levels is also necessary for policy-makers to design and prioritize appropriate child survival interventions. My analyses on changes over time in NMR in Bangladesh identified the trends on mortality across different socio-demographic characteristics, along with gaps in the uptake of health care services. Thus, the research may assist in formulating and/or revising policies and health intervention strategies that target vulnerable groups, which is important to achieve SDG 3 targets.

9.3 Implications of the Research

My research has important implications for policies and programs to reduce NMR in Bangladesh. Specifically, based on the gaps identified in different component of health care services, my recommendations may assist in improving health interventions in the country. It is likely that the recommendations would also be relevant for other LMICs where health systems are relatively poor and the numbers of skilled health care providers are inadequate.

The findings highlight that improvement in the quality and quantity of facilities, along with the skill level of health professionals, needs to be prioritized. As discussed earlier, around 70% of people in Bangladesh live in rural areas, while HRH are mainly concentrated in urban areas. This may cause rural facilities to be overburdened and insufficiently equipped. Therefore, public health policies should take measures to reduce the disparity between urban and rural settings.

Health policy-makers should also focus on improving the skill level of health professionals. The low proficiency of qualified health professionals remains a major issue that impedes the improvement of newborn health outcomes. Uniformity regarding the approaches and duration of workforce training and staff supervision can be a useful workforce intervention strategy. Competency assessment can also be an important measure for improvement in the performance of health care providers.

My research findings may also assist in the adoption and implementation of standard ENC practices. The findings suggested that neonatal mortality may be substantially reduced by emphasizing delayed bathing. My findings point out the harmful effects of the common practices of using unhygienic fabric to wrap newborns and premature breast milk supplementation. Specifically, the national neonatal health strategy for Bangladesh does not include any instruction relating to the hygiene of the cloth used to dry and wrap newborns. Therefore, specific guidelines on these practices are required to improve hygiene at baby's birth.

The study findings on the determinants of ENC emphasized the critical role of SBAs and ANC visits in promoting essential newborn care practices. It is worth mentioning that communities have their own unique cultures and traditions and, therefore, that newborn practices may differ from community to community. Thus, health education on newborn care could be integrated into routine ANC services to increase mothers' and family members' knowledge and skill in safe newborn care. My research also demonstrates that parental education is associated with the uptake of ENC services. In particular, the effect of mothers' education is an important finding for policy-makers and may induce them to place more emphasis on girls' education.

The research findings on the impact of antenatal and postnatal care demonstrate that successful promotion of ANC services may reduce neonatal deaths. This highlights the

need for more investment in ANC services. My study also emphasizes the need to revisit the current health intervention strategy on PNC to understand the reasons for the insignificant impact of PNC on neonatal mortality in Bangladesh.

In terms of changes in NMR over time in Bangladesh, female NMR remains unchanged between the two survey periods, despite considerable improvement in the use of different health care services together with an equal use of these services by newborns of both sexes. Policies to restrict doctors and sonographers from notifying parents of the sex of their baby before delivery may reduce neonatal mortality arising from gender discrimination. Again, lower uptake of health care services among newborns from rural areas and lower SES needs to be addressed in future health intervention strategies. The lack of any observed improvement in NMR in some divisions may indicate that these areas need special attention. A voucher scheme, which has already been introduced in Bangladesh, could be expanded in such areas to improve health outcomes in those regions.

9.4 Limitations of the Research

This research has some limitations that should be noted when interpreting the findings. First, temporality may be an issue as my research relies on cross-sectional surveys. Therefore, the research was only able to identify statistically significant associations; identification of the causality of factors affecting neonatal mortality is not possible. Second, my research may suffer from an information bias. On the one hand, the survey relies on self-reported information and thus there is a possibility of relying on incorrect information. On the other hand, recall bias can also be an issue, as interviewees were required to recollect events as far back as five years. However, this is likely to be a non-differential misclassification as mothers of alive and deceased children are equally likely to provide incorrect information. Third, the variables used in the analyses of my study rely on the availability of information in the survey. For example, due to the lack of data some relevant variables, such as delivery complication, timing of antenatal care, and preterm birth, are not considered in this research. Finally, relatively small sample sizes, specifically the number of neonatal deaths, may have resulted in low statistical power for some research questions. Nevertheless, these limitations are unlikely to impact on the validity of the analyses and the resulting findings and recommendations.

9.5 Strengths of the Research

The major strength of the research is that it used data from a large, nationally representative survey with high response rates at households and individual levels. Appropriate selection of participants is another strength; as the inclusion criteria for this research encompass all the children born in those time frames, it avoids the problem of whether participation is related to exposures or risk factors or both. It also ensures that the group of children (alive and deceased) being compared in the research are not different. Selection bias due to non-participation is not an issue in this research as well. It is observed that the response rate is around 98% in the original surveys. The contemporary nature of the data covering the time period between 2007 to 2014, is another strength of this research; as it covers all new initiatives in health facilities and surrounding infrastructural change, which may help to overcome confounding effects from unknown variables in the analysis. Analytical techniques in this research include multiple logistic regression and adjusted Cox proportion hazard models, which are standard methods for dealing with these types of datasets and have been widely used in biomedical research.

A proper selection of participants, appropriate analytical techniques and controlling for probable confounders in the models are likely to increase the internal validity of this research. It is also likely that the results of this research are generalizable to other LMICs that exhibit high neonatal mortality and have similarly poor health systems.

9.6 Future Research Directions

More research needs to be undertaken to provide all the necessary information to reduce the neonatal death rates in Bangladesh, in line with the targets of SDG 3. My research outlines several issues that require future research attention, as presented below.

While investigating the impact of different component of health care services on neonatal mortality, this research demonstrates that the risk of neonatal death may increase if deliveries occur at health facilities. My research cannot confirm, based on the available data, whether this occurs as a result of a larger proportion of mothers with severe complications presenting at health facilities, or because of the lack of skilled health professionals, or for any other reasons. Hence, further research is required to

identify the reason behind such findings. Such research may collect detailed information on antenatal, intrapartum and postnatal care along with the health status of mother and newborn.

My research also demonstrates, as a part of ANC, the role of iron/folic acid supplements and tetanus toxoid immunization in reducing NMR. However, future research may examine relative contribution of different components of ANC in reducing neonatal deaths. The success of this research would depend on the collection of detailed information on the components of ANC.

Future research is also required to understand the reasons why mortality is higher for neonates who undergo postnatal check-ups and why some ENC practices do not have any impact on neonatal mortality. This will assist policy-makers to understand cultural practices and norms in detail and, consequently, to formulate guidelines to improve practices. Further research is also required into why NMR and ENC practices differ across regions in Bangladesh. Qualitative research can be a useful starting point to gain insights into the problem and to develop ideas or hypotheses for potential quantitative research. This is important because the progress of overall reduction in NMR can be slowed if some regions lag behind others.

9.7 Concluding Remarks

This is the first study to examine the impact of different components of health care practices on neonatal mortality in Bangladesh. The literature review observed that competency assessment, the acquisition of appropriate skills and supervisory guidelines can improve health professional performance. My empirical investigation indicated that neonatal deaths were significantly higher for facility-based deliveries compared to home deliveries in Bangladesh. It also demonstrated a significant contribution of delayed bathing on neonatal mortality which was not the case for other ENC practices. The investigation revealed that the factors affecting ENC practices were low parental education, low utilization of ANC services, the absence of SBAs, smaller size at birth, higher birth order, and mother's age at birth. The study also identified that neonatal mortality was significantly lower for newborns whose mothers attended at least four ANC visits. Finally, examining the changes over time in the NMR and its association with health care practices in Bangladesh, this research observed that higher mortality in

rural areas and in lower SES quintiles may be reduced by emphasizing the uptake of ANC services, facility-based and SBS assisted deliveries and PNC by trained providers.

In my research, I have investigated the key factors that affect the delivery of health interventions to reduce the neonatal mortality in Bangladesh. This investigation may provide useful insights into the impact of different health care practices on neonatal mortality and, thus, can be useful for policy-making, planning and implementing interventions in Bangladesh and, indeed, other LMICs where health systems are relatively poor and neonatal mortality is high. My research has also identified several areas of future research that are likely to contribute to a better understanding of neonatal mortality issues in LMICs and, ultimately, a reduction in neonatal mortality in LMICs over time.

References

Ahmed SM, Hossain MA, RajaChowdhury AM, & Bhuiya AU. (2011). The health workforce crisis in Bangladesh: shortage, inappropriate skill-mix and inequitable distribution. *Hum Resour Health, 9*(1), 3.

Akter T, Dawson A, & Sibbritt D. (2015). What impact do essential newborn care practices have on neonatal mortality in low and lower-middle income countries? Evidence from Bangladesh. *Journal of Perinatology, 36*(3), 225-230.

Akter T, Hoque DME, Chowdhury EK, Rahman M, Russell M, & Arifeen SE. (2015). Is there any association between parental education and child mortality? A study in a rural area of Bangladesh. *Public Health, 129*(12), 1602-1609.

Akter T, Dawson A, & Sibbritt D. (2016). The determinants of essential newborn care for home births in Bangladesh. *Public Health, 141*(12), 7-16.

Akter T, Sibbritt D, & Dawson A. (2016). Workforce interventions to deliver postnatal care to improve neonatal outcomes in low-and lower-middle-income countries: a narrative synthesis. *Asia Pacific Journal of Public Health, 28*(8), 659-681.

Allen CW, & Jeffery H. (2006). Implementation and evaluation of a neonatal educational program in rural Nepal. *Journal of Tropical Pediatrics, 52*(3), 218-222.

Arifeen SE, Mullany LC, Shah R, Mannan I, Rahman SM, Talukder MRR, et al. (2012). The effect of cord cleansing with chlorhexidine on neonatal mortality in rural Bangladesh: a community-based, cluster-randomised trial. *Lancet, 379*(9820), 1022-1028.

Ariff S, Soofi SB, Sadiq K, Feroze AB, Khan S, Jafarey SN, et al. (2010). Evaluation of health workforce competence in maternal and neonatal issues in public health sector of Pakistan: an assessment of their training needs. *BMC Health Services Research, 10*(1), 319.

Bang AT, Bang RA, Baitule SB, Reddy MH, & Deshmukh MD. (1999). Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *Lancet, 354*(9194), 1955-1961.

Bang AT, Bang RA, Baitule SB, Reddy HM, & Deshmukh MD. (2005a). Management of birth asphyxia in home deliveries in rural Gadchiroli: the effect of two types

of birth attendants and of resuscitating with mouth-to-mouth, tube-mask or bag–mask. *Journal of Perinatology, 25*, S82-S91.

Bang AT, Bang RA, & Reddy HM. (2005). Home-based neonatal care: summary and applications of the field trial in rural Gadchiroli, India (1993 to 2003). *Journal of Perinatology, 25*, S108-S122.

Bang AT, Bang RA, Reddy HM, Deshmukh MD, & Baitule SB. (2005b). Reduced incidence of neonatal morbidities: effect of home-based neonatal care in rural Gadchiroli, India. *Journal of Perinatology, 25*, S51-S61.

Bang AT, Reddy HM, Deshmukh MD, Baitule SB, & Bang RA. (2005c). Neonatal and infant mortality in the ten years (1993 to 2003) of the Gadchiroli field trial: effect of home-based neonatal care. *Journal of Perinatology, 25*, S92-S107.

Baqui AH, Williams E, Darmstadt G, Kumar V, Kiran T, Panwar D, et al. (2007). Newborn care in rural Uttar Pradesh. *The Indian Journal of Pediatrics, 74*(3), 241-247.

Baqui AH, Arifeen SE, Darmstadt GL, Ahmed S, Williams EK, Seraji HR, et al. (2008a). Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a cluster-randomised controlled trial. *Lancet, 371*(9628), 1936-1944.

Baqui AH, Williams EK, Rosecrans AM, Agrawal PK, Ahmed S, Darmstadt GL, et al. (2008b). Impact of an integrated nutrition and health programme on neonatal mortality in rural northern India. *Bulletin of the World Health Organization, 86*(10), 796-804.

Baqui AH, Ahmed S, Arifeen SE, Darmstadt GL, Rosecrans AM, Mannan I, et al. (2009a). Effect of timing of first postnatal care home visit on neonatal mortality in Bangladesh: a observational cohort study. *Bmj, 339*, b2826.

Baqui AH, Ahmed S, Arifeen SE, Darmstadt GL, Rosecrans AM, Mannan I, et al. (2009b). Effect of timing of first postnatal care home visit on neonatal mortality in Bangladesh: a observational cohort study. *BMJ, 339*, b2826.

Baqui AH, Arifeen SE, Williams EK, Ahmed S, Mannan I, Rahman SM, et al. (2009c). Effectiveness of home-based management of newborn infections by community health workers in rural Bangladesh. *The Pediatric Infectious Disease Journal, 28*(4), 304-310.

Baqui AH, Rosen H, Lee A, Applegate J, El Arifeen S, Rahman S, et al. (2013). Preterm birth and neonatal mortality in a rural Bangladeshi cohort: implications for health programs. *Journal of Perinatology, 33*(12), 977-981.

Barcellos SH, Carvalho LS, & Lleras-Muney A. (2014). Child Gender and Parental Investments in India: Are Boys and Girls Treated Differently? *American Economic Journal: Applied Economics, 6*(1), 157-189.

Baschat AA, Cosmi E, Bilardo CM, Wolf H, Berg C, Rigano S, et al. (2007). Predictors of neonatal outcome in early-onset placental dysfunction. *Obstetrics and Gynecology, 109*, 253-261.

BBF. (2012). *Annual Report of Bangladesh Breastfeeding Foundation*. Dhaka: Bangladesh Breastfeeding Foundation (BBF), Institute of Public Health.

Bhandari N, Mazumder S, Taneja S, Sommerfelt H, & Strand TA. (2012). Effect of implementation of Integrated Management of Neonatal and Childhood Illness (IMNCI) programme on neonatal and infant mortality: cluster randomised controlled trial. *BMJ, 344*, e1634.

Bhutta ZA, Ali S, Cousens S, Ali TM, Haider BA, Rizvi A, et al. (2008). Alma-Ata: Rebirth and Revision 6 Interventions to address maternal, newborn, and child survival: what difference can integrated primary health care strategies make? *Lancet, 372*(9642), 972-989.

Bhutta ZA, Soofi S, Cousens S, Mohammad S, Memon ZA, Ali I, et al. (2011). Improvement of perinatal and newborn care in rural Pakistan through community-based strategies: a cluster-randomised effectiveness trial. *Lancet, 377*(9763), 403-412.

Bhutta ZA, Das JK, Bahl R, Lawn JE, Salam RA, Paul VK, et al. (2014). Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? *Lancet, 384*(9940), 347-370.

Blencowe H, Lawn J, Vandelaer J, Roper M, & Cousens S. (2010). Tetanus toxoid immunization to reduce mortality from neonatal tetanus. *International Journal of Epidemiology, 39*(suppl 1), i102-i109.

Blencowe H, Cousens S, Mullany LC, Lee AC, Kerber K, Wall S, et al. (2011). Clean birth and postnatal care practices to reduce neonatal deaths from sepsis and tetanus: a systematic review and Delphi estimation of mortality effect. *BMC Public Health, 11*(Suppl 3), S11.

Bryan G, Chowdhury S, & Mobarak AM. (2014). Underinvestment in a profitable technology: The case of seasonal migration in Bangladesh. *Econometrica, 82*(5), 1671-1748.

Carlo WA, Goudar SS, Jehan I, Chomba E, Tshefu A, Garces A, et al. (2010a). Newborn-care training and perinatal mortality in developing countries. *New England Journal of Medicine, 362*(7), 614-623.

Carlo WA, McClure EM, Chomba E, Chakraborty H, Hartwell T, Harris H, et al. (2010b). Newborn care training of midwives and neonatal and perinatal mortality rates in a developing country. *Pediatrics, 126*(5), e1064-e1071.

Carroli G, Villar J, Piaggio G, Khan-Neelofur D, Gülmezoglu M, Mugford M, et al. (2001). WHO systematic review of randomised controlled trials of routine antenatal care. *Lancet, 357*(9268), 1565-1570.

Chakravarty A. (2015). Gender-Biased Breastfeeding in Egypt: Examining the Fertility Preference Hypotheses of Jayachandran and Kuziemko (2011). *Journal of Applied Econometrics, 30*(5), 848-855.

Chen XK, Wen SW, Yang Q, & Walker MC. (2007). Adequacy of prenatal care and neonatal mortality in infants born to mothers with and without antenatal high-risk conditions. *Australian and New Zealand Journal of Obstetrics and Gynaecology, 47*(2), 122-127.

Chowdhury AMR, Bhuiya A, Chowdhury ME, Rasheed S, Hussain Z, & Chen LC. (2013). The Bangladesh paradox: exceptional health achievement despite economic poverty. *Lancet, 382*(9906), 1734-1745.

Christopher JB, Le May A, Lewin S, & Ross DA. (2011). Thirty years after Alma-Ata: a systematic review of the impact of community health workers delivering curative interventions against malaria, pneumonia and diarrhoea on child mortality and morbidity in sub-Saharan Africa. *Human Resources for Health, 9*(1), 27.

CRD. (2009). *Systematic Reviews CRD's Guidance for Undertaking Reviews in Health Care*. University of York: Centre for Reviews and Dissemination.

Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, & de Bernis L. (2005). Evidence-based, cost-effective interventions: how many newborn babies can we save? *Lancet, 365*(9463), 977-988.

Darmstadt GL, Syed U, Patel Z, & Kabir N. (2006). Review of domiciliary newborn-care practices in Bangladesh. *Journal of Health, Population, and Nutrition, 24*(4), 380-393.

Darmstadt GL, Baqui AH, Choi Y, Bari S, Rahman SM, Mannan I, et al. (2009a). Validation of community health workers' assessment of neonatal illness in rural Bangladesh. *Bulletin of the World Health Organization, 87*(1), 12-19.

Darmstadt GL, Saha SK, Choi Y, Arifeen SE, Ahmed NU, Bari S, et al. (2009b). Population-based incidence and etiology of community-acquired neonatal bacteremia in Mirzapur, Bangladesh: an observational study. *Journal of Infectious Diseases, 200*(6), 906-915.

Darmstadt GL, Choi Y, Arifeen SE, Bari S, Rahman SM, Mannan I, et al. (2010a). Evaluation of a cluster-randomized controlled trial of a package of community-based maternal and newborn interventions in Mirzapur, Bangladesh. *PloS One, 5*(3), e9696.

Darmstadt GL, El Arifeen S, Choi Y, Bari S, Rahman SM, Mannan I, et al. (2010b). Household surveillance of severe neonatal illness by community health workers in Mirzapur, Bangladesh: coverage and compliance with referral. *Health Policy and Planning, 25*(2), 112-124.

Datar A, Liu J, Linnemayr S, & Stecher C. (2013). The impact of natural disasters on child health and investments in rural India. *Social Science and Medicine, 76*, 83-91.

Dawson AJ, Buchan J, Duffield C, Homer CS, & Wijewardena K. (2013). Task shifting and sharing in maternal and reproductive health in low-income countries: a narrative synthesis of current evidence. *Health Policy and Planning, 29*(3), 396-408.

Dettrick Z, Firth S, & Soto EJ. (2013). Do strategies to improve quality of maternal and child health care in lower and middle income countries lead to improved outcomes? A review of the evidence. *PloS One, 8*(12), e83070.

Dhakal S, Chapman GN, Simkhada PP, Van Teijlingen ER, Stephens J, & Raja AE. (2007). Utilisation of postnatal care among rural women in Nepal. *BMC Pregnancy and Childbirth, 7*, 19.

DHS Program. (2017a). The DHS Program: Demographic and Health Surveys. Retrieved February 2017 from http://www.dhsprogram.com/.

DHS Program. (2017b). The DHS Program: Demographic and Health Surveys. Retrieved 2018 January from https://dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm.

Dibley MJ, Titaley CR, d'Este C, & Agho K. (2012). Iron and folic acid supplements in pregnancy improve child survival in Indonesia. *The American Journal of Clinical Nutrition, 95*(1), 220-230.

Edmond KM, Zandoh C, Quigley MA, Amenga-Etego S, Owusu-Agyei S, & Kirkwood BR. (2006). Delayed breastfeeding initiation increases risk of neonatal mortality. *Pediatrics, 117*(3), e380-e386.

El Arifeen S. (2008). Child health and mortality. *Journal of Health, Population and Nutrition, 26*(3), 273.

El Arifeen S, Christou A, Reichenbach L, Osman FA, Azad K, Islam KS, et al. (2013). Community-based approaches and partnerships: innovations in health-service delivery in Bangladesh. *Lancet, 382*(9909), 2012-2026.

El Arifeen S, Hill K, Ahsan KZ, Jamil K, Nahar Q, & Streatfield PK. (2014). Maternal mortality in Bangladesh: a Countdown to 2015 country case study. *The Lancet, 384*(9951), 1366-1374.

EPHPP. (2009). Effective Public Health Practice Projects: quality assessment tool for quantitative studies. Retrieved 18 September 2014 from http://www.ephpp.ca/tools.html.

Ezeh OK, Agho KE, Dibley MJ, Hall J, & Page AN. (2014). Determinants of neonatal mortality in Nigeria: evidence from the 2008 demographic and health survey. *BMC Public Health, 14*(1), 521.

Feng XL, Guo S, Hipgrave D, Zhu J, Zhang L, Song L, et al. (2011). China's facility-based birth strategy and neonatal mortality: a population-based epidemiological study. *Lancet, 378*(9801), 1493-1500.

Fiedler J, D'Agostino A, & Sununtnasuk C. (2014). *Nutrition Technical Brief: A Rapid Initial Assessment of the Distribution and Consumption of Iron–Folic Acid Tablets through Antenatal Care in Bangladesh*. Arlington, VA: USAID/Strengthening Partnerships, Results and Innovations in Nutrition Globally (SPRING) Project.

Fottrell E, Osrin D, Alcock G, Azad K, Bapat U, Beard J, et al. (2015). Cause-specific neonatal mortality: analysis of 3772 neonatal deaths in Nepal, Bangladesh,

Malawi and India. *Archives of Disease in Childhood-Fetal and Neonatal Edition, 100*, F439–F447.

Frimpong JA, Helleringer S, Awoonor-Williams JK, Yeji F, & Phillips JF. (2011). Does supervision improve health worker productivity? Evidence from the Upper East Region of Ghana. *Tropical Medicine and International Health, 16*(10), 1225-1233.

Gellatly C, & Petrie M. (2016). Prenatal sex selection and female infant mortality are more common in India after firstborn and second-born daughters. *Journal of Epidemiology and Community Health, 71*, 269-274.

Gill CJ, Phiri-Mazala G, Guerina NG, Kasimba J, Mulenga C, MacLeod WB, et al. (2011). Effect of training traditional birth attendants on neonatal mortality (Lufwanyama Neonatal Survival Project): randomised controlled study. *BMJ, 342*, d346.

Gilmore B, & McAuliffe E. (2013). Effectiveness of community health workers delivering preventive interventions for maternal and child health in low-and middle-income countries: a systematic review. *BMC Public Health, 13*(1), 1-14.

Haider R, Rasheed S, Sanghvi TG, Hassan N, Pachon H, Islam S, et al. (2010). Breastfeeding in infancy: identifying the program-relevant issues in Bangladesh. *International Breastfeeding Journal, 5*(1), 21.

Haines A, Sanders D, Lehmann U, Rowe AK, Lawn JE, Jan S, et al. (2007). Achieving child survival goals: potential contribution of community health workers. *Lancet, 369*(9579), 2121-2131.

Haque U, Hashizume M, Kolivras KN, Overgaard HJ, Das B, & Yamamoto T. (2012). Reduced death rates from cyclones in Bangladesh: what more needs to be done? *Bulletin of the World Health Organization, 90*(2), 150-156.

Harvey SA, Blandón YCW, McCaw-Binns A, Sandino I, Urbina L, Rodríguez C, et al. (2007). Are skilled birth attendants really skilled? A measurement method, some disturbing results and a potential way forward. *Bulletin of the World Health Organization, 85*(10), 783-790.

Haws RA, Thomas AL, Bhutta ZA, & Darmstadt GL. (2007). Impact of packaged interventions on neonatal health: a review of the evidence. *Health Policy and Planning, 22*(4), 193-215.

Hill Z, Dumbaugh M, Benton L, Källander K, Strachan D, ten Asbroek A, et al. (2014). Supervising community health workers in low-income countries–a review of impact and implementation issues. *Global health action, 7*, 24085.

Hodgins S, Pradhan Y, Khanal L, Upreti S, & KC NP. (2013). Chlorhexidine for umbilical cord care: game-changer for newborn survival? *Global Health: Science and Practice, 1*(1), 5-10.

Holman DJ, & Grimes MA. (2001). Colostrum feeding behaviour and initiation of breast-feeding in rural Bangladesh. *Journal of Biosocial Science, 33*(1), 139-154.

Hosmer D, & Lemeshow S. (2000). *Applied Logistic Regression*. New York: Wiley.

Imdad A, Bautista RMM, Senen KAA, Uy MEV, Mantaring III JB, & Bhutta ZA. (2013). Umbilical cord antiseptics for preventing sepsis and death among newborns. *Cochrane Database of Systematic Reviews, Issue 5*, Art No.: CD008635. DOI: 10.1002/14651858.CD008635.pub2.

Iyengar S, Iyengar K, Martines J, Dashora K, & Deora K. (2008). Childbirth practices in rural Rajasthan, India: implications for neonatal health and survival. *Journal of Perinatology, 28*, S23-S30.

Jokhio AH, Winter HR, & Cheng KK. (2005). An intervention involving traditional birth attendants and perinatal and maternal mortality in Pakistan. *New England Journal of Medicine, 352*(20), 2091-2099.

Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS, & Group BCSS. (2003). How many child deaths can we prevent this year? *Lancet, 362*(9377), 65-71.

Kabir I, Khanam M, Agho KE, Mihrshahi S, Dibley MJ, & Roy SK. (2012). Determinants of inappropriate complementary feeding practices in infant and young children in Bangladesh: secondary data analysis of Demographic Health Survey 2007. *Maternal & Child Nutrition, 8*, 11-27.

Khanal V, Gavidia T, Adhikari M, Mishra SR, & Karkee R. (2014). Poor Thermal Care Practices among Home Births in Nepal: Further Analysis of Nepal Demographic and Health Survey 2011. *PloS One, 9*(2), e89950.

Kirkwood BR, Manu A, ten Asbroek AH, Soremekun S, Weobong B, Gyan T, et al. (2013). Effect of the Newhints home-visits intervention on neonatal mortality rate and care practices in Ghana: a cluster randomised controlled trial. *Lancet, 381*(9884), 2184-2192.

Kiros G-E, & Hogan DP. (2001). War, famine and excess child mortality in Africa: the role of parental education. *International Journal of Epidemiology, 30*(3), 447-455.

Kumar V, Mohanty S, Kumar A, Misra RP, Santosham M, Awasthi S, et al. (2008). Effect of community-based behaviour change management on neonatal mortality in Shivgarh, Uttar Pradesh, India: a cluster-randomised controlled trial. *Lancet, 372*(9644), 1151-1162.

Kumar V, Shearer J, Kumar A, & Darmstadt G. (2009). Neonatal hypothermia in low resource settings: a review. *Journal of Perinatology, 29*(6), 401-412.

Lawn JE, Cousens S, & Zupan J. (2005). 4 million neonatal deaths: when? Where? Why? *Lancet, 365*(9462), 891-900.

Lawn JE, Lee AC, Kinney M, Sibley L, Carlo WA, Paul VK, et al. (2009). Two million intrapartum-related stillbirths and neonatal deaths: where, why, and what can be done? *International Journal of Gynecology & Obstetrics, 107*, S5-S19.

Lawn JE, Kerber K, Enweronu-Laryea C, & Cousens S. (2010). 3.6 million neonatal deaths—what is progressing and what is not? *Seminars in Perinatology, 34*(6), 371-386.

Lawn JE, Blencowe H, Oza S, You D, Lee AC, Waiswa P, et al. (2014). Every Newborn: progress, priorities, and potential beyond survival. *Lancet, 384*(9938), 189-205.

Lewin S, Munabi-Babigumira S, Glenton C, Daniels K, Bosch-Capblanch X, van Wyk BE, et al. (2010). Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database of Systematic Reviews, Issue 3*, Art No.: CD004015. DOI: 10.1002/14651858.CD004015.pub3.

Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. (2015). Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. *Lancet, 385*(9966), 430-440.

Lohela TJ, Campbell OM, & Gabrysch S. (2012). Distance to care, facility delivery and early neonatal mortality in Malawi and Zambia. *PloS One, 7*(12), e52110.

Lucas PJ, Baird J, Arai L, Law C, & Roberts HM. (2007). Worked examples of alternative methods for the synthesis of qualitative and quantitative research in systematic reviews. *BMC Medical Research Methodology, 7*(1), 4.

Lunze K, Bloom DE, Jamison DT, & Hamer DH. (2013). The global burden of neonatal hypothermia: systematic review of a major challenge for newborn survival. *BMC Medicine, 11*(1), 24.

Mahtab H, & Bhowmik B. (2016). Gestational Diabetes Mellitus–Global and Bangladesh Perspectives. *Journal of Endocrinology, 3*(2), 1041.

Målqvist M, Sohel N, Do TT, Eriksson L, & Persson L-Å. (2010). Distance decay in delivery care utilisation associated with neonatal mortality. A case referent study in northern Vietnam. *BMC Public Health, 10*(1), 762.

Manasyan A, Chomba E, McClure EM, Wright LL, Krzywanski S, & Carlo WA. (2011). Cost-effectiveness of essential newborn care training in urban first-level facilities. *Pediatrics, 127*(5), e1176-e1181.

Mannan M, Rahman M, Ara I, & Afroz H. (2012). Prevalence and pregnancy outcome of gestational diabetes mellitus among Bangladeshi urban pregnant women. *Journal of Medicine, 13*(2), 147.

McClure EM, Carlo WA, Wright LL, Chomba E, Uxa F, Lincetto O, et al. (2007). Evaluation of the educational impact of the WHO Essential Newborn Care course in Zambia. *Acta Paediatrica, 96*(8), 1135-1138.

Ministry of Health and Family Welfare. (2009). *National Neonatal Health Strategy and Guidelines for Bangladesh*. Dhaka, Bangladesh: Ministry of Health and Family Welfare, Government of the Peoples Republic of Bangladesh.

Ministry of Health and Family Welfare. (2011). *Health, Population and Nutrition Sector Development Program (2011-2016), Volume I, Program Implementation Plan (PIP)*. Dhaka, Bangladesh: Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh.

Ministry of Health and Family Welfare. (2015). *Health Bulletin 2015*. Dhaka, Bangladesh: Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh.

Ministry of Planning. (2005). *National Low Birth Weight Survey of Bangladesh, 2003-2004*. Dhaka, Bangladesh: Bangladesh Bureau of Statistics, Planning Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh.

Ministry of Planning. (2008). *A strategy for poverty reduction in the lagging regions of Bangladesh*. Dhaka, Bangladesh: General Economics Division, Planning Commission, Government of the Peoples Republic of Bangladesh.

Ministry of Planning. (2010). *Report of the household income and expenditure survey 2010*. Dhaka, Bangladesh: Bangladesh Bureau of Statistics, Ministry of Planning, Government of the Peoples Republic of Bangladesh.

Ministry of Planning. (2013). *Health and Morbidity Status Survey- 2012*. Dhaka, Bangladesh: Bangladesh Bureau of Statistics, Statistics and Informatics Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh.

Mitra SN, M. Nawab Ali, Shahidul Islam, Anne R. Cross, & Tulshi Saha. (1994). *Bangladesh Demographic and Health Survey, 1993-1994*. Calverton, Maryland: National Institute of Population Research and Training (NIPORT), Mitra and Associates, and Macro International.

Mitra SN, Ahmed Al-Sabir, Anne R. Cross, & Kanta Jamil. (1997). *Bangladesh Demographic and Health Survey, 1996-1997*. Dhaka and Calverton, Maryland: National Institute of Population Research and Training (NIPORT), Mitra and Associates, and Macro International.

Moher D, Liberati A, Tetzlaff J, & Altman DG. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine, 151*(4), 264-269.

MOHP, New ERA, & ICF International. (2012). *Nepal Demographic and Health Survey 2011*. Kathmandu, Nepal, and Calverton, Maryland, USA: Ministry of Health and Population (MOHP), New ERA and ICF International.

Moran AC, Choudhury N, Khan NUZ, Karar ZA, Wahed T, Rashid SF, et al. (2009). Newborn care practices among slum dwellers in Dhaka, Bangladesh: a quantitative and qualitative exploratory study. *BMC Pregnancy and Childbirth, 9*(1), 54.

Neonatal Mortality Formative Research Working Group. (2008). Developing community-based intervention strategies to save newborn lives: lessons learned from formative research in five countries. *Journal of Perinatology, 28*, S2-S8.

NIPORT, Mitra and Associates, & ICF International. (2013). *Bangladesh Demographic and Health Survey 2011*. Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ICF International.

NIPORT, Mitra and Associates, & ICF International. (2016). *Bangladesh Demographic and Health Survey 2014*. Dhaka, Bangladesh and Rockville, Maryland, USA: National Institute of Population Research and Training (NIPORT), Mitra and Associates, and ICF International.

NIPORT, icddrb, & MEASURE Evaluation. (2017). *Bangladesh Maternal Mortality and Health Care Survey 2016: Preliminary Report*. Dhaka, Bangladesh, and Chapel Hill, NC, USA: National Institute of Population Research and Training (NIPORT), International Centre for Diarrhoeal Disease Research, Bangladesh (icddrb), and MEASURE Evaluation.

NIPS, & ICF International. (2013). *Pakistan Demographic and Health Survey 2012-13*. Islamabad, Pakistan, and Calverton, Maryland, USA: National Institute of Population Studies (NIPS) and ICF International.

Nisar YB, & Dibley MJ. (2014a). Determinants of neonatal mortality in Pakistan: secondary analysis of Pakistan Demographic and Health Survey 2006-07. *BMC Public Health, 14*(1), 663.

Nisar YB, & Dibley MJ. (2014b). Earlier Initiation and Use of a Greater Number of Iron-Folic Acid Supplements during Pregnancy Prevents Early Neonatal Deaths in Nepal and Pakistan. *PloS One, 9*(11), e112446.

Nisar YB, Dibley MJ, Mebrahtu S, Paudyal N, & Devkota M. (2015). Antenatal Iron-Folic Acid Supplementation Reduces Neonatal and Under-5 Mortality in Nepal. *The Journal of Nutrition, 145*(8), 1873-1883.

Onalo R. (2013). Neonatal hypothermia in sub-Saharan Africa: A review. *Nigerian Journal of Clinical Practice, 16*(2), 129-138.

Osrin D, Tumbahangphe KM, Shrestha D, Mesko N, Shrestha BP, Manandhar MK, et al. (2002). Cross sectional, community based study of care of newborn infants in Nepal. *BMJ, 325*(7372), 1063.

Pagel C, Prost A, Hossen M, Azad K, Kuddus A, Roy SS, et al. (2014). Is essential newborn care provided by institutions and after home births? Analysis of prospective data from community trials in rural South Asia. *BMC Pregnancy and Childbirth, 14*(1), 99.

Pallikadavath S, Foss M, & Stones RW. (2004). Antenatal care: provision and inequality in rural north India. *Social Science and Medicine, 59*(6), 1147-1158.

Patel A, Badhoniya N, Khadse S, Senarath U, Agho KE, & Dibley MJ. (2010). Infant and young child feeding indicators and determinants of poor feeding practices in India: secondary data analysis of National Family Health Survey 2005–06. *Food and Nutrition Bulletin, 31*(2), 314-333.

Pena-Rosas JP, & Viteri FE. (2006). Effects of routine oral iron supplementation with or without folic acid for women during pregnancy. *Cochrane Database of Systematic Reviews, Issue 3*, Art. No.: CD004736. DOI: 10.1002/14651858.CD004736.pub2.

Persson LÅ, Arifeen S, Ekström E-C, Rasmussen KM, Frongillo EA, & Team MS. (2012). Effects of prenatal micronutrient and early food supplementation on maternal hemoglobin, birth weight, and infant mortality among children in Bangladesh: the MINIMat randomized trial. *JAMA, 307*(19), 2050-2059.

Perz SG. (2004). Population change. In J. S. Siegel & D. A. Swanson (Eds.), *The methods and materials of demography* (2nd ed., pp. 253-264). San Diego: Elsevier Academic Press.

Planning Commission. (2015). *Seventh Five Year Plan. FY2016 – FY2020*. Dhaka, Bangladesh: General Economics Division (GED), Planning Commission, Government of the People's Republic of Bangladesh.

Prost A, Colbourn T, Seward N, Azad K, Coomarasamy A, Copas A, et al. (2013). Women's groups practising participatory learning and action to improve maternal and newborn health in low-resource settings: a systematic review and meta-analysis. *Lancet, 381*(9879), 1736-1746.

Raatikainen K, Heiskanen N, & Heinonen S. (2007). Under-attending free antenatal care is associated with adverse pregnancy outcomes. *BMC Public Health, 7*(1), 268.

Rahman SM, Ali NA, Jennings L, Seraji MHR, Mannan I, Shah R, et al. (2010). Factors affecting recruitment and retention of community health workers in a newborn care intervention in Bangladesh. *Human Resources for Health, 8*(1), 12.

Ronsmans C, Chowdhury ME, Koblinsky M, & Ahmed A. (2010). Care seeking at time of childbirth, and maternal and perinatal mortality in Matlab, Bangladesh. *Bulletin of the World Health Organization, 88*(4), 289-296.

Rowe AK, de Savigny D, Lanata CF, & Victora CG. (2005). How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet, 366*(9490), 1026-1035.

Rutstein S. (1984). *Infant and child mortality: levels, trends and demographic differentials. Revised edition. (WFS Comparative Studies No. 43; Cross National Summaries)*. Voorburg, Netherlands: International Statistical Institute.

Rutstein S. (1999). *Wealth versus expenditure: Comparison between the DHS wealth index and household expenditures in four departments of Guatemala*. Calverton, Maryland: ORC Macro.

Saaka M, & Iddrisu M. (2014). Patterns and Determinants of Essential Newborn Care Practices in Rural Areas of Northern Ghana. *International Journal of Population Research, 2014*, 1-10.

Sabin LL, Knapp AB, MacLeod WB, Phiri-Mazala G, Kasimba J, Hamer DH, et al. (2012). Costs and cost-effectiveness of training traditional birth attendants to reduce neonatal mortality in the Lufwanyama Neonatal Survival study (LUNESP). *PloS One, 7*(4), e35560.

Seward N, Osrin D, Li L, Costello A, Pulkki-Brännström A-M, Houweling TA, et al. (2012). Association between clean delivery kit use, clean delivery practices, and neonatal survival: pooled analysis of data from three sites in South Asia. *PLoS Medicine, 9*(2), e1001180.

Shahjahan M, Ahmed MR, Rahman MM, & Afroz A. (2012). Factors affecting newborn care practices in Bangladesh. *Paediatric and Perinatal Epidemiology, 26*(1), 13-18.

Shamba D, Schellenberg J, Hildon ZJ-L, Mashasi I, Penfold S, Tanner M, et al. (2014). Thermal care for newborn babies in rural southern Tanzania: a mixed-method study of barriers, facilitators and potential for behaviour change. *BMC Pregnancy and Childbirth, 14*(1), 267.

Sousa S, & Mielke JG. (2015). Does resuscitation training reduce neonatal deaths in low-resource communities? A systematic review of the literature. *Asia-Pacific Journal of Public Health, 27*(7), 690-704.

Speybroeck N, Kinfu Y, Dal Poz MR, & Evans DB. (2006). *Reassessing the relationship between human resources for health, intervention coverage and health outcomes*. Geneva: World Health Organization.

Sutherland SE. (2004). An introduction to systematic reviews. *Journal of Evidence Based Dental Practice, 4*(1), 47-51.

Thairu L, & Pelto G. (2008). Newborn care practices in Pemba Island (Tanzania) and their implications for newborn health and survival. *Maternal & Child Nutrition, 4*(3), 194-208.

Tielsch JM, Darmstadt GL, Mullany LC, Khatry SK, Katz J, LeClerq SC, et al. (2007). Impact of newborn skin-cleansing with chlorhexidine on neonatal mortality in southern Nepal: a community-based, cluster-randomized trial. *Pediatrics, 119*(2), e330-e340.

Titaley CR, Dibley MJ, Agho K, Roberts CL, & Hall J. (2008). Determinants of neonatal mortality in Indonesia. *BMC Public Health, 8*(1), 232.

Titaley CR, Dibley MJ, & Roberts CL. (2009). Factors associated with non-utilisation of postnatal care services in Indonesia. *Journal of Epidemiology and Community Health, 63*(10), 827-831.

Titaley CR, Dibley MJ, & Roberts CL. (2010). Factors associated with underutilization of antenatal care services in Indonesia: results of Indonesia Demographic and Health Survey 2002/2003 and 2007. *BMC Public Health, 10*(1), 485.

Titaley CR, Dibley MJ, Roberts CL, Hall J, & Agho K. (2010). Iron and folic acid supplements and reduced early neonatal deaths in Indonesia. *Bulletin of the World Health Organization, 88*(7), 500-508.

Titaley CR, & Dibley MJ. (2012). Antenatal iron/folic acid supplements, but not postnatal care, prevents neonatal deaths in Indonesia: analysis of Indonesia Demographic and Health Surveys 2002/2003–2007 (a retrospective cohort study). *BMJ open, 2*(6), e001399.

Titaley CR, Dibley MJ, & Roberts CL. (2012). Type of delivery attendant, place of delivery and risk of early neonatal mortality: analyses of the 1994–2007 Indonesia Demographic and Health Surveys. *Health Policy and Planning, 27*(5), 405-416.

Tran NT, Portela A, de Bernis L, & Beek K. (2014). Developing Capacities of Community Health Workers in Sexual and Reproductive, Maternal, Newborn, Child, and Adolescent Health: A Mapping and Review of Training Resources. *PloS One, 9*(4), e94948.

Tura G, Fantahun M, & Worku A. (2013). The effect of health facility delivery on neonatal mortality: systematic review and meta-analysis. *BMC Pregnancy and Childbirth, 13*(1), 18.

UN. (2016). Sustainable Development Goals; 17 Goals to Transform Our World. Retrieved June 2016 from http://www.un.org/sustainabledevelopment/.

UNDP. (2016). United Nations Development Programme in Bangladesh. Retrieved June 2016 from http://www.bd.undp.org/content/bangladesh/en/home/countryinfo/.

UNICEF. (2014). *Committing to Child Survival: A Promise Renewed. Progress Report 2014.* New York, USA: UNICEF.

UNICEF. (2015a). *Levels & trends in child mortality: estimates developed by the UN Inter-agency Group for Child Mortality Estimation*. New York, USA: UNICEF.

UNICEF. (2015b). *The State of the World's Children 2015: Executive Summary*. New York, USA: UNICEF.

UNICEF. (2015c). *Committing to Child Survival: A Promise Renewed 2015*. New York, USA: UNICEF.

UNICEF. (2016). UNICEF Data: Monitoring the Situation of Children and Women. Retrieved August 2016 from http://data.unicef.org/child-mortality/under-five.html.

USAID, & MCHIP. (2009). ACCESS End of Project Report. Retrieved May 2015 from http://www.mchip.net/node/627.

Victor R, Baines SK, Agho KE, & Dibley MJ. (2013). Determinants of breastfeeding indicators among children less than 24 months of age in Tanzania: a secondary analysis of the 2010 Tanzania Demographic and Health Survey. *BMJ open, 3*(1), e001529.

Wardlaw T, You D, Hug L, Amouzou A, & Newby H. (2014). UNICEF Report: enormous progress in child survival but greater focus on newborns urgently needed. *Reproductive health, 11*, 1-4.

Weaver SJ, Dy SM, & Rosen MA. (2014). Team-training in healthcare: a narrative synthesis of the literature. *BMJ quality & safety, 23*, 359-372.

WHO. (1998). *Care of the umbilical cord. WHO/FHE/MSM-cord care*. Geneva: World Health Organization.

WHO. (2006a). *Working together for health. The World Health Report 2006.* Switzerland: WHO Press, World Health Organization.

WHO. (2006b). *Pregnancy, Childbirth, Postpartum and Newborn Care: a guide for essential practice*. Switzerland: WHO Press, World Health Organization.

WHO, & UNICEF. (2009). *WHO/UNICEF Joint Statement: home visits for the newborn child: a strategy to improve survival*. Geneva, Switzerland: World Health Organization (WHO).

WHO. (2010). *Packages of Interventions for Family Planning, Safe Abortion care, Maternal, Newborn and Child Health*. Switzerland: WHO Press, World Health Organization.

WHO, & PMNCH. (2011). *A Global Review of the Key Interventions Related to Reproductive, Maternal, Newborn and Child Health (RMNCH)*. Geneva, Switzerland: WHO and The Partnership for Maternal Newborn & Child Health (PMNCH).

WHO. (2013). *WHO recommendations on postnatal care of the mother and newborn*. Geneva, Switzerland: World Health Organization (WHO).

WHO. (2015a). *World Health Statistics 2015*. Switzerland: WHO Press, World Health Organization.

WHO. (2015b). *Bangladesh Health System Review*. Switzerland: WHO Press, World Health Organization.

WHO. (2016a). *World Health Statistics 2016*. Switzerland: WHO Press, World Health Organization.

WHO. (2016b). Health systems. Retrieved October 2016 from http://www.who.int/healthsystems/topics/delivery/en/.

Willis-Shattuck M, Bidwell P, Thomas S, Wyness L, Blaauw D, & Ditlopo P. (2008). Motivation and retention of health workers in developing countries: a systematic review. *BMC Health Services Research, 8*(1), 247.

Winch PJ, Alam MA, Akther A, Afroz D, Ali NA, Ellis AA, et al. (2005). Local understandings of vulnerability and protection during the neonatal period in Sylhet District, Bangladesh: a qualitative study. *Lancet, 366*(9484), 478-485.

Yasmin S, Osrin D, Paul E, & Costello A. (2001). Neonatal mortality of low-birth-weight infants in Bangladesh. *Bulletin of the World Health Organization, 79*(7), 608-614.

You D, Hug L, Ejdemyr S, Idele P, Hogan D, Mathers C, et al. (2015). Global, regional, and national levels and trends in under-5 mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Inter-agency Group for Child Mortality Estimation. *Lancet, 386*(10010), 2275-2286.

Zeng L, Cheng Y, Dang S, Yan H, Dibley MJ, Chang S, et al. (2008). Impact of micronutrient supplementation during pregnancy on birth weight, duration of gestation, and perinatal mortality in rural western China: double blind cluster randomised controlled trial. *BMJ, 337*, a2522.

Appendices

Appendix 1:

Questionnaires of Bangladesh Demographic and Health Survey

Source: Bangladesh Demographic and Health Survey 2011 (NIPORT et al., 2013)

BANGLADESH DEMOGRAPHIC AND HEALTH SURVEY 2011
HOUSEHOLD QUESTIONNAIRE

NIPORT, MOHFW, and
Mitra and Associates

IDENTIFICATION

DIVISION _____
DISTRICT _____
UPAZILA _____
UNION/WARD _____
VILLAGE/MOHALLA/BLOCK _____
CLUSTER NUMBER . . . . . .
HOUSEHOLD NUMBER . . . . . .
RURAL=1, CITY CORPORATION=2, OTHER URBAN=3 . . . . . .
NAME OF THE HOUSEHOLD HEAD _____
HOUSEHOLD SELECTED FOR MEN'S SURVEY (YES=1, NO=2) _____
ALTITUDE (METER) . . . . . .

INTERVIEWER VISITS

	1	2	3	FINAL VISIT
DATE				DAY / MONTH / YEAR (2011)
INTERVIEWER'S NAME				INT. NUMBER
RESULT*				RESULT
NEXT VISIT: DATE				TOTAL NUMBER OF VISITS
TIME				

*RESULT CODES:
1 COMPLETED
2 NO HOUSEHOLD MEMBER AT HOME OR NO COMPETENT RESPONDENT AT HOME AT TIME OF VISIT
3 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME
4 POSTPONED
5 REFUSED
6 DWELLING VACANT OR ADDRESS NOT A DWELLING
7 DWELLING DESTROYED
8 DWELLING NOT FOUND
9 OTHER _____ (SPECIFY)

TOTAL PERSONS IN HOUSEHOLD
TOTAL WOMEN 12-49 YR
TOTAL MEN 15-54 YR
TOTAL ADULTS 35+ YEARS
LINE NO. OF RESPONDENT TO HOUSEHOLD QUESTIONNAIRE

SUPERVISOR	FIELD EDITOR	HEALTH TECHNICIAN	OFFICE EDITOR	KEYED BY
NAME	NAME			

INTRODUCTION AND CONSENT

Hello. My name is _____. I am working with NIPORT, the Ministry of Health and Family Welfare, and Mitra and Associates, a private research organization located in Dhaka. We are conducting a survey about health all over Bangladesh. The information we collect will help the government to plan health services. Your household was selected for the survey. I would like to ask you some questions about your household. The questions usually take about 15 to 20 minutes. All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.
In case you need more information about the survey, you may contact the person listed on this card.

GIVE CARD WITH CONTACT INFORMATION

Do you have any questions?
May I begin the interview now?

SIGNATURE OF INTERVIEWER: _____ DATE: _____

RESPONDENT AGREES TO BE INTERVIEWED . . . 1 ↓

RESPONDENT DOES NOT AGREE TO BE INTERVIEWED . . . 2 → END

HOUSEHOLD SCHEDULE

							IF AGE 12 OR OLDER	IF AGE 5 YEARS OR OLDER		IF AGE 5-24 YEARS		IF AGE 8 OR OLDER
LINE NO.	USUAL RESIDENTS AND VISITORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX	RESIDENCE		AGE	MARITAL STATUS	EVER ATTENDED SCHOOL		CURRENT/RECENT SCHOOL ATTENDANCE		CURRENT WORK STATUS
1	2	3	4	5	6	7	8	9	10	11	12	13
	Please give me the names of the persons who usually live in your household and guests of the household who stayed here last night, starting with the head of the household. AFTER LISTING THE NAMES AND RECORDING THE RELATIONSHIP AND SEX FOR EACH PERSON, ASK QUESTIONS 2A-2C TO BE SURE THAT THE LISTING IS COMPLETE. THEN ASK APPROPRIATE QUESTIONS IN COLUMNS 5-22 FOR EACH PERSON.	What is the relationship of (NAME) to the head of the household? SEE CODES BELOW.	Is (NAME) male or female?	Does (NAME) usually live here?	Did (NAME) stay here last night?	How old is (NAME)? IF 95 OR MORE, RECORD '95'.	What is (NAME)'s current marital status? 1 = CURRENTLY MARRIED 2 = DIVORCED/ SEPARATED/ DESERTED/ WIDOWED 3 = NEVER-MARRIED	Has (NAME) ever attended school?	What is the highest level of school (NAME) has attended? SEE CODES BELOW. What is the highest class (NAME) completed at that level? SEE CODES BELOW.	Did (NAME) attend school at any time during the **(2010-2011)** school year?	During this/that school year, what level and class [is/was] (NAME) attending? SEE CODES BELOW.	Is (NAME) currently working?
			M F	Y N	Y N	IN YEARS		Y N	LEVEL CLASS	Y N	LEVEL CLASS	Y N
01			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
02			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
03			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
04			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
05			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
06			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
07			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
08			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
09			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
10			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2

CODES FOR Q. 3: RELATIONSHIP TO HEAD OF HOUSEHOLD

01 = HEAD
02 = WIFE OR HUSBAND
03 = SON OR DAUGHTER
04 = SON-IN-LAW OR DAUGHTER-IN-LAW
05 = GRANDCHILD
06 = PARENT
07 = PARENT-IN-LAW
08 = BROTHER OR SISTER
09 = OTHER RELATIVE
10 = ADOPTED/FOSTER/ STEPCHILD
11 = NOT RELATED
98 = DON'T KNOW

CODES FOR Qs. 10 AND 12: EDUCATION

LEVEL
1 = PRIMARY
2 = SECONDARY
3 = HIGHER
6 = PRE-PRIMARY
8 = DON'T KNOW

CLASS
00 = LESS THAN 1 YEAR COMPLETED (USE '00' FOR Q. 10 ONLY. THIS CODE IS NOT ALLOWED FOR Q. 12)
98 = DON'T KNOW

IF AGE 0-4 YEARS	ELIGIBILITY							
BIRTH REGIS-TRATION	INTERVIEW		BIOMARKERS					
	WOMEN	MEN	ALL HOUSEHOLDS		HOUSEHOLDS SELECTED FOR MEN'S SURVEY			
			CHILDREN	WOMEN	WOMEN		MEN	
14	15	16	17	18	19	20	21	22
Does (NAME) have a birth certificate? IF NO, PROBE: Has (NAME)'s birth ever been registered with the civil authority? 1 = HAS CERTIFICATE 2 = REGISTERED 3 = NEITHER 8 = DON'T KNOW	CIRCLE LINE NUMBER OF ALL EVER-MARRIED WOMEN AGE 12-49	CIRCLE LINE NUMBER OF ALL EVER-MARRIED MEN AGE 15-54 IF HOUSEHOLD SELECTED FOR MALE SURVEY	CIRCLE LINE NUMBER OF ALL CHILDREN AGE 0-5 IF COLUMN 7 IS 0 TO 5	HEIGHT WEIGHT ANEMIA CIRCLE LINE NUMBER EVER-MARRIED WOMEN AGE 12-49 IF COL. 4 IS 2 AND IF COL. 7 IS 12 - 49 AND IF COL. 8 IS 1 OR 2.	BLOOD PRESSURE BLOOD GLUCOSE CIRCLE LINE NUMBER EVER-MARRIED WOMEN AGE 35 -49 IF COL. 4 IS 2 AND IF COL. 7 IS 35 - 49 AND IF COL. 8 IS 1 OR 2.	HEIGHT WEIGHT BLOOD PRESSURE BLOOD GLUCOSE CIRCLE LINE NUMBER EVER-MARRIED WOMEN AGE 50 + IF COL. 4 IS 2 AND IF COL. 7 IS 50 + AND IF COL. 8 IS 1 or 2. NEVER-MARRIED WOMEN AGE 35+ IF COL. 4 IS 2 AND IF COL. 7 IS 35+ AND IF COL. 8 IS 3.	HEIGHT WEIGHT CIRCLE LINE NUMBER OF ALL EVER-MARRIED MEN AGE 15-34 IF COL. 4 IS 1 AND IF COL. 7 IS 15-34 AND IF COL. 8 IS 1 OR 2.	HEIGHT WEIGHT BLOOD PRESSURE BLOOD GLUCOSE CIRCLE LINE NUMBER OF ALL MEN AGE 35 + IF COL. 4 IS 1 AND IF COL. 7 IS 35 +.
☐	01	01	01	01	01	01	01	01
☐	02	02	02	02	02	02	02	02
☐	03	03	03	03	03	03	03	03
☐	04	04	04	04	04	04	04	04
☐	05	05	05	05	05	05	05	05
☐	06	06	06	06	06	06	06	06
☐	07	07	07	07	07	07	07	07
☐	08	08	08	08	08	08	08	08
☐	09	09	09	09	09	09	09	09
☐	10	10	10	10	10	10	10	10

							IF AGE 12 OR OLDER	IF AGE 5 YEARS OR OLDER		IF AGE 5-24 YEARS		IF AGE 8 OR OLDER
LINE NO.	USUAL RESIDENTS AND VISITORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX	RESIDENCE		AGE	MARITAL STATUS	EVER ATTENDED SCHOOL		CURRENT/RECENT SCHOOL ATTENDANCE		CURRENT WORK STATUS
1	2	3	4	5	6	7	8	9	10	11	12	13
	Please give me the names of the persons who usually live in your household and guests of the household who stayed here last night, starting with the head of the household. AFTER LISTING THE NAMES AND RECORDING THE RELATIONSHIP AND SEX FOR EACH PERSON, ASK QUESTIONS 2A-2C TO BE SURE THAT THE LISTING IS COMPLETE. THEN ASK APPROPRIATE	What is the relationship of (NAME) to the head of the household? SEE CODES BELOW.	Is (NAME) male or female?	Does (NAME) usually live here?	Did (NAME) stay here last night?	How old is (NAME)? IF 95 OR MORE, RECORD '95'.	What is (NAME)'s current marital status? 1 = CURRENTLY MARRIED 2 = DIVORCED/ SEPARATED/ DESERTED/ WIDOWED 3 = NEVER-MARRIED	Has (NAME) ever attended school?	What is the highest level of school (NAME) has attended? SEE CODES BELOW. What is the highest class (NAME) completed at that level? SEE CODES BELOW.	Did (NAME) attend school at any time during the (2010-2011) school year?	During this/that school year, what level and class [is/was] (NAME) attending? SEE CODES BELOW.	Is (NAME) currently working?
11			M F 1 2	Y N 1 2	Y N 1 2	IN YEARS		Y N 1 2 ↓ GO TO 13	LEVEL CLASS	Y N 1 2 ↓ GO TO 13	LEVEL CLASS	1 2
12			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
13			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
14			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
15			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
16			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
17			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
18			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
19			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2
20			1 2	1 2	1 2			1 2 ↓ GO TO 13		1 2 ↓ GO TO 13		1 2

TICK HERE IF CONTINUATION SHEET USED ☐

2A) Just to make sure that I have a complete listing: are there any other persons such as small children or infants that we have not listed? YES ☐ → ADD TO TABLE NO ☐

2B) Are there any other people who may not be members of your family, such as domestic servants, lodgers, or friends who usually live here? YES ☐ → ADD TO TABLE NO ☐

2C) Are there any guests or temporary visitors staying here, or anyone else who stayed here last night, who have not been listed? YES ☐ → ADD TO TABLE NO ☐

CODES FOR Q. 3: RELATIONSHIP TO HEAD OF HOUSEHOLD

01 = HEAD
02 = WIFE OR HUSBAND
03 = SON OR DAUGHTER
04 = SON-IN-LAW OR DAUGHTER-IN-LA'
05 = GRANDCHILD
06 = PARENT
07 = PARENT-IN-LAW
08 = BROTHER OR SISTER
09 = OTHER RELATIVE
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11 = NOT RELATED
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CODES FOR Qs. 10 AND 12: EDUCATION

LEVEL
1 = PRIMARY
2 = SECONDARY
3 = HIGHER
6 = PRE-PRIMARY
8 = DON'T KNOW

CLASS
00 = LESS THAN 1 YEAR COMPLETED (USE '00' FOR Q. 10 ONLY. THIS CODE IS NOT ALLOWED FOR Q. 12)
98 = DON'T KNOW

IF AGE 0-4 YEARS	ELIGIBILITY							
BIRTH REGIS-TRATION	INTERVIEW		BIOMARKERS					
	WOMEN	MEN	ALL HOUSEHOLDS		HOUSEHOLDS SELECTED FOR MEN'S SURVEY			
			CHILDREN	WOMEN	WOMEN		MEN	
14	15	16	17	18	19	20	21	22
Does (NAME) have a birth certificate? IF NO, PROBE: Has (NAME)'s birth ever been registered with the civil authority? 1 = HAS CERTIFICATE 2 = REGISTERED 3 = NEITHER 8 = DON'T KNOW	CIRCLE LINE NUMBER OF ALL EVER-MARRIED WOMEN AGE 12-49	CIRCLE LINE NUMBER OF ALL EVER-MARRIED MEN AGE 15-54 IF HOUSEHOLD SELECTED FOR MALE SURVEY	CIRCLE LINE NUMBER OF ALL CHILDREN AGES 0-5 IF COLUMN 7 IS 0 TO 5	HEIGHT WEIGHT ANEMIA CIRCLE LINE NUMBER EVER-MARRIED WOMEN AGE 12-49 IF COL. 4 IS 2 AND IF COL. 7 IS 12 - 49 AND IF COL. 8 IS 1 OR 2.	BLOOD PRESSURE BLOOD GLUCOSE CIRCLE LINE NUMBER EVER-MARRIED WOMEN AGE 35 -49 IF COL. 4 IS 2 AND IF COL. 7 IS 35 - 49 AND IF COL. 8 IS 1 OR 2.	HEIGHT WEIGHT BLOOD PRESSURE BLOOD GLUCOSE CIRCLE LINE NUMBER EVER-MARRIED WOMEN AGE 50 + IF COL. 4 IS 2 AND IF COL. 7 IS 50 + AND IF COL. 8 IS 1 or 2. NEVER-MARRIED WOMEN AGE 35+ IF COL. 4 IS 2 AND IF COL. 7 IS 35+ AND IF COL. 8 IS 3.	HEIGHT WEIGHT CIRCLE LINE NUMBER OF ALL EVER-MARRIED MEN AGE 15-34 IF COL. 4 IS 1 AND IF COL. 7 IS 15-34 AND IF COL. 8 IS 1 OR 2.	HEIGHT WEIGHT BLOOD PRESSURE BLOOD GLUCOSE CIRCLE LINE NUMBER OF ALL MEN AGE 35 + IF COL. 4 IS 1 AND IF COL. 7 IS 35 +.
☐	11	11	11	11	11	11	11	11
☐	12	12	12	12	12	12	12	12
☐	13	13	13	13	13	13	13	13
☐	14	14	14	14	14	14	14	14
☐	15	15	15	15	15	15	15	15
☐	16	16	16	16	16	16	16	16
☐	17	17	17	17	17	17	17	17
☐	18	18	18	18	18	18	18	18
☐	19	19	19	19	19	19	19	19
☐	20	20	20	20	20	20	20	20

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
102	What is the main source of drinking water for members of your your household?	PIPED WATER PIPED INTO DWELLING . . . . . 11 PIPED TO YARD/PLOT . . . . . 12 PUBLIC TAP/STANDPIPE . . . . . 13 TUBE WELL OR BOREHOLE . . . . . 21 DUG WELL PROTECTED WELL . . . . . 31 UNPROTECTED WELL . . . . . 32 WATER FROM SPRING PROTECTED SPRING . . . . . 41 UNPROTECTED SPRING . . . . . 42 RAINWATER . . . . . 51 TANKER TRUCK . . . . . 61 CART WITH SMALL TANK . . . . . 71 SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/ IRRIGATION CHANNEL) . . . . . 81 BOTTLED WATER . . . . . 91 OTHER _____ 96 (SPECIFY)	→ 105 → 105
103	Where is that water source located?	IN OWN DWELLING . . . . . 1 IN OWN YARD/PLOT . . . . . 2 ELSEWHERE 3	→ 105
104	How long does it take to go there, get water, and come back?	MINUTES . . . . . ☐☐☐ DON'T KNOW 998	
104A	Do you share this source with other households?	YES . . . . . 1 NO 2	→ 105
104B	How many households use this source of water?	NO. OF HOUSEHOLDS IF LESS THAN 10 . . . . . 0☐ 10 OR MORE HOUSEHOLDS . . . . . 95 DON'T KNOW 98	
105	Do you do anything to the water to make it safer to drink?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	→ 107
106	What do you usually do to make the water safer to drink? Anything else? RECORD ALL MENTIONED.	BOIL . . . . . A ADD BLEACH/CHLORINE . . . . . B STRAIN THROUGH A CLOTH . . . . . C USE WATER FILTER (CERAMIC/ SAND/COMPOSITE/ETC.) . . . . . D SOLAR DISINFECTION . . . . . E LET IT STAND AND SETTLE . . . . . F OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
107	What kind of toilet facility do members of your household usually use?	FLUSH OR POUR FLUSH TOILET FLUSH TO PIPED SEWER SYSTEM . . . 11 FLUSH TO SEPTIC TANK . . . 12 FLUSH TO PIT LATRINE . . . 13 FLUSH TO SOMEWHERE ELSE . . . 14 FLUSH, DON'T KNOW WHERE . . . 15 PIT LATRINE VENTILATED IMPROVED PIT LATRINE . . . 21 PIT LATRINE WITH SLAB . . . 22 PIT LATRINE WITHOUT SLAB/ OPEN PIT . . . 23 COMPOSTING TOILET . . . 31 BUCKET TOILET . . . 41 HANGING TOILET/HANGING LATRINE . . . 51 NO FACILITY/BUSH/FIELD . . . 61 OTHER _____ 96 (SPECIFY)	→ 110
108	Do you share this toilet facility with other households?	YES . . . 1 NO . . . 2	→ 110
109	How many households use this toilet facility?	NO. OF HOUSEHOLDS IF LESS THAN 10 . . . [0] 10 OR MORE HOUSEHOLDS . . . 95 DON'T KNOW . . . 98	
110	Does your household have: Electricity? A radio? A television? A mobile telephone? A non-mobile telephone? A refrigerator? An almirah/wardrobe? A table? A chair? An electric fan? A DVD/VCD player? A water pump?	YES NO ELECTRICITY . . . 1 2 RADIO . . . 1 2 TELEVISION . . . 1 2 MOBILE TELEPHONE . . . 1 2 NON-MOBILE TELEPHONE . . . 1 2 REFRIGERATOR . . . 1 2 ALMIRAH/WARDROI . . . 1 2 TABLE . . . 1 2 CHAIR . . . 1 2 ELETRIC FAN . . . 1 2 DVD/VCD PLAYER . . . 1 2 WATER PUMP . . . 1 2	
111	What type of fuel does your household mainly use for cooking?	ELECTRICITY . . . 01 LPG . . . 02 NATURAL GAS . . . 03 BIOGAS . . . 04 KEROSENE . . . 05 COAL, LIGNITE . . . 06 CHARCOAL . . . 07 WOOD . . . 08 STRAW/SHRUBS/GRASS . . . 09 AGRICULTURAL CROP . . . 10 ANIMAL DUNG . . . 11 NO FOOD COOKED IN HOUSEHOLD . . . 95 OTHER _____ 96 (SPECIFY)	→ 113A

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
112	Is the cooking usually done in the house, in a separate building, or outdoors?	IN THE HOUSE . . . . . 1 IN A SEPARATE BUILDING . . . . . 2 OUTDOORS . . . . . 3 OTHER _____ 6 (SPECIFY)	→ 113A
113	Do you have a separate room which is used as a kitchen?	YES . . . . . 1 NO 2	
113A	How often does anyone smoke inside your house? Would you say daily, weekly, monthly, less than monthly, or never?	DAILY . . . . . 1 WEEKLY . . . . . 2 MONTHLY . . . . . 3 LESS THAN MONTHLY . . . . . 4 NEVER 5	
114	MAIN MATERIAL OF THE FLOOR. RECORD OBSERVATION.	NATURAL FLOOR EARTH/SAND . . . . . 11 RUDIMENTARY FLOOR WOOD PLANKS . . . . . 21 PALM/BAMBOO . . . . . 22 FINISHED FLOOR PARQUET OR POLISHED WOOD . . . . . 31 CERAMIC TILES . . . . . 33 CEMENT . . . . . 34 CARPET . . . . . 35 OTHER _____ 96 (SPECIFY)	
115	MAIN MATERIAL OF THE ROOF. RECORD OBSERVATION.	NATURAL ROOFING NO ROOF . . . . . 11 THATCH/PALM LEAF . . . . . 12 RUDIMENTARY ROOFING PALM/BAMBOO . . . . . 22 WOOD PLANKS . . . . . 23 CARDBOARD . . . . . 24 FINISHED ROOFING TIN . . . . . 31 WOOD . . . . . 32 CERAMIC TILES . . . . . 34 CEMENT . . . . . 35 ROOFING SHINGLES . . . . . 36 OTHER _____ 96 (SPECIFY)	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
116	MAIN MATERIAL OF THE EXTERIOR WALLS. RECORD OBSERVATION.	NATURAL WALLS NO WALLS . . . . . 11 CANE/PALM/TRUNKS . . . . . 12 DIRT . . . . . 13 RUDIMENTARY WALLS BAMBOO WITH MUD . . . . . 21 STONE WITH MUD . . . . . 22 PLYWOOD . . . . . 24 CARDBOARD . . . . . 25 FINISHED WALLS TIN . . . . . 31 CEMENT . . . . . 32 STONE WITH LIME/CEMENT . . . . . 33 BRICKS . . . . . 34 WOOD PLANKS/SHINGLES . . . . . 36 OTHER _____ 96 (SPECIFY)	
117	How many rooms in this household are used for sleeping?	ROOMS	
118	Does any member of this household own: An autobike? A rickshaw/van? A bicycle? A motorcycle or motor scooter/tempo/CNG?	YES NO AUTOBIKE . . . . . 1 2 RICKSHAW . . . . . 1 2 BICYCLE . . . . . 1 2 MOTORCYCLE/SCOOTER . . . 1 2	
121	Does this household own any livestock, herds, other farm animals, or poultry?	YES . . . . . 1 NO 2	→ 122A
122	How many of the following animals does this household own? IF NONE, ENTER '00'. IF 95 OR MORE, ENTER '95'. IF UNKNOWN, ENTER '98'. Buffaloes? Cows? Goats or sheep? Chickens or ducks?	BULLS/BUFFALOES . . . . . MILK COWS/BULLS . . . . . GOAT/SHEEP . . . . . CHICKENS/DUCKS	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
122A	Does your household own any homestead? IF 'NO' PROBE: Does your household own homestead in any other places?	YES . . . . . 1 NO 2	
122B	Does your household own any land (other than the homestead land)?	YES . . . . . 1 NO 2	→ 123
122C	How much land does your household own (other than the homestead land)? AMOUNT _____ SPECIFY UNIT _____ IF 95 OR MORE CIRCLE '9995'	ACRES DECIMALS AREA . . . . . ☐☐ . ☐☐ 95 OR MORE ACRES . . . . . 9995 DON'T KNOW 9998	
123	Does any member of this household have a bank account?	YES . . . . . 1 NO 2	
137	Please show me where members of your household most often wash their hands.	OBSERVED . . . . . 1 NOT OBSERVED, NOT IN DWELLING/YARD/PLOT . . . . . 2 NOT OBSERVED, NO PERMISSION TO SEE . . . . . 3 NOT OBSERVED, OTHER REASON . . . . . 4 (SKIP TO 140)	
138	OBSERVATION ONLY: OBSERVE PRESENCE OF WATER AT THE PLACE FOR HANDWASHING.	WATER IS AVAILABLE . . . . . 1 WATER IS NOT AVAILABLE 2	
139	OBSERVATION ONLY: OBSERVE PRESENCE OF SOAP, DETERGENT, OR OTHER CLEANSING AGENT.	SOAP (BAR, LIQUID, PASTE) . . . . . A DETERGENT (BAR, LIQUID, POWDER) . . . B ASH, MUD, SAND . . . . . C NONE . . . . . D	
140	ASK RESPONDENT FOR A TEASPOONFUL OF COOKING SALT. TEST SALT FOR IODINE.	IODINE PRESENT . . . . . 1 NO IODINE . . . . . 2 NO SALT IN HOUSEHOLD . . . . . 3 SALT NOT TESTED _____ 6 (SPECIFY REASON)	

WEIGHT, HEIGHT AND HAEMOGLOBIN MEASUREMENT FOR CHILDREN AGE 0-5

CLUSTER NUMBER ☐☐☐ HOUSEHOLD NUMBER ☐☐☐

		CHILD 1	CHILD 2	CHILD 3
201	CHECK **COLUMN 17** IN HOUSEHOLD SCHEDULE. RECORD THE LINE NUMBER AND NAME FOR ALL ELIGIBLE CHILDREN 0-5 YEARS IN QUESTION 202. IF MORE THAN SIX CHILDREN, USE ADDITIONAL QUESTIONNAIRE(S).			
202	LINE NUMBER FROM COLUMN 17 NAME FROM COLUMN 2	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____
203	IF MOTHER INTERVIEWED, COPY MONTH AND YEAR OF BIRTH FROM BIRTH HISTORY AND ASK DAY; IF MOTHER NOT INTERVIEWED, ASK: What is (NAME)'s birth date?	DAY ..... ☐☐ MONTH ..... ☐☐ YEAR ☐☐☐☐	DAY ..... ☐☐ MONTH ..... ☐☐ YEAR ☐☐☐☐	DAY ..... ☐☐ MONTH ..... ☐☐ YEAR ☐☐☐☐
204	CHECK 203: CHILD BORN IN JANUARY 2006 OR LATER?	YES ..... 1 NO ..... 2 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)	YES ..... 1 NO ..... 2 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)	YES ..... 1 NO ..... 2 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)
205	WEIGHT IN KILOGRAMS	KG. ☐☐.☐☐ NOT PRESENT ... 9994 REFUSED ..... 9995 OTHER 9996	KG. ☐☐.☐☐ NOT PRESENT ... 9994 REFUSED ..... 9995 OTHER 9996	KG. ☐☐.☐☐ NOT PRESENT ... 9994 REFUSED ..... 9995 OTHER 9996
206	HEIGHT IN CENTIMETERS	CM. ☐☐☐.☐ NOT PRESENT ... 9994 REFUSED ..... 9995 OTHER 9996	CM. ☐☐☐.☐ NOT PRESENT ... 9994 REFUSED ..... 9995 OTHER 9996	CM. ☐☐☐.☐ NOT PRESENT ... 9994 REFUSED ..... 9995 OTHER 9996
207	MEASURED LYING DOWN OR STANDING UP?	LYING DOWN ..... 1 STANDING UP ..... 2 NOT MEASURED 3	LYING DOWN ..... 1 STANDING UP ..... 2 NOT MEASURED 3	LYING DOWN ..... 1 STANDING UP ..... 2 NOT MEASURED 3
207A	CHECK THE COVER PAGE: HOUSEHOLD SELECTED FOR MEN'S SURVEY	YES ..... 1 ↓	NO ..... 2 (GO TO 213)	
208	CHECK 203: IS CHILD AGE 0-5 MONTHS, I.E., WAS CHILD BORN IN MONTH OF INTERVIEW OR FIVE PREVIOUS MONTHS?	0-5 MONTHS ..... 1 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214) OLDER 2	0-5 MONTHS ..... 1 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214) OLDER 2	0-5 MONTHS ..... 1 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214) OLDER 2
209	LINE NUMBER OF PARENT/ OTHER ADULT RESPONSIBLE FOR THE CHILD (FROM COLUMN 1 OF HOUSEHOLD SCHEDULE). RECORD '00' IF NOT LISTED.	LINE NUMBER ..... ☐☐	LINE NUMBER ..... ☐☐	LINE NUMBER ..... ☐☐
210	ASK CONSENT FOR ANEMIA TEST FROM PARENT/OTHER ADULT IDENTIFIED IN 209 AS RESPONSIBLE FOR CHILD.	As part of this survey, we are asking people all over the country to take an anemia test. Anemia is a serious health problem that usually results from poor nutrition, infection, or chronic disease. This survey will assist the government to develop programs to prevent and treat anemia. We ask that all children born in 2006 or later take part in anemia testing in this survey and give a few drops of blood from a finger or heel. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for anemia immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team. Do you have any questions? You can say yes to the test, or you can say no. It is up to you to decide. Will you allow (NAME OF CHILD) to participate in the anemia test?		
211	CIRCLE THE APPROPRIATE CODE AND SIGN YOUR NAME.	GRANTED ..... 1 _____ (SIGN) REFUSED 2	GRANTED ..... 1 _____ (SIGN) REFUSED 2	GRANTED ..... 1 _____ (SIGN) REFUSED 2
212	RECORD HEMOGLOBIN LEVEL HERE AND IN THE ANEMIA	G/DL ☐☐.☐ NOT PRESENT .....994 REFUSED .....995 OTHER 996	G/DL ☐☐.☐ NOT PRESENT .....994 REFUSED .....995 OTHER 996	G/DL ☐☐.☐ NOT PRESENT .....994 REFUSED .....995 OTHER 996
213	GO BACK TO 203 IN NEXT COLUMN OF THIS QUESTIONNAIRE OR IN THE FIRST COLUMN OF THE NEXT PAGE; IF NO MORE CHILDREN, GO TO 214.			

WEIGHT, HEIGHT AND HAEMOGLOBIN MEASUREMENT FOR CHILDREN AGE 0-5

CLUSTER NUMBER ☐☐☐ HOUSEHOLD NUMBER ☐☐☐

		CHILD 3	CHILD 4	CHILD 5
201	CHECK **COLUMN 17** IN HOUSEHOLD SCHEDULE. RECORD THE LINE NUMBER AND NAME FOR ALL ELIGIBLE CHILDREN 0-5 YEARS IN QUESTION 202. IF MORE THAN SIX CHILDREN, USE ADDITIONAL QUESTIONNAIRE(S).			
202	LINE NUMBER FROM COLUMN 17 NAME FROM COLUMN 2	LINE NUMBER ☐☐ NAME _____	LINE NUMBER ☐☐ NAME _____	LINE NUMBER ☐☐ NAME _____
203	IF MOTHER INTERVIEWED, COPY MONTH AND YEAR OF BIRTH FROM BIRTH HISTORY AND ASK DAY; IF MOTHER NOT INTERVIEWED, ASK: What is (NAME)'s birth date?	DAY ☐☐ MONTH ☐☐ YEAR ☐☐☐☐	DAY ☐☐ MONTH ☐☐ YEAR ☐☐☐☐	DAY ☐☐ MONTH ☐☐ YEAR ☐☐☐☐
204	CHECK 203: CHILD BORN IN JANUARY 2006 OR LATER?	YES . . . 1 NO . . . 2 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)	YES . . . 1 NO . . . 2 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)	YES . . . 1 NO . . . 2 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)
205	WEIGHT IN KILOGRAMS	KG. ☐☐.☐☐ NOT PRESENT . . . 9994 REFUSED . . . 9995 OTHER . . . 9996	KG. ☐☐.☐☐ NOT PRESENT . . . 9994 REFUSED . . . 9995 OTHER . . . 9996	KG. ☐☐.☐☐ NOT PRESENT . . . 9994 REFUSED . . . 9995 OTHER . . . 9996
206	HEIGHT IN CENTIMETERS	CM. ☐☐☐.☐ NOT PRESENT . . . 9994 REFUSED . . . 9995 OTHER . . . 9996	CM. ☐☐☐.☐ NOT PRESENT . . . 9994 REFUSED . . . 9995 OTHER . . . 9996	CM. ☐☐☐.☐ NOT PRESENT . . . 9994 REFUSED . . . 9995 OTHER . . . 9996
207	MEASURED LYING DOWN OR STANDING UP?	LYING DOWN . . . 1 STANDING UP . . . 2 NOT MEASURED . . . 3	LYING DOWN . . . 1 STANDING UP . . . 2 NOT MEASURED . . . 3	LYING DOWN . . . 1 STANDING UP . . . 2 NOT MEASURED . . . 3
207A	CHECK THE COVER PAGE: HOUSEHOLD SELECTED FOR MEN'S SURVEY	YES . . . 1 ↓	NO . . . 2 (GO TO 213)	
208	CHECK 203: IS CHILD AGE 0-5 MONTHS, I.E., WAS CHILD BORN IN MONTH OF INTERVIEW OR FIVE PREVIOUS MONTHS?	0-5 MONTHS . . . 1 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214) OLDER . . . 2	0-5 MONTHS . . . 1 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214) OLDER . . . 2	0-5 MONTHS . . . 1 (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214) OLDER . . . 2
209	LINE NUMBER OF PARENT/ OTHER ADULT RESPONSIBLE FOR THE CHILD (FROM COLUMN 1 OF HOUSEHOLD SCHEDULE). RECORD '00' IF NOT LISTED.	LINE NUMBER ☐☐	LINE NUMBER ☐☐	LINE NUMBER ☐☐
210	ASK CONSENT FOR ANEMIA TEST FROM PARENT/OTHER ADULT IDENTIFIED IN 209 AS RESPONSIBLE FOR CHILD.	As part of this survey, we are asking people all over the country to take an anemia test. Anemia is a serious health problem that usually results from poor nutrition, infection, or chronic disease. This survey will assist the government to develop programs to prevent and treat anemia. We ask that all children born in 2006 or later take part in anemia testing in this survey and give a few drops of blood from a finger or heel. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for anemia immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team. Do you have any questions? You can say yes to the test, or you can say no. It is up to you to decide. Will you allow (NAME OF CHILD) to participate in the anemia test?		
211	CIRCLE THE APPROPRIATE CODE AND SIGN YOUR NAME.	GRANTED . . . 1 (SIGN) REFUSED . . . 2	GRANTED . . . 1 (SIGN) REFUSED . . . 2	GRANTED . . . 1 (SIGN) REFUSED . . . 2
212	RECORD HEMOGLOBIN LEVEL HERE AND IN THE ANEMIA	G/DL ☐☐.☐ NOT PRESENT . . . 994 REFUSED . . . 995 OTHER . . . 996	G/DL ☐☐.☐ NOT PRESENT . . . 994 REFUSED . . . 995 OTHER . . . 996	G/DL ☐☐.☐ NOT PRESENT . . . 994 REFUSED . . . 995 OTHER . . . 996
213	GO BACK TO 203 IN NEXT COLUMN OF THIS QUESTIONNAIRE OR IN THE FIRST COLUMN OF THE NEXT PAGE; IF NO MORE CHILDREN, GO TO 214.			

WEIGHT, HEIGHT, HAEMOGLOBIN MEASUREMENT FOR EVER-MARRIED WOMEN AGE **12- 49**

CLUSTER NUMBER ☐☐☐ HOUSEHOLD NUMBER ☐☐☐

		WOMAN 1	WOMAN 2	WOMAN 3
214	CHECK COLUMN 18 IN HOUSEHOLD SCHEDULE. RECORD THE LINE NUMBER AND NAME OF ALL ELIGIBLE EVER-MARRIED WOMEN IN 215. IF THERE ARE MORE THAN THREE EVER MARRIED WOMEN, USE ADDITIONAL QUESTIONNAIRE(S).			
215	LINE NUMBER FROM COLUMN 18 NAME FROM COLUMN 2	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____
216	WEIGHT IN KILOGRAMS	KG. ☐☐☐.☐☐ NOT PRESENT ..... 99994 REFUSED ..... 99995 OTHER 99996	KG. ☐☐☐.☐☐ NOT PRESENT ..... 99994 REFUSED ..... 99995 OTHER 99996	KG. ☐☐☐.☐☐ NOT PRESENT ..... 99994 REFUSED ..... 99995 OTHER 99996
217	HEIGHT IN CENTIMETERS	CM. ☐☐☐.☐ NOT PRESENT ..... 9994 REFUSED ..... 9995 OTHER 9996	CM. ☐☐☐.☐ NOT PRESENT ..... 9994 REFUSED ..... 9995 OTHER 9996	CM. ☐☐☐.☐ NOT PRESENT ..... 9994 REFUSED ..... 9995 OTHER 9996
218	CHECK COVER PAGE: HOUSEHOLD SELECTED FOR MEN'S SURVEY	YES ..... 1 ↓ NO ..... 2 → (GO TO 223)		
219	ASK CONSENT FOR ANEMIA TEST FROM RESPONDENT.	As part of this survey, we are asking people all over the country to take an anemia test. Anemia is a serious health problem that usually results from poor nutrition, infection, or chronic disease. This survey will assist the government to develop programs to prevent and treat anemia. For the anemia testing, we will need a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for anemia immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team. Do you have any questions? You can say yes to the test, or you can say no. It is up to you to decide. Will you take the anemia test?		
220	CIRCLE THE APPROPRIATE CODE AND SIGN YOUR NAME.	GRANTED ..... 1 RESPONDENT REFUSED ..... 2 → _____ (SIGN) (IF REFUSED, GO TO 223)	GRANTED ..... 1 RESPONDENT REFUSED ..... 2 → _____ (SIGN) (IF REFUSED, GO TO 223)	GRANTED ..... 1 RESPONDENT REFUSED ..... 2 → _____ (SIGN) (IF REFUSED, GO TO 223)
221	PREGNANCY STATUS: CHECK 226 IN WOMAN'S QUESTIONNAIRE OR ASK: Are you pregnant?	YES ..... 1 NO ..... 2 DK 8	YES ..... 1 NO ..... 2 DK 8	YES ..... 1 NO ..... 2 DK 8
222	RECORD HEMOGLOBIN LEVEL HERE AND IN ANEMIA PAMPHLET	G/DL ..... ☐☐.☐ NOT PRESENT ..... 994 REFUSED ..... 995 OTHER 996	G/DL ..... ☐☐.☐ NOT PRESENT ..... 994 REFUSED ..... 995 OTHER 996	G/DL ..... ☐☐.☐ NOT PRESENT ..... 994 REFUSED ..... 995 OTHER 996
223	GO BACK TO 216 IN NEXT COLUMN OF THIS QUESTIONNAIRE OR IN THE FIRST COLUMN OF AN ADDITIONAL QUESTIONNAIRE: IF NO MORE EVER-MARRIED WOMEN AGE 12-49, BUT HOUSEHOLD IS SELECTED FOR MEN'S SURVEY, GO TO 224; OTHERWISE END MEASUREMENT.			

WEIGHT AND HEIGHT MEASUREMENT FOR EVER-MARRIED MEN AGE 15-34

CLUSTER NUMBER ☐☐☐ HOUSEHOLD NUMBER ☐☐☐

HOUSEHOLD SELECTED FOR MEN'S SURVEY ..... YES ☐ NO ☐ (END MEASUREMENT)

		MAN 1	MAN 2	MAN 3
224	CHECK COLUMN 21 IN HOUSEHOLD SCHEDULE, RECORD THE LINE NUMBER AND NAME FOR ALL ELIGIBLE EVER-MARRIED MEN AGE 15-34 IN 225. IF THERE ARE MORE THAN THREE EVER-MARRIED MEN AGE 15-34, USE ADDITIONAL QUESTIONNAIRE(S).			
225	LINE NUMBER FROM COLUMN 21 NAME FROM COLUMN 2	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____
226	WEIGHT IN KILOGRAMS	KG. ☐☐☐.☐☐ NOT PRESENT ..... 99994 REFUSED ..... 99995 OTHER 99996	KG. ☐☐☐.☐☐ NOT PRESENT ..... 99994 REFUSED ..... 99995 OTHER 99996	KG. ☐☐☐.☐☐ NOT PRESENT ..... 99994 REFUSED ..... 99995 OTHER 99996
227	HEIGHT IN CENTIMETERS	CM. ☐☐☐.☐ NOT PRESENT ..... 9994 REFUSED ..... 9995 OTHER 9996	CM. ☐☐☐.☐ NOT PRESENT ..... 9994 REFUSED ..... 9995 OTHER 9996	CM. ☐☐☐.☐ NOT PRESENT ..... 9994 REFUSED ..... 9995 OTHER 9996
228	GO BACK TO 225 IN NEXT COLUMN OF THIS QUESTIONNAIRE OR IN THE FIRST COLUMN OF AN ADDITIONAL QUESTIONNAIRE: IF NO MORE EVER-MARRIED MEN AGE 15-34, GO TO 229.			

BIOMARKER DATA FORM (FOR ADULTS 35 OR OLDER)

CLUSTER NUMBER ☐☐☐ HOUSEHOLD NUMBER ☐☐☐

USE THIS BIOMARKER DATA FORM ONLY IF HOUSEHOLD IS SELECTED FOR MEN'S SURVEY AND RESPONDENT IS 35 OR OLDER

229 CHECK **COLUMNS 19, 20, AND 22 IN HOUSEHOLD SCHEDULE**. RECORD THE LINE NUMBER AND NAME OF ALL ELIGIBLE WOMEN AND MEN AGE 35 AND ABOVE FOR BIOMARKER MEASUREMENTS IN 230. IF THERE ARE MORE THAN THREE ADULTS, USE ADDITIONAL QUESTIONNAIRE(S).

		ADULT 1	ADULT 2	ADULT 3
230	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER ..... ☐☐ NAME_____	LINE NUMBER ..... ☐☐ NAME _____	LINE NUMBER ..... ☐☐ NAME _____
231	SEX FROM COLUMN 4 OF THE HOUSEHOLD SCHEDULE	MALE ..... 1 (GO TO 233) FEMALE 2	MALE ..... 1 (GO TO 233) FEMALE 2	MALE ..... 1 (GO TO 233) FEMALE 2
232	PREGNANCY STATUS: CHECK 226 IN WOMAN'S QUESTIONNAIRE OR ASK: Are you pregnant?	YES ..... 1 NO ..... 2 DK 3	YES ..... 1 NO ..... 2 DK 3	YES ..... 1 NO ..... 2 DK 3
233	CHECK HOUSEHOLD SCHEDULE: COLUMN 19 CIRCLED	NO ☐ YES ☐ (GO TO 240)	NO ☐ YES ☐ (GO TO 240)	NO ☐ YES ☐ (GO TO 240)

233A **PROVIDE INFORMATION ABOUT BIOMARKER TESTING**

Now I am going to ask you to participate in several physical measurements or tests. I will explain each measurement or test before starting the procedure. You will be free to say yes or no to each one. Before taking the measurements, I am going to ask a few questions about yourself.

234	AGE How old were you at your last birthday?	YEARS ..... ☐☐	YEARS ..... ☐☐	YEARS ..... ☐☐
235	MARITAL STATUS What is your current marital status?	NEVER MARRIED ..... 1 MARRIED, DIVORCED, SEPARATED, DESERTED OR WIDOWED 2	NEVER MARRIED ..... 1 MARRIED, DIVORCED, SEPARATED, DESERTED OR WIDOWED 2	NEVER MARRIED ..... 1 MARRIED, DIVORCED, SEPARATED, DESERTED OR WIDOWED 2
236	EDUCATION Have you ever attended school or madrasha?	YES ..... 1 NO ..... 2 (GO TO 238)	YES ..... 1 NO ..... 2 (GO TO 238)	YES ..... 1 NO ..... 2 (GO TO 238)
237	What is the highest level of school you attended, primary, secondary, college or higher?	PRIMARY ..... 1 SECONDARY ..... 2 COLLEGE OR HIGHER 3	PRIMARY ..... 1 SECONDARY ..... 2 COLLEGE OR HIGHER 3	PRIMARY ..... 1 SECONDARY ..... 2 COLLEGE OR HIGHER 3
238	WORK Are you currently working?	YES ..... 1 NO ..... 2 (GO TO 240)	YES ..... 1 NO ..... 2 (GO TO 240)	YES ..... 1 NO ..... 2 (GO TO 240)
239	What is your occupation, that is the kind of work do you mainly do?	_____ ☐☐ _____	_____ ☐☐ _____	_____ ☐☐ _____

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER . . . ☐☐ NAME _____	LINE NUMBER . . . . . ☐☐ NAME _____	LINE NUMBER . . . . . ☐☐ NAME _____
240	**ASK CONSENT FOR BLOOD PRESSURE MEASUREMENT** I would like to measure your blood pressure. This will be done three times during the interview, with an interval of about five to ten minute period. This is a harmless procedure. It is used to find out if a person has high blood pressure. If it is not treated, high blood pressure may eventually cause serious damage to the heart. The results of this blood pressure measurement will be given to you after the measurement process is completed. I will explain the meaning of your blood pressure numbers. If your blood pressure is high, we will suggest that you consult a health facility or doctor since we cannot provide any further testing or treatment during the survey. Do you have any questions about the blood pressure measurement so far? If you have any questions about the procedure at any time, please ask me. You can say yes or no to having the blood pressure measurement now. You can also decide at anytime not to participate in the blood pressure measures.			
241	CIRCLE THE APPROPRIATE CODE AND SIGN YOUR NAME. (MARK CODE 3 ONLY IF YOU HAVE MADE AT LEAST 3 CALL BACKS TO FIND THE RESPONDENT)	GRANTED . . . . . 1 RESPONDENT REFUSED . . . . . (GO TO 248) 2 RESPONDENT NOT PRESENT (GO TO 266) 3 _____ (SIGN)	GRANTED . . . . . 1 RESPONDENT REFUSED . (GO TO 248) 2 RESPONDENT NOT PRESENT (GO TO 266) 3 _____ (SIGN)	GRANTED . . . . . 1 RESPONDENT REFUSED . . . . . (GO TO 248) 2 RESPONDENT NOT PRESENT (GO TO 266) 3 _____ (SIGN)
242	Before taking your blood pressure, I would like to ask a few questions about things that may affect these measurements. Have you done any of the following within the past 30 minutes: Eaten anything? Had coffee, tea, cola or other drink that has caffeine? Smoked any tobacco product?	YES NO EATEN . . . . . 1 2 HAD CAFFEINATED DRINK . . . . . 1 2 SMOKED 1 2	YES NO EATEN . . . . . . HAD CAFFEINATED DRINK . . . . . . SMOKED	YES NO EATEN . . . . . 1 2 HAD CAFFEINATED DRINK . . . . . 1 2 SMOKED 1 2
243	May I begin the process of measuring your blood pressure? I will begin by measuring the circumference of your arm to make sure that I use the right equipment. BEFORE TAKING THE FIRST BLOOD PRESSURE READING, MEASURE THE CIRCUMFERENCE OF THE RESPONDENT'S ARM MIDWAY BETWEEN THE ELBOW AND THE SHOULDER. RECORD THE MEASUREMENT IN CENTIMETRES.	ARM CIRCUMFERENCE (IN CENTIMETRES) ☐☐	ARM CIRCUMFERENCE (IN CENTIMETRES) ☐☐	ARM CIRCUMFERENCE (IN CENTIMETRES) ☐☐

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER . . . . . [ ][ ] NAME _____	LINE NUMBER . . . . . [ ][ ] NAME _____	LINE NUMBER . . . . . [ ][ ] NAME _____
244	USE THE ARM CIRCUM-FERENCE MEASUREMENT TO SELECT THE APPROPRIATE BLOOD PRESSURE MONITOR CUFF SIZE. CIRCLE THE CODE FOR THE CUFF SIZE.	SMALL: 16 CM – 23 CM . . . 1 MEDIUM: 24 CM – 35 CM 2 LARGE: 36 CM – 45 CM . . . 3	SMALL: 16 CM – 23 CM . . . 1 MEDIUM: 24 CM – 35 CM . . . 2 LARGE: 36 CM – 45 CM . . . 3	SMALL: 16 CM – 23 CM . . . . 1 MEDIUM: 24 CM – 35 CM . . . . 2 LARGE: 36 CM – 45 CM 3
245	RECORD TIME	HOURS . . . . . [ ][ ] MINUTES . . . . [ ][ ]	HOURS . . . . . [ ][ ] MINUTES . . . . [ ][ ]	HOURS . . . . . [ ][ ] MINUTES . . . . . [ ][ ]
246	TAKE THE FIRST BLOOD PRESSURE READING. RECORD THE SYSTOLIC AND DIASTOLIC PRESSURE, THEN PROCEED TO Q.248. IF YOU ARE UNABLE TO MEASURE THE RESPONDENT'S BLOOD PRESSURE, RECORD THE REASON IN Q.247.	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . . . [ ][ ][ ] DIASTOLIC . . . . . [ ][ ][ ]	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . . . [ ][ ][ ] DIASTOLIC . . . . . [ ][ ][ ]	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . [ ][ ][ ] DIASTOLIC . . . [ ][ ][ ]
247	RECORD REASON BLOOD PRESSURE IS NOT MEASURED	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . 995 OTHER 996	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . 995 OTHER 996	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . 995 OTHER 996
248	Before this survey, has your blood pressure ever been checked?	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2
249	Have you ever been told by a doctor or a nurse that you have high blood pressure?	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2
250	To lower your blood pressure, are you now taking a prescribed medicine?	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER . . . . . ☐☐ NAME _____	LINE NUMBER . . . . . ☐☐ NAME _____	LINE NUMBER . . . . . ☐☐ NAME _____
252	**HEALTH TECHNICIAN: CHECK THAT IT HAS BEEN AT LEAST 5 MINUTES BEFORE TAKING THE SECOND BLOOD PRESSURE MEASUREMENT.**			
253	RECORD TIME	HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐
254	May I take your blood pressure this time?	YES . . . . . 1 NO . . . . . 2 (GO TO 256)	YES . . . . . 1 NO . . . . . 2 (GO TO 256)	YES . . . . . 1 NO . . . . . 2 (GO TO 256)
255	TAKE THE SECOND BLOOD PRESSURE READING. RECORD THE SYSTOLIC AND DIASTOLIC PRESSURE, THEN PROCEED TO Q. 257. IF YOU ARE UNABLE TO MEASURE THE RESPONDENT'S BLOOD PRESSURE, RECORD THE REASON IN Q.256.	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . ☐☐☐ DIASTOLIC . . . . . ☐☐☐	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . . . ☐☐☐ DIASTOLIC . . . . . ☐☐☐	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . ☐☐☐ DIASTOLIC . . . ☐☐☐
256	RECORD REASON BLOOD PRESSURE IS NOT MEASURED	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . . . 995 OTHER 996	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . . . 995 OTHER 996	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . 995 OTHER 996
257	Have you ever heard of an illness called diabetes (local name)?	YES . . . . . 1 NO . . . . . 2 (GO TO 261)	YES . . . . . 1 NO . . . . . 2 (GO TO 261)	YES . . . . . 1 NO . . . . . 2 (GO TO 261)
258	Have you ever been told by a doctor or nurse that you have diabetes?	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2
259	Are you taking medication for diabetes prescribed by a doctor or nurse?	YES . . . . . 1 NO . . . . . 2 (GO TO 261)	YES . . . . . 1 NO . . . . . 2 (GO TO 261)	YES . . . . . 1 NO . . . . . 2 (GO TO 261)
260	How do you take the medication?	INJECTED . . . . . 1 ORALLY . . . . . 2 INJECTED AND ORALLY 3	INJECTED . . . . . 1 ORALLY . . . . . 2 INJECTED AND ORALLY 3	INJECTED . . . . . 1 ORALLY . . . . . 2 INJECTED AND ORALLY 3

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER . . . . . ☐☐ NAME _____	LINE NUMBER . . . . . ☐☐ NAME _____	LINE NUMBER . . . . . ☐☐ NAME _____
261	**HEALTH TECHNICIAN: CHECK THAT IT HAS BEEN AT LEAST 5 MINUTES BEFORE TAKING THE THIRD BLOOD PRESSURE MEASUREMENT.**			
262	RECORD TIME	HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐
263	May I take your blood pressure this time?	YES . . . . . 1 NO . . . . . 2 (GO TO 265)	YES . . . . . 1 NO . . . . . 2 (GO TO 265)	YES . . . . . 1 NO . . . . . 2 (GO TO 265)
264	TAKE THE THIRD BLOOD PRESSURE READING. RECORD THE SYSTOLIC AND DIASTOLIC PRESSURE, THEN PROCEED TO Q. 266. IF YOU ARE UNABLE TO MEASURE THE RESPONDENT'S BLOOD PRESSURE, RECORD THE REASON IN Q.265.	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . ☐☐☐ DIASTOLIC . . . ☐☐☐	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . ☐☐☐ DIASTOLIC . . . ☐☐☐	**BLOOD PRESSURE MEASURED** SYSTOLIC . . . . ☐☐☐ DIASTOLIC . . . ☐☐☐
265	RECORD REASON BLOOD PRESSURE IS NOT MEASURED	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . 995 OTHER 996	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . 995 OTHER 996	**REASON BLOOD PRESSURE NOT MEASURED** REFUSED . . . . . 994 TECHNICAL PROBLEMS . . . 995 OTHER 996
266	**CHECK HOUSEHOLD SCHEDULE: COLUMN 19 CIRCLED**	NO ☐ YES ☐ (GO TO 275)	NO ☐ YES ☐ (GO TO 275)	NO ☐ YES ☐ (GO TO 275)

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER . . . . . NAME	LINE NUMBER . . . . . NAME	LINE NUMBER . . . . . NAME
271	RECORD THE WEIGHT IN KILOGRAMS THEN PROCEED TO Q273. IF YOUR ARE UNABLE TO MEASURE THE RESPONDENTS WEIGHT RECORD THE REASON IN Q272.	KG. ___.___	KG. ___.___	KG. ___.___
272	RECORD REASON WEIGHT IS NOT MEASURED	**REASON WEIGHT NOT MEASURED** NOT PRESENT . . . . . 99994 REFUSED . . . . . 99995 OTHER 99996	**REASON WEIGHT NOT MEASURED** NOT PRESENT . . . . . 99994 REFUSED . . . . . 99995 OTHER 99996	**REASON WEIGHT NOT MEASURED** NOT PRESENT . . . . . 99994 REFUSED . . . . . 99995 OTHER 99996
273	RECORD THE HEIGHT IN CENTIMETERS THEN PROCEED TO Q275. IF YOUR ARE UNABLE TO MEASURE THE RESPONDENTS HEIGHT RECORD THE REASON IN Q274.	CM. ___.___	CM. ___.___	CM. ___.___
274	RECORD REASON HEIGHT IS NOT MEASURED	**REASON HEIGHT NOT MEASURED** NOT PRESENT . . . . . 9994 REFUSED . . . . . 9995 OTHER 9996	**REASON HEIGHT NOT MEASURED** NOT PRESENT . . . . . 9994 REFUSED . . . . . 9995 OTHER 9996	**REASON HEIGHT NOT MEASURED** NOT PRESENT . . . . . 9994 REFUSED . . . . . 9995 OTHER 9996

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER ☐☐ NAME _____	LINE NUMBER ☐☐ NAME _____	LINE NUMBER ☐☐ NAME _____
275	**ASK CONSENT FOR FASTING BLOOD SUGAR TESTING** As part of this survey, we are also measuring the level of sugar in blood. If it is not treated, high level of blood sugar may increase the risk for heart disease and stroke. For the blood glucose testing, we will need a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for glucose immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team. The results of this blood glucose test will be given to you with an explanation of the meaning of your blood glucose numbers. If your blood glucose is high, we will suggest that you consult a health facility or doctor since we cannot provide any counseling, further testing or treatment during the survey. Do you have any questions about the blood glucose measurement so far? If you have any questions about the procedure at any time, please ask me. To obtain correct measurement, we would ask that you do not eat or drink anything except plain water from about the time of call of the evening prayer until my visit tomorrow morning. Would you allow me to return in the morning to take your blood glucose measurement before you break your fast?			
276	CIRCLE THE APPROPRIATE CODE AND SIGN YOUR NAME.	GRANTED . . . . . 1 RESPONDENT REFUSED . 2 _____ (SIGN) (IF REFUSED, GO TO 286)	GRANTED . . . . . 1 RESPONDENT REFUSED . . . 2 _____ (SIGN) (IF REFUSED, GO TO 286)	GRANTED . . . . . 1 RESPONDENT REFUSED . . . . . 2 _____ (SIGN) (IF REFUSED, GO TO 286)
277	FIRST APPOINTMENT FOR BLOOD GLUCOSE TESTING	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐
277A	SECOND APPOINTMENT FOR BLOOD GLUCOSE TESTING (IF THE RESPONDENT WAS NOT FASTING AT THE DATE AND TIME IN Q277, TAKE ANOTHER APPOINTMENT)	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐
277B	THIRD APPOINTMENT FOR BLOOD GLUCOSE TESTING (IF THE RESPONDENT WAS NOT FASTING AT THE DATE AND TIME IN Q277A, TAKE ANOTHER APPOINTMENT)	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐ (IF RESPONDENT IS NOT AVAILABLE FOR THE MEASUREMENT, **SKIP TO 285**)	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐ (IF RESPONDENT IS NOT AVAILABLE FOR THE MEASUREMENT, **SKIP TO 285**)	DATE _____ HOURS . . . . . ☐☐ MINUTES . . . . . ☐☐ (IF RESPONDENT IS NOT AVAILABLE FOR THE MEASUREMENT, **SKIP TO 285**)
278	**ASK CONSENT FOR FASTING BLOOD SUGAR TESTING** As I mentioned yesterday, we are going to measure the level of sugar in blood. If it is not treated, high level of blood sugar may increase the risk for heart disease and stroke. For the blood glucose testing, we will need a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for glucose immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team. The results of this blood glucose test will be given to you with an explanation of the meaning of your blood glucose numbers. If your blood glucose is high, we will suggest that you consult a health facility or doctor since we cannot provide any counseling, further testing or treatment during the survey. Do you have any questions about the blood glucose measurement so far? If you have any questions about the procedure at any time, please ask me. You can say yes or no to having the blood glucose measurement now. Would you allow me to proceed to take your measurement?			
279	CIRCLE THE APPROPRIATE CODE AND SIGN YOUR NAME.	GRANTED . . . . . 1 RESPONDENT REFUSED . 2 _____ (SIGN) (IF REFUSED, GO TO 286)	GRANTED . . . . . 1 RESPONDENT REFUSED . . . 2 _____ (SIGN) (IF REFUSED, GO TO 286)	GRANTED . . . . . 1 RESPONDENT REFUSED . . . . . 2 _____ (SIGN) (IF REFUSED, GO TO 286)

		ADULT 1	ADULT 2	ADULT 3
	LINE NUMBER FROM COLUMNS 19, 20, AND 22 NAME FROM COLUMN 2	LINE NUMBER ☐☐ NAME _____	LINE NUMBER ☐☐ NAME _____	LINE NUMBER ☐☐ NAME _____
280	When was the last time you had something to eat?	HOURS ☐☐ MINUTES ☐☐	HOURS ☐☐ MINUTES ☐☐	HOURS ☐☐ MINUTES ☐☐
281	When was the last time you had something to drink other than plain water?	HOURS ☐☐ MINUTES ☐☐	HOURS ☐☐ MINUTES ☐☐	HOURS ☐☐ MINUTES ☐☐
282	**PREPARE EQUIPMENT AND SUPPLIES FOR WHICH CONSENT HAS BEEN OBTAINED AND PROCEED WITH THE TEST.**			
283	RECORD TIME FOR BLOOD GLUCOSE TESTING	DAY . . . . . ☐☐ MONTH . . . . . ☐☐ YEAR ☐☐☐☐ HOURS ☐☐ MINUTES ☐☐	DAY . . . . . ☐☐ MONTH . . . . . ☐☐ YEAR ☐☐☐☐ HOURS ☐☐ MINUTES ☐☐	DAY . . . . . ☐☐ MONTH . . . . . ☐☐ YEAR ☐☐☐☐ HOURS ☐☐ MINUTES ☐☐
284	RECORD FASTING BLOOD SUGAR IN MG/DL THEN PROCEED TO Q286 IF YOUR ARE UNABLE TO MEASURE THE RESPONDENTS BLOOD GLUCOSE RECORD THE REASON IN Q285	MG/DL ☐☐☐	MG/DL ☐☐☐	MG/DL . . . . . ☐☐☐
285	RECORD REASON BLOOD GLUCOSE IS NOT MEASURED	**REASON BLOOD GLUCOSE NOT MEASURED** NOT PRESENT . . . . . 994 REFUSED . . . . . 995 OTHER 996	**REASON BLOOD GLUCOSE NOT MEASURED** NOT PRESENT . . . . . 994 REFUSED . . . . . 995 OTHER 996	**REASON BLOOD GLUCOSE NOT MEASURED** NOT PRESENT . . . . . 994 REFUSED . . . . . 995 OTHER 996
286	**GO BACK TO 230 IN NEXT COLUMN OF THIS QUESTIONNAIRE OR IN THE FIRST COLUMN OF AN ADDITIONAL QUESTIONNAIRE. IF NO MORE ADULTS ELIGIBLE FOR BIOMARKER, END MEASUREMENT.**			

BANGLADESH DEMOGRAPHIC AND HEALTH SURVEY 2011
WOMAN'S QUESTIONNAIRE

NIPORT, MOHFW, and
Mitra and Associates

IDENTIFICATION	
CLUSTER NUMBER	☐☐☐
HOUSEHOLD NUMBER	☐☐☐
NAME OF THE HOUSEHOLD HEAD _____	
NAME AND LINE NUMBER OF WOMAN _____	☐☐

INTERVIEWER VISITS				
	1	2	3	FINAL VISIT
DATE	_____	_____	_____	DAY ☐☐ MONTH ☐☐ YEAR ☐☐☐☐
INTERVIEWER'S NAME	_____	_____	_____	INT. NUMBER ☐☐☐
RESULT*	_____	_____	_____	RESULT ☐
NEXT VISIT: DATE	_____	_____		TOTAL NUMBER OF VISITS ☐
TIME	_____	_____		

*RESULT CODES:
1 COMPLETED
2 NOT AT HOME
3 POSTPONED
4 REFUSED
5 PARTLY COMPLETED
6 INCAPACITATED
7 OTHER _____ (SPECIFY)

NUMBER OF CHILD DEATHS 0 - 28 DAYS ☐

NUMBER OF CHILD DEATHS 29 DAYS - <5 YEARS ☐

SUPERVISOR	FIELD EDITOR	OFFICE EDITOR	KEYED BY
NAME _____ ☐☐☐	NAME _____ ☐☐☐	☐☐	☐☐
DATE _____	DATE _____		

SECTION 1. RESPONDENT'S BACKGROUND

INTRODUCTION AND CONSENT

INFORMED CONSENT

Hello. My name is _____. I am working with NIPORT, the Ministry of Health and Family Welfare, and Mitra and Associates, a private research organization located in Dhaka. We are conducting a survey about health all over Bangladesh. The information we collect will help the government to plan health services. Your household was selected for the survey. The questions usually take about 30 to 60 minutes. All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop he interview at any time.

Do you have any questions? May I begin the interview now?

SIGNATURE OF INTERVIEWER: _____ DATE: _____

RESPONDENT AGREES TO BE INTERVIEWED . . . 1 ↓ RESPONDENT DOES NOT AGREE TO BE INTERVIEWED . . . 2 → END

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
101	RECORD THE TIME.	HOUR . . . . . [ ][ ] MINUTES . . . . . [ ][ ]	
102	In what month and year were you born?	MONTH . . . . . [ ][ ] DON'T KNOW MONTH . . . . . 98 YEAR . . . . . [ ][ ][ ][ ] DON'T KNOW YEAR 9998	
103	How old were you at your last birthday? COMPARE AND CORRECT 102 AND/ OR 103 IF INCONSISTENT.	AGE IN COMPLETED YEARS [ ][ ]	
103A	Are you now married, separated, deserted, divorced, widowed, or have you never been married?	CURRENTLY MARRIED . . . . . 1 SEPARATED . . . . . 2 DESERTED . . . . . 3 DIVORCED . . . . . 4 WIDOWED . . . . . 5 NEVER MARRIED 6	→ END
104	Have you ever attended school/madrasha?	YES . . . . . 1 NO 2	→ 108
104A	What type of school have you last attended?	SCHOOL . . . . . 1 MADRASHA 2	
105	What is the highest level of school you attended: primary, secondary, or higher?	PRIMARY . . . . . 1 SECONDARY . . . . . 2 HIGHER 3	
106	What is the highest class you completed at that level? IF COMPLETED LESS THAN ONE YEAR AT THAT LEVEL, RECORD '00'	CLASS . . . . . [ ][ ]	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
107	CHECK 105: PRIMARY ☐ → SECONDARY OR HIGHER ☐ → 110		
108	Now I would like you to read this sentence to me. SHOW CARD TO RESPONDENT. IF RESPONDENT CANNOT READ WHOLE SENTENCE, PROBE: Can you read any part of the sentence to me?	CANNOT READ AT ALL . . . . . 1 ABLE TO READ ONLY PARTS OF SENTENCE . . . . . 2 ABLE TO READ WHOLE SENTENCE 3 NO CARD WITH REQUIRED LANGUAGE _____ 4 (SPECIFY LANGUAGE) BLIND/VISUALLY IMPAIRED 5	
109	CHECK 108: CODE 2, 3 OR 4 CIRCLED ☐ → CODE 1 OR 5 CIRCLED ☐ → 111		
110	Do you read a newspaper or magazine at least once a week, less than once a week or not at all?	AT LEAST ONCE A WEEK . . . . . 1 LESS THAN ONCE A WEEK . . . . . 2 NOT AT ALL 3	
111	Do you listen to the radio at least once a week, less than once a week or not at all?	AT LEAST ONCE A WEEK . . . . . 1 LESS THAN ONCE A WEEK . . . . . 2 NOT AT ALL 3	
112	Do you watch television at least once a week, less than once a week or not at all?	AT LEAST ONCE A WEEK . . . . . 1 LESS THAN ONCE A WEEK . . . . . 2 NOT AT ALL 3	
112A	Do you personally have a mobile phone?	YES . . . . . 1 NO 2	→ 113
112B	Do you have access to a mobile phone?	YES . . . . . 1 NO 2	
113	What is your religion?	ISLAM . . . . . 1 HINDUISM . . . . . 2 BUDDHISM . . . . . 3 CHRISTIANITY . . . . . 4 OTHER _____ 6 (SPECIFY)	
114	Do you belong to any of the following organizations: Grameen Bank? BRAC? BRDB? ASHA? PROSHIKA? Mother's Club? Any other organization (such as micro credit)?	YES NO GRAMEEN BANK . . . . . 1 2 BRAC . . . . . 1 2 BRDB . . . . . 1 2 ASHA . . . . . 1 2 PROSHIKA . . . . . 1 2 MOTHER'S CLUB . . . . . 1 2 OTHER _____ 1 2 (SPECIFY)	

SECTION 2 REPRODUCTION

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
201	Now I would like to ask about all the births you have had during your life. Have you ever given birth?	YES . . . . . 1 NO 2	→ 206
202	Do you have any sons or daughters to whom you have given birth who are now living with you?	YES . . . . . 1 NO 2	→ 204
203	How many sons live with you? And how many daughters live with you? IF NONE, RECORD '00'	SONS AT HOME . . . . . [ ][ ] DAUGHTERS AT HOME . . . . . [ ][ ]	
204	Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?	YES . . . . . 1 NO 2	→ 206
205	How many sons are alive but do not live with you? And how many daughters are alive but do not live with you? IF NONE, RECORD '00'	SONS ELSEWHERE . . . . . [ ][ ] DAUGHTERS ELSEWHERE [ ][ ]	
206	Have you ever given birth to a boy or girl who was born alive but later died? IF NO, PROBE: Any baby who cried or showed signs of life but did not survive?	YES . . . . . 1 NO 2	→ 208
207	How many boys have died? And how many girls have died? IF NONE, RECORD '00'	BOYS DEAD . . . . . [ ][ ] GIRLS DEAD . . . . . [ ][ ]	
208	SUM ANSWERS TO 203, 205, AND 207, AND ENTER TOTAL. IF NONE, RECORD '00'	TOTAL BIRTHS . . . . . [ ][ ]	
209	CHECK 208: Just to make sure that I have this right: you have had in TOTAL _____ births during your life. Is that correct? YES ☐ NO ☐ → PROBE AND CORRECT 201-208 AS NECESSARY.		
210	CHECK 208: ONE OR MORE BIRTHS ☐ NO BIRTHS ☐ → 226		

211 Now I would like to record the names of all your births, whether still alive or not, starting with the first one you had.
RECORD NAMES OF ALL THE BIRTHS IN 212 RECORD TWINS AND TRIPLETS ON SEPARATE ROWS.
(IF THERE ARE MORE THAN 12 BIRTHS, USE AN ADDITIONAL QUESTIONNAIRE, STARTING WITH THE SECOND ROW) .

212 What name was given to your (first/next) baby? RECORD NAME. BIRTH HISTORY NUMBER	213 Is (NAME) a boy or a girl?	214 Were any of these births twins?	216 In what month and year was (NAME) born? PROBE: When is his/her birthday?	 Is (NAME) still alive?	217 IF ALIVE: How old was (NAME) at his/her last birthday? RECORD AGE IN COMPLETED YEARS.	218 IF ALIVE: Is (NAME) living with you?	219 IF ALIVE: RECORD HOUSEHOLD LINE NUMBER OF CHILD (RECORD 00 IF CHILD NOT LISTED IN HOUSEHOLD).	220 IF DEAD: How old was (NAME) when he/she died? IF 1 YR PROBE: How many months old was (NAME)? RECORD DAYS IF LESS THAN 1 MONTH; MONTHS IF LESS THAN TWO YEARS; OR YEARS.	221 Were there any other live births between (NAME OF PREVIOUS BIRTH) and (NAME), including any children who died after birth?
01	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (NEXT BIRTH)	DAYS . . . 1 MONTHS 2 YEARS . . 3	
02	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
03	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
04	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
05	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
06	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
07	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH

212 What name was given to your next baby? RECORD NAME. BIRTH HISTORY NUMBER	213 Is (NAME) a boy or a girl?	214 215 Were any of these births twins?	216 In what month and year was (NAME) born? PROBE: When is his/her birthday?	 Is (NAME) still alive?	217 IF ALIVE: How old was (NAME) at his/her last birthday? RECORD AGE IN COM-PLETED YEARS.	218 IF ALIVE: Is (NAME) living with you?	219 IF ALIVE: RECORD HOUSE-HOLD LINE NUMBER OF CHILD (RECORD 00 IF CHILD NOT LISTED IN HOUSE-HOLD).	220 221 IF DEAD: How old was (NAME) when he/she died? IF 1 YR: PROBE: How many months old was (NAME)? RECORD DAYS IF LESS THAN 1 MONTH; MONTHS IF LESS THAN TWO YEARS; OR YEARS.	 Were there any other live births between (NAME OF PREVIOUS BIRTH) and (NAME), including any children who died after birth?
08	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
09	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
10	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
11	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH
12	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . 2 → 220	AGE IN YEARS	YES . . . 1 NO . . . 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH

222	Have you had any live births since the birth of (NAME OF LAST BIRTH)? IF YES, RECORD BIRTH(S) IN TABLE.	YES . . . . . 1 NO 2
223	COMPARE 208 WITH NUMBER OF BIRTHS IN HISTORY ABOVE AND MARK: NUMBERS ARE SAME ↓ NUMBERS ARE DIFFERENT → (PROBE AND RECONCILE)	
223A	CHECK 215, 216 AND 220 AND ENTER THE NUMBER OF DEATHS AT AGE DAYS, MONTHS AND 24 YEARS SINCE JANUARY 2006. IF NONE, RECORD 00 AND SKIP TO 224.	
223B	CHECK 223A. IF ONE OR MORE READ THE FOLLOWING STATEMENT: We would like to get more information on the circumstances around the deaths of young children so that the government can provide services to help reduce these deaths. We would like to come back and talk with you about your child(ren's) death. Is this okay?	
224	CHECK 215: ENTER THE NUMBER OF BIRTHS IN 2006 OR LATER.	NUMBER OF BIRTHS . . . . . NONE . . . . . 0 → 226

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
225	C FOR EACH BIRTH SINCE JANUARY 2006, ENTER BIRTH IN THE MONTH OF BIRTH IN THE CALENDAR. WRITE THE NAME OF THE CHILD TO THE LEFT OF THE BIRTH CODE. FOR EACH BIRTH, ASK THE NUMBER OF MONTHS THE PREGNANCY LASTED AND RECORD PREGNANCY IN EACH OF THE PRECEDING MONTHS ACCORDING TO THE DURATION OF PREGNANCY. (NOTE: THE NUMBER OF PREGNANCIES MUST BE ONE LESS THAN THE NUMBER OF MONTHS THAT THE PREGNANCY LASTED.)		
226	Are you pregnant now?	YES . . . . . 1 NO . . . . . 2 UNSURE 8	→ 229A
227	How many months pregnant are you? RECORD NUMBER OF COMPLETED MONTHS. C ENTER PREGNANCIES IN THE CALENDAR, BEGINNING WITH THE MONTH OF INTERVIEW AND FOR THE TOTAL NUMBER OF COMPLETED MONTHS.	MONTHS	
228	When you got pregnant, did you want to get pregnant at that time?	YES . . . . . 1 NO 2	→ 229A
229	Did you want to have a baby later on or did you not want any (more) children?	LATER . . . . . 1 NO MORE 2	
229A	Have you ever heard of menstrual regulation (MR)?	YES . . . . . 1 NO 2	→ 230
229B	Have you ever used MR?	YES . . . . . 1 NO 2	→ 230
229C	In the last three years did you use MR?	YES . . . . . 1 NO 2	→ 230
229D	Where did you use it the last time?	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . 11 SPECIALISED GOVT.HOSPITAL HOSPITAL _____ (SPECIFY) 12 DISTRICT HOSPITAL . . . . . 13 MCWC . . . . . 14 UPAZILLA HEALTH COMPLEX . . . 15 H&FWC . . . . . 17 SAT. CLINIC/EPI OUTREACH . . . . . 18 COMMUNITY CLINIC . . . . . 19 GOVT. FIELD WORKER (FWA) 20 OTHER PUBLIC SECTOR _____ (SPECIFY) 16 NGO SECTOR NGO STATIC CLINIC . . . . . 21 NGO SATELLITE CLINIC . . . . . 22 NGO DEPO HOLDER . . . . . 23 NGO FIELDWORKER . . . . . 24 OTHER NGO SECTOR _____ (SPECIFY) 26 PRIVATE MEDICAL SECTOR PRIVATE HOSPITAL/CLINIC . . . . . 31 QUALIFIED DOCTOR'S CHAMBER . 32 NON-QUALIFIED DOCTOR'S CHAMBER . . . . . 33 PHARMACY/DRUG STORE . . . . . 34 PRIVATE MEDICAL COLLEGE HOSPITAL _____ (SPECIFY) 35 OTHER PRIVATE MEDICAL SECTOR _____ (SPECIFY) 36 OTHER _____ (SPECIFY) 96 DON'T KNOW 98	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
230	Have you ever had a pregnancy that miscarried, ended using menstrual regulation, was aborted, or ended in a stillbirth?	YES . . . . . 1 NO 2	→ 238
231	When did the last such pregnancy end?	MONTH . . . . . [ ][ ] YEAR . . . . . [ ][ ][ ][ ]	
232	CHECK 231: LAST PREGNANCY ENDED IN JAN. 2006 OR LATER LAST PREGNANCY ENDED BEFORE JAN. 2006		→ 238
233	How many months pregnant were you when the last such pregnancy ended? C RECORD NUMBER OF COMPLETED MONTHS. ENTER 00 IN THE CALENDAR IN THE MONTH THAT THE PREGNANCY TERMINATED AND 01 FOR THE REMAINING NUMBER OF COMPLETED MONTHS.	MONTHS . . . . . [ ][ ]	
234	Since January 2006, have you had any other pregnancies that did not result in a live birth?	YES . . . . . 1 NO 2	→ 236
235	ASK THE DATE AND THE DURATION OF PREGNANCY FOR EACH EARLIER NON-LIVE BIRTH PREGNANCY BACK TO JANUARY 2006 C ENTER 00 IN THE CALENDAR IN THE MONTH THAT EACH PREGNANCY TERMINATED AND 01 FOR THE REMAINING NUMBER OF COMPLETED MONTHS.		
236	Did you have any miscarriages, abortions or stillbirths that ended before 2006?	YES . . . . . 1 NO 2	→ 238
237	When did the last such pregnancy that terminated before 2006 end?	MONTH . . . . . [ ][ ] YEAR . . . . . [ ][ ][ ][ ]	
238	When did your last menstrual period start? _____ (DATE, IF GIVEN)	DAYS AGO . . . . . 1 [ ][ ] WEEKS AGO . . . . . 2 [ ][ ] MONTHS AGO . . . . . 3 [ ][ ] YEARS AGO . . . . . 4 [ ][ ] IN MENOPAUSE/ HAS HAD HYSTERECTOMY . . . 994 BEFORE LAST BIRTH . . . . . 995 NEVER MENSTRUATED 996	

SECTION 3. CONTRACEPTION

302	CHECK 103A: CURRENTLY MARRIED ☐ ↓ SEPARATED/DESERTED DIVORCED/WIDOWED ☐ → 311		
302A	CHECK 226: NOT PREGNANT OR UNSURE ☐ ↓ PREGNANT ☐ → 311		
303	Are you currently doing something or using any method to delay or avoid getting pregnant?	YES . . . . . 1 NO 2	→ 311
304	Which method are you using? CIRCLE ALL MENTIONED. IF MORE THAN ONE METHOD MENTIONED, FOLLOW SKIP INSTRUCTION FOR HIGHEST METHOD IN LIST.	FEMALE STERILIZATION . . . . . A MALE STERILIZATION . . . . . B IUD . . . . . C INJECTABLES . . . . . D IMPLANTS . . . . . E PILL . . . . . F CONDOM . . . . . G SAFE PERIOD/PERIODIC ABST. . . . L WITHDRAWAL . . . . . M OTHER _____ X SPECIFY	→ 307 → 308A → 306 → 308A
305	May I see the brand name of the pills you are using? RECORD NAME OF BRAND IF PACKAGE SEEN. IF PACKAGE NOT SEEN SHOW THE BRAND CHART. Please tell me among these which brand of pills are you using? WRITE THE BRAND NAME.	PACKAGE/CHART SEEN . . . . . 1 BRAND NAME _____ ☐☐ (SPECIFY) DON'T KNOW 8	→ 306A
306	May I see the brand name of the condom you are using? RECORD NAME OF BRAND IF PACKAGE SEEN. IF PACKAGE NOT SEEN SHOW THE BRAND CHART. Please tell me among these which brand of condom are you using? WRITE THE BRAND NAME.	PACKAGE/CHART SEEN . . . . . 1 BRAND NAME _____ ☐☐ (SPECIFY) DON'T KNOW 8	
306A	Who obtained the (pills/condoms) the last time you got them?	RESPONDENT . . . . . 1 HUSBAND . . . . . 2 SON/DAUGHTER . . . . . 3 OTHER RELATIVE . . . . . 4 OTHER _____ 6 (SPECIFY)	→ 308A

307	In what facility did the sterilization take place? PROBE TO IDENTIFY THE TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . 11 SPECIALISED GOVT.HOSPITAL HOSPITAL _____ 12 (SPECIFY) DISTRICT HOSPITAL . . . . . 13 MCWC . . . . . 14 UPAZILLA HEALTH COMPLEX . . . 15 H& FWC . . . . . 17 OTHER PUBLIC SECTOR _____ 16 (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . 21 OTHER NGO SECTOR _____ 26 (SPECIFY) PRIVATE MEDICAL SECTOR PRIVATE HOSPITAL/CLINIC . . . . . 31 QUALIFIED DOCTOR'S CHAMBER 32 PRIVATE MEDICAL COLLEGE HOSPITAL _____ 34 (SPECIFY) OTHER PRIVATE MEDICAL SECTOR _____ 36 (SPECIFY) OTHER _____ 96 (SPECIFY) DON'T KNOW 98	
308	In what month and year was the sterilization performed?		
308A	Since what month and year have you been using (CURRENT METHOD) without stopping? PROBE: For how long have you been using (CURRENT METHOD) now without stopping?	MONTH . . . . . ☐☐ YEAR . . . . . ☐☐☐☐	
309	CHECK 308/308A, 215 AND 231: ANY BIRTH OR PREGNANCY TERMINATION AFTER MONTH AND YEAR OF START OF USE OF CONTRACEPTION IN 308/308A GO BACK TO 308/308A, PROBE AND RECORD MONTH AND YEAR AT START OF CONTINUOUS USE OF CURRENT METHOD (MUST BE AFTER LAST BIRTH OR PREGNANCY TERMINATION).	YES ☐ NO ☐	
310	CHECK 308/308A: YEAR IS 2006 OR LATER ☐ C ENTER CODE FOR METHOD USED IN MONTH OF INTERVIEW IN THE CALENDAR AND IN EACH MONTH BACK TO THE DATE STARTED USING.	YEAR IS 2005 OR EARLIER ☐ C ENTER CODE FOR METHOD USED IN MONTH OF INTERVIEW IN THE CALENDAR AND EACH MONTH BACK TO JANUARY 2006. THEN SKIP TO → 314	

311	I would like to ask you some questions about the times you or your partner may have used a method to avoid getting pregnant during the last few years. USE CALENDAR TO PROBE FOR EARLIER PERIODS OF USE AND NONUSE, STARTING WITH MOST RECENT USE, BACK TO JANUARY 2006. USE NAMES OF CHILDREN, DATES OF BIRTH, AND PERIODS OF PREGNANCY AS REFERENCE POINTS. C IN COLUMN 1, ENTER METHOD USE CODE OR '0' FOR NONUSE IN EACH BLANK MONTH. ILLUSTRATIVE QUESTIONS: * When was the last time you used a method? Which method was that? * When did you start using that method? How long after the birth of (NAME)? * How long did you use the method then? IN COLUMN 2, ENTER CODES FOR DISCONTINUATION NEXT TO THE LAST MONTH OF USE. NUMBER OF CODES IN COLUMN 2 MUST BE SAME AS NUMBER OF INTERRUPTIONS OF METHOD USE IN COLUMN 1. ASK WHY SHE STOPPED USING THE METHOD. IF A PREGNANCY FOLLOWED, ASK WHETHER SHE BECAME PREGNANT UNINTENTIONALLY WHILE USING THE METHOD OR DELIBERATELY STOPPED TO GET PREGNANT. ILLUSTRATIVE QUESTIONS: * Why did you stop using the (METHOD)? Did you become pregnant while using (METHOD), or did you stop to get pregnant, or did you stop for some other reason? * IF DELIBERATELY STOPPED TO BECOME PREGNANT, ASK: How many months did it take you to get pregnant after you stopped using (METHOD)? AND ENTER '0' IN EACH SUCH MONTH IN COLUMN 1.	
312	CHECK THE CALENDAR FOR USE OF ANY CONTRACEPTIVE METHOD IN ANY MONTH NO METHOD USED ☐ ANY METHOD USED ☐ → 314		
313	Have you ever used anything or tried in any way to delay or avoid getting pregnant?	YES . . . . . 1 NO 2	→ 324
314	CHECK 304: CIRCLE METHOD CODE: IF MORE THAN ONE METHOD CODE CIRCLED IN 304, CIRCLE CODE FOR HIGHEST METHOD IN LIST.	NO CODE CIRCLED . . . . . 00 FEMALE STERILIZATION . . . . . 01 MALE STERILIZATION . . . . . 02 IUD . . . . . 03 INJECTABLES . . . . . 04 IMPLANTS . . . . . 05 PILL . . . . . 06 CONDOM . . . . . 07 SAFE PERIOD . . . . . 12 WITHDRAWAL . . . . . 13 OTHER MODERN METHOD 96	→ 324 → 325A → 324

323	Where did you obtain (CURRENT METHOD) the last time? PROBE TO IDENTIFY THE TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . 11 SPECIALISED GOVT.HOSPITAL HOSPITAL _____ (SPECIFY) 12 DISTRICT HOSPITAL . . . . . 13 MCWC . . . . . 14 UPAZILLA HEALTH COMPLEX . . . 15 H& FWC . . . . . 17 SAT. CLINIC/EPI OUTREACH . . . . . 18 COMMUNITY CLINIC . . . . . 19 GOVT. FIELD WORKER (FWA) 20 OTHER PUBLIC SECTOR _____ (SPECIFY) 16 NGO SECTOR NGO STATIC CLINIC . . . . . 21 NGO SATELLITE CLINIC . . . . . 22 NGO DEPO HOLDER . . . . . 23 NGO FIELD WORKER . . . . . 24 OTHER NGO SECTOR _____ (SPECIFY) 26 PRIVATE MEDICAL SECTOR PRIVATE HOSPITAL/CLINIC . . . . . 31 QUALIFIED DOCTOR'S CHAMBER . 32 NON-QUALIFIED DOCTOR'S CHAMBER . . . . . 33 PHARMACY . . . . . 34 PRIVATE MEDICAL COLLEGE HOSPITAL _____ (SPECIFY) 35 OTHER PRIVATE MEDICAL SECTOR _____ (SPECIFY) 36 OTHER SOURCE GROCERY . . . . . 41 FRIENDS/RELATIVES . . . . . 42 OTHER _____ (SPECIFY) 96	→ 325A
324	Do you know of a place where you can obtain a method of family planning?	YES . . . . . 1 NO 2	→ 325A

325	Where is that? Any other place? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE(S))	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . A SPECIALISED GOVT.HOSPITAL HOSPITAL _____ B (SPECIFY) DISTRICT HOSPITAL . . . . . C MCWC . . . . . D UPAZILLA HEALTH COMPLEX . . . E H& FWC . . . . . F SAT. CLINIC/EPI OUTREACH . . . . . G COMMUNITY CLINIC . . . . . H GOVT. FIELD WORKER (FWA) . . . I OTHER PUBLIC SECTOR _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . K NGO SATELLITE CLINIC . . . . . L NGO DEPO HOLDER . . . . . M NGO FIELD WORKER . . . . . N OTHER NGO SECTOR _____ O (SPECIFY) PRIVATE MEDICAL SECTOR PRIVATE HOSPITAL/CLINIC . . . . . P QUALIFIED DOCTOR'S CHAMBER . Q NON-QUALIFIED DOCTOR'S CHAMBER . . . . . R PHARMACY . . . . . S PRIVATE MEDICAL COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE MEDICAL SECTOR _____ U (SPECIFY) OTHER SOURCE GROCERY . . . . . V FRIENDS/RELATIVES . . . . . W OTHER _____ X (SPECIFY)	
325A	In some places, there is a clinic set up for a day or part of a day in someone's house or in a school. During the past three months, was there any such clinic in this village or mohalla?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	→ 325D
325B	Did you visit such temporary health clinic in the past three months?	YES . . . . . 1 NO 2	→ 325D

325C	What services did you receive?	FAMILY PLANNING METHODS . . . . . A IMMUNIZATIONS . . . . . B CHILD GROWTH MONITORING . . . . . C TETANUS INJECTION . . . . . D ANTENATAL CARE . . . . . E VITAMIN A FOR CHILDREN . . . . . F OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z	
325D	Are you aware of any community clinic in your area?	YES . . . . . 1 NO 2	→326
325E	Did you visit the community clinic in the past three months?	YES . . . . . 1 NO 2	→326
325F	What services did you receive?	FAMILY PLANNING METHODS . . . . . A IMMUNIZATIONS . . . . . B CHILD GROWTH MONITORING . . . . . C TETANUS INJECTION . . . . . D ANTENATAL CARE . . . . . E VITAMIN A FOR CHILDREN . . . . . F OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z	
326	In the last 6 months, were you visited by a fieldworker who talked to you about family planning or gave you a family planning method?	TALKED . . . . . 1 GAVE FAMILY PLANNING METHOD . 2 TALKED AND GAVE METHOD . . . . . 3 NO 4	→401
326A	Who visited you to talk about family planning or to give you family planning methods? Name _____ Anyone else? Name _____	GOVT. FP WORKER . . . . . A GOVT. HEALTH WORKER . . . . . B NGO WORKER . . . . . C OTHER _____ X (SPECIFY)	
326B	During the last six months, how many times did a health worker or workers visit you to talk about family planning or to give you family planning methods?	NUMBER OF TIMES . . . . . [ ][ ] DON'T KNOW 98	
326C	When was the last time you were visited by a fieldworker who talked to you about family planning? IF MORE THAN ONE WORKER VISITED: When did the last worker visit you? IF LESS THAN ONE MONTH AGO WRITE '00'	MONTHS AGO . . . . . [ ] DON'T KNOW 8	

SECTION 4 PREGNANCY AND POSTNATAL CARE

401	CHECK 224: ONE OR MORE BIRTHS IN 2006 OR LATER ☐ ↓ NO BIRTHS IN 2006 OR LATER ☐ → 601			
402	CHECK 215: ENTER IN THE TABLE THE BIRTH HISTORY NUMBER, NAME, AND SURVIVAL STATUS OF EACH BIRTH IN 2006 OR LATER. ASK THE QUESTIONS ABOUT ALL OF THESE BIRTHS. BEGIN WITH THE LAST BIRTH. (IF THERE ARE MORE THAN 3 BIRTHS, USE LAST 2 COLUMNS OF ADDITIONAL QUESTIONNAIRES) . Now I would like to ask some questions about your children born in the last five years. (We will talk about each separately.)			
403	BIRTH HISTORY NUMBER FROM 212 IN BIRTH HISTORY	LAST BIRTH BIRTH HISTORY NUMBER ☐☐	NEXT-TO-LAST BIRTH BIRTH HISTORY NUMBER ☐☐	SECOND-FROM-LAST BIRTH BIRTH HISTORY NUMBER ☐☐
404	FROM 212 AND 216	NAME _____ LIVING ☐ ↓ DEAD ☐ ↓	NAME _____ LIVING ☐ ↓ DEAD ☐ ↓	NAME _____ LIVING ☐ ↓ DEAD ☐ ↓
405	When you got pregnant with (NAME), did you want to get pregnant at that time?	YES . . . . . 1 (SKIP TO 408) ← NO 2	YES . . . . . 1 (SKIP TO 430) ← NO 2	YES . . . . . 1 (SKIP TO 430) ← NO 2
406	Did you want to have a baby later on, or did you not want any (more) children?	LATER . . . . . 1 NO MORE . . . . . 2 (SKIP TO 408) ←	LATER . . . . . 1 NO MORE . . . . . 2 (SKIP TO 430) ←	LATER . . . . . 1 NO MORE . . . . . 2 (SKIP TO 430) ←
407	How much longer did you want to wait?	MONTHS . . 1 ☐☐ YEARS . . 2 ☐☐ DON'T KNOW 998	MONTHS . . 1 ☐☐ YEARS . . 2 ☐☐ DON'T KNOW . . . 998	MONTHS . . 1 ☐☐ YEARS . . 2 ☐☐ DON'T KNOW . . . 998
408	Did you see anyone for antenatal care for this pregnancy?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 415) ←		
409	Whom did you see? Anyone else? PROBE TO IDENTIFY EACH TYPE OF PERSON AND RECORD ALL MENTIONED. IF 'DK' MENTIONED WRITE THE NAME OF THE CSBA. NAME _____ NAME _____	HEALTH PERSONNEL QUAL. DOCTOR . A NURSE/MIDWIFE/ PARAMEDIC . B FAMILY WELFARE VISITOR . . . . . C COMMUNITY SKILLED BIRTH ATTENDANT . D MA/SACMO . . . . . E HEALTH ASST. . F FAMILY WELFARE ASSISTANT . . . . G OTHER PERSON TRAINED TBA . . . . H UNTRAINED TBA . I UNQUALIFIED DOCTOR . . . . . J NGO WORKER . . . . K OTHER _____ X (SPECIFY)		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
410	Where did you receive antenatal care for this pregnancy? Anywhere else? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE(S))	HOME HOME . . . . . A PUBLIC SECTOR HOSP./MEDICAL COLLEGE . . . . B SPE. MEDICAL COL._____ C (SPECIFY) DIST. HOSP. . . . . D MCWC . . . . . E UPAZILLA HEALTH COMPLEX . . . . F H & FAMILY WELFARE CENTRE . . . . . G SAT. CLINIC/EPI OUTREACH . H COMM. CLINIC . . . . I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . K NGO SAT CLINIC . L OTHER _____ M (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . N QUAL.DOCTOR . . . . O TRAD. DOCTOR ... P PHARMACY . . . . . Q PVT. MED COLL. HOSP. _____ R (SPECIFY) OTHER _____ X (SPECIFY)		
412	How many times did you receive antenatal care during this pregnancy?	NUMBER OF TIMES ☐☐ DON'T KNOW 98		
414	During (any of) your antenatal care visit(s), were you told about things to look out for that might suggest problems with the pregnancy?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8		
415	During this pregnancy, were you given an injection in the arm to prevent the baby from getting tetanus, that is, convulsions after birth?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 418) ← DON'T KNOW 8		
416	During this pregnancy, how many times did you get a tetanus injection?	TIMES . . . . . ☐ DON'T KNOW 8		
417	CHECK 416:	2 OR MORE TIMES ☐ → (SKIP TO 430) OTHER ☐ →		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
418	At any time before this pregnancy, did you receive any tetanus injections?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 430) ← DON'T KNOW 8		
419	Before this pregnancy, how many times did you receive a tetanus injection? IF 7 OR MORE TIMES, RECORD '7'	TIMES . . . . . [ ] DON'T KNOW 8		
420	How many years ago did you receive the last tetanus injection before this pregnancy?	YEARS AGO . . . . . [ ][ ]		
430	When (NAME) was born, was he/she very large, larger than average, average, smaller than average, or very small?	VERY LARGE . . . . . 1 LARGER THAN AVERAGE . . . . . 2 AVERAGE . . . . . 3 SMALLER THAN AVERAGE . . . . . 4 VERY SMALL . . . . . 5 DON'T KNOW 8	VERY LARGE . . . . . 1 LARGER THAN AVERAGE . . . . . 2 AVERAGE . . . . . 3 SMALLER THAN AVERAGE . . . . . 4 VERY SMALL . . . . . 5 DON'T KNOW 8	VERY LARGE . . . . . 1 LARGER THAN AVERAGE . . . . . 2 AVERAGE . . . . . 3 SMALLER THAN AVERAGE . . . . . 4 VERY SMALL . . . . . 5 DON'T KNOW 8
433	Who assisted with the delivery of (NAME)? Anyone else? PROBE FOR THE TYPE(S) OF PERSON(S) AND RECORD ALL MENTIONED. IF RESPONDENT SAYS NO ONE ASSISTED, PROBE TO DETERMINE WHETHER ANY ADULTS WERE PRESENT AT THE DELIVERY. IF 'MENTIONED WRITE THE NAME OF THE CSBA. NAME _____ NAME _____	HEALTH PERSONNEL QUAL. DOCTOR ... A NURSE/MIDWIFE/ PARAMEDIC ... B FAMILY WELFARE VISITOR . . . . . C COMMUNITY SKILLED BIRTH ATTENDANT ... D MA/SACMO . . . . . E HEALTH ASST. ... F FAMILY WELFARE ASSISTANT . . . . G OTHER PERSON TRAINED TBA . . . . H UNTRAINED TBA ... I UNQUALIFIED DOCTOR . . . . . J RELATIVES . . . . . K NEIGHBORS/FRIEND L NGO WORKER . . . . M OTHER _____ X (SPECIFY) NO ONE ASSISTED ... Y	HEALTH PERSONNEL QUAL. DOCTOR ... A NURSE/MIDWIFE/ PARAMEDIC ... B FAMILY WELFARE VISITOR . . . . . C COMMUNITY SKILLED BIRTH ATTENDANT ... D MA/SACMO . . . . . E HEALTH ASST. ... F FAMILY WELFARE ASSISTANT . . . G OTHER PERSON TRAINED TBA . . . H UNTRAINED TBA ... I UNQUALIFIED DOCTOR . . . . . J RELATIVES . . . . . K NEIGHBORS/FRIEN L NGO WORKER . . . M OTHER _____ X (SPECIFY) NO ONE ASSISTED ... Y	HEALTH PERSONNEL QUAL. DOCTOR ... A NURSE/MIDWIFE/ PARAMEDIC ... B FAMILY WELFARE VISITOR . . . . . C COMMUNITY SKILLED BIRTH ATTENDANT ... D MA/SACMO . . . . . E HEALTH ASST. ... F FAMILY WELFARE ASSISTANT . . . G OTHER PERSON TRAINED TBA . . . H UNTRAINED TBA ... I UNQUALIFIED DOCTOR . . . . . J RELATIVES . . . . . K NEIGHBORS/FRIEN L NGO WORKER . . . M OTHER _____ X (SPECIFY) NO ONE ASSISTED ... Y

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
434	Where did you give birth to (NAME)? PROBE TO IDENTIFY THE TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. (NAME OF PLACE)	HOME HOME . . . . 11 (SKIP TO 435A) ←┘ PUBLIC SECTOR HOSP./MEDICAL COLLEGE . . . . 21 SPE. MED COL _____ 22 (SPECIFY) DIST. HOSP. . . . . 23 MCWC . . . . . 24 UPAZILLA HEALTH COMPLEX . . . . 25 H & FAMILY WELFARE CENTRE . . . . . 26 NGO SECTOR NGO STATIC CLINIC . . . . . 31 OTHER _____ 36 (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . 41 PVT. MED COLL. HOSP. _____ 42 (SPECIFY) OTHER _____ 96 (SPECIFY) (SKIP TO 435A)	HOME HOME . . . 11 (SKIP TO 448) ←┘ PUBLIC SECTOR HOSP./MEDICAL COLLEGE . . . 21 SPE. MED COL _____ 22 (SPECIFY) DIST. HOSP. . . . 23 MCWC . . . . . 24 UPAZILLA HEALTH COMPLEX . . . 25 H & FAMILY WELFARE CENTRE . . . . . 26 NGO SECTOR NGO STATIC CLINIC . . . . . 31 OTHER _____ 36 (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . 41 PVT. MED COLL. HOSP. _____ 42 (SPECIFY) OTHER _____ 96 (SPECIFY) (SKIP TO 448)	HOME HOME . . . 11 (SKIP TO 448) ←┘ PUBLIC SECTOR HOSP./MEDICAL COLLEGE . . . 21 SPE. MED COL _____ 22 (SPECIFY) DIST. HOSP. . . . 23 MCWC . . . . . 24 UPAZILLA HEALTH COMPLEX . . . 25 H & FAMILY WELFARE CENTRE . . . . . 26 NGO SECTOR NGO STATIC CLINIC . . . . . 31 OTHER _____ 36 (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . 41 PVT. MED COLL. HOSP. _____ 42 (SPECIFY) OTHER _____ 96 (SPECIFY) (SKIP TO 448)
434A	How long after (NAME) was delivered did you stay there? IF LESS THAN ONE DAY, RECORD HOURS. IF LESS THAN ONE WEEK, RECORD DAYS.	HOURS 1 DAYS 2 WEEKS 3 DON'T KNOW 998		
435	Was (NAME) delivered by caesarean, that is, did they cut your belly open to take the baby out?	YES . . . . . 1 (SKIP TO 436) ←┘ NO 2	YES . . . . . 1 (SKIP TO 448) ←┘ NO 2	YES . . . . . 1 (SKIP TO 448) ←┘ NO 2
435A	CHECK 215:	LAST BIRTH IN JAN 2008 OR LATER LAST BIRTH BEFORE 2008 JAN (SKIP TO 438)		
435B	CHECK 434:	DELIVERED AT HOME (CODE 11 CIRCLED) DELIVERED AT HEALTH FACILITY (CIRCLED ANY CODE 21 TO 96) (SKIP TO 435F)		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
	Now I would like to ask you some specific questions about what was done with (NAME) during and immediately following delivery.			
435C	Was a Clean Delivery Kit used during the delivery of (NAME)? SHOW THE DELIVERY KIT	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8		
435D	What was used to cut the cord?	BLADE FROM DELIVERY KIT . . . . 1 BLADE FROM OTHER SOURCE . 2 BAMBOO STRIPS . . . . 3 SCISSOR . . . . . 4 OTHER _____ 6 (SPECIFY) CORD WAS NOT CUT 7 (SKIP TO 435F) DON'T KNOW 8		
435E	Was the _____ (INSTRUMENT IN 435D) boiled before the cord was cut?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8		
435F	Was anything applied to the cord immediately after cutting and tying it?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 435H) DON'T KNOW 8		
435G	What was applied to the cord after it was cut and tied? Anything else?	ANTIBIOTICS (POWDER/OINTM) . A ANTISEPTIC (DETOL/SAVLON HEXISOL). . . . . B SPIRIT/ALCOHOL . . . . C MUSTARD OIL WITH GARLIC . . . . . D CHEWED RICE . . . . E TUMERIC JUICE/ POWDER . . . . . F GINGER JUICE . . . . G SHIDUR . . . . . H BORIC POWDER . . . . I GENTIAN VIOLET (BLUE INK) . . . . . J TALCOM POWDER . K OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z		
435H	How long after delivery was (NAME) bathed for the first time? IF LESS THAN ONE DAY, RECORD IN HOURS IF LESS THAN ONE WEEK, RECORD IN DAYS	HOURS 1 ☐☐ DAYS 2 ☐☐ WEEKS 3 ☐☐ NOT BATHED . . . . . 995 DON'T KNOW 998		
435I	How long after birth was (NAME) dried ?	<5 minutes . . . . . 1 5-9 minutes . . . . . 2 10 + minutes . . . . . 3 Not dried . . . . . 4 Don't know 8		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
435J	How long after birth was (NAME) wrapped?	<5 minutes . . . . . 1 5-9 minutes . . . . . 2 10 + minutes . . . . . 3 No wrapped . . . . . 4 Don't know 8		
435K	CHECK 434:	DELIVERED AT HOME (CODE 11 CIRCLED) → (SKIP TO 438) DELIVERED AT HEALTH FACILITY (CODE 21 TO 96) →		
436	I would like to talk to you about checks on your health after delivery, for example, someone asking you questions about your health or examining you. Did anyone check on your health while you were still in the facility?	YES . . . . . 1 (SKIP TO 439) ← NO 2		
437	Did anyone check on your health after you left the facility?	YES . . . . . 1 (SKIP TO 439) ← NO . . . . . 2 (SKIP TO 442) ←		
438	I would like to talk to you about checks on your health after delivery, for example, someone asking you questions about your health or examining you. Did anyone check on your health after you gave birth do (NAME)?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 442) ←		
439	Who checked on your health at that time? PROBE FOR MOST QUALIFIED PERSON. IF '14' MENTIONED WRITE THE NAME OF THE CSBA. NAME _____	HEALTH PERSONNEL QUAL. DOCTOR . 11 NURSE/MIDWIFE/ PARAMEDIC . 12 FAMILY WELFARE VISITOR . . . . . 13 COMMUNITY SKILLED BIRTH ATTENDANT . 14 MA/SACMO . . . . . 15 HEALTH ASST. . . . 16 FAMILY WELFARE ASSISTANT . . . . 17 OTHER PERSON TRAINED TBA . . . . 21 UNTRAINED TBA . . . 22 UNQUALIFIED DOCTOR . . . . . 23 NGO WORKER . . . . 31 OTHER _____ 96 (SPECIFY)		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
439A	Where did this first check take place?	HOME HOME .... 11 (SKIP TO 442) ←┘ PUBLIC SECTOR HOSP./MEDICAL COLLEGE .... 21 SPE. MED COL _____ 22 (SPECIFY) DIST. HOSP. .... 23 MCWC ..... 24 UPAZILLA HEALTH COMPLEX .... 25 H & FAMILY WELFARE CENTRE ..... 27 SAT. CLINIC/EPI OUTREACH .... 28 COMM. CLINIC .... 29 OTHER _____ 26 (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... 31 NGO SAT CLINIC . 32 OTHER _____ 36 (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... 41 QUALIFIED DOC. CHAMBER .... 42 UNQUALIFIED DOC. CHAMBER .... 43 PHARMACY ..... 44 PVT. MED COLL. HOSP. _____ 45 (SPECIFY) OTHER _____ 96 (SPECIFY) (SKIP TO 442) ←┘		
440	How long after delivery did the first check take place? IF LESS THAN ONE DAY, RECORD HOURS. IF LESS THAN ONE WEEK, RECORD DAYS.	HOURS 1 ☐☐ DAYS 2 ☐☐ WEEKS 3 ☐☐ DON'T KNOW 998		
442	In the two months after (NAME) was born, did any health care provider or a traditional birth attendant check on his/her health?	YES ..... 1 NO ..... 2 (SKIP TO 446) ←┐ DON'T KNOW 8		
443	How many hours, days or weeks after the birth of (NAME) did the first check take place? IF LESS THAN ONE DAY, RECORD HOURS. IF LESS THAN ONE WEEK, RECORD DAYS.	HRS AFTER BIRTH .. 1 ☐☐ DAYS AFTER BIRTH .. 2 ☐☐ WKS AFTER BIRTH .. 3 ☐☐ DON'T KNOW 998		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
444	Who checked on (NAME)'s health at that time? PROBE FOR MOST QUALIFIED PERSON. IF "14" MENTIONED WRITE THE NAME OF THE CSBA. NAME _____	HEALTH PERSONNEL QUAL. DOCTOR . 11 NURSE/MIDWIFE/ PARAMEDIC .... 12 FAMILY WELFARE VISITOR ..... 13 COMMUNITY SKILLED BIRTH ATTENDANT .... 14 MA/SACMO ..... 15 HEALTH ASST. .... 16 FAMILY WELFARE ASSISTANT .... 17 OTHER PERSON TRAINED TBA .... 21 UNTRAINED TBA . 22 UNQUALIFIED DOCTOR ..... 23 NGO WORKER .... 31 OTHER _____ 96 (SPECIFY)		
445	Where did this first check of (NAME) take place? PROBE TO IDENTIFY THE TYPE OF SOURCE AND CIRCLE THE APPROPRIATE CODE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE)	HOME YOUR HOME .... 11 PUBLIC SECTOR HOSP./MEDICAL COLLEGE .... 21 SPE. MED COL _____ 22 (SPECIFY) DIST. HOSP. .... 23 MCWC ..... 24 UPAZILLA HEALTH COMPLEX .... 25 H & FAMILY WELFARE CENTRE ..... 27 SAT. CLINIC/EPI OUTREACH . 28 COMM. CLINIC .... 29 OTHER _____ 26 (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... 31 NGO SAT CLINIC . 32 OTHER _____ 36 (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... 41 QUALIFIED DOC. CHAMBER .... 42 UNQUALIFIED DOC. CHAMBER .... 43 PHARMACY ..... 44 PVT. MED COLL. HOSP. _____ 45 (SPECIFY) OTHER _____ 96 (SPECIFY)		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
446	In the first two months after delivery, did you receive a vitamin A dose like (this/any of these)? SHOW COMMON TYPES OF AMPULES/CAPSULES/SYRUPS.	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8		
447	Has your menstrual period returned since the birth of (NAME)?	YES . . . . . 1 (SKIP TO 449) ← NO . . . . . 2 (SKIP TO 450) ←		
448	Did your period return between the birth of (NAME) and your next pregnancy?		YES . . . . . 1 NO . . . . . 2 (SKIP TO 452) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 452) ←
449	For how many months after the birth of (NAME) did you not have a period?	MONTHS . . . ☐☐ DON'T KNOW 98	MONTHS . . . ☐☐ DON'T KNOW 98	MONTHS . . . ☐☐ DON'T KNOW 98
450	CHECK 226: IS RESPONDENT PREGNANT?	NOT PREGNANT → (SKIP TO 451) PREGNANT OR UNSURE → (SKIP TO 452)		
451	Have you had sexual intercourse since the birth of (NAME)?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 453) ←		
452	For how many months after the birth of (NAME) did you not have sexual intercourse?	MONTHS . . . ☐☐ DON'T KNOW 98	MONTHS . . . ☐☐ DON'T KNOW 98	MONTHS . . . ☐☐ DON'T KNOW 98
453	Did you ever breastfeed (NAME)?	YES . . . . . 1 (SKIP TO 455) ← NO 2	YES . . . . . 1 NO 2	YES . . . . . 1 NO 2
454	CHECK 404: IS CHILD LIVING?	LIVING → (SKIP TO 460) DEAD → (GO BACK TO 405 IN NEXT COLUMN; OR IF NO MORE BIRTHS, GO TO 501)		
455	How long after birth did you first put (NAME) to the breast? IF LESS THAN 1 HOUR, RECORD '00' HOURS. IF LESS THAN 24 HOURS, RECORD HOURS. OTHERWISE, RECORD DAYS.	IMMEDIATELY . . . . 000 HOURS 1 ☐☐ DAYS 2 ☐☐		
456	In the first three days after delivery, was (NAME) given anything to drink other than breast milk?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 458) ←		

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
457	What was (NAME) given to drink? Anything else? RECORD ALL LIQUIDS MENTIONED.	MILK (OTHER THAN BREAST MILK) A PLAIN WATER . . . . B SUGAR OR GLUCOSE WATER . . . . C GRIPE WATER . . . . D SUGAR-SALT-WATER SOLUTION . . . . . E FRUIT JUICE . . . . . F INFANT FORMULA G TEA/INFUSIONS . . . . H COFFEE . . . . . I HONEY . . . . . J OTHER _____ X (SPECIFY)		
458	CHECK 404: IS CHILD LIVING?	LIVING ☐ DEAD ☐ (GO BACK TO 405 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 501)	LIVING ☐ DEAD ☐ (GO BACK TO 405 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 501)	LIVING ☐ DEAD ☐ (GO BACK TO 405 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE; OR, IF NO MORE BIRTHS, GO TO 501)
459	Are you still breastfeeding (NAME)?	YES . . . . . 1 (SKIP TO 460) ← NO 2		
459A	For how many months did you breastfeed (NAME)?	MONTHS . . . ☐☐ DON'T KNOW 98		
460	Did (NAME) drink anything from a bottle with a nipple yesterday or last night?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8
461		GO BACK TO 405 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 501.	GO BACK TO 405 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 501.	GO BACK TO 405 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE; OR, IF NO MORE BIRTHS, GO TO 501.

SECTION 5. CHILD IMMUNIZATION, HEALTH AND NUTRITION

501	ENTER IN THE TABLE THE BIRTH HISTORY NUMBER, NAME, AND SURVIVAL STATUS OF EACH BIRTH IN 2006 OR LATER. ASK THE QUESTIONS ABOUT ALL OF THESE BIRTHS. BEGIN WITH THE LAST BIRTH. (IF THERE ARE MORE THAN 3 BIRTHS, USE LAST 2 COLUMNS OF ADDITIONAL QUESTIONNAIRES).			
502	BIRTH HISTORY NUMBER FROM 212 IN BIRTH HISTORY	LAST BIRTH BIRTH HISTORY NUMBER	NEXT-TO-LAST BIRTH BIRTH HISTORY NUMBER	SECOND-FROM-LAST BIRTH BIRTH HISTORY NUMBER . . . . .
503	FROM 212 AND 216	NAME _____ LIVING ☐ DEAD ☐ (GO TO 503 IN NEXT COLUMN OR, IF NO MORE BIRTHS, GO TO 557)	NAME _____ LIVING ☐ DEAD ☐ (GO TO 503 IN NEXT COLUMN OR, IF NO MORE BIRTHS, GO TO 557)	NAME _____ LIVING ☐ DEAD ☐ (GO TO 503 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE, OR IF NO MORE BIRTHS, GO TO 557)
504	Do you have a card where (NAME)'s vaccinations are written down? IF YES: May I see it please?	YES, SEEN . . . . . 1 (SKIP TO 506) YES, NOT SEEN . . . . . 2 (SKIP TO 509) NO CARD 3	YES, SEEN . . . . . 1 (SKIP TO 506) YES, NOT SEEN . . . . . 2 (SKIP TO 509) NO CARD 3	YES, SEEN . . . . . 1 (SKIP TO 506) YES, NOT SEEN . . . . . 2 (SKIP TO 509) NO CARD 3
505	Did you ever have a vaccination card for (NAME)?	YES . . . . . 1 (SKIP TO 509) NO 2	YES . . . . . 1 (SKIP TO 509) NO 2	YES . . . . . 1 (SKIP TO 509) NO 2

506 (1) COPY DATES FROM THE CARD.
(2) WRITE '44' IN 'DAY' COLUMN IF CARD SHOWS THAT A DOSE WAS GIVEN, BUT NO DATE IS RECORDED.
(3) IF HEP-B IS GIVEN IN COMBINATION WITH DPT, RECORD SEPARATELY FOR BOTH DPT AND HEP-B.

506A

	LAST BIRTH DAY MONTH YEAR		NEXT-TO-LAST BIRTH DAY MONTH YEAR		SECOND-FROM-LAST BIRTH DAY MONTH YEAR	
DATE OF BIRTH						
BCG		BCG		BCG		BCG
POLIO 0 (POLIO GIVEN AT BIRTH)		P0		P0		P0
POLIO 1		P1		P1		P1
POLIO 2		P2		P2		P2
POLIO 3		P3		P3		P3
DPT 1		D1		D1		D1
DPT 2		D2		D2		D2
DPT 3		D3		D3		D3
HEP. B1		HE1		HE1		HE1
HEP. B2		HE2		HE2		HE2
HEP. B3		HE3		HE3		HE3
MEASLES		MEA		MEA		MEA
VITAMIN A		VIT A		VIT A		VIT A

507	CHECK 506A:	BCG TO MEASLES ALL RECORDED ☐ (GO TO 510 J) OTHER ☐	BCG TO MEASLES ALL RECORDED ☐ (GO TO 510 J) OTHER ☐	BCG TO MEASLES ALL RECORDED ☐ (GO TO 510 J) OTHER ☐

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
508	Has (NAME) had any vaccinations that are not recorded on this card, including vaccinations given in a national immunization day campaign? RECORD ‘YES’ ONLY IF THE RESPONDENT MENTIONS AT LEAST ONE OF THE VACCINATIONS IN 506 THAT ARE NOT RECORDED AS HAVING BEEN GIVEN.	YES . . . . . 1 (PROBE FOR VACCINATIONS AND WRITE ‘66’ IN THE CORRESPONDING DAY COLUMN IN 506A) (SKIP TO 510 J) NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8	YES . . . . . 1 (PROBE FOR VACCINATIONS AND WRITE ‘66’ IN THE CORRESPONDING DAY COLUMN IN 506A) (SKIP TO 510 J) NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8	YES . . . . . 1 (PROBE FOR VACCINATIONS AND WRITE ‘66’ IN THE CORRESPONDING DAY COLUMN IN 506A) (SKIP TO 510 J) NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8
509	Did (NAME) ever have any vaccinations to prevent him/her from getting diseases, including vaccinations received in a national immunization day campaign?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8
510	Please tell me if (NAME) had any of the following vaccinations:			
510 A	A BCG vaccination against tuberculosis, that is, an injection in the arm or shoulder that usually causes a scar?	YES . . . . . 1 NO . . . . . 2 DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON’T KNOW 8
510 B	Polio vaccine, that is, drops in the mouth?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 E) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 E) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 E) DON’T KNOW 8
510 C	Was the first polio vaccine given in the first two weeks after birth or later?	FIRST 2WEEKS . . . 1 LATER 2	FIRST 2WEEKS . . . 1 LATER 2	FIRST 2WEEKS . . . 1 LATER 2
510 D	How many times was the polio vaccine given?	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES . . . . .
510 E	A DPT/Pentavalent vaccination, that is, an injection given in the thigh or buttocks, sometimes at the same time as polio drops?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 G) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 G) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 G) DON’T KNOW 8
510 F	How many times was the DPT/Pentavalent vaccination given?	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES . . . . .
510 G	A measles injection or an MMR injection - that is, a shot in the arm at the age of 9 months or older - to prevent him/her from getting measles?	YES . . . . . 1 NO . . . . . 2 DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON’T KNOW 8
510 H	A HEP-B vaccination, that is, an injection given in the right thigh, sometimes given at the same time as DPT?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 510 J) DON’T KNOW 8
510 I	How many times was a HEP-B vaccination received?	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES . . . . .
510 J	Did (NAME) receive any polio vaccine from the National Immunization Days (NID)?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 511) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 511) DON’T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 511) DON’T KNOW 8

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
510 K	At which national immunization day campaigns did (NAME) receive vaccinations? RECORD ALL CAMPAIGNS MENTIONED.	CAMPAIGN 1 (POLIO/JAN 2010) A CAMPAIGN 2 (POLIO/FEB 2010) B CAMPAIGN 3 (POLIO/JAN 2011) C CAMPAIGN 4 (POLIO/FEB 2011) D	CAMPAIGN 1 (POLIO/JAN 2010) A CAMPAIGN 2 (POLIO/FEB 2010) B CAMPAIGN 3 (POLIO/JAN 2011) C CAMPAIGN 4 (POLIO/FEB 2011) D	CAMPAIGN 1 (POLIO/JAN 2010) A CAMPAIGN 2 (POLIO/FEB 2010) B CAMPAIGN 3 (POLIO/JAN 2011) C CAMPAIGN 4 (POLIO/FEB 2011) D
511	Within the last six months, was (NAME) given a vitamin A dose like (this/any of these)? SHOW COMMON TYPES OF AMPULES/CAPSULES/SYRUPS.	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8
512	In the last seven days, was (NAME) given iron pills, sprinkles with iron, or iron syrup like (this/any of these)? SHOW COMMON TYPES OF PILLS/SPRINKLES/ SYRUPS.	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8
513	Was (NAME) given any drug for intestinal worms in the last six months?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8
514	Has (NAME) had diarrhea in the last 2 weeks?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 525) ← DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 525) ← DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 525) ← DON'T KNOW 8
515	Was there any blood in the stools?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8
516	Now I would like to know how much (NAME) was given to drink during the diarrhea (including breastmilk). Was he/she given less than usual to drink, about the same amount, or more than usual to drink? IF LESS, PROBE: Was he/she given much less than usual to drink or somewhat less?	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8
517	When (NAME) had diarrhea, was he/she given less than usual to eat, about the same amount, more than usual, or nothing to eat? IF LESS, PROBE: Was he/she given much less than usual to eat or somewhat less?	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8
518	Did you seek advice or treatment for the diarrhea from any source?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 522) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 522) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 522) ←

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
519	Where did you seek advice or or treatment? Anywhere else? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE(S))	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOSP. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASSISTANT I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO FIELD WORKER M OTHER _____ N (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... O QUALIFIED DOCTOR ... P UNQUALIFIED DOCTOR ..... Q PHARMACY ..... R PRIVATE MED. COLLEGE HOSPITAL _____ S (SPECIFY) OTHER PRIVATE SECTOR _____ T (SPECIFY) OTHER _____ X (SPECIFY)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOSP. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASSISTANT I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO FIELD WORKER M OTHER _____ N (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... O QUALIFIED DOCTOR ... P UNQUALIFIED DOCTOR ..... Q PHARMACY ..... R PRIVATE MED. COLLEGE HOSPITAL _____ S (SPECIFY) OTHER PRIVATE SECTOR _____ T (SPECIFY) OTHER _____ X (SPECIFY)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOSP. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASSISTANT I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO FIELD WORKER M OTHER _____ N (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... O QUALIFIED DOCTOR ... P UNQUALIFIED DOCTOR ..... Q PHARMACY ..... R PRIVATE MED. COLLEGE HOSPITAL _____ S (SPECIFY) OTHER PRIVATE SECTOR _____ T (SPECIFY) OTHER _____ X (SPECIFY)
522	Was he/she given any of the following to drink at any time since he/she started having the diarrhea:			
	a) A fluid made from a special saline packet called ORSaline PACKET?	YES NO DK ORS PKT 1 2 8	YES NO DK ORS PKT 1 2 8	YES NO DK ORS PKT 1 2 8
	b) A homemade sugar-salt-water solution (laban gur)?	LABAN GUR 1 2 8	LABAN GUR 1 2 8	LABAN GUR 1 2 8
	c) Zinc syrup?	ZINC SYRUP 1 2 8	ZINC SYRUP 1 2 8	ZINC SYRUP 1 2 8
	d) Zinc tablets?	ZINC TABLET 1 2 8	ZINC TABLET 1 2 8	ZINC TABLET 1 2 8

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
522A	CHECK 522	☐ ORS GIVEN ☐ ORS NOT GIVEN (SKIP TO 525) →	☐ ORS GIVEN ☐ ORS NOT GIVEN (SKIP TO 525) →	☐ ORS GIVEN ☐ ORS NOT GIVEN (SKIP TO 525) →
523	Where did you get the ORS packet?	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOPT. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASST. (FWA) I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO DEPO HOLDER ..... M NGO FIELD WORKER ..... N OTHER _____ O (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... P QUALIFIED DOCTOR ... Q UNQUALIFIED DOCTOR ..... R PHARMACY ..... S PRIVATE MED. COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE _____ U (SPECIFY) OTHER SOURCE SHOP ..... V FRIEND/RELATIVE W OTHER _____ X (SPECIFY)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOPT. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASST. (FWA) I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO DEPO HOLDER ..... M NGO FIELD WORKER ..... N OTHER _____ O (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... P QUALIFIED DOCTOR ... Q UNQUALIFIED DOCTOR ..... R PHARMACY ..... S PRIVATE MED. COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE _____ U (SPECIFY) OTHER SOURCE SHOP ..... V FRIEND/RELATIVE W OTHER _____ X (SPECIFY)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOPT. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASST. (FWA) I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO DEPO HOLDER ..... M NGO FIELD WORKER ..... N OTHER _____ O (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... P QUALIFIED DOCTOR ... Q UNQUALIFIED DOCTOR ..... R PHARMACY ..... S PRIVATE MED. COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE _____ U (SPECIFY) OTHER SOURCE SHOP ..... V FRIEND/RELATIVE W OTHER _____ X (SPECIFY)
525	Has (NAME) been ill with a fever at any time in the last 2weeks?	YES ..... 1 NO ..... 2 DON'T KNOW 8	YES ..... 1 NO ..... 2 DON'T KNOW 8	YES ..... 1 NO ..... 2 DON'T KNOW 8
527	Has (NAME) had an illness with a cough at any time in the last 2weeks?	YES ..... 1 NO ..... 2 (SKIP TO 530) → DON'T KNOW 8	YES ..... 1 NO ..... 2 (SKIP TO 530) → DON'T KNOW 8	YES ..... 1 NO ..... 2 (SKIP TO 530) → DON'T KNOW 8

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
528	When (NAME) had an illness with a cough, did he/she breathe faster than usual with short, rapid breaths or have difficulty breathing?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 531) ← DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 531) ← DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 (SKIP TO 531) ← DON'T KNOW 8
529	Was the fast or difficult breathing due to a problem in the chest or to a blocked or runny nose?	CHEST ONLY . . . 1 NOSE ONLY . . . . . 2 BOTH . . . . . 3 OTHER _____ 6 (SPECIFY) DON'T KNOW . . . . . 8 (SKIP TO 531) ←	CHEST ONLY . . . 1 NOSE ONLY . . . . . 2 BOTH . . . . . 3 OTHER _____ 6 (SPECIFY) DON'T KNOW . . . . . 8 (SKIP TO 531) ←	CHEST ONLY . . . 1 NOSE ONLY . . . . . 2 BOTH . . . . . 3 OTHER _____ 6 (SPECIFY) DON'T KNOW . . . . . 8 (SKIP TO 531) ←
530	CHECK 525: HAD FEVER?	YES ☐ NO OR DK ☐ (GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 557)	YES ☐ NO OR DK ☐ (GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 557)	YES ☐ NO OR DK ☐ (GO TO 503 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE; OR, IF NO MORE BIRTHS, GO TO 557)
531	Now I would like to know how much (NAME) was given to drink (including breastmilk) during the illness with a (fever/cough). Was he/she given less than usual to drink, about the same amount, or more than usual to drink? IF LESS, PROBE: Was he/she given much less than usual to drink or somewhat less?	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8
532	When (NAME) had a (fever/cough), was he/she given less than usual to eat, about the same amount, more than usual, or nothing to eat? IF LESS, PROBE: Was he/she given much less than usual to eat or somewhat less?	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8	MUCH LESS . . . . . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8
533	Did you seek advice or treatment for the illness from any source?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 537) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 537) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 537) ←

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
536	Where did you first seek advice or treatment? FILL UP THE BOXES ACCORDING TO THE SEQUENCE OF CARE RECEIVED.	SEQUENCE OF CARE 1 2 3 4 ☐ ☐ ☐ ☐ HOME . . . . . A PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . B SPECIALIZED GOVT. HOSPITAL _____ C (SPECIFY) DISTRICT HOSP. . D MCWC . . . . . E UHC . . . . . F H&FWC . . . . . G SATELITE CLINIC/ EPI OUTREACH SITE . . . . . H COMMUNITY CLINIC . . . . . I FAMILY WELFARE ASSIST. . . . . J OTHER _____ K (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . L NGO SATELLITE CLINIC . . . . . M NGO DEPO HOLDER . . . . . N NGO FIELD WORKER . . . . . O OTHER _____ P (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . Q QUALIFIED DOCTOR . . . . R UNQUALIFIED DOCTOR . . . S PHARMACY/ DRUG STORE . T PRIVATE MED. COLLEGE HOSPITAL _____ U (SPECIFY) OTHER PVT._____ V (SPECIFY) OTHER _____ X (SPECIFY)	SEQUENCE OF CARE 1 2 3 4 ☐ ☐ ☐ ☐ HOME . . . . . A PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . B SPECIALIZED GOVT. HOSPITAL _____ C (SPECIFY) DISTRICT HOSP. . D MCWC . . . . . E UHC . . . . . F H&FWC . . . . . G SATELITE CLINIC/ EPI OUTREACH SITE . . . . . H COMMUNITY CLINIC . . . . . I FAMILY WELFARE ASSIST. . . . . J OTHER _____ K (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . L NGO SATELLITE CLINIC . . . . . M NGO DEPO HOLDER . . . . . N NGO FIELD WORKER . . . . . O OTHER _____ P (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . Q QUALIFIED DOCTOR . . . . R UNQUALIFIED DOCTOR . . . S PHARMACY/ DRUG STORE . T PRIVATE MED. COLLEGE HOSPITAL _____ U (SPECIFY) OTHER PVT._____ V (SPECIFY) OTHER _____ X (SPECIFY)	SEQUENCE OF CARE 1 2 3 4 ☐ ☐ ☐ ☐ HOME . . . . . A PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . B SPECIALIZED GOVT. HOSPITAL _____ C (SPECIFY) DISTRICT HOSP. . D MCWC . . . . . E UHC . . . . . F H&FWC . . . . . G SATELITE CLINIC/ EPI OUTREACH SITE . . . . . H COMMUNITY CLINIC . . . . . I FAMILY WELFARE ASSIST. . . . . J OTHER _____ K (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . L NGO SATELLITE CLINIC . . . . . M NGO DEPO HOLDER . . . . . N NGO FIELD WORKER . . . . . O OTHER _____ P (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . . Q QUALIFIED DOCTOR . . . . R UNQUALIFIED DOCTOR . . . S PHARMACY/ DRUG STORE . T PRIVATE MED. COLLEGE HOSPITAL _____ U (SPECIFY) OTHER PVT._____ V (SPECIFY) OTHER _____ X (SPECIFY)
537	At any time during the illness, did (NAME) take any drugs for the illness?	YES . . . . . 1 NO . . . . . 2 (GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 557) DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 (GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 557) DON'T KNOW 8	YES . . . . . 1 NO . . . . . 2 (GO TO 503 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE; OR, IF NO MORE BIRTHS, GO TO 557) DON'T KNOW 8

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
538	What drugs did (NAME) take? Any other drugs? RECORD ALL MENTIONED.	ANTIMALARIAL DRUGS SP/FANSIDAR . . . A CHLOROQUINE B QUININE . . . . . D COMBINATION WITH ARTEMISININ E OTHER ANTI-MALARIAL _____ . . . F (SPECIFY) ANTIBIOTIC DRUGS PILL/SYRUP . . . G INJECTION . . . H OTHER DRUGS ASPIRIN . . . . . I ACETA-MINOPHEN . . . J IBUPROFEN . . . K OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z	ANTIMALARIAL DRUGS SP/FANSIDAR . . . A CHLOROQUINE . B QUININE . . . . . D COMBINATION WITH ARTEMISININ E OTHER ANTI-MALARIAL _____ . . . F (SPECIFY) ANTIBIOTIC DRUGS PILL/SYRUP . . . G INJECTION . . . H OTHER DRUGS ASPIRIN . . . . . I ACETA-MINOPHEN . . . J IBUPROFEN . . . K OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z	ANTIMALARIAL DRUGS SP/FANSIDAR . . . A CHLOROQUINE B QUININE . . . . . D COMBINATION WITH ARTEMISININ E OTHER ANTI-MALARIAL _____ . . . F (SPECIFY) ANTIBIOTIC DRUGS PILL/SYRUP . . . G INJECTION . . . H OTHER DRUGS ASPIRIN . . . . . I ACETA-MINOPHEN . . . J IBUPROFEN . . . K OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z
539	Did anybody prescribe the drug?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 552) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 552) ←	YES . . . . . 1 NO . . . . . 2 (SKIP TO 552) ←
540	Who prescribed the drug?	HEALTH PROFESSIONAL/ WORKER QUALIFIED DOCTOR . . . . . A NURSE/MIDWIFE/ PARAMEDIC B FAMILY WELFARE VISITOR . . . . . C CSBA . . . . . D MA/SACMO . . . . . E HEALTH ASSISTANT . . . F FAMILY WELFARE ASSISTANT . . . G OTHER PROVIDER TRAINED TBA . . . H UNTRAINED TBA . I UNQUALIFIED DOCTOR . . . . . J DRUG SELLER . K NGO WORKER . . . . . L OTHER _____ X (SPECIFY)	HEALTH PROFESSIONAL/ WORKER QUALIFIED DOCTOR . . . . . A NURSE/ MIDWIFE/ PARAMEDIC B FAMILY WELFARE VISITOR . . . . . C CSBA . . . . . D MA/SACMO . . . . . E HEALTH ASSISTANT . . . F FAMILY WELFARE ASSISTANT . . . G OTHER PROVIDER TRAINED TBA . . . H UNTRAINED TBA . I UNQUALIFIED DOCTOR . . . . . J DRUG SELLER . K NGO WORKER . . . . . L OTHER _____ X (SPECIFY)	HEALTH PROFESSIONAL/ WORKER QUALIFIED DOCTOR . . . . . A NURSE/ MIDWIFE/ PARAMEDIC B FAMILY WELFARE VISITOR . . . . . C CSBA . . . . . D MA/SACMO . . . . . E HEALTH ASSISTANT . . . F FAMILY WELFARE ASSISTANT . . . G OTHER PROVIDER TRAINED TBA . . . H UNTRAINED TBA . I UNQUALIFIED DOCTOR . . . . . J DRUG SELLER . K NGO WORKER . . . . . L OTHER _____ X (SPECIFY)

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
541	Where did you get the drug?	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOPT. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASST. (FWA) I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO DEPO HOLDER ..... M NGO FIELD WORKER ..... N OTHER _____ O (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... P QUALIFIED DOCTOR ... Q UNQUALIFIED DOCTOR ..... R PHARMACY/ DRUG STORE . S PRIVATE MED. COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE _____ U (SPECIFY) OTHER SOURCE SHOP ..... V FRIEND/RELATIVE W OTHER _____ X (SPECIFY)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOPT. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASST. (FWA) I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO DEPO HOLDER ..... M NGO FIELD WORKER ..... N OTHER _____ O (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... P QUALIFIED DOCTOR ... Q UNQUALIFIED DOCTOR ..... R PHARMACY/ DRUG STORE . S PRIVATE MED. COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE _____ U (SPECIFY) OTHER SOURCE SHOP ..... V FRIEND/RELATIVE W OTHER _____ X (SPECIFY)	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL ... A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOPT. C MCWC ..... D UHC ..... E H&FWC ..... F SATELITE CLINIC/ EPI OUTREACH SITE ..... G COMMUNITY CLINIC ..... H FAMILY WELFARE ASST. (FWA) I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC ..... K NGO SATELLITE CLINIC ..... L NGO DEPO HOLDER ..... M NGO FIELD WORKER ..... N OTHER _____ O (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC ..... P QUALIFIED DOCTOR ... Q UNQUALIFIED DOCTOR ..... R PHARMACY / DRUG STORE . S PRIVATE MED. COLLEGE HOSPITAL _____ T (SPECIFY) OTHER PRIVATE _____ U (SPECIFY) OTHER SOURCE SHOP ..... V FRIEND/RELATIVE W OTHER _____ X (SPECIFY)
562		GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 557.	GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 557.	GO TO 503 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE; OR, IF NO MORE BIRTHS, GO TO 557.

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
557	CHECK 215 AND 218, ALL ROWS: NUMBER OF CHILDREN BORN IN 2009 OR LATER LIVING WITH THE RESPONDENT ONE OR MORE ☐ NONE ☐ RECORD NAME OF YOUNGEST CHILD LIVING WITH HER AND CONTINUE WITH 558 (NAME)		→ 601

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
558	Now I would like to ask you about liquids or foods that (NAME FROM 557) had yesterday during the day or at night. I am interested in whether your child had the item I mention even if it was combined with other foods. Did (NAME FROM 557) (drink/eat):	YES NO DK	
	a) Plain water?	a) 1 2 8	
	b) Juice or juice drinks?	b) 1 2 8	
	d) Milk such as tinned, powdered, or fresh animal milk? IF YES: How many times did (NAME) drink milk? IF 7 OR MORE TIMES, RECORD '7'	d) 1 2 8 NUMBER OF TIMES DRANK MILK ☐	
	e) Infant formula like Lactogen? IF YES: How many times did (NAME) drink infant formula? IF 7 OR MORE TIMES, RECORD '7'	e) 1 2 8 NUMBER OF TIMES DRANK FORMULA ☐	
	f) Any other liquids?	f) 1 2 8	
	g) Yogurt? IF YES: How many times did (NAME) eat yogurt? IF 7 OR MORE TIMES, RECORD '7'	g) 1 2 8 NUMBER OF TIMES ATE YOGURT ☐	
	h) Any commercially fortified baby food like Cerelac?	h) 1 2 8	
	i) Bread, rice, noodles, porridge, or other foods made from grains?	i) 1 2 8	
	j) Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside?	j) 1 2 8	
	k) White potatoes, white yams, manioc, cassava, or any other foods made from roots?	k) 1 2 8	
	l) Any dark green, leafy vegetables like spinach, poi sag, methi, kolmi, kochu, palak?	l) 1 2 8	
	m) Ripe mangoes, papayas, ripe kathal, bangi or other Vitamin A rich fruits?	m) 1 2 8	
	n) Any other fruits like banana, grapes, apple, guava or other vegetables like cabbage, patal, kopi?	n) 1 2 8	
	o) Liver, kidney, heart or other organ meats?	o) 1 2 8	
	p) Any meat, such as beef, pork, lamb, goat, chicken, or duck?	p) 1 2 8	
	q) Eggs?	q) 1 2 8	
	r) Fish, shrimps or crab ?	r) 1 2 8	
	s) Any foods made from beans, peas, lentils, or nuts?	s) 1 2 8	
	t) Cheese or other food made from milk like paneer?	t) 1 2 8	
	u) Any other solid, semi-solid, or soft food (bengali sweets)?	u) 1 2 8	
559	CHECK 558 (CATEGORIES 'g" THROUGH 'u') : NOT A SINGLE "YES" ☐ ↓ AT LEAST ONE "YES" ☐ →		561

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
560	Did (NAME) eat any solid, semi-solid, or soft foods yesterday during the day or at night? IF 'YES' PROBE: What kind of solid, semi-solid or soft foods did (NAME) eat?	YES . . . . . 1 (GO BACK TO 558 TO RECORD FOOD EATEN YESTERDAY) NO . . . . . 2 → 601	
561	How many times did (NAME FROM 557) eat solid, semi-solid, or soft foods yesterday during the day or at night? IF 7 OR MORE TIMES, RECORD '7'	NUMBER OF TIMES . . . . . ☐ DON'T KNOW 8	

SECTION 6. MARRIAGE

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
601	CHECK 103A: CURRENTLY MARRIED ☐ SEPARATED/DESERTED DIVORCED/WIDOWED ☐ → 609		
604	Is your husband living with you now or is he staying elsewhere?	LIVING WITH HER . . . . . 1 STAYING ELSEWHERE 2	→ 605
604A	How often did he come home in the past 12 months?	NUMBER OF TIMES . . . . . ☐☐ DID NOT COME IN THE LAST 12 MONTHS 96	
605	RECORD THE HUSBAND'S/PARTNER'S NAME AND LINE NUMBER FROM THE HOUSEHOLD QUESTIONNAIRE. IF HE IS NOT LISTED IN THE HOUSEHOLD, RECORD '00'	NAME _____ LINE NO. . . . . ☐☐	
609	Have you been married only once or more than once?	ONLY ONCE . . . . . 1 MORE THAN ONCE 2	
610	CHECK 609: MARRIED ONLY ONCE ☐ In what month and year did you start living with your (husband/partner)? MARRIED MORE THAN ONCE ☐ Now I would like to ask about your first (husband/partner). In what month and year did you start living with him?	MONTH . . . . . ☐☐ DON'T KNOW MONTH . . . . . 98 YEAR . . . . . ☐☐☐☐ DON'T KNOW YEAR 9998	→ 612
611	How old were you when you first started living with him?	AGE . . . . . ☐☐	
612	CHECK FOR THE PRESENCE OF OTHERS. BEFORE CONTINUING, MAKE EVERY EFFORT TO ENSURE PRIVACY.		
613	Now I would like to ask some questions about sexual activity in order to gain a better understanding of some important life issues. How old were you when you had sexual intercourse for the very first first time?	NEVER HAD SEXUAL INTERCOURSE . . . . . 00 AGE IN YEARS . . . . . ☐☐ FIRST TIME WHEN STARTED LIVING WITH (FIRST) HUSBAND/PARTNER 95	→ 701
614	Now I would like to ask you some questions about your recent sexual activity. Let me assure you again that your answers are completely confidential and will not be told to anyone. If we should come to any question that you don't want to answer, just let me know and we will go to the next question.		
615	When was the last time you had sexual intercourse? IF LESS THAN 12 MONTHS, ANSWER MUST BE RECORDED IN DAYS, WEEKS OR MONTHS. IF 12 MONTHS (ONE YEAR) OR MORE, ANSWER MUST BE RECORDED IN YEARS.	DAYS AGO . . . . . 1 ☐☐ WEEKS AGO . . . . . 2 ☐☐ MONTHS AGO . . . . . 3 ☐☐ YEARS AGO . . . . . 4 ☐☐	→ 701
616	How many times during the last month did you have sexual intercourse? IF NON-NUMERIC ANSWER, PROBE TO GET AN ESTIMATE. IF NUMBER OF TIMES IS 95 OR MORE, WRITE '95'	NUMBER OF TIMES . . . . . ☐☐	

SECTION 7. FERTILITY PREFERENCES

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
701	CHECK 103A: CURRENTLY MARRIED ☐ SEPARATED/DESERTED DIVORCED/WIDOWED ☐ →		712
701A	CHECK 304: NEITHER STERILIZED ☐ HE OR SHE STERILIZED ☐ →		710
702	CHECK 226: PREGNANT ☐ NOT PREGNANT OR UNSURE ☐ →		704
703	Now I have some questions about the future. After the child you are expecting now, would you like to have another child, or would you prefer not to have any more children?	HAVE ANOTHER CHILD . . . . . 1 NO MORE . . . . . 2 UNDECIDED/DON'T KNOW 8	→ 705 → 711
704	Now I have some questions about the future. Would you like to have (a/another) child, or would you prefer not to have any (more) children?	HAVE (A/ANOTHER) CHILD . . . . . 1 NO MORE/NONE . . . . . 2 SAYS SHE CAN'T GET PREGNANT 3 UNDECIDED/DON'T KNOW 8	→ 707 → 712 → 710
705	CHECK 226: NOT PREGNANT OR UNSURE ☐ How long would you like to wait from now before the birth of (a/another) child? PREGNANT ☐ After the birth of the child you are expecting now, how long would you like to wait before the birth of another child?	MONTHS . . . . . 1 ☐☐ YEARS . . . . . 2 ☐☐ SOON/NOW . . . . . 993 SAYS SHE CAN'T GET PREGNANT 994 OTHER _____ 996 (SPECIFY) DON'T KNOW 998	→ 710 → 712 → 710
706	CHECK 226: NOT PREGNANT OR UNSURE ☐ PREGNANT ☐ →		711
707	CHECK 303: USING A CONTRACEPTIVE METHOD? NOT CURRENTLY USING ☐ CURRENTLY USING ☐ →		712
708	CHECK 705: NOT ASKED ☐ 24 OR MORE MONTHS OR 02 OR MORE YEARS ☐ 00-23 MONTHS OR 00-01 YEAR ☐ →		711

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
709	CHECK 703 AND 704: WANTS TO HAVE A/ANOTHER CHILD ⚑ ↓ You have said that you do not want (a/another) child soon. Can you tell me why you are not using a method to prevent pregnancy? Any other reason? WANTS NO MORE/ NONE ⚑ ↓ You have said that you do not want any (more) children. Can you tell me why you are not using a method to prevent pregnancy? Any other reason? RECORD ALL REASONS MENTIONED.	FERTILITY-RELATED REASONS NOT HAVING SEX . . . . . B INFREQUENT SEX . . . . . C MENOPAUSAL/HYSTERECTOMY D CAN'T GET PREGNANT . . . . . E NOT MENSTRUATED SINCE LAST BIRTH . . . . . F BREASTFEEDING . . . . . G UP TO GOD/FATALISTIC . . . . . H OPPOSITION TO USE RESPONDENT OPPOSED . . . . . I HUSBAND/PARTNER OPPOSED . . . J OTHERS OPPOSED . . . . . K RELIGIOUS PROHIBITION . . . . . L LACK OF KNOWLEDGE KNOWS NO METHOD . . . . . M KNOWS NO SOURCE . . . . . N METHOD-RELATED REASONS SIDE EFFECTS/HEALTH CONCERNS . . . . . O LACK OF ACCESS/TOO FAR . . . . . P COSTS TOO MUCH . . . . . Q PREFERRED METHOD NOT AVAILABLE . . . . . R NO METHOD AVAILABLE . . . . . S INCONVENIENT TO USE . . . . . T INTERFERES WITH BODY'S NORMAL PROCESSES . . . . . U OTHER _____ X (SPECIFY) DON'T KNOW . . . . . Z	
710	CHECK 301 3: USING A CONTRACEPTIVE METHOD? NOT ASKED ⚑ ↓ NOT CURRENTLY USING ⚑ ↓ CURRENTLY USING ☐ →		712
711	Do you think you will use a contraceptive method to delay or avoid pregnancy at any time in the future?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	→ 711B
711A	Which contraceptive method would you prefer to use?	FEMALE STERILIZATION . . . . . 01 MALE STERILIZATION . . . . . 02 IUD . . . . . 03 INJECTABLES . . . . . 04 IMPLANTS . . . . . 05 PILL . . . . . 06 CONDOM . . . . . 07 SAFE PERIOD . . . . . 12 WITHDRAWAL . . . . . 13 OTHER _____ 96 (SPECIFY) UNSURE 98	→ 712

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
711B	What is the main reason that you think you will not use a contraceptive method at any time in the future?	FERTILITY-RELATED REASONS INFREQUENT SEX/NO SEX . . . 22 MENOPAUSAL/HYSTERECTOMY 23 SUBFECUND/INFECUND . . . . . 24 WANTS AS MANY CHILDREN AS POSSIBLE . . . . . 26 OPPOSITION TO USE RESPONDENT OPPOSED . . . . . 31 HUSBAND/PARTNER OPPOSED 32 OTHERS OPPOSED . . . . . 33 RELIGIOUS PROHIBITION . . . . . 34 LACK OF KNOWLEDGE KNOWS NO METHOD . . . . . 41 KNOWS NO SOURCE . . . . . 42 METHOD-RELATED REASONS HEALTH CONCERNS . . . . . 51 FEAR OF SIDE EFFECTS . . . . . 52 LACK OF ACCESS/TOO FAR . . . 53 COSTS TOO MUCH . . . . . 54 INCONVENIENT TO USE . . . . . 55 INTERFERES WITH BODY'S NORMAL PROCESSES . . . . . 56 OTHER _____ 96 (SPECIFY) DON'T KNOW 98	
712	CHECK 216: HAS LIVING CHILDREN → If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be? NO LIVING CHILDREN → If you could choose exactly the number of children to have in your whole life, how many would that be? PROBE FOR A NUMERIC RESPONSE.	NONE 00	→714
		NUMBER	
		OTHER _____ 96 (SPECIFY)	→714
713	How many of these children would you like to be boys, how many would you like to be girls and for how many would it not matter if it's a boy or a girl?	BOYS GIRLS EITHER NUMBER	
		OTHER _____ 96 (SPECIFY)	
714	In the last month have you: Heard about family planning on the radio? Seen anything about family planning on the television? Read about family planning in a newspaper or magazine? Read about family planning in a poster, billboard or leaflet? Heard about family planning from a community event?	YES NO RADIO . . . . . 1 2 TELEVISION . . . . . 1 2 NEWSPAPER OR MAGAZINE . . . 1 2 POSTER/BILLBOARD . . . . . 1 2 COMMUNITY EVENT 1 2	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
714A	In the last month have you heard about family planning from any community health worker?	YES . . . . . 1 NO 2	→ 716
714B	Were these government or non-government worker?	GOVERNMENT . . . . . A NON-GOVERNMENT . . . . . B DON'T KNOW C	
716	CHECK 103A: YES, CURRENTLY MARRIED ☐↓ SEPARATED/DESERTED DIVORCED/WIDOWED ☐ → 801		
717	CHECK 303: USING A CONTRACEPTIVE METHOD? CURRENTLY USING ☐↓ NOT CURRENTLY USING OR NOT ASKED ☐ → 720		
718	Would you say that using contraception is mainly your decision, mainly your (husband's/partner's) decision, or did you both decide together?	MAINLY RESPONDENT . . . . . 1 MAINLY HUSBAND/PARTNER . . . . . 2 JOINT DECISION . . . . . 3 OTHER _____ 6 (SPECIFY)	
719	CHECK 304: NEITHER STERILIZED ☐↓ HE OR SHE STERILIZED ☐ → 801		
720	Does your (husband/partner) want the same number of children that you want, or does he want more or fewer than you want?	SAME NUMBER . . . . . 1 MORE CHILDREN . . . . . 2 FEWER CHILDREN . . . . . 3 DON'T KNOW 8	

SECTION 8. HUSBAND'S BACKGROUND AND WOMAN'S WORK

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
801	CHECK 103A: CURRENTLY MARRIED ☐ ↓ SEPARATED/DESERTED DIVORCED/WIDOWED ☐ →		803
802	How old was your (husband) on his last birthday?	AGE IN COMPLETED YEARS ☐☐	
803	Did your (last) (husband) ever attend school or madrasha?	YES . . . . . 1 NO 2	→ 806
803A	What type of schooling did your husband last attend?	SCHOOL . . . . . 1 MADRASHA 2	
804	What level of schooling did he last attend?	PRIMARY . . . . . 1 SECONDARY . . . . . 2 COLLEGE AND HIGHER 3	
805	What is the highest class he completed at that level?	CLASS . . . . . ☐☐	
806	CHECK 801: CURRENTLY MARRIED/ LIVING WITH A MAN ☐ ↓ What is your (husband's/ partner's) occupation? That is, what kind of work does he mainly do? FORMERLY MARRIED/ LIVED WITH A MAN ☐ ↓ What was your (last) (husband's/ partner's) occupation? That is, what kind of work did he mainly do?	☐☐ _____ _____ _____	
807	Aside from your own housework, have you done any work in the last seven days?	YES . . . . . 1 NO 2	→ 811
808	As you know, some women take up jobs for which they are paid in cash or kind. Others sell things, have a small business or work on the family farm or in the family business. In the last seven days, have you done any of these things or any other work?	YES . . . . . 1 NO 2	→ 811
809	Although you did not work in the last seven days, do you have any job or business from which you were absent for leave, illness, vacation, maternity leave, or any other such reason?	YES . . . . . 1 NO 2	→ 811
810	Have you done any work in the last 12 months?	YES . . . . . 1 NO 2	→ 815
811	What is your occupation, that is, what kind of work do you mainly mainly do?	☐☐ _____ _____ _____	
812	Do you do this work for a member of your family, for someone else, or are you self-employed?	FOR FAMILY MEMBER . . . . . 1 FOR SOMEONE ELSE . . . . . 2 SELF-EMPLOYED 3	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
813	Do you usually work throughout the year, or do you work seasonally, or only once in a while?	THROUGHOUT THE YEAR . . . . . 1 SEASONALLY/PART OF THE YEAR 2 ONCE IN A WHILE 3	
814	Are you paid in cash or kind for this work or are you not paid at all?	CASH ONLY . . . . . 1 CASH AND KIND . . . . . 2 IN KIND ONLY . . . . . 3 NOT PAID 4	
815	CHECK 10 3A: CURRENTLY MARRIED — SEPARATED/DESERTED DIVORCED/WIDOWED		→ 823A
816	CHECK 814: CODE 1 OR 2 CIRCLED — OTHER		→ 820
817	Who usually decides how the money you earn will be used: you, you, your husband, you and your husband jointly, or someone else?	RESPONDENT . . . . . 1 HUSBAND . . . . . 2 RESPONDENT AND HUSBAND JOINTLY . . . . . 3 OTHER _____ 6 (SPECIFY)	
820	Who usually makes decisions about health care for yourself: you, you, your husband, you and your husband jointly, or someone else?	RESPONDENT . . . . . 1 HUSBAND . . . . . 2 RESPONDENT AND HUSBAND JOINTLY . . . . . 3 SOMEONE ELSE . . . . . 4 OTHER 6	
821	Who usually makes decisions about making major household purchases?	RESPONDENT . . . . . 1 HUSBAND . . . . . 2 RESPONDENT AND HUSBAND JOINTLY . . . . . 3 SOMEONE ELSE . . . . . 4 OTHER 6	
822	Who usually makes decisions about visits to your family or relatives?	RESPONDENT . . . . . 1 HUSBAND . . . . . 2 RESPONDENT AND HUSBAND JOINTLY . . . . . 3 SOMEONE ELSE . . . . . 4 OTHER 6	
823	Who usually makes decisions about your child health care?	RESPONDENT . . . . . 1 HUSBAND . . . . . 2 RESPONDENT AND HUSBAND JOINTLY . . . . . 3 SOMEONE ELSE . . . . . 4 OTHER 6	
823A	Do you go to a health centre or hospital alone or with your young children?	YES, ALONE . . . . . 1 YES, WITH CHILDREN . . . . . 2 NO . . . . . 3 OTHER _____ 6 (SPECIFY)	→ 825

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
823B	Can you go to a health centre or hospital alone or with your young children?	YES, ALONE . . . . . 1 YES, WITH CHILDREN . . . . . 2 NO . . . . . 3 OTHER _____ 6 (SPECIFY)	
825	PRESENCE OF OTHERS AT THIS POINT (PRESENT AND LISTENING, PRESENT BUT NOT LISTENING, OR NOT PRESENT)	PRES./ LISTEN. / PRES./ NOT LISTEN. / NOT PRES. CHILDREN < 10 . . . . . 1 2 3 HUSBAND . . . . . 1 2 3 OTHER MALES . . . . . 1 2 3 OTHER FEMALES . . . 1 2 3	
826	In your opinion, is a husband justified in hitting or beating his wife in the following situations: If she goes out without telling him? If she neglects the children? If she argues with him? If she refuses to have sex with him? If she burns the food?	YES / NO / DK GOES OUT . . . . . 1 2 8 NEGL. CHILDREN . . . 1 2 8 ARGUES . . . . . 1 2 8 REFUSES SEX . . . . . 1 2 8 BURNS FOOD 1 2 8	

SECTION 9. HIV/AIDS

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
901	Now I would like to talk about something else. Have you ever heard of an illness called AIDS?	YES . . . . . 1 NO 2	→ 937
902	Can people reduce their chance of getting the AIDS virus by having just one uninfected sex partner who has no other sex partners?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
903	Can people get the AIDS virus from mosquito bites?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
904	Can people reduce their chance of getting the AIDS virus by using a condom every time they have sex?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
905	Can people get the AIDS virus by sharing food with a person who has AIDS?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
906	Can people get the AIDS virus because of witchcraft or other supernatural means?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
906A	Can people get the AIDS virus by using unsterilized needle or syringe?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
906B	Can people get the AIDS virus through unsafe blood transfusion?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
907	Is it possible for a healthy-looking person to have the AIDS virus?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
908	Can the virus that causes AIDS be transmitted from a mother to her baby: During pregnancy? During delivery? By breastfeeding?	YES NO DK DURING PREG. . . . . 1 2 8 DURING DELIVERY . . . 1 2 8 BREASTFEEDING . . . 1 2 8	
937	CHECK 901: HEARD ABOUT AIDS → Apart from AIDS, have you heard about other infections that can be transmitted through sexual contact? NOT HEARD ABOUT AIDS → Have you heard about infections that can be transmitted through sexual contact?	YES . . . . . 1 NO 2	
937A	Have you ever heard about: a) Syphilis? b) Gonorrhea?	YES NO SYPHILIS . . . . . 1 2 GONORRHEA 1 2	
938	CHECK 613: HAS HAD SEXUAL INTERCOURSE NEVER HAD SEXUAL INTERCOURSE		→ 945A

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
939	CHECK 937 and 937A: HEARD ABOUT OTHER SEXUALLY TRANSMITTED INFECTIONS? YES ☐ (↓) NO ☐ → 941		
940	Now I would like to ask you some questions about your health in the last 12 months. During the last 12 months, have you had a disease which you got through sexual contact?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
941	Sometimes women experience a bad-smelling abnormal genital discharge. During the last 12 months, have you had a bad-smelling abnormal genital discharge?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
942	Sometimes women have a genital sore or ulcer. During the last 12 months, have you had a genital sore or ulcer?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
943	CHECK 940, 941, AND 942 HAS HAD AN INFECTION (ANY 'YES') ☐ (↓) HAS NOT HAD AN INFECTION OR DOES NOT KNOW ☐ → 945A		
944	The last time you had (PROBLEM FROM 940/941/942), did you seek any kind of advice or treatment?	YES . . . . . 1 NO . . . . . 2 → 945A	
945	Where did you go? Any other place? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE(S))	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . . . A SPECIALIZED GOVT. HOSPITAL _____ (SPECIFY) B DISTRICT HOSPITAL . . . . . C MCWC . . . . . D UHC . . . . . E H&FWC . . . . . F SATELITE CLINIC/EPI OUTREACH SITE . . . . . G COMMUNITY CLINIC . . . . . H FAMILY WELFARE ASST. . . . . I OTHER _____ (SPECIFY) J NGO SECTOR NGO STATIC CLINIC . . . . . K NGO SATELLITE CLINIC . . . . . L NGO DEPO HOLDER . . . . . M NGO FIELD WORKER . . . . . N OTHER _____ (SPECIFY) O PRIVATE MEDICAL SECTOR PRIVATE HOSPITAL/CLINIC/ . . . . . P QUALIFIED DOCTOR . . . . . Q UNQUALIFIED DOCTOR . . . . . R PHARMACY/DRUG STORE . . . . . S PRIVATE MEDICAL COLLEGE HOSPITAL _____ (SPECIFY) T OTHER _____ (SPECIFY) U OTHER SOURCE OTHER _____ (SPECIFY) X	
945A	Husbands and wives do not always agree on everything. If a wife knows her husband has a disease that she can get during sexual intercourse, is she justified in refusing to have sex with him?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	

SECTION 10. FOOD SECURITY

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
10 01	How often did you eat three ¡square meals@(full stomach meals) a day in the past 12 months (not a festival day) ?	MOSTLY (3 MEALS EACH DAY) . . . 1 SOMETIMES (3 MEALS PER DAY) . . . . . 2 RARELY (3 MEALS PER DAY 1-6 TIMES THIS YEAR) . . . . . 3 NEVER 4	
10 02	In the last 12 months how often did you yourself skip entire meals because there was not enough food?	NEVER . . . . . 1 RARELY (1-6 TIMES THIS YEAR) . . . 2 SOMETIMES (7-12 TIMES THIS YEAR) 3 OFTEN (FEW TIMES EACH MONTH) . 4	
10 03	In the last 12 months how often did you personally eat less food in a meal because there was not enough food?	NEVER . . . . . 1 RARELY (1-6 TIMES THIS YEAR) . . . 2 SOMETIMES (7-12 TIMES THIS YEAR) 3 OFTEN (FEW TIMES EACH MONTH) . 4	
10 04	In the last 12 months, how often did you or any of your family have to eat wheat (or another grain) although you wanted to eat rice (not including when you were sick)?	NEVER . . . . . 1 RARELY (1-6 TIMES THIS YEAR) . . . 2 SOMETIMES (7-12 TIMES THIS YEAR) 3 OFTEN (FEW TIMES EACH MONTH) . 4	
10 05	In the past 12 months how often did your family have to ask food from relatives or neighbors to make a meal?	NEVER . . . . . 1 RARELY (1-6 TIMES THIS YEAR) . . . 2 SOMETIMES (7-12 TIMES THIS YEAR) 3 OFTEN (FEW TIMES EACH MONTH) . 4	
10 06	RECORD THE TIME.	HOUR . . . . . [ ][ ] MINUTES . . . . . [ ][ ]	

INTERVIEWER'S OBSERVATIONS

TO BE FILLED IN AFTER COMPLETING INTERVIEW

COMMENTS ABOUT RESPONDENT:

COMMENTS ON SPECIFIC QUESTIONS:

ANY OTHER COMMENTS:

SUPERVISOR'S OBSERVATIONS

NAME OF SUPERVISOR: _____ DATE: _____

EDITOR'S OBSERVATIONS

NAME OF EDITOR: _____ DATE: _____

INSTRUCTIONS:
ONLY ONE CODE SHOULD APPEAR IN ANY BOX.
COLUMN 1 REQUIRES A CODE IN EVERY MONTH.

INFORMATION TO BE CODED FOR EACH COLUMN

COLUMN 1: BIRTHS, PREGNANCIES, CONTRACEPTIVE USE**

- B BIRTHS
- P PREGNANCIES
- T TERMINATIONS

- 0 NO METHOD
- 1 FEMALE STERILIZATION
- 2 MALE STERILIZATION
- 3 IUD
- 4 INJECTABLES
- 5 IMPLANTS
- 6 PILL
- 7 CONDOM
- L RHYTHM METHOD
- M WITHDRAWAL

- X OTHER _____ (SPECIFY)

COLUMN 2 DISCONTINUATION OF CONTRACEPTIVE USE

- 0 INFREQUENT SEX/ HUSBAND AWAY
- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND/PARTNER DISAPPROVED
- 4 WANTED MORE EFFECTIVE METHOD
- 5 SIDE EFFECTS/ HEALTH CONCERNS
- 6 LACK OF ACCESS/TOO FAR
- 7 COSTS TOO MUCH
- 8 INCONVENIENT TO USE
- F UP TO GOD/FATALISTIC
- A DIFFICULT TO GET PREGNANT/MENOPAUSAL
- D MARITAL DISSOLUTION/SEPARATION
- X OTHER _____ (SPECIFY)
- Z DON'T KNOW

				1	2	
	12	DEC	01			
	11	NOV	02			
	10	OCT	03			
	09	SEP	04			
2	08	AUG	05			2
0	07	JUL	06			0
1	06	JUN	07			1
1	05	MAY	08			1
	04	APR	09			
	03	MAR	10			
	02	FEB	11			
	01	JAN	12			
	12	DEC	13			
	11	NOV	14			
	10	OCT	15			
	09	SEP	16			
2	08	AUG	17			2
0	07	JUL	18			0
1	06	JUN	19			1
0	05	MAY	20			0
	04	APR	21			
	03	MAR	22			
	02	FEB	23			
	01	JAN	24			
	12	DEC	25			
	11	NOV	26			
	10	OCT	27			
	09	SEP	28			
2	08	AUG	29			2
0	07	JUL	30			0
0	06	JUN	31			0
9	05	MAY	32			9
	04	APR	33			
	03	MAR	34			
	02	FEB	35			
	01	JAN	36			
	12	DEC	37			
	11	NOV	38			
	10	OCT	39			
	09	SEP	40			
2	08	AUG	41			2
0	07	JUL	42			0
0	06	JUN	43			0
8	05	MAY	44			8
	04	APR	45			
	03	MAR	46			
	02	FEB	47			
	01	JAN	48			
	12	DEC	49			
	11	NOV	50			
	10	OCT	51			
	09	SEP	52			
2	08	AUG	53			2
0	07	JUL	54			0
0	06	JUN	55			0
7	05	MAY	56			7
	04	APR	57			
	03	MAR	58			
	02	FEB	59			
	01	JAN	60			
	12	DEC	61			
	11	NOV	62			
	10	OCT	63			
	09	SEP	64			
2	08	AUG	65			2
0	07	JUL	66			0
0	06	JUN	67			0
6	05	MAY	68			6
	04	APR	69			
	03	MAR	70			
	02	FEB	71			
	01	JAN	72			

2011 BANGLADESH DEMOGRAPHIC AND HEALTH SURVEYS
MAN'S QUESTIONNAIRE

NIPORT, MOHFW, and
Mitra and Associates

IDENTIFICATION	
CLUSTER NUMBER	
HOUSEHOLD NUMBER	
NAME OF THE HOUSEHOLD HEAD _____	
NAME AND LINE NUMBER OF MAN _____	

INTERVIEWER VISITS				
	1	2	3	FINAL VISIT
DATE				DAY / MONTH / YEAR 2011
INTERVIEWER'S NAME				INT. NUMBER
RESULT*				RESULT
NEXT VISIT: DATE				TOTAL NUMBER OF VISITS
TIME				

*RESULT CODES:
1 COMPLETED 4 REFUSED
2 NOT AT HOME 5 PARTLY COMPLETED 7 OTHER _____ (SPECIFY)
3 POSTPONED 6 INCAPACITATED

SUPERVISOR	FIELD EDITOR	OFFICE EDITOR	KEYED BY
NAME _____	NAME _____		
DATE _____	DATE _____		

SECTION 1. RESPONDENT'S BACKGROUND

INTRODUCTION AND CONSENT

INFORMED CONSENT

Hello. My name is _____. I am working with NIPORT, the Ministry of Health and Family Welfare and Mitra Associates, a private research company in Dhaka. We are conducting a survey about health all over Bangladesh. The information we collect will help the government to plan health services. Your household was selected for the survey. The questions usually take about 20 minutes. All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.

In case you need more information about the survey, you may contact the person listed on the card that has already been given to your household.

Do you have any questions? May I begin the interview now?

SIGNATURE OF INTERVIEWER: _____ DATE: _____

RESPONDENT AGREES TO BE INTERVIEWED ..... 1 ↓ RESPONDENT DOES NOT AGREE TO BE INTERVIEWED ... 2 → END

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
101	RECORD THE TIME.	HOUR ..... [ ][ ] MINUTES ..... [ ][ ]	
102	In what month and year were you born?	MONTH ..... [ ][ ] DON'T KNOW MONTH ..... 98 YEAR ..... [ ][ ][ ][ ] DON'T KNOW YEAR 9998	
103	How old were you at your last birthday? COMPARE AND CORRECT 102 AND/ OR 103 IF INCONSISTENT.	AGE IN COMPLETED YEARS [ ][ ]	
103A	Are you now married, separated, deserted, widowed, divorced or have you never been married?	CURRENTLY MARRIED ..... 1 SEPARATED ..... 2 DESERTED ..... 3 DIVORCED ..... 4 WIDOWED ..... 5 NEVER MARRIED 6	→ END
104	Have you ever attended school/ madrasha?	YES ..... 1 NO 2	→ 108
104A	What type of school have you last attended?	SCHOOL ..... 1 MADRASHA 2	
105	What is the highest level of school you attended: primary, secondary, or college and higher?	PRIMARY ..... 1 SECONDARY ..... 2 COLLEGE AND HIGHER 3	
106	What is the highest class you completed at that level?	CLASS ..... [ ][ ]	

107	CHECK 105: PRIMARY ☐ SECONDARY OR HIGHER ☐ → 110		
108	Now I would like you to read this sentence to me. SHOW CARD TO RESPONDENT. IF RESPONDENT CANNOT READ WHOLE SENTENCE, PROBE: Can you read any part of the sentence to me?	CANNOT READ AT ALL . . . . . 1 ABLE TO READ ONLY PARTS OF SENTENCE . . . . . 2 ABLE TO READ WHOLE SENTENCE. . 3 NO CARD WITH REQUIRED LANGUAGE _____ 4 (SPECIFY LANGUAGE) BLIND/VISUALLY IMPAIRED 5	
109	CHECK 108: CODE 1, 2 OR 3 CIRCLED ☐ CODE 4 OR 5 CIRCLED ☐ → 111		
110	Do you read a newspaper or magazine, at least once a week, less than once a week or not at all?	AT LEAST ONCE A WEEK . . . . . 1 LESS THAN ONCE A WEEK . . . . . 2 NOT AT ALL 3	
111	Do you listen to the radio, at least once a week, less than once a week or not at all?	AT LEAST ONCE A WEEK . . . . . 1 LESS THAN ONCE A WEEK . . . . . 2 NOT AT ALL 3	
112	Do you watch television, at least once a week, less than once a week or not at all?	AT LEAST ONCE A WEEK . . . . . 1 LESS THAN ONCE A WEEK . . . . . 2 NOT AT ALL 3	
113	What is your religion?	ISLAM . . . . . 1 HINDUISM . . . . . 2 BUDDHISM . . . . . 3 CHRISTIANITY . . . . . 4 OTHER _____ 6 (SPECIFY)	
114	Are you currently working?	YES . . . . . 1 NO 2	→ 119
115	What is your occupation, that is, what kind of work do you mainly do?	_____ ☐☐ _____ _____	
116	Do you usually work throughout the year, or do you work seasonally, or only once in a while?	THROUGHOUT THE YEAR . . . . . 1 SEASONALLY/PART OF THE YEAR . 2 ONCE IN A WHILE 3	→ 118
117	During the last 12 months, how many months did you work?	NUMBER OF MONTHS . . . . . ☐☐	
118	Do you think that your earning is sufficient, moderately sufficient, or not sufficient to provide for your family's basic needs?	SUFFICIENT . . . . . 1 MODERATELY SUFFICIENT . . . . . 2 NOT SUFFICIENT 3	→ 201
119	Have you done any work in the last 12 months?	YES . . . . . 1 NO 2	→ 201
120	What have you been doing over the last 12 months?	GOING TO SCHOOL . . . . . 1 LOOKING FOR WORK . . . . . 2 INACTIVE . . . . . 3 COULD NOT WORK/HANDICAPPED 4 OTHER _____ 6 (SPECIFY)	

SECTION 2 MARRIAGE

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
201	CHECK 103A: CURRENTLY MARRIED ☐ NOT CURRENTLY MARRIED (SEPARATED/DESERTED DIVORCED/WIDOWED) ☐	→ 207	
202	Is your wife staying with you now or is she staying elsewhere?	STAYING WITH HIM . . . . . 1 STAYING ELSEWHERE 2	
203	Do you currently have one wife or more than one wife?	ONE WIFE . . . . . 1 MORE THAN ONE WIFE 2	→ 205
204	Altogether, how many wives do you have?	TOTAL NUMBER OF WIVES . . . . . ☐☐	
205	CHECK 203: ONE WIFE ☐ Please tell me the name of your wife. MORE THAN ONE WIFE ☐ Please tell me the name of each of your current wives . RECORD THE NAME AND THE LINE NUMBER FROM THE HOUSEHOLD QUESTIONNAIRE FOR EACH WIFE AND LIVE-IN PARTNER. IF A WOMAN IS NOT LISTED IN THE HOUSEHOLD, RECORD ©00© 206 ASK 206 FOR EACH PERSON.	NAME _____ LINE NUMBER ☐☐ 206 How old was (NAME) on her last birthday? AGE ☐☐	
206A	CHECK 203: ONE WIFE ☐ MORE THAN ONE WIFE ☐	→ 208A	
207	Have you been married only once or more than once?	ONLY ONCE . . . . . 1 MORE THAN ONCE 2	→ 208A
208	In what month and year did you start living with your wife?	MONTH . . . . . ☐☐ DON'T KNOW MONTH 98	
208A	Now I would like to ask about your first wife. In what month and year did you start living with her?	YEAR . . . . . ☐☐☐☐ DON'T KNOW YEAR 9998	→ 210
209	How old were you when you started living with her?	AGE . . . . . ☐☐	
210	CHECK FOR THE PRESENCE OF OTHERS. BEFORE CONTINUING, MAKE EVERY EFFORT TO ENSURE PRIVACY.		
211	Now I would like to ask you some questions about sexual activity in order to gain a better understanding of some important life issues. How old were you when you had sexual intercourse for the very first time?	NEVER HAD SEXUAL INTERCOURSE . . . . . 00 AGE IN YEARS . . . . . ☐☐ FIRST TIME WHEN STARTED LIVING WITH (FIRST) WIFE 95	

SECTION 3. FERTILITY PREFERENCES

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
301	CHECK 203: ONE OR MORE WIVES ☐ QUESTION NOT ASKED ☐ → 307		
302	(Is your wife /Are any of your wives) currently pregnant?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
303	CHECK 302: NO WIFE PREGNANT OR DON'T KNOW ☐ WIFE(WIVES) PREGNANT ☐ Now I have some questions about the future. Would you like to have (a/another) child, or would you prefer not to have any (more) children? Now I have some questions about the future. After the child(ren) you and your (wife/wives) are expecting now, would you like to have another child, or would you prefer not to have any more children?	HAVE (A/ANOTHER) CHILD . . . . . 1 NO MORE/NONE . . . . . 2 COUPLE INFECUND . . . . . 3 WIFE (WIVES) STERILIZED . . . . . 4 RESPONDENT STERILIZED . . . . . 5 UNDECIDED/ DON'T KNOW 8	→ 307
304	CHECK 205: ONE WIFE ☐ MORE THAN ONE WIFE ☐ → 306		
305	CHECK 303: WIFE NOT PREGNANT OR DON'T KNOW ☐ WIFE PREGNANT ☐ How long would you like to wait from now before the birth of (a/another) child? After the birth of the child you are expecting now, how long would you like to wait before the birth of another child?	MONTHS . . . . . 1 ☐☐ YEARS . . . . . 2 ☐☐ SOON/NOW . . . . . 993 COUPLE INFECUND . . . . . 994 OTHER _____ 996 (SPECIFY) DON'T KNOW 998	→ 307
306	How long would you like to wait from now before the birth of (a/another) child?	MONTHS . . . . . 1 ☐☐ YEARS . . . . . 2 ☐☐ SOON/NOW . . . . . 993 HE/ALL HIS WIVES ARE INFECUND . . . . . 994 OTHER _____ 996 (SPECIFY) DON'T KNOW 998	
307	Do you have any living children?	YES . . . . . 1 NO 2	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
308	CHECK 307: HAS LIVING CHILDREN → If you could go back to the time you did not have any children and could choose exactly the number of children to have in your whole life, how many would that be? NO LIVING CHILDREN → If you could choose exactly the number of children to have in your whole life, how many would that be? PROBE FOR A NUMERIC RESPONSE.	NONE . . . . . 00 NUMBER . . . . . [ ][ ] OTHER _____ 96 (SPECIFY)	→310 →310
309	How many of these children would you like to be boys, how many would you like to be girls and for how many would the sex not matter?	BOYS GIRLS EITHER NUMBER [ ][ ][ ][ ][ ][ ] OTHER _____ 96 (SPECIFY)	
310	In the last month have you:	YES NO	
	Heard about family planning on the radio?	RADIO 1 2	
	Seen shows about family planning on the television?	TELEVISION 1 2	
	Read about family planning in a newspaper or magazine?	NEWSPAPER OR MAGAZINE . 1 2	
	Read about family planning in a poster, billboard or leaflet?	POSTER/BILLBOARD 1 2	
	Heard about family planning from a community event?	COMMUNITY EVENT 1 2	
311	In the last month have you heard about family planning from any community health workers?	YES . . . . . 1 NO 2	 →313
312	Were these government or non-government worker?	GOVERNMENT . . . . . A NON-GOVERNMENT . . . . . B DON'T KNOW C	
313	I will now read you some statements about contraception. Please tell me if you agree or disagree with each one.	AGREE DISAGREE DK	
	a) Contraception is women's business and a man should not have to worry about it.	CONTRACEPTION WOMAN'S BUSINESS . 1 2 8	
	b) Women who use contraception may become promiscuous.	WOMAN MAY BECOME PROMISCUOUS . . . 1 2 8	

SECTION 5. PARTICIPATION IN HEALTH CARE

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
502	Do you think that women need to have a medical checkup when they are pregnant even if they are not sick?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	→ 504
503	At what month of pregnancy do you think that women need to have their first checkup?	MONTH ☐☐ DON'T KNOW 98	
504	During their pregnancy, do you think that women need to eat more, the same, or less than they did before their pregnancy?	MORE . . . . . 1 SAME . . . . . 2 LESS . . . . . 3 DON'T KNOW 8	
505	CHECK 307: HAS LIVING CHILDREN ☐ ↓ DOES NOT HAVE LIVING CHILDREN ☐ →		→ 601
506	How many years old is your youngest child?	AGE IN YEARS ☐☐	
507	CHECK 506: YOUNGEST CHILD IS 0-3 YEARS OLD ☐ ↓ YOUNGEST CHILD 4 YEARS OR OLDER ☐ →		→ 601
508	What is the name of your youngest child? WRITE NAME OF YOUNGEST CHILD _____ (NAME OF YOUNGEST CHILD)		
509	Did your wife go to a health facility for antenatal care when she was pregnant with (NAME OF YOUNGEST CHILD)?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	→ 511
510	Did any medical persons such as a doctor, nurse, FWV or others visit your wife when she was pregnant with (NAME)?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	→ 512

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
511	Were you present during any of the antenatal care visits?	YES . . . . . 1 NO 2	
512	At any time during this pregnancy, did any medical person s such as a doctor, nurse, FWV or others talk to you about this particular pregnancy?	YES . . . . . 1 NO 2	
513	At any time during this pregnancy, did you ever talk with your wife about what the medical persons such as a doctor, nurse FWV or others told her about her own health or that of the babyÕs health?	YES . . . . . 1 NO 2	
514	Where did your wife give birth to (NAME)?	HOME OWN HOME . . . . . 11 PUBLIC SECTOR HOSP./MEDICAL COLLEGE . . . . . 21 SPE. MED. COLLEGE _____ 22 (SPECIFY) DISTRICT HOSPITAL . . . . . 23 MCWC . . . . . 24 UPAZILLA HEALTH COMPLEX . . . . . 25 H & FAMILY WELFARE CENTRE . . . . . 26 NGO SECTOR NGO STATIC CLINIC . . . . . 31 OTHER _____ 36 (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/CLINIC . . . . . 41 PVT. MED. COLLEGE HOSPITAL. _____ 42 (SPECIFY) OTHER _____ 96 (SPECIFY)	
515	Were you present at the birth of (NAME) in (NAME OF PLACE IN 514) ?	YES . . . . . 1 NO 2	
516	In the first two months after (NAME) was born, did your wife visit a health facility to have her own health or the babyÕs health checked?	YES . . . . . 1 NO . . . . . 2 DONÕT KNOW 8	→ 518
517	In the first two months after (NAME) was born, did a medical person such as a doctor, nurse, FWV or others make a visit to check on your wifeÕs or babyÕs health?	YES . . . . . 1 NO . . . . . 2 DONÕT KNOW 8	→ 519
518	Were you present during any of the visits?	YES . . . . . 1 NO 2	
519	Did (NAME OF THE YOUNGEST CHILD) ever receive any vaccinations to prevent him/her from getting diseases?	YES . . . . . 1 NO . . . . . 2 DONÕT KNOW 8	→ 601
520	Did you take (NAME) to be vaccinated at any time?	YES . . . . . 1 NO 2	

SECTION 6. HIV/AIDS AND STI

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
601	Now I would like to talk about something else. Have you ever heard of an illness called AIDS?	YES . . . . . 1 NO 2	→613
602	Can people reduce their chance of getting the AIDS virus by having just one uninfected sex partner who has no other sex partners?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
603	Can people get the AIDS virus from mosquito bites?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
604	Can people reduce their chance of getting the AIDS virus by using a condom every time they have sex?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
605	Can people get the AIDS virus by sharing food with a person who has AIDS?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
606A	Can people get the AIDS virus because of witchcraft or other supernatural means?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
606B	Can people get the AIDS virus by using unsterilized needle or syringe?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
606C	Can people get the AIDS virus through unsafe blood transfusions?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
608	Is it possible for a healthy-looking person to have the AIDS virus?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
613	CHECK 601: HEARD ABOUT AIDS → Apart from AIDS, have you heard about other infections that can be transmitted through sexual contact? NOT HEARD ABOUT AIDS → Have you heard about infections that can be transmitted through sexual contact?	YES . . . . . 1 NO 2	
613A	Have you heard about: a) Syphilis? b) Gonorrhea?	YES NO SYPHILIS 1 2 GONORRHEA 1 2	
614	CHECK 211: HAS HAD SEXUAL INTERCOURSE NEVER HAD SEXUAL INTERCOURSE →		→622
615	CHECK 613/ 613A: HEARD ABOUT OTHER SEXUALLY TRANSMITTED INFECTIONS? YES NO →		→617
616	Now I would like to ask you some questions about your health in the last 12 months. During the last 12 months, have you had a disease which you got through sexual contact?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
617	Sometimes men experience an abnormal discharge from their penis. During the last 12 months, have you had a discharge from your penis?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
618	Sometimes men experience a sore or ulcear on or near their penis. During the last 12 months, have you had a sore or ulcer on or near your penis?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
618A	During the last 12 months, have you had pain or burning sensation during urination?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
619	CHECK 616, 617, 618 AND 618A HAS HAD AN INFECTION ("YES" IN ANY) HAS NOT HAD AN INFECTION OR DOES NOT KNOW		→ 622
620	The last time you had (PROBLEM FROM 616, 617, 618 and 618A) , did you seek any kind of advice or treatment?	YES . . . . . 1 NO 2	→ 622
621	Where did you go? Any other place? PROBE TO IDENTIFY EACH TYPE OF SOURCE AND CIRCLE THE APPROPRIATE CODE(S). IF UNABLE TO DETERMINE IF HOSPITAL, HEALTH CENTER VCT CENTER, OR CLINIC IS PUBLIC OR PRIVATE MEDICAL, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE(S))	PUBLIC SECTOR MEDICAL COLLEGE HOSPITAL . . . . . A SPECIALIZED GOVT. HOSPITAL _____ B (SPECIFY) DISTRICT HOSPITAL . . . . . C MCWC . . . . . D UHC . . . . . E H&FWC . . . . . F SATELITE CLINIC/EPI OUTREACH SITE . . . . . G COMMUNITY CLINIC . . . . . H FAMILY WELFARE ASST. . . . . I OTHER _____ J (SPECIFY) NGO SECTOR NGO STATIC CLINIC . . . . . K NGO SATELLITE CLINIC . . . . . L NGO DEPO HOLDER . . . . . M NGO FIELD WORKER . . . . . N OTHER _____ O (SPECIFY) PRIVATE MEDICAL SECTOR PRIVATE HOSPITAL/CLINIC/ . . . . . P QUALIFIED DOCTOR . . . . . Q UNQUALIFIED DOCTOR . . . . . R PHARMACY/DRUG STORE . . . . . S PRIVATE MEDICAL COLLEGE HOSPITAL _____ T (SPECIFY) OTHER _____ U (SPECIFY) OTHER SOURCE OTHER _____ X (SPECIFY)	
622	Husbands and wives do not always agree on everything. If a wife knows her husband has a disease that she can get during sexual intercourse, is she justified in refusing to have sex with him?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
623	Is a wife justified in refusing to have sex with her husband when she knows her husband has sex with other women?	YES . . . . . 1 NO . . . . . 2 DON'T KNOW 8	
624	RECORD THE TIME.	HOUR . . . . . ☐☐ MINUTES . . . . . ☐☐	

INTERVIEWER'S OBSERVATIONS

TO BE FILLED IN AFTER COMPLETING INTERVIEW

COMMENTS ABOUT RESPONDENT:

COMMENTS ON SPECIFIC QUESTIONS:

ANY OTHER COMMENTS:

SUPERVISOR'S OBSERVATIONS

NAME OF SUPERVISOR: _____ DATE: _____

EDITOR'S OBSERVATIONS

NAME OF EDITOR: _____ DATE: _____

Appendix 2:
Ethics Approval

From: Research.Ethics@uts.edu.au

Date:05/05/2015 3:10 PM (GMT+10:00)

To: Tasnima.Akter@student.uts.edu.au, David.Sibbritt@uts.edu.au, Angela.Dawson@uts.edu.au, Research.Ethics@uts.edu.au

Subject: UTS HREC Letter of Noting

Dear Applicant,

The Faculty has considered your Nil/Negligible Risk Declaration Form for your project titled, "Neonatal mortality in low and lower-middle income countries: which areas require further attention?", and agree your research does not require review from the UTS Human Research Ethics Committee. Please keep a copy of your Declaration form on file to show you have considered risk.

For tracking purposes, you have been provided with an ethics application number, which is UTS HREC 2015000228.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

You should consider this your official letter of noting.

Instructions for saving the declaration form can be downloaded from:
http://www.research.uts.edu.au/policies/restricted/human/forms.html#instructions

To access this application, please follow the URLs below:
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If you or anyone connected with this research have any queries please do not hesitate to contact Research.Ethics@uts.edu.au

Yours sincerely,

Professor Marion Haas
Chairperson
UTS Human Research Ethics Committee
C/- Research & Innovation Office
University of Technology, Sydney
E: Research.Ethics@uts.edu.au
I: http://www.research.uts.edu.au/policies/restricted/ethics.html
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Title: Workforce Interventions to Deliver Postnatal Care to Improve Neonatal Outcomes in Low- and Lower-Middle-Income Countries

Author: Tasnima Akter, David Sibbritt, Angela Dawson

Publication: ASIA-PACIFIC JOURNAL OF PUBLIC HEALTH

Publisher: SAGE Publications

Date: 11/01/2016

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Title: What impact do essential newborn care practices have on neonatal mortality in low and lower-middle income countries[quest] Evidence from Bangladesh

Author: T Akter, A Dawson, D Sibbritt and

Publication: Journal of Perinatology

Publisher: Nature Publishing Group

Date: Mar 1, 2016

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Title:	The determinants of essential newborn care for home births in Bangladesh
Author:	T. Akter,A. Dawson,D. Sibbritt
Publication:	Public Health
Publisher:	Elsevier
Date:	December 2016

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Title: What impact does antenatal and postnatal care have on neonatal deaths in low- and lower-middle-income countries? Evidence from Bangladesh

Author: Tasnima Akter, Angela Dawson, David Sibbritt

Publication: Health Care for Women International

Publisher: Taylor & Francis

Date: Aug 3, 2017

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