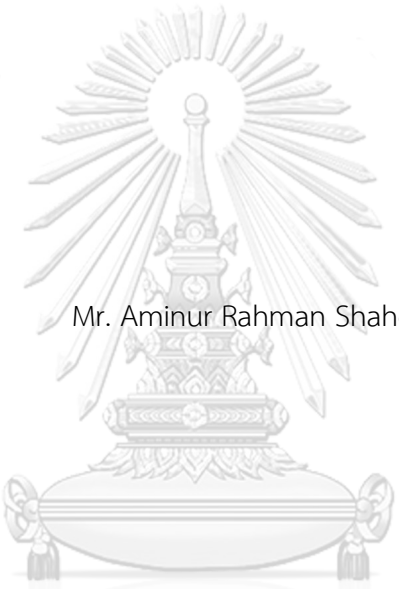
Pregnancy outcome and exclusive breastfeeding status among adolescent mother in Matlab, Bangladesh: A retrospective cohort study

Mr. Aminur Rahman Shaheen



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ผลลัพธ์ของการตั้งครรภ์และการเลี้ยงบุตรด้วยนมมารดาอย่างเดียวของมารดาวัยรุ่นในเมืองแมทแลป ประเทศบังคลาเทศ: การศึกษาวิจัยแบบเชิงวิเคราะห์แบบเก็บข้อมูลกลุ่มย้อนหลัง

นายอไมเนอร์ ราแมน ชาฮีน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรดุษฎีบัณฑิต
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Thesis Title	Pregnancy outcome and exclusive breastfeeding status among a dolescent mother in Matlab, Bangladesh: A retrospective cohort study
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ผลลัพธ์ของการตั้งครรภ์และการเลี้ยงบุตรด้วยนมมารดาอย่างเดียวของมารดาวัยรุ่นในเมืองแมทแลปประเทศบังคลาเทศ: การศึกษาวิจัยแบบเชิงวิเคราะห์แบบเก็บข้อมูลกลุ่มย้อนหลัง. (

Pregnancy outcome and exclusive breastfeeding status among adolescent mother in Matlab, Bangladesh: A retrospective cohort study) อ.ที่ปรึกษาหลัก : สุรศักดิ์ ฐานีพานิชสกุล

ความเป็นมา: วัยรุ่นสิบหกล้านคนให้กำเนิดในแต่ละปีคิดเป็น 11% ของการเกิดทั้งหมดทั่วโลกส่วนใหญ่ในประเทศที่มีรายได้ต่ำและปานกลาง การให้นมแม่แบบเอกสิทธิ์เฉพาะบุคคล (EBF) เป็นเงินช่วยเหลือที่จัดตั้งขึ้นสำหรับทั้งแม่และทารก บทความนี้รายงานเกี่ยวกับแนวโน้มในการตั้งครรภ์ของวัยรุ่นและผลลัพธ์ที่ไม่พึงประสงค์ที่เกี่ยวข้อง ANC การส่งมอบสิ่งอำนวยความสะดวกการปฏิบัติของ EBF ใน Matlab, บังคลาเทศ วิธีการ: ใช้มารดาวัยรุ่นวัยรุ่นรวม 5,774 คนในฐานข้อมูล HDSS ระหว่างปี 2550 ถึง 2558 ข้อมูลเหล่านี้ถูกนำมาใช้เพื่อตรวจสอบแนวโน้มการเป็นมารดาของวัยรุ่นใน icddr, b พื้นที่บริการ (ISA) และพื้นที่ให้บริการของรัฐ (GSA) ระหว่างปี 2550 ถึง 2558 รวมถึงมารดาวัยรุ่น 4,996 คนในการวิเคราะห์ส่วนปริกำเนิดและฝากครรภ์ การทดสอบไคสแควร์และการถดถอยโลจิสติกแบบไบนารีถูกใช้เพื่อบันทึกความแตกต่างทางสถิติเกี่ยวกับตัวบ่งชี้ผลลัพธ์ในพื้นที่ศึกษาสองแห่ง ผลลัพธ์: อัตราการเกิดของประชากร 27 ใน ISA และ 20 ใน GSA ต่อมารดาวัยรุ่น 1,000 คนในช่วงระยะเวลาการศึกษา อัตราต่อรองที่ปรับของมารดาวัยรุ่นที่เสียชีวิตจากปริกำเนิดใน ISA เทียบกับ GSA เท่ากับ 0.69 อัตราต่อรองที่ปรับของแม่วัยรุ่นที่เข้าถึงการเยี่ยมชม 4+ ANC ใน GSA คือ 0.57 เทียบกับ ISA และของวัยรุ่นที่เข้าถึงการส่งมอบสิ่งอำนวยความสะดวกใน ISA คือ 6.63 เทียบกับ GSA อุบัติการณ์ของการทำแท้งในกลุ่มมารดาวัยรุ่นลดลง 18% ใน ISA เมื่อเทียบกับ GSA ความชุกของ EBF ต่อเนื่องลดลงอย่างมีนัยสำคัญสำหรับแม่วัยรุ่นที่อาศัยอยู่ใน GSA เมื่อเทียบกับแม่วัยรุ่นที่อาศัยอยู่ใน ISA สรุป: การตายปริกำเนิดและการทำแท้งใน ISA ต่ำกว่า GSA และอัตราการเยี่ยมชม ANC มากกว่า 4 ครั้งการส่งมอบสิ่งอำนวยความสะดวกและ EBF ในกลุ่มมารดาวัยรุ่นใน ISA มากกว่า GSA ระบุว่าการแทรกแซงที่ริเริ่มโดย icddr, b มีประสิทธิภาพในการปรับปรุงผลลัพธ์ของมารดาและทารกแรกเกิด

สาขาวิชา	สาธารณสุขศาสตร์	ลายมือชื่อนิสิต .....
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Aminur Rahman Shaheen :

Pregnancy outcome and exclusive breastfeeding status among adolescent mother in Matlab, Bangl adesh: A retrospective cohort study. Advisor: Prof. SURASAK TANEEPANICHSKUL, MD

Background: Sixteen million adolescents give birth each year, constituting 11% of all births world-wide, mostly in low- and middle- income countries. Exclusive breastfeeding (EBF) is an established subsidy for both mothers and infants but unfortunately the rate of breastfeeding among adolescent mothers is lowest worldwide. This paper reports on trends in adolescent pregnancy and associated adverse birth outcomes, ANC, facility delivery, practice of EBF in Matlab, Bangladesh. Methods: Total 5,774 adolescent mothers in the HDSS database between 2007 and 2015 were used as the study population. These data were used to examine trends in adolescent motherhood in the icddr,b service areas (ISA) and government service areas (GSA) between 2007 and 2015. Total 4,996 adolescent mothers were included in the analysis of perinatal and antenatal part. Chi-square tests and Binary logistic regression was used to document the statistical difference on outcome indicators in the two study areas. Results: The fertility rate was 27 in ISA and 20 in GSA per 1000 adolescent mothers, during the study period. The adjusted odds of an adolescent mother having a perinatal death in ISA, relative to GSA was 0.69. The adjusted odds of an adolescent mother accessing 4+ ANC visits in the GSA was 0.57 relative to ISA and that of an adolescent mother accessing facility-based delivery in the ISA was 6.63 relative to GSA. The incidence of abortion among adolescent mothers was significantly 18% lower in ISA compared to GSA. The prevalence of continuing EBF was significantly lower for an adolescent mother residing in GSA compared to an adolescent mother residing in ISA. Conclusion: Lower perinatal death and abortion in ISA than GSA, and higher rates of 4+ ANC visits, facility delivery and EBF among adolescent mothers in ISA than GSA indicate that interventions initiated by icddr,b have been effective in improving maternal and newborn outcomes.

Field of Study:	Public Health	Student's Signature .....
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Aminur Rahman Shaheen

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CHAPTER 1

Introduction

1.1 Background

Adolescent is the transition between childhood and adulthood, a period of biological maturity and a time to prepare for participation in the civilization[1]. Getting married and become pregnant during adolescent period is both a developmental and biological warning. Pregnancy in a girl aged between 10-19 years is adolescent or teenage pregnancy. According to World Health Organization (WHO) definition adolescent or teen is defined as when aged 15-19 years[2]. About 16 million women 15-19 years old give birth each year, which is about 11% of all births throughout the worldwide[3]. Ninety-five per cent of these births occur in low- and middle-income countries [4, 5]. The average adolescent birth rate in middle-income countries is more than two times as high as that in high-income countries, with the rate in low-income countries being five times as high. The proportion of births that take place during adolescence is about 2% in China, 18% in Latin America and the Caribbean and more than 50% sub-Saharan Africa. Nearly half of all adolescent births occur in just seven countries: Bangladesh, Brazil, the Democratic Republic of the Congo, Ethiopia, India, Nigeria and the United States[6].

1.2 Pregnancy among very young adolescents is a significant problem

In low- and middle-income countries, almost 10% of girls become mothers by age 16 years, with the highest rates in sub-Saharan Africa and south-central and south-eastern Asia. The proprtion of women who become pregnant before age 15 years varies with a great deal even within regions in sub-Saharan Africa, for example, the rate in Rwanda is 0.3% versus 12.2% in Mozambique. The contexts of adolescent pregnancies are not always the same having a child outside marriage is not uncommon in many countries. Latin America, the Caribbean, parts of sub- Saharan Africa and high income countries have higher rates of adolescent pregnancy outside marriage than does Asia[7].

1.3 Adolescent pregnancy is dangerous for the mother

Although adolescents aged 10-19 years account for 11% of all births worldwide, they account for 23% of the overall burden of disease (disability- adjusted life years) due to pregnancy and childbirth. Fourteen percent of all unsafe abortions in low- and middle-income countries are among women aged 15-19 years. About 2.5 million adolescents have unsafe abortions every year, and adolescents are more seriously affected by complications than older women[8]. Births to unmarried adolescent mothers are far more likely to be unintended and are more likely to end

in induced abortion. Intimidated sex, reported by 10% of girls who first had sex before age 15 years, contributes to unwanted adolescent pregnancies. Each year, approximately 70,000 adolescent women worldwide die from pregnancy-related causes[9].In Latin America, the risk of maternal death is four times higher among adolescents younger than 16 years than among women in their twenties[7]. Younger mothers are at an increased risk of obstetric fistula, anemia, eclampsia, postpartum hemorrhage, and puerperal endometritis [10-12]. Girls younger than 19 years have a 50% increased risk of stillbirths and neonatal deaths, as well as an increased risk for preterm birth, low birth weight, caesarean delivery and asphyxia [11]. Up to 65% of women with obstetric fistula develop this as adolescents, with terrible consequences for their lives, physically and socially. Adolescent pregnancy is dangerous for the child stillbirths and death in the first week of life are 50% higher among babies born to mothers younger than 20 years than among babies born to mothers 20-29 years old[7]. Deaths during the first month of life are 50-100% more frequent if the mother is an adolescent versus older, and the younger the mother, the higher the risk. The rates of preterm birth, low birth weight and asphyxia are higher among the children of adolescents, all of which increase the chance of death and of future health problems for the baby [13-16].

1.4 Situation in Bangladesh

In Bangladesh the total adolescent population comprises of about 22% of the total population and adolescent birth rate is 113/1000 live birth which is one of the highest in the world [17, 18]. Despite substantial progress in reducing maternal mortality in the past two decades, the issue of adolescent (aged 10-19 years) pregnancy is still quite rampant in Bangladesh. Although the legal age of marriage in Bangladesh for girls is 18 years, about 66% of the women get married before that age[19]. This huge proportion of child marriage contributes to the high rates of pregnancies among adolescent girls. Most recent (2014) Bangladesh Demographic & Health Survey (BDHS) data shows that among adolescent girls, about 20% do not receive any antenatal care while 58% of the deliveries take place at home without assistance from skilled attendants. The survey also mentioned that unmet need below 20 is highest 15.7% compared to elder age groups, age at first marriage among 15-19 years group is 54.8%, age of first sexual intercourse among 15-19 year is 55%, one third of the mother among 15-19 has begun childbearing, unmet need is highest among 15-19 years age groups than others (17%). Perinatal mortality 44/1000 LB is quiet high and in numbers it is second highest after the age group 20-29. 64% home delivery still occurred among 15-19 age groups and 42% delivery conducted by medically trained providers among 15-19 years age group[20].

1.5 Breast feeding status among adolescent

There are several beneficial effects have been documented for exclusive breast feeding (EBF) around the globe; like: less risk of childhood infections[21-23], reduced postnatal mortality rates[23], decreased sudden infant death syndrome rates[24], lowered probabilities of developing diabetes[24], improved cognitive and motor development[24], among others. Maternal breastfeeding benefits include: lower risk of developing breast and ovarian cancers[21], adequate weight recovery[21] and lactational amenorrhea which could be a natural birth control. The EBF varies around the world among adolescent mother. In Ecuador it is higher than the national average (43% vs 63%)[25]. There are also opposite scenario exist at Ontario for breastfeeding status among young versus older mother (50.2% vs 63.5%)[26]. Breastfeeding practices are not straight forward, it is highly vary with environment and buttress with complex network that consider personal, biological socio-cultural factors[27, 28]. The UK younger mother <20 years age are less likely to breast feed their child than adult as they are less parenting experiences, less education and most of them has come from disadvantageous group[28]. Study showed 13% death could have been prevented if under 5 children had EBF globally [23]. In Bangladesh adolescent mother perceived exclusive breastfeeding includes water and other liquid along breastfeeding upto six months of child age[29] .Currently exclusive breast feeding status in Bangladesh is 65% but no such information is available about adolescent mother[18, 20].

1.6 Context of Abortion in Bangladesh

Although the Bangladesh penal code restricts abortion except to save the life of a woman, since 1979 the Government of Bangladesh has allowed Menstrual Regulation (MR) to induce menstruation and thus to return to non-pregnancy either at the time of, or within 8-10 weeks of the due date of menstruation[30]. Accurate data on the incidence of abortion in Bangladesh is not available because of under-reporting and lack of record keeping. However, a survey in 2010 found an estimated 653,000 MR procedures were performed in health facilities nationwide [31]. An additional 647,000 induced abortions were performed in the same year, the majority of which were unsafe [31]. It is estimated that 231,400 women suffered from complications following induced abortion in 2010[31]. Reliable and robust information on abortion among adolescent women are still scarce in Bangladesh.

1.7 Rationale

Though a bunch of evidences are available about adverse adolescent pregnant outcome but there are still disagreeing evidences exist, in terms of whether it is for biological nature of the adolescent women or frequent poor socio economic condition or the adolescent have access to inadequate health care[13, 32-35]. All the published articles or reports had considered the

reported age for deciding the adolescent age in developing countries including Bangladesh. These studies were mostly in survey or retrospective design in nature which might not capture the real age of the adolescents. There are evidences that survey data may put forth the social desirability and recall bias which may produce incorrect estimation for age calculation [36-38]. So, there has ample scope to fill out this gap through long standing surveillance longitudinal data where demographic and service information are collected periodically and age is followed from birth. Adolescent pregnancies are closely associated with adverse outcome and this might effect on raring her child which could hindrance the breast feeding status. Developed countries have enough information on breast feeding status on adolescent mothers, but from developing countries, this information is really dearth. In Bangladesh, no reports on breast feeding status from the adolescent mother are available till date. This is important and would be the first instance in Bangladesh that how a cohort of adolescent pregnancy affects the delivery outcome and also how their children comply with the recommended breast feeding advices. The proposed study site has been collecting information on maternal and child health including breast feeding information along with other vital demographic events since 1966, but there is no single publication till dated using Matlab HDSS data which has explored the adolescent pregnancy events that link with their child breast feeding status, abortion and adverse event from pregnancy outcome[39].

1.8 Research question

1. Does adolescent pregnancy outcomes (abortion, 4 ANC, facility delivery and perinatal death) differ between icddr,b and government service areas under Matlab Health and Demographic Surveillance Site, Bangladesh

2. Does the exclusive breast feeding and child survival of adolescent mothers differ between icddr,b and government service areas under Matlab Health and Demographic Surveillance Site, Bangladesh

1.9 Conceptual framework

Conceptual framework for Hypothesis 1: Adolescent pregnancy and service delivery outcome

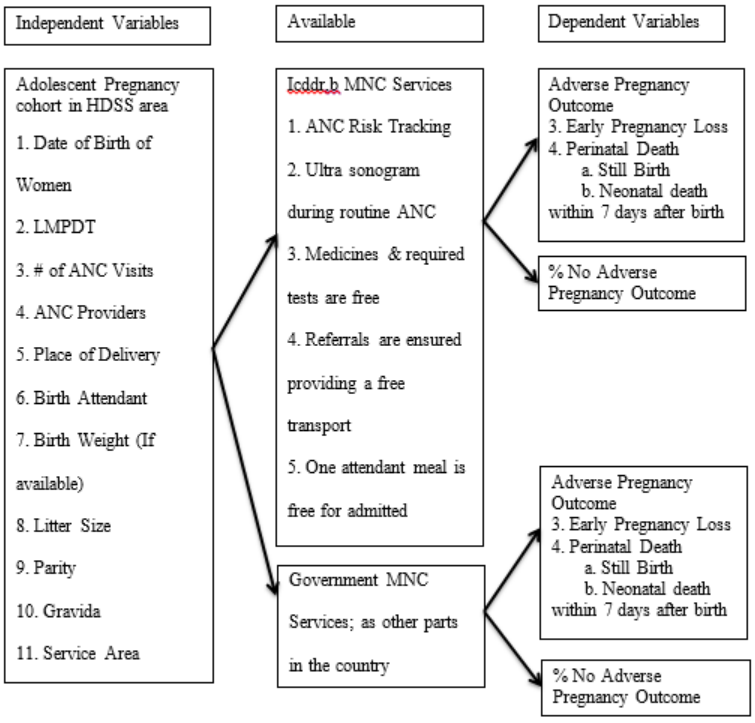


Figure 1: Conceptual framework for hypothesis 1 of the proposed study (x. c)

Conceptual framework of hypothesis 2: Exclusive breastfeeding status adolescent pregnant cohort

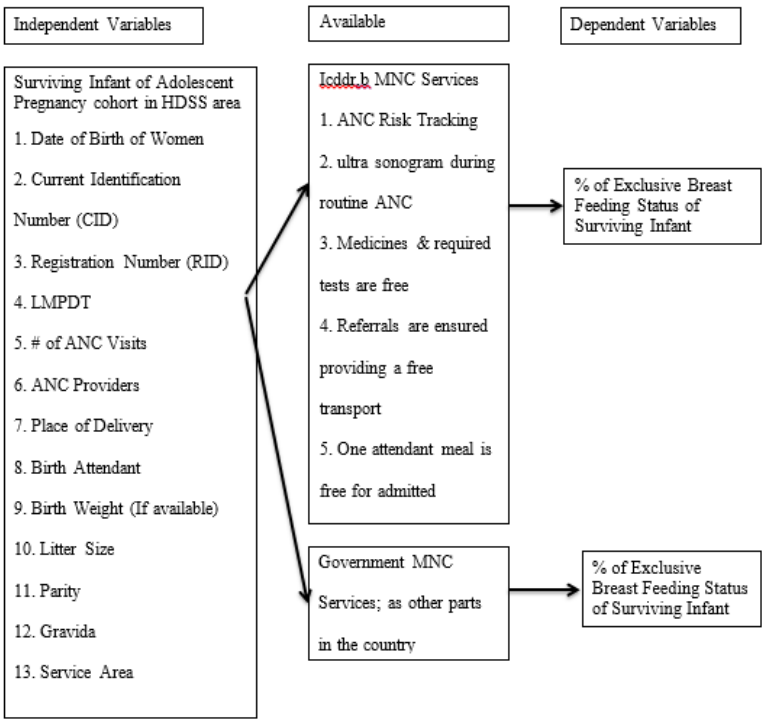


Figure 2: Conceptual framework for hypothesis 2 of the proposed study (x. c)

1.10 Research Objective

a. General Objective

To determine the differences in trends, burden and risk factors of adverse pregnancy outcome of adolescent mothers and their children breast feeding practices and survival in icddr,b

and government service areas under Matlab Health and Demographic Surveillance Site, Bangladesh.

b. Specific Objective

1. To measure the trends and burden of adolescent pregnancy adverse outcomes (abortion, perinatal death) in both icddr,b and government service areas at rural Matlab in Bangladesh.
2. To measure the trends in healthy behaviors during pregnancy (attending 4 ANC and delivery at facility) among adolescent mothers in both the areas.
3. To measure the determinants of adverse pregnancy outcomes among adolescent mothers in two areas of different health service delivery systems.
4. To measure the trends of exclusive breastfeeding status at six month among the selected adolescent cohort in both the areas.
5. To measure the determinants of exclusive breastfeeding status at six month among the selected adolescent cohort in both the areas.

1.11 Research Hypothesis

1. The pregnancy outcome of adolescent mothers in icddr,b service area is fairly healthy than it is in the government service area

2. The exclusive breast feeding status among children from adolescent pregnant cohort in icddr,b service area is better than government service area

1.12 Operational definition

Adolescent: The women whose age falls below the age of 20 years in the study area.

Abortion: Termination of pregnancy before 28 weeks of gestational age in the study area.

4 ANC: The pregnant women who receive four antenatal care as following interval: 1st: at 16 weeks, 2nd: 24-28 weeks, 3rd: 32 weeks and 4th: 36 week.

Perinatal death: It includes still birth and neonatal death within 1st seven days after birth. Stillbirth is defined as the birth of a baby showing no signs of life. For international comparisons of perinatal mortality rates only such stillborn infants with a birth weight of 1000 gr. or more are included (from 1989 it is recommended that the lower weight limit should be 500 gr). Sometimes stillborn babies are not weighed, in these cases a gestational age of 28 completed weeks. Still birth has two different entities. Fresh stillbirth: Fresh stillbirth is defined as birth of a dead foetus of at least 28 weeks gestation where intrauterine death occurred during and around delivery [40].

Early Neonatal Death: Early neonatal death is defined as the death of a newborn between zero and seven days after birth.

Adverse Outcome: Adverse outcome involves abortion and perinatal death for this particular study.

Live Birth: Live birth means the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy, that, after such expulsion or extraction, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached.

Normal Vaginal Delivery: Normal vaginal delivery is a completely natural delivery of a baby by the mother without any medical intervention.

Caesarean Section: Cesarean Section delivery is a surgical procedure used to deliver a baby through incisions in the abdomen and uterus. A C-section might be planned ahead of time if pregnant woman develop pregnancy complications or she had a previous C-section and aren't considering a vaginal birth after cesarean. Often, however, the need for a first-time C-section does not become obvious until labor is underway.

Facility Delivery: If the births take place in a government or non-government facilities

Excusive Breast Feeding: If a newborn does not take anything other than mother breast milk till his/her 6 month of age except saline or medicine when prescribed.

CHAPTER 2

LITERATURE REVIEW

The term adolescence broadly refers to the period between 10 and 19 years of age[41]. This age range is not fixed. World organizations such the World Health Organizations (WHO) and the United Nations (UN) prescribe different age ranges [42]. The period of adolescence is defined by changes in social roles as well as biological characteristics. In the absence of adequate support, adolescents are likely vulnerable to domination, and poor physical and mental health. Intimidation to physical and mental well-being unfortunately have long-lasting effects[43].

Recent World Health Organization (WHO) estimate showed that the rate of adolescent pregnancy will grow by the end of 2030, and a major increase in adolescent pregnancy is projected to be in Africa and South-East Asia[44]. Globally adolescent pregnancy has continuously drawing attention to the international society for their enormous numbers and adverse outcome. In recent decades adolescent pregnancy has become an important health issue is a great number of countries including Bangladesh, both developed and developing[45, 46]. This problem is particularly critical

in south Asian and Sub-Saharan African where the incidence of adolescent pregnancies is the highest, mainly due to lack of effective contraception for adolescent (Fig 2-4). So, this was considered to be a big crisis in developing countries[46, 47]

2.1 Global Status of adolescent pregnancy outcome

Adolescent women are the main contributor of the global age pyramid along with their counterpart. In 2030 south Asia will have the 136 million adolescent women and along with pacific it will raise up to 233 million in 2030 (Fig:1) This huge numbers will have experiences of marriage and ultimately it will have ended up to either complete pregnancy or abortion due to high birth rate (Fig:3). About 16 million girls aged 15-19 years give birth annually. 90% of them are in developing countries. The characteristics of young mothers are common across the regions of the world: little education, rural dwelling, middle and low income. (Fig: 2)[48] The different types of maternity care referenced in the literature are defined and described below. [49]

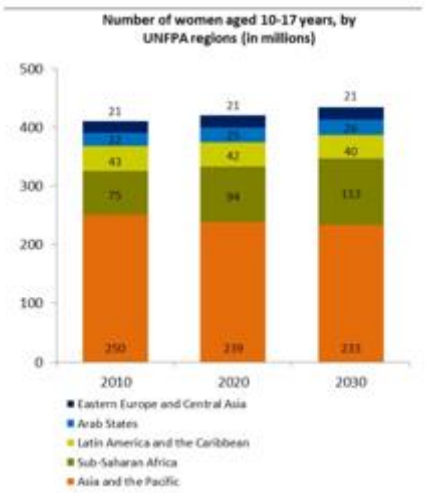


Fig: 1 UNFPA database, using United Nations Population Division, 2010 estimates

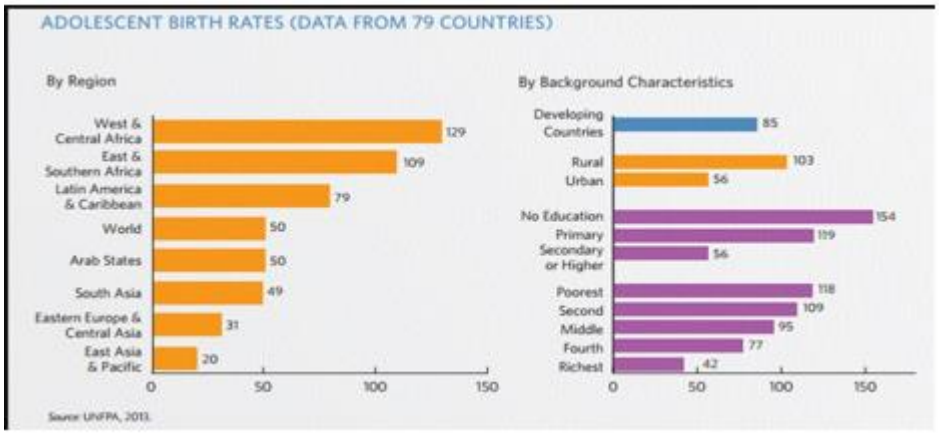


Figure 2: Adolescent birth rate from 79 countries (UNFPA 2013)

Adolescent birth rate is much higher in African and Latin Americans and Caribbean countries. The burden is more within rural areas, women with no education and in poorest quintile.

PER CENT OF ADOLESCENT GIRLS IN MARRIAGES AND ADOLESCENT BIRTH RATES

Developing Regions	Girls, ages 15-19	
	Currently married (%)	Adolescent birth rate
Arab States	12	50
Asia and Pacific	15	80
East Asia and Pacific	5	50
South Asia	25	88
Eastern Europe and Central Asia	9	31
Latin America and Caribbean	12	84
Sub-Saharan Africa	24	120
East and Southern Africa	19	112
West and Central Africa	28	129
Developing countries	16	85

Source: www.devinfo.org/mdg5b

Figure 3: Proportion of adolescent girl marriage and birth rates by regions (source: www.devinfo.org/mdg5b)

The proportion adolescent pregnancy is much higher in African and south Asian countries

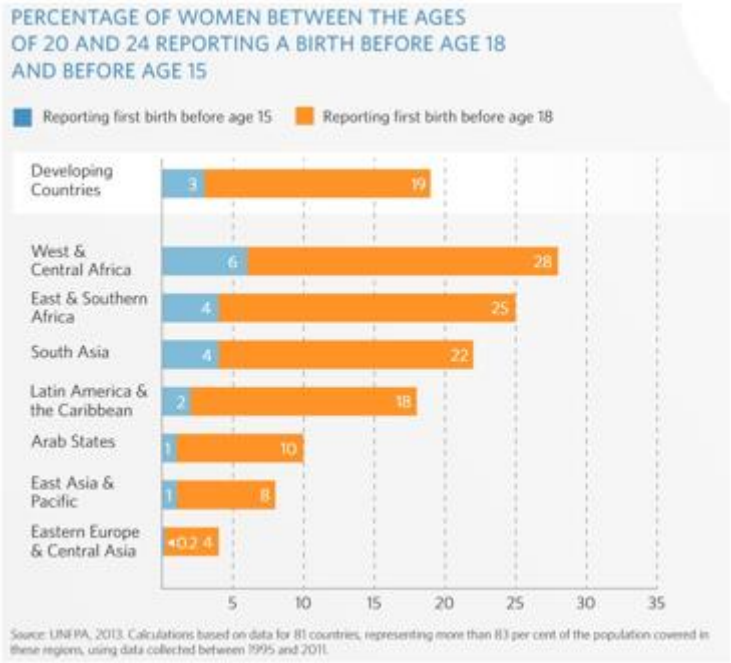


Figure 4: Percentage of 20-24 years women who reported their birth before age 18 and 15[50]

In developing countries, first birth before age 18 is much higher than developed countries and Africa, south & East Asia have high burden of early childbirth periods. Maternal age less than 18 years is an independent risk factor for preterm birth [51], low birth weight (LBW) infants [16], intrauterine growth restriction and stillbirth [51], and neonatal mortality[16]. Modifying the risk and protective factors in young women's daily lives, particularly for those who are socioeconomically disadvantaged, can improve health outcomes[52].

UNFPA 2013. Calculation based on data for 81 countries, representing more than 83 percent of the population covered in this region, using data collected between 1995-2011.

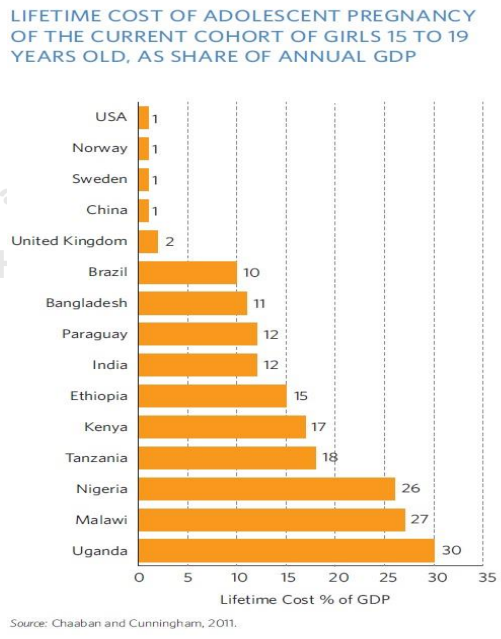


Figure 5: Lifetime cost for adolescent pregnancy as share of annual GDP by countries [53]

Pregnant adolescents are more likely to come from socio-economically disadvantaged backgrounds [54], which is associated with smoking, alcohol and illicit drug use [55], social isolation and mental health issues [56], poor nutrition and inadequate weight gain [57], and psychosocial stressors including low income, unemployment and housing issues [58]. Maternal age less than 18 years is an independent risk factor for preterm birth [51], low birth weight (LBW) infants [32], intrauterine growth restriction and stillbirth [51], and neonatal mortality [32]. Modifying the risk and protective factors in young women's daily lives, particularly for those who are socioeconomically disadvantaged, can improve health outcomes [52]. Young women attend specialist programs more frequently than standard antenatal care; attendance increases the opportunities for health interventions to occur. There is increasing evidence that 'adequate' antenatal care (e.g. minimum five visits) can improve perinatal outcomes [59]. Too-early childbearing also negatively impacts the survival of newborns. Studies have shown rates of newborn death to average about 50% higher to adolescent mothers versus mothers in their 20s (Macro International 2008) (Fig.6).

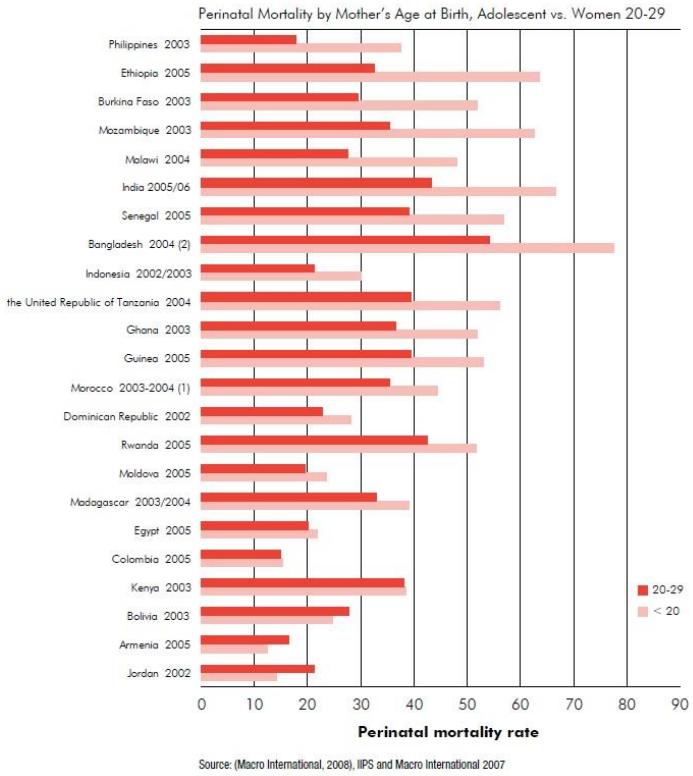


Fig: 6 Perinatal mortality by Mother's at age of birth, Adolescent vs Women 20-29

Recently shahabuddin et al. have published two papers on adolescent women using BDHS data which covered the service accessibility of adolescent women using the existing health system and determinants and trends in health facility deliveries of adolescent women for caesarean section [60, 61]. Both paper used the survey data and which has dilemma of correct age information estimation and assumption. Adolescent are less likely to go for maternal health services comparing with the older 24-29 age women[62]. Maternal health seeking behavior among adolescent pregnant women are complex and multi-factorial[63].

A comprehensive electronic literature search was conducted in the PubMed database, and the Google Scholar since December 2016 to explore the numbers of publications used Matlab HDSS data and reported the adolescent pregnancy outcome and breast feeding status of their children. We performed a preliminary scan of “adolescent”, “pregnancy”, “adverse outcome”, and “perinatal health” to determine if a full search of the Gray literature is necessary. Key search terms were included, Adolescent, Pregnancy, Matlab hospital, Matlab demographic surveillance, Matlab demographic surveillance system, exclusive breast feeding. The language of publication was restricted to the English. We found 143 citations which had have used Matlab HDSS data with on pregnancy and breast feeding. Out of 143, only 9 articles reported on abortion and only one described about adolescent abortion. This study showed the adolescent group (<18 years) are more prevalent to have experienced with abortion than the older group [64]. Elahi et al. analyzed Matlab HDSS data to explore the reduction of maternal mortality and showed mother whose age <19 years are more likely to die than older group but they didn’t analyze the other adverse outcome for adolescent [65]. Ronsmans et al. used Matlab HDSS 1975-2002 data and analyzed for stillbirth and early neonatal death for all ages and found the mother who gave birth <20 years age had less stillbirth and more early neonatal rate than the older mother. But didn’t measure the perinatal death of the adolescent[66]. Kausiako et al also measured the perinatal death for all age groups and they found <19 years age mother have more perinatal deaths than

the older age mother [67]. These studies considered adolescent age differently, which are not comparable at current context. The others studies concentrated on other than adolescent group. None of the studies analyzed the cohort of adolescent pregnancy and the breastfeeding status of their children at six months.

CHAPTER 3

METHODOLOGY

3.1 Study Design

This study explored information of a retrospective longitudinal cohort of adolescent women who gave birth below 20 years age from Matlab Health and Demographic Surveillance System (HDSS) database.

3.2 Study population

The women below 20 years old who gave birth during 2007 to 2015 and their children survived up to their six months of age was considered as study population.

3.2.1 Selection of the respondent

a. Inclusion criteria

- Adolescent women (age less than 20 years) whose pregnancy outcome, eg; abortion, stillbirth, live birth and early neonatal death was available between 2007-2015 from HDSS data base
- The infant of the above cohort whose breast feeding information was available till their six month of age

b. Exclusion criteria

- If any adolescent women whose any of the pregnancy outcome was not available during the study period (2007-2015)
- If any child breast feeding information of the above mentioned adolescent cohort was not available during the study period (2007-2015)

3.3 Study settings

The study was conducted in one of the rural area of Bangladesh. Matlab being rural Bangladesh is sub district of Chandpur which is located about 55 km southeast of Dhaka. Since 1966 the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr, b) has been collecting vital statistics by community health research workers (CHRWs) through a health and demographic surveillance system (HDSS). The CHRWs are collecting vital demographic like birth, death, migration and health information by visiting each household bi- monthly in their assigned areas and fill out the event registration form. The HDSS area is basically divided into two parts: the icddr, b service area (ISA) and the government service area (GSA) covering the total 70 and 79 villages in each wing respectively. Since the introduction of icddr,b Service programme the service CHRWs are providing additional maternal health care, information on contraception and contraceptives, and immunizations to mothers and children in the Icddr,b SA. However, to get

the better project effect the icddr, b SA is further sub - divided into 4 administrative blocks (A, B, C & D) which are serving a population of about 27,000 through four sub- centres hospitals staffed by midwives and they provide 24/7 delivery care and related services. These sub centres are directly linked with the MCH - FP clinic at Matlab Township, staffed by doctors & nurses to provide the basic obstetric care round the clock[68]. (Fig: 6)

Since 2007, the Maternal, Neonatal and Child Health (MNCH) Project was embedded in the ongoing MCH -FP Project in the Icddr,b SA with an aim to increase facility based delivery. For this purpose, the service area was further strengthen through introducing evidence based maternal & neonatal package starting from identifying pregnancy through urine test to household visit of 6 months after delivery through continuum of care approach. At the community level maternal care is offered by service CHRWs with some preventive care like counseling for pregnancy danger signs, referral and birth planning using a pictorial card and to establish a birth team. Each facility delivery is monitored through partograph under a standard guideline. Some major intervention packages under this project are; four antenatal checks up with ultrasonography, risk group identification and administration of antenatal corticosteroid, active management of third stage of labour with oxytocin. Moreover, in the Matalb hospital every delivery has to follow specific clinical guidelaine prepared by Obstetrical and Gynecological Society of Bangladesh (OGSB) & Lamb Hospital. All the doctors working in this hospital follow this protocol and thus a patient

referred from this hospital for CS other than maternal request is considered to have a valid reason[69].

The HDSS data set comprises health, demographic and social characteristics, at the individual and household level. These data can be linked a wide range of research and clinical information. This array of interrelated information is invaluable in a country that has no nationwide registration systems and scant resources to develop health information systems and monitor trends in the nation's health.

Matlab's observational data provide insight into changing patterns of disease, their links to social and environmental factors, and healthcare-seeking behaviour. Matlab also provides a platform on which interventions can be evaluated in a natural setting and on a significant scale. Findings from Matlab studies have helped to improve the health of the local population, but have also provided evidence to support wider implementation of interventions across Bangladesh.

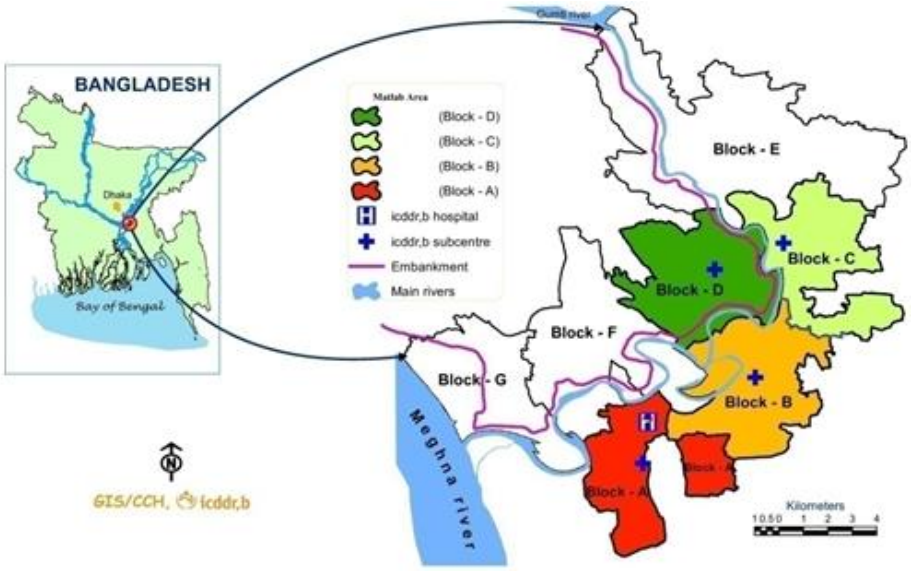


Figure 7: Matlab study area

3.4 Data collection in icddr,b areas (ISA)

In the whole study area, the demographic information is being collected since 1966. There are two groups of community Health Research Worker (CHRW): one Surveillance CHRW (#43) and another Service CHRW (#41). Service CHRW collects data through monthly visits to each household. But surveillance CHRW visits each household at two months interval. In intervention area two groups of CHRWs are available but in comparison area only surveillance CHRW works.

The Health and Demographic Surveillance system (HDSS) collects vital events of the population (live birth, still birth, miscarriage, deaths, marriage and dissolution, in and out migration). For this, they use a register book named “Service Record Book (SRB)” and these records are collected

electronically by hand held tablet at field and facilities. In the service area they collect data on reproductive events (menstrual status, pregnancy and outcome status, lactation status, contraceptive use, under five children's Diarrhoea and pneumonia history of last two weeks) as well as immunization status of eligible women and their under-5 children in icddrb service area. Also they record all the services provided to eligible mothers and children; Contraceptives method, oral dehydration salt packets, essential drugs, immunization. They record this information in Service Record book. From 1987 in the intervention area the pictorial card was introduced to help follow up pregnancy & newborn care. The pictorial card is called pictorial because it has drawings depicting a variety of common danger signs during pregnancy like oedema, headache, antepartum and post-partum bleeding, hand prolapse and prolonged labour and health information's on prenatal care, diet during pregnancy and birth preparedness. With this card, the programme collects information and provides services regarding pregnant women and new born. Several numbers of staff are involved in the MCH-FP services in different ways. Like; One Field Research Officer (FRO), Two Field research supervisors (FRS), and two male Health Research Officer (HRO), one Field Research Assistant (FRA) and all HROs supervise field activities of CHRW under each Block. In block A, the numbers of CHRWs are 11, in block B 12, in block C 10 and in block D they are 8. The variation of this distribution is due to work load for each block. CHRWs are the key workers in Matlab research field. Within the icddr,b area (23000) each person

has two unique identification numbers. A permanent registration number (RID) and a current identification (CID). RID helps to trace movements of individuals at different places (indicated by CIDs) and over time. (For example, a female child born in a village is assigned a RID & CID (both are same). In course of time, she has grown up and got married to a person in another village. In this case, she will be assigned another CID, but her RID will remain the same. Her exposures were different at different places at different points in time and both RID and CID help to account for this. It is possible to miss the information of migration if the CID isn't kept in records. icddr,b provides a family visit record (FVR) book for each household. In each FVR all RID and CID is recorded for each member of the household. These records are also updated in two register books. One is the Service record book (SRB) and another is the Record Keeping system (RKS) book. (Now the surveillance CHRWs are capturing this information digitally since 2010). So, each service CHRW needs to carry these electronic gadgets during her field visits. Each CHRW covers 24 households in a month and 410 couples in 18 months. In each visit, they update the field census book and FVR book (Mother- Reproductive, Contraceptive, Child- Morbidity, Immunization, MUAC, TT, Feeding Practice, Vitamin-A), if required, fill-up events form (Birth, Death, Marriage, Divorce, Migration, Internal Movement, Household Split, and Head Change, Collect health data using SRB). In their (CHRWs) visit, if a woman is found in her missing period for - one and half months, then the CHRW perform urine test for pregnancy and gives her a Health Service card and asks the

woman to visit the sub center clinic (each block has one sub-centre clinic) for further care (pregnancy confirmation & ANC). Before handed over the service card to the pregnant women the CHRW fills up the first page of the card (general information with previous obstetrical history). At the sub center, the HRO(midwives) provides all kinds of services (antenatal care and postnatal care, deliveries, keeping of all records, and referral of patients to the Matlab hospital if required). The CHRWs also conducts counseling on pregnancy risk and sends them to the sub-center for further action. HRO are fully qualified nurses or midwives and CHRWs have at least passed class ten. The HRO fill up the rest of the Health Service card in due time (ANC, delivery, postnatal care and interview about knowledge regarding danger signs of pregnancy). If the delivery is conducted by a HRO in the sub-centre, she monitors the labour using the partograph and when the mother is referred to the next higher level hospital women is instructed to carry the card with her in order for labour monitoring to be continued there. If delivery is conducted at home, part of the delivery portions is completed by the CHRW in Pregnancy Record Book which include all ANC coverage and outcome status. After each pregnancy outcome CHRW submits outcome report to FRS in subcentre meeting and FRS compile those reports and send it to FRO at Matlab Office. One final disposition report of follow-up completion is submitted by CHRW at 6 months after the delivery which include infant immunization status. The complete description has been reported elsewhere [39].

3.5 Data collection in Government service area (GSA)

The control area also serves 115,000 populations it is also divided by three blocks (E, F & G). icddr,b has deployed 6 CHRWs for each block (additional one person is responsible to provide back up support), but they are only involve data collection, do not provided any sorts of services. It has also three government Family Welfare Centre (FWCs) where a family welfare visitor (FWV) is posted to serve the MNCH services to the respective population (each FWC usually covers around 30000 populations). They provide ANC, PNC, delivery cares, TT injection and child vaccination and capable of providing post abortion care to the pregnant women and the adolescent girls. They have their accommodation with in the FWC premises and their services are available round the clock. If the pregnancy is complicated and out of their capacity to deal with they refer to the upazila health complex (UHC) which is the nearest higher referral point for each FWC.

Each community health research worker (CHRW) has around 1200 households according to the population covered by each household and they complete the data collection in their catchment area by two months period. In both the areas pregnancies are identified by pregnancy strip test with morning urine sample. Each CHRW collect the following information for mother and her child. (Fig. 7)

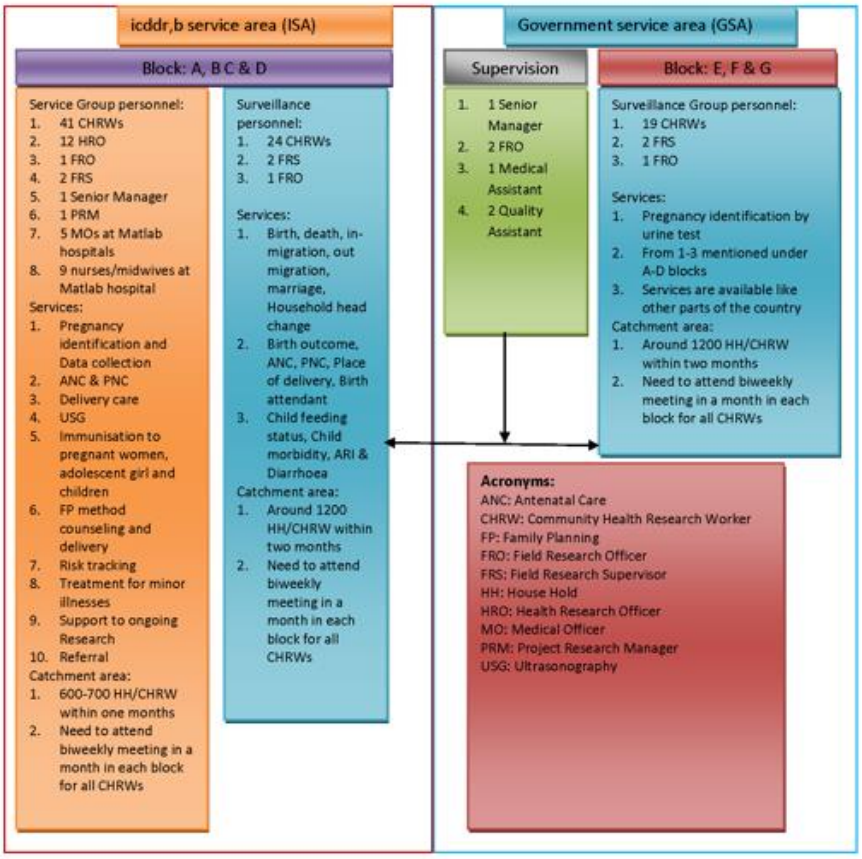


Figure 8: HDSS organization and services

Mother information:

1. 1st date of the last menstrual period
2. # of ANC
3. Provider of ANC service
4. Place of delivery
5. Birth attendant by
6. Mode of delivery

7. Birth weight (if available)
8. Littre size
9. Pregnancy outcome: LB, SB, Abortion (Spontaneous, Induced or MR)
10. Baby crying spontaneously or not
11. Household distance from nearest facility

Child information:

1. Sex of the child:
2. Date of birth:
3. Loss date (death):
4. Feeding status by month
5. Post natal visit date (1-4):

3.6 Quality of the data

Each month all the CHRWs sit together both in icddr,b and government service area for exchanging information update their registrar book and make query if they had any unanswered question to others or to their supervisors. As each CHRW area are assigned from the beginning of the year, so a yearly work plan to visit the households are prepared and kept with the

supervisors. The supervisors know beforehand where a CHRW is available for a particular day. The routinely provide a sudden visit and check a 2% sample data in monthly basis.

The collected data went through a three tire of supervision. First one by FRS extensively, the next one by FRO a piece of sample and then by a senior manager in a routine monthly meeting with all the supervisors. The collected data are extracted from the tab and checked through an error detecting program developed on oracle program. If any error is found, the information is sent to the respective CHRW with a notification to her supervisor for immediate correction. Then all cleaned data are sent to Dhaka office to store it within the longitudinal data system and checked with set of validation before final store. In this way all the data are linked by year since 1966.

The birth and child form are in place since 1966 with a several updated variables since now. The forms have been tested adequately before finalization and modification done if required any. The information under each form was checked by demographic and health expert before it went to printing and adequate training were provided to the CHRWs and observed they collect the correct information as mentioned in the training manual. The standard was set to zero error and training was continued till it reaches up to zero errors.

Variables were incorporated in this study:

1. RID of the mother

2. CID of the mother
3. RID of the child
4. Date of birth of the women
5. Religion
6. Education of the women
7. Husband education
8. Occupation of women
9. Husband occupation
10. Are of residence
11. Asset index
12. Parity
13. Gravida
14. # of ANC
15. Date of ANC
16. Place of ANC
17. Providers of ANC
18. Place of delivery
19. Mode of delivery

20. Delivery attendant by

21. Outcome of pregnancy

22. Still birth (if any)

23. Date of neonate (if any):

24. # Post-natal visit

25. Breast feeding status of the child (up to six months)

Data were collected from birth file, child file and socio-demographic file. All the variables of each mother and child were linked through RID and crosschecked was done by CID (Fig 8).

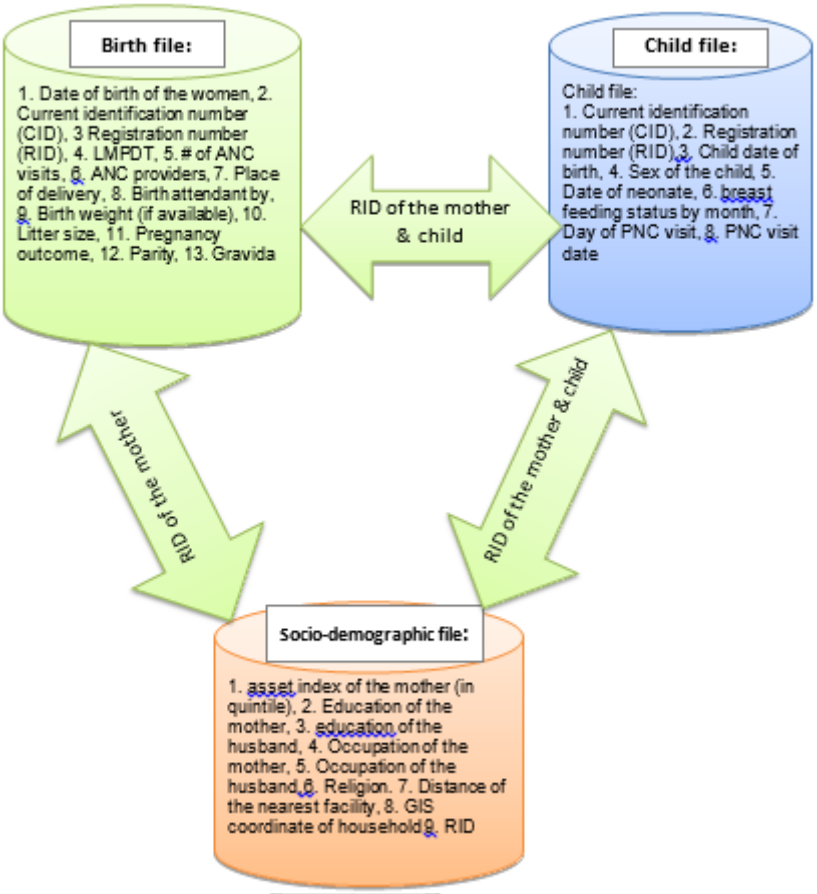


Figure 9: Longitudinal data Architecture of Health and Demographic Surveillance System in Matlab, Bangladesh

3.7 Data analysis

Women were categorized under <20 years. Socio-demographic and general characteristics of the group were calculated for two areas and differences were measured through chi-square test for categorical variables and t test for the quantitative variables. The trends of ANC services, delivery by place, providers and mode were measured by two areas. The main outcome was two:

perinatal death and exclusive breastfeeding status. The delivery was considered as who have delivered their babies either by vaginal or C-section and completed neonatal period in different groups was calculated separately for both the areas. The perinatal death outcome was calculated considering stillbirth and neonatal death within first seven days after birth and trends, rate was calculated by areas. The determinants of early termination of pregnancy, normal delivery and adverse pregnancy outcome (perinatal death) were calculated through logistic regression analysis and adjustment was done accordingly. A distance variable was generated from the household GIS coordinator data for each women and was categorized the distance of each women house with nearest facility by <5 km, 5-10 km and over 10 km. For measuring the exclusive breastfeeding status between two areas Kaplan Mayer curve was generated for both areas and determinants were identified through hazards ratios through Cox regression analysis. Data was analyzed using SPSS 22 version analytical software.

Table 1: Analysis summary of objective

Sl.	Specific study objectives	Indicator	Analysis Plan
1	To measure the trend & burden of adolescent pregnancy adverse outcome at icddr,b and government service area	_Percentages of interim pregnancy outcome (*abortion)* among the adolescent pregnant cohort segregated by the service area _Percentages of final pregnancy outcome*(live birth, still birth, early neonatal death)*among the adolescent	-Frequency distribution/cross tabulation of interim and final pregnancy outcome attended by the adolescent pregnant cohort segregated by the service area and by month - Line trend of interim and final outcome variables stratified by two areas.

		pregnant cohort segregated by the service area	
2	To measure the trend of healthy behaviors during pregnancy among adolescent pregnant women in both the areas	_ Percentages of 4+ANC attendance and facility based delivery attended by the adolescent pregnant cohort segregated by the service area	-The trends of 4+ ANC services, delivery by place, providers and mode were measured by two areas
3	To measure the determinants of adverse pregnancy outcome among adolescent	_Percentages of adverse pregnancy outcomes segregated by the	-Women were extracted out into <20 years. Socio-demographic and general characteristics of them were calculated for two

	pregnant women in both the areas	independent variables (age, gravida, parity, religion, SES, parent education, occupation, husband education, age of marriage, age of birth, distance of HH to the nearest health facility) and by the service area	areas and differences were measured through chi-square test for categorical variables and t test for the quantitative variables - logistic regression analysis was done to determine the determinants of early termination of pregnancy, normal delivery and adverse pregnancy outcome
4	To measure the trends of exclusive breastfeeding status at six months	_median value of exclusive breastfed	-Kaplan Mayer curve of exclusive breastfeeding status among child cohort segregated by the service

	among the selected adolescent cohort in both the areas	newborn among the selected adolescent cohort in both the areas	area
5	To measure the determinants of exclusive breastfeeding status at six months among the selected adolescent cohort children in both the areas	_Percentages of exclusive breastfed newborn segregated by the list of independent variables in the both service areas	-Outcome variable; exclusive breastfeeding -Determinants were identified by hazards ratios through Cox regression analysis

3.8 Ethical Consideration

The protocol was submitted to the institutional review committee at icddr,b for ethical clearance. Accessibility of the data was available following icddr,b data policy. The confidentiality

and anonymity of the study participant was strictly maintained. Data were presented in such a way as if any individual person cannot be identified or traced back through the reported presentation of the information.

3.9 Internal validity

We have considered all the women below 20 years age who delivered between the periods from 2007 to 2015 and their children survived up to 6 months of age in both the study areas.

3.10 Content validity

The questionnaire was organized and variables were chosen by expert consultation

3.11 Context validity

The questionnaires were contextualized and tested before finalization with proper field testing with prior training to the data collectors

Table 2 Gantt chart of the study

Study activities	1st year											
	J	F	M	A	M	J	Jl	A	S	O	N	D

Protocol development and IRB approval											
Approval of use of data, Data extraction & Data cleaning,											
Data organize and Quality control											
Intervention data											
Analysis, report writing & dissemination											

3.12 Budget

Protocol title: Trends and determinants of adolescent pregnancy adverse outcome and exclusive breast feeding status of the adolescent mother in icddr,b and government service area: Analysis from a nine years retrospective cohort (2007-2015) from Matlab Health and Demographic Surveillance System in Bangladesh

Principal Investigator name: Dr. Aminur Rahman Shaheen

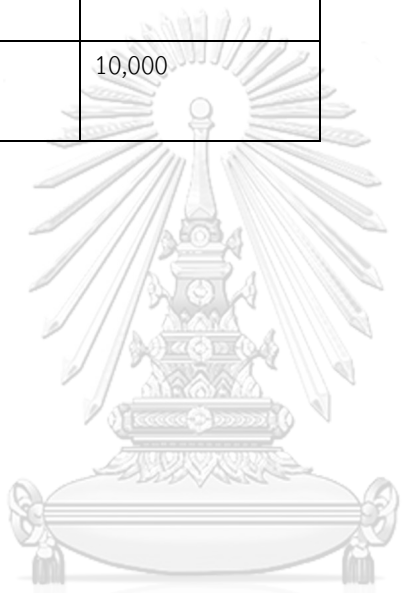
Organization: Health System and Population Studies Division, icddr,b

Duration: 1.9.2017- 30.8.2018

Total estimated budget for this study is US$ 10,000

Table 3: Study budget

Line Item	Amount in USD
Personnel	3500
Travel	500
Data accessibility cost	5000
Others	1000
Total Cost	10,000



CHAPTER 4

RESULTS

a. Adolescent pregnancy and perinatal outcome

There were 4,996 adolescents in the HDSS database, who gave birth (live birth or still birth) between the ages of 10 and 19, between 2007 and 2015 (2857 live births and 35 still births in ISA; 2,066 live births and 38 still births in GSA). Using the total midyear female population of 15-19 age group as the denominators in these two areas during 2007-2015 periods (1,04,426 in the ISA; 1,02,798 in the GSA), the fertility rate was 27 per 1000 adolescent mothers in ISA and 20 per 1000 adolescent mothers in GSA, during the 9 years of study period.

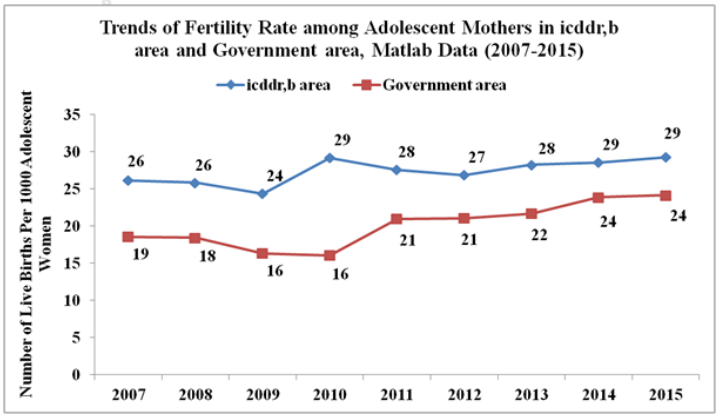


Figure 10: Trends of Adolescent Fertility Rates in icddr,b service area and Government service area, Matlab Data (2007 - 2015)

Throughout the study period, the annual fertility rates per 1000 adolescent mothers were higher in the ISA than in the GSA. The difference was much wider on 2010, when the annual fertility rate per 1000 adolescent mothers was almost double in ISA (29) relative to GSA (16). However, annual fertility rate per 1000 adolescent mothers started to increase in the GSA in 2011 (21) and in 2014 and 2015, the fertility rate in ISA and GSA remained the same (29 in ISA; and 24 in GSA) (Figure 9).

Table 4: Socio-demographic characteristics of adolescent mothers in both icddr,b service area (ISA) and Government service area (GSA)

Socio-demographic Variables	ISA (2892)	GSA (2104)	p-value
	n (%)	n (%)	
Age at first birth $(mean \pm SD)$	17.93 $\pm$ 2.51	17.95 $\pm$ 2.43	0.383
Maternal education			
No education	83 (2.9)	74 (3.5)	<0.001*
Primary	472 (16.3)	431 (20.5)	
Above Primary	2337 (80.8)	1599 (76.0)	
Paternal education			

Socio-demographic Variables	ISA (2892)	GSA (2104)	p-value
	n (%)	n (%)	
No education	1270 (43.9)	905 (43.0)	0.008*
Primary	600 (20.7)	511 (24.3)	
Above Primary	1022 (35.3)	688 (32.7)	
Religion			
Islam	2570 (88.9)	1963 (93.3)	<0.001*
Hindu	322 (11.1)	141 (6.7)	
Asset Score			
Lowest	454 (15.7)	324 (15.4)	0.090
Second	545 (18.8)	403 (19.2)	
Middle	525 (18.2)	417 (19.8)	
Fourth	644 (22.3)	499 (23.7)	
Richest	724 (25.0)	461 (21.9)	
Parity			
Nullipara	46 (1.6)	43 (2.0)	<0.001*
1	2749 (95.1)	1922 (91.3)	

Socio-demographic Variables	ISA (2892)	GSA (2104)	p-value
	n (%)	n (%)	
2	97 (3.4)	139 (6.6)	

Note: * indicates that the results are significant at p-value < 0.05

Among the 4,996 adolescent mothers, more than 90% had completed at least primary education or higher in both icddr,b and Government service area which is greater than the percentage of father's primary and higher education level. In both areas, adolescent mothers were predominantly Muslim and most of the adolescent mothers had a parity of 1. The mean age of first birth was 17.93 (SD:2.51) years for ISA and 17.95 (SD:2.43) years for GSA (Table 4).

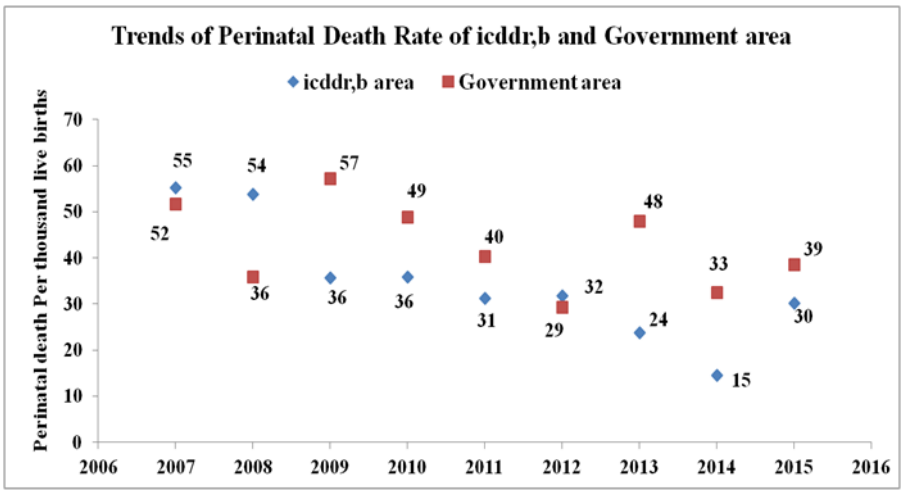


Figure 11: Perinatal death rate between icddr,b area and Government area over years (2007 – 2015) among adolescent mothers

Figure 10 shows the perinatal death per thousand live births in the icddr,b area (blue) and the Government area (red). Dots indicate that perinatal death rates are decreasing more quickly in the icddr,b area relative to the Government area. In 2009 and 2013, the perinatal death rate (2009 = 57 and 2013 = 48) was higher in the GSA relative to the ISA. The lowest perinatal death was recorded in 2014 in the ISA (15). At the end of the study, it is noticed that the perinatal death rate per thousand births was lower (30) in the ISA relative to the GSA (39).

Table 5: Factors associated with perinatal death: results from bivariate analysis

	Perinatal Death (N=4996)	
	Yes (n=187)	p-value
	n (%)	
Service Area		
ISA	99 (3.4)	0.163
GSA	88 (4.2)	
History of ANC visits		
Less than 4 ANC	165 (3.8)	0.351
4+ ANC	22 (3.1)	
Mothers age at first birth		

<=17	38 (3.4)	
18	54 (3.6)	0.638
19	95 (4.0)	
Maternal education		
No education	11 (7.0)	
Primary	42 (4.7)	0.019*
Above Primary	134 (3.4)	
Paternal education		
No education	89 (4.1)	
Primary	45 (4.1)	0.224
Above Primary	53 (3.1)	
Asset Score		
Lowest	39 (5.0)	
Second	34 (3.6)	
Middle	40 (4.2)	0.121
Fourth	41 (3.6)	
Richest	33 (2.8)	

Repeated pregnancy		
Multiple	10 (3.2)	0.568
Single	177 (3.8)	

Note: * indicates that the results are significant at P-value < 0.05

There were a total of 187 perinatal deaths among the 4,996 adolescent mothers. Bivariate findings (Table 5) revealed that there was no significant difference in number of perinatal deaths between the icddr,b area (n=99) and the Government area (n =88). The level of maternal education was found to be the only significant determinant for perinatal deaths. Bivariate findings show that there was no significant difference in perinatal deaths by paternal education, mothers age at first birth, no. of ANC visits, asset score, and repeated pregnancy. To examine the impact of icddr,b area in reducing perinatal deaths, binary logistic regression was used to adjust for the effect of all other variables in Table 6.

Table 6: Factors associated with perinatal death: results from multivariate analysis

	Perinatal Death (N=4996)	
	Adjusted OR	95% CI
Service Area		
ISA	0.69	0.52 - 0.91
GSA	Ref	
Distance from nearest facility	0.54	0.40 - 0.72
History of ANC visits		
Less than 4 ANC	Ref	
4+ ANC	0.80	0.50 - 1.28
Mothers age at first birth		
<=17	Ref	
18	0.68	0.47 - 0.99
19	0.76	0.55 - 1.04
Maternal education		
No education	Ref	
Primary	0.22	0.14 - 0.34

Above Primary	0.19	0.13- 0.28
Paternal education		
No education	Ref	
Primary	0.73	0.51 - 1.06
Above Primary	0.71	0.50 – 1.00
Asset Score		
Lowest	Ref	
Second	0.51	0.33 – 0.78
Middle	0.65	0.43 – 0.99
Fourth	0.59	0.38 – 0.89
Richest	0.46	0.29 – 0.72
Repeated pregnancy		
Multiple	0.69	0.36 – 1.33
Single	Ref	

The impact of reducing the perinatal deaths among adolescent mothers was measured by adjusting the effect of Area (government area or icddr,b area), Maternal Education, Paternal Education, Asset Score, Distance from the Nearest Facility, Historyof Antenatal Care (ANC) Visits,

Adolescent Mothers' Age at Birth, Repeated Pregnancy during the study period. The odds of perinatal death decreases by 31.0% for adolescent mother residing in icddr,b area (OR: 0.69, CI: 0.52 – 0.91) compared to an adolescent mother residing in government area keeping all the other variables at fixed level. However, ANC visits were not associated with perinatal death. The other strong determinants of perinatal death were maternal education, paternal education, mothers' age at first birth, distance from nearest facility and asset score. Adolescent mothers having primary education (OR: 0.22, CI: 0.14 – 0.34) and above primary education (OR: 0.19, CI: 0.13 – 0.28) had 78% and 81% lower odds of perinatal mortality respectively than the adolescent mother with completely no education. The odds of perinatal mortality decreased with increases in the mother's age at first birth. Adolescent mothers, who gave birth at age 18 years (OR: 0.68, CI: 0.47 - 0.99) or 19 years (OR: 0.76, CI: 0.55 – 1.04) had lower odds of perinatal mortality relative to adolescent mothers whose age at first birth was 17 or younger. Richest adolescents had 54% (OR: 0.46, CI: 0.29 - 0.72) lower odds of having perinatal death compared to poorest adolescents. Similar trends found for other economic classes compared to poorest. Adolescent mothers residing closer to facilities had a reduced odds of perinatal death (OR: 0.54, CI: 0.40 – 0.72) (Table 6). We also performed sub-group analysis for stillbirths and found that stillbirth was 44% less likely (OR: 0.56, CI: 0.36 – 0.88) to happen in ISA than GSA (data was not shown).

Additionally, a logistic regression model analysis of PNM at the level of individual births/Parity with all independent variables included along with area to reveal the impact of ISA on PNM compared to GSA. But surprisingly found the same result as the findings from previous modelling without considering parity where it is indicated that perinatal mortality rate is lower in ISA compared to GSA. It is also seemed that, mothers who had single and multi-parity had less chance of experiencing perinatal mortality compared adolescent mothers who did not gave birth yet (data not shown).

b. Adolescent mother and service delivery

Socio-demographic characteristics of adolescent mothers regarding service delivery (4+ antenatal care and facility delivery) in both icddr,b service area (ISA) and Government service area (GSA) was similar as displayed in Table 4 in perinatal result section.

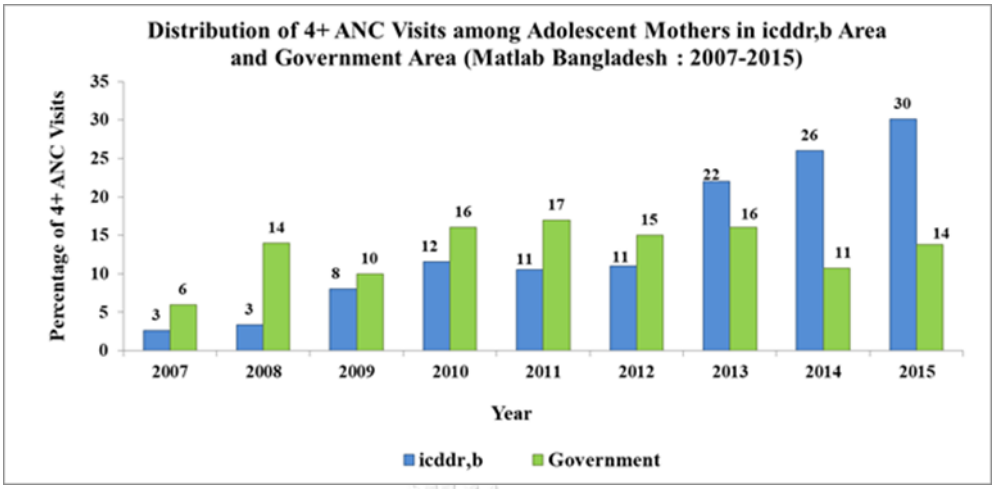


Figure 12: Distribution of 4+ ANC visits in both icddr,b service area and Government service area among adolescent mothers (Matlab Bangladesh: 2007-2015).

Figure 11 shows the distribution of 4+ ANC visits in both ISA & GSA, the rate was higher in GSA till 2012 but started to fall after that the year the 4+ ANC attendance became higher in ISA (22%) than the GSA (16%) on 2013 the gap in service coverage has continued to increase since 2014 onwards.

Table 7: Factors associated with 4+ ANC visits: results from bivariate analysis

	4+ ANC Visits (N=4996)	
	Yes (n =704)	P-value
	n (%)	
Service Area		

icddr,b Service Area (ISA)	425 (14.7)	0.150
Government Service Area (GSA)	279 (13.3)	
Maternal Education		
No Education	11 (7.0)	<0.001*
Primary	96 (10.6)	
Above Primary	597 (15.2)	
Paternal Education		
No Education	323 (14.9)	0.006*
Primary	124 (11.2)	
Above Primary	257 (15.0)	
Religion		
Islam	615 (13.6)	0.001*
Hindu	89 (19.2)	
Asset Score		
Lowest	85 (10.9)	<0.001*
Second	117 (12.3)	
Middle	128 (13.6)	

Fourth	166 (14.5)	
Richest	208 (17.6)	
Repeated Pregnancy		
Yes	45 (14.2)	0.956
No	659 (14.1)	

Note: * indicates that the results are significant at P-value < 0.05

Bivariate findings revealed that maternal education, paternal education, religion, and asset scores were significantly related to 4+ ANC visits. In total 704 adolescent mothers from both ISA and GSA had received 4+ ANC. It was seen that the percentage of mothers from ISA (14.7%) who received 4+ ANC was higher than the mothers from GSA (13.3%). Only 15.2% of adolescent mothers with the above primary education received 4+ ANC from both areas (Table 7).

Table 8 shows the results from multivariate findings on the determinants of 4+ ANC among adolescent mothers. The adjusted model included area of residence (ISA vs. GSA), maternal education, paternal education, religion, asset score, repeated pregnancy and distance from nearest facility.

Table 8: Factors associated with 4+ ANC visits: results from multivariate analysis

	4+ ANC Visits (N=4996)	
	Adjusted OR	95% CI
Service Area		
icddr,b Service Area (ISA)	Ref	--
Government Service Area (GSA)	0.57	0.49 – 0.66
Maternal Education		
No Education	0.39	0.20 - 0.72
Primary	0.72	0.56 - 0.91
Above Primary	Ref	--
Paternal Education		
No Education	0.49	0.43 – 0.57
Primary	0.48	0.38 - 0.59
Above Primary	Ref	--
Religion		
Islam	Ref	--

Hindu	0.95	0.73 - 1.22
Asset Score		
Lowest	0.31	0.24 – 0.40
Second	0.31	0.25 – 0.39
Middle	0.33	0.27 – 0.41
Fourth	0.34	0.28 – 0.40
Richest	Ref	--
Repeated Pregnancy		
Yes	0.71	0.51 – 0.99
No	Ref	--

Table 8 also shows that the adjusted odds of 4+ ANC visits among adolescent mothers was significantly 43% lower in GSA (OR= 0.57, 95% CI: 0.49 – 0.66) compared to that of ISA. Adolescent mothers with no education (OR = 0.39, 95% CI: 0.20 – 0.72) and primary education (OR = 0.72, 95% CI: 0.56 – 0.91) were less likely to receive 4+ ANC compared to adolescent mothers having above primary education. Similar trends found for paternal education. People from Hindu communities (OR= 0.95, 95% CI: 0.73 – 1.22) were less likely to receive four or more ANC than Muslims though the results were not significant. Asset scores were also found to be a

significant determinant for receiving 4+ ANC. Poorest adolescent mothers were less likely to receive 4+ ANC (OR = 0.31, 95% CI: 0.24 – 0.40) compared to richest adolescent mothers. Similar behaviours found in adolescent women of other asset score groups compared to the richest group.

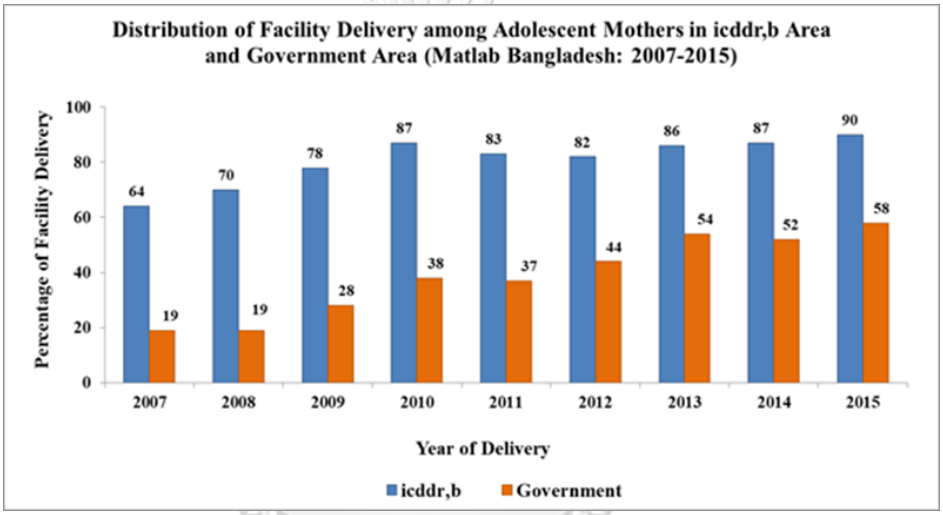


Figure 13: Distribution of Facility Delivery among adolescent mothers in icddr,b service area and Government service area (Matlab Bangladesh: 2007-2015)

Figure 12 shows the distribution of facility deliveries among adolescent mothers in both ISA and GSA. The percentage of adolescent mothers having facility deliveries in the ISA was consistently higher than in the GSA. Facility deliveries among adolescent mothers increased in both ISA and GSA between 2007 and 2015.

Table 9: Factors associated with getting facility delivery: results from bivariate analysis

	Facility Delivery (N=4996)	
	Yes (n= 3185)	P-value
	n(%)	
Service Area		
icddr,b Service Area (ISA)	2343 (81.0)	<0.001*
Government Service Area (GSA)	842 (40.0)	
Maternal Education		
No education	90 (57.3)	<0.001*
Primary	429 (47.5)	
Above Primary	2666 (67.7)	
Paternal Education		
No education	1440 (66.2)	<0.001*
Primary	592 (53.3)	

Above Primary	1153 (67.4)	
Religion		
Islam	2864 (63.2)	0.009*
Hindu	321 (69.3)	
Asset Score		
Lowest	430 (55.3)	<0.001*
Second	586 (61.8)	
Middle	554 (58.8)	
Fourth	744 (65.1)	
Richest	871 (73.5)	
History of ANC Visits		
Less than 4	2645 (61.6)	<0.001*
4+	540 (76.7)	
Repeated Pregnancy		
Multiple	189 (59.6)	0.114
Single	2996 (64.0)	

Note: * indicates that the results are significant at P-value < 0.05

Bivariate findings in Table 9 demonstrated that 3185 adolescent mothers from both ISA and GSA accessed facility deliveries. Service area, maternal education, paternal education, religion, asset score, and history of ANC visits were found to be significant predictors of facility-based deliveries among adolescent mothers (p-value < 0.05). 81.0% of adolescent mothers in ISA had accessed facility delivery whereas in GSA only 40.0% had accessed for the same. Less than 50% of primary educated adolescent mothers' and roughly 67.7% of adolescent mothers' with higher education received facility delivery. In addition, 53.3% of fathers with primary education and 67.4% of fathers with higher education assisted their wives to receive facility-based deliveries. 76.7% of adolescent mothers from both areas who had received 4+ ANC also received facility-based delivery care.

The adjusted odds of receiving facility-based delivery among adolescent mothers was almost 6 times higher in ISA compared to that of GSA (OR = 6.63, 95% CI: 5.85 – 7.52). Poorest adolescent mothers (OR = 0.55, 95% CI: 0.45 – 0.67) were less likely to receive facility deliveries compared to richest. Other asset score groups of adolescent mothers also have shown the same behaviours compared to the richest group in receiving facility delivery. Adolescent mothers who received 4+ ANC during pregnancy were more likely to receive facility delivery service compared to those who did not receive 4+ ANC (OR = 2.04, 95% CI: 1.67 – 2.49) (Table-10).

To visualize the effect of the practice of 4+ ANC visits on receiving facility delivery in ISA and GSA separately we have done two logistic regression analyses using data from ISA and GSA separately. Findings showed (data not shown) that adolescent mothers who received 4+ ANC during pregnancy were more likely to receive facility delivery service compared to those who did not received 4+ ANC in both ISA (OR = 3.33, 95% CI: 2.39 – 4.62) and GSA (OR = 1.96, 95% CI: 1.52 – 2.53).

Table 10: Factors associated with getting facility delivery: results from multivariate analysis

	Facility Delivery (N=4996)	
	Adjusted OR	95% CI
Service Area		
icddr,b Service Area (ISA)	6.63	5.85- 7.52
Government Service Area (GSA)	Ref	--
Maternal Education		
No education	0.77	0.53 – 1.11
Primary	0.51	0.43 – 0.61
Above Primary	Ref	--
Paternal Education		

No education	1.05	0.92 – 1.20
Primary	0.73	0.62 - 0.87
Above Primary	Ref	--
Religion		
Islam	Ref	--
Hindu	1.13	0.89 - 1.44
Asset Score		
Lowest	0.55	0.45 – 0.67
Second	0.71	0.59 – 0.86
Middle	0.59	0.49 – 0.70
Fourth	0.75	0.64 – 0.88
Richest	Ref	--
History of ANC Visits		
Less than 4	Ref	--
4+	2.04	1.67 – 2.49
Repeated Pregnancy		
Multiple	0.90	0.69 - 1.18

Single	Ref	--

c. Adolescent pregnancy and abortion:

There were 5,715 adolescents (3,329 in ISA; 2,386 in GSA) in the HDSS database, who become pregnant (live birth, stillbirth, miscarriage spontaneous, and miscarriage induced) between the ages of 10 and 19, between 2007 and 2015. Using the total midyear female population of 15-19 age group as the denominators in this two areas during 2007-2015 periods (1,04,426 in the ISA; 1,02,798 in the GSA), the average pregnancy rate was 32 per 1000 adolescent women in ISA and 23 per 1000 adolescent women in GSA, during the 9 years of study period.

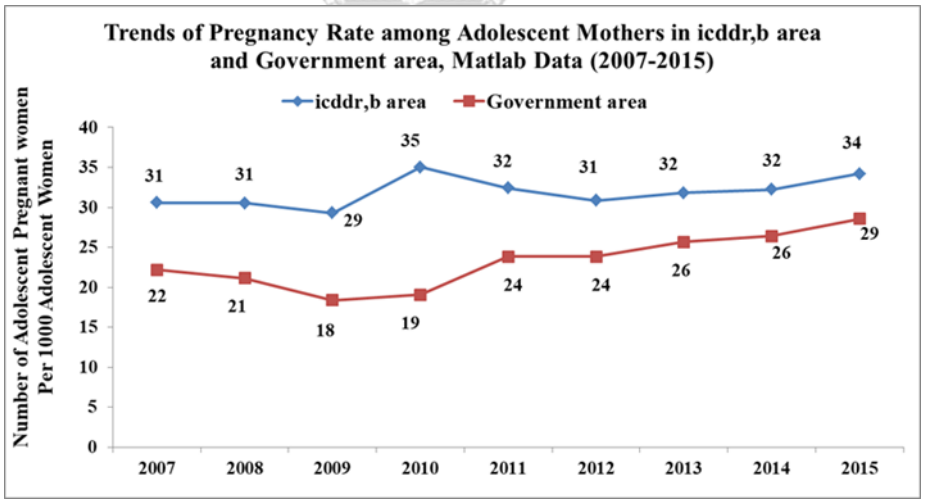


Figure 14: Trends of Adolescent Pregnancy Rates in icddr,b service area (ISA) and Government service area (GSA), Matlab Data (2007 - 2015)

Throughout the study period, the annual pregnancy rates per 1000 adolescent women were higher in the ISA than in the GSA. The difference was much wider on 2010, when the annual pregnancy rate per 1000 adolescent women was almost double in ISA (35) relative to GSA (19). However, annual pregnancy rate per 1000 adolescent women continuously increasing form 2011 till 2105 in GSA (Figure 13).

The Socio-demographic characteristics of adolescent mothers are described in Table 11.

Table 11: Socio-demographic characteristics of adolescent mothers in both icddr,b service area (ISA) and Government service area (GSA)

Socio-demographic Variables	ISA	GSA	P-value
Age at First Birth $(mean \pm SD)$	18.22 $\pm$ 0.81	18.24 $\pm$ 0.79	0.132
Maternal Education			
No education	97 (2.9)	86 (3.6)	<0.001*
Primary	533 (16.0)	477 (20.0)	
Above primary	2699 (81.1)	1823 (76.4)	
Paternal Education			
No education	1437 (43.2)	1017 (42.6)	<0.001*

Socio-demographic Variables	ISA	GSA	P-value
Primary	686 (20.6)	591 (24.8)	
Above primary	1206 (36.2)	778 (32.6)	
Religion			
Islam	2964 (89.0)	2225 (93.3)	<0.001*
Hindu	365 (11.0)	161 (6.7)	
Asset Score			
Lowest	528 (15.9)	367 (15.4)	
Second	636 (19.1)	451 (18.9)	
Middle	610 (18.3)	477 (20.0)	0.219
Fourth	739 (22.2)	557 (23.3)	
Richest	816 (24.5)	534 (22.4)	
Number of Parity			
0	441 (13.3)	284 (11.9)	
1	2790 (83.8)	1959 (82.1)	
2+	98 (2.9)	143 (6.0)	<0.001*
Birth Order			

Socio-demographic Variables	ISA	GSA	P-value
1	3108 (93.4)	2208 (92.5)	
2	208 (6.2)	166 (7.0)	0.456
3	13 (0.4)	12 (0.5)	
History of ANC Visits			
Less than 4	2904 (87.2)	2107 (88.3)	0.223
4 or more	425 (12.8)	279 (11.7)	

Note: * indicates that the results are significant at P-value < 0.05

Mean age of adolescent mothers at first birth was around 18 years in both icddr,b service area (ISA) and Government service area (GSA) for this particular study. Amongst 5,715 adolescent mothers, more than 90% had completed at least primary or higher education in both icddr,b and Government service areas whereas the percentage of father's primary and higher education level was around 56% only. In both areas, adolescent mothers are mainly Muslim and more than 80% of the adolescent mothers had a parity of 1. More than 90% of adolescent mothers in both the areas had pregnancy with first birth order. Barely 12% of adolescent mothers had visited for ANC for 4 times or more than 4 times in both areas separately (Table 11).

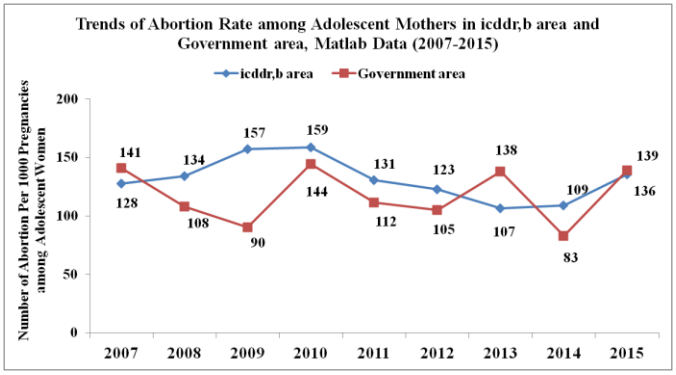


Figure 15: Abortion rate between icddr,b area and Government area over years (2007 – 2015) among adolescent women

In Figure 14, the blue line shows the number of abortion per thousand adolescent women in the icddr,b area where the red line indicates the Government area. It is appeared from the figure that abortion rates were higher in the icddr,b area relative to the Government area from 2008 to 2012. From 2010 to 2012 there were a decrease in abortion rates in Government areas but in icddr,b areas it continuous till 2013. After 2013, there was a huge downward pick in this rate for Government areas. In 2015, the rate was almost converged in both areas.

Table 12: Factors associated with abortion: results from bivariate analysis

	Abortion (N=5715)	
	Yes (N=719)	P-value
	n%	

Service Area		
icddr,b	437 (13.1)	0.141
Government	282 (11.8)	
Maternal Education		
No education	26 (14.2)	0.098
Primary	107 (10.6)	
Above primary	586 (13.0)	
Paternal Education		
No education	279 (11.4)	0.045*
Primary	166 (13.0)	
Above primary	274 (13.8)	
Mothers Age at First Birth		
<=17	224 (16.6)	<0.001*
18	208 (12.3)	
19	287 (10.8)	
Religion		
Islam	656 (12.6)	0.661

Hindu	63 (12.0)	
Asset Score		
Lowest	117 (13.1)	
Second	139 (12.8)	
Middle	145 (13.3)	0.795
Fourth	153 (11.8)	
Richest	165 (12.2)	
Birth Order		
1	661 (12.4)	
2	52 (13.9)	0.160
3	6 (24.0)	

Note: * indicates that the results are significant at P-value < 0.05

Table 12 shows the results from bivariate analysis to identify the determinants associated with abortion and multivariate analysis using binary logistic regression to examine the impact of icddr,b area (ISA) in decreasing the abortion rate among adolescent mothers by adjusting the effects of other variables namely Area, Maternal Education, Paternal Education, Mothers age at first birth, Religion, Asset Score, Birth Order.

Paternal education and mothers' age at first birth were found to be significantly related to abortion as per bivariate findings. In total 719 adolescent mothers from both ISA and GSA had experienced the incidence of abortion. It was seen that percentage of mothers from ISA (13.1%) who experienced abortion was slightly higher than the mothers from GSA (11.8%). Only 23.6% of adolescent mothers with primary and above primary education had been gone through the incidence of abortion in both areas. With the increase of adolescent's age, the incident of abortion also seemed to be decreasing significantly.

Table 13: Factors associated with abortion: results from multivariate analysis

	Abortion (N=5715)	
	Adjusted OR	95% CI
Service Area		
icddr,b	0.82	0.71 – 0.95
Government	Ref	--
Maternal Education		
No education	0.87	0.56 – 1.34
Primary	0.56	0.45 – 0.71
Above primary	Ref	--

Paternal Education		
No education	0.55	0.47 – 0.64
Primary	0.63	0.52 – 0.77
Above primary	Ref	--
Mothers Age at First Birth		
<=17	Ref	--
18	0.48	0.39 – 0.58
19	0.41	0.34 – 0.48
Religion		
Islam	Ref	--
Hindu	0.81	0.61 – 1.08
Asset Score		
Lowest	Ref	--
Second	0.47	0.38 – 0.58
Middle	0.48	0.39 – 0.59
Fourth	0.40	0.33 – 0.49
Richest	0.39	0.32 – 0.48

Birth Order		
1	Ref	--
2	1.13	0.83 – 1.54
3	1.93	0.75 – 5.00

Table 13 also shows that the incidence of abortion among adolescent mothers was significantly 18% lower in ISA (OR= 0.82, 95% CI: 0.71 – 0.95) compared to that of GSA. Adolescent women having primary education (OR= 0.56, 95% CI: 0.45 – 0.71) were less likely to experience the incidence of abortion relative to the adolescent women who have above primary education. The incidence of abortion was found to be significantly decreased among adolescents whose husbands' have completed primary level education compared to those whose husbands have completed above primary level education. With the increase of adolescents' age at first birth, the possibility of experiencing abortion decreased in both areas. Adolescent women of age 18 years (OR= 0.48, 95% CI: 0.39 – 0.58) and 19 years (OR= 0.41, 95% CI: 0.34 – 0.48) had lower chance of facing the occurrence of abortion compared to adolescents whose age was less than or equal to 17 years. Asset Score was also found to be a significant determinant for experiencing the occurrence of miscarriage spontaneous. Richest adolescent women were less likely to experience the incidence of abortion (OR = 0.39, 95% CI: 0.32 – 0.48) compared to poorest adolescent

women. Similar findings were observed for other economic classes based on asset score. The possibility of having abortion was found to be higher among adolescent women who had birth order 2 (OR = 1.13, 95% CI: 0.83 – 1.54) and 3 (OR = 1.93, 95% CI: 0.75 – 5.00) compared to those who have birth order 1; though the results were not significant for this particular study.

There were 719 abortion cases during 15 years of study period. Abortion (both spontaneous and induced) is overall higher in ISA area (13.1%) than GSA (11.8%). We found induced abortion is more likely to happen in GSA than ISA. We have performed logistic regression analysis adjusted with parity, year of termination, religion, distance from facility, asset score and found GSA is 1.7 times than ISA to like to have an induced abortion (OR: 1.67, CI: 1.21-2.33) (data was not shown).

d. Adolescent mother and exclusive breastfeeding

There were 2,947 cases of adolescents mothers who breastfed their children in the HDSS database for the years 2007 to 2015. Using the live births as the denominator in these two areas during 2007-2015 periods, the percentage of adolescent mothers practicing exclusive breastfeeding was 43 in ISA and 46 in GSA in 2007. Throughout the study period, the percentage of adolescent mothers practicing exclusive breast feeding was lower for icddr,b compared to government area, except the year 2010. The difference was little wider in 2013 compared to other years where the percentage of adolescent mothers practicing exclusive breastfeeding was

42 in icddr,b area and 54 in government area. In 2015, the percentages are almost same both in icddr,b and government areas (Figure 15).

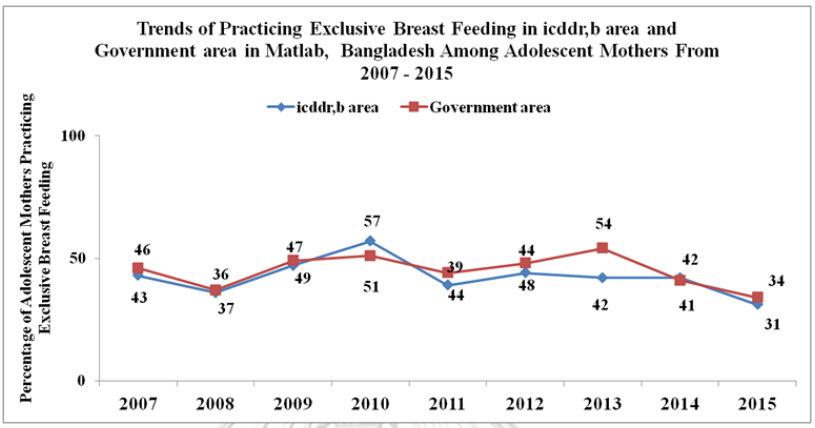


Figure 16: Trends of practicing exclusive breastfeeding in icddr,b and government service area, Matlab data (2007-2015)

Amongst 2,947 adolescent mothers practicing exclusive breastfeeding in both icddr,b service area (ISA) and Government service area (GSA), the distribution of categories of mothers age at first birth across ISA and GSA was found to be nearly even. More than 95% had completed at least primary education or higher in both ISA and GSA. Around 55% of husbands of adolescent mothers had completed the same. Percentage of male children was found to be higher in both areas compared to female children. In both areas, adolescent mothers were predominantly Muslim and most of the adolescent mothers had a parity of 1. More than 70 % deliveries were normal in

both areas. Facility deliveries were double in the icddr,b service area (ISA) relative to the government service area (GSA). Approximately, 14% adolescent's mothers had taken 4+ ANC in both areas (Table 14).

Table 14: Socio-demographic characteristics of adolescent mothers practicing exclusive breast feeding in both icddr,b service area (ISA) and Government service area (GSA)	ISA (1711)	GSA (1236)	p-value
Socio-demographic Variables	n (%)	n (%)	
Mothers age at first birth			
<=17	379 (22.2%)	266 (21.5%)	0.259
18	488 (28.5%)	387 (31.3%)	
19	844 (49.3%)	583 (47.2%)	
Child sex			
Male	870 (50.8%)	624 (50.5%)	0.846

Table 14: Socio-demographic characteristics of adolescent mothers practicing exclusive breast feeding in both icddr,b service area (ISA) and Government service area (GSA)	ISA (1711)	GSA (1236)	
Socio-demographic Variables	n (%)	n (%)	p-value
Female	841 (49.2%)	612 (49.5%)	
Maternal education			
No education	31 (1.8%)	28 (2.3%)	
Primary	262 (15.3%)	223 (18.0%)	0.087
Above Primary	1418 (82.9%)	985 (79.7%)	
Paternal education			
No education	770 (45.0%)	541 (43.8%)	
Primary	331 (19.3%)	289 (23.4%)	0.024*
Above Primary	610 (35.7%)	406 (32.8%)	
Religion			

Table 14: Socio-demographic characteristics of adolescent mothers practicing exclusive breast feeding in both icddr,b service area (ISA) and Government service area (GSA)	ISA (1711)	GSA (1236)	
Socio-demographic Variables	n (%)	n (%)	p-value
Islam	1533 (89.6%)	1171 (94.7%)	<0.001*
Hindu	178 (10.4%)	65 (5.3%)	
Asset Score			
Lowest	258 (15.1%)	182 (14.7%)	0.897
Second	318 (18.6%)	227 (18.4%)	
Middle	302 (17.7%)	233 (18.9%)	
Fourth	414 (24.2%)	305 (24.7%)	
Richest	419 (24.5%)	289 (23.4%)	
Number of Parity			
1	1650 (96.4%)	1169 (94.6%)	0.015*

Table 14: Socio-demographic characteristics of adolescent mothers practicing exclusive breast feeding in both icddr,b service area (ISA) and Government service area (GSA)	ISA (1711)	GSA (1236)	
Socio-demographic Variables	n (%)	n (%)	p-value
2+	61 (3.6%)	67 (5.4%)	
Place of delivery			
Home	329 (19.2%)	730 (59.1%)	<0.001*
Facility Delivery	1382 (80.8%)	506 (40.9%)	
Mode of delivery			
CS	474 (27.7%)	313 (25.3%)	0.15
Normal	1237 (72.3%)	923 (74.7%)	
History of 4+ ANC			
Less than 4 visits	1465 (85.6%)	1070 (86.6%)	0.464
4 or more visits	246 (14.4%)	166 (13.4%)	

Note: * indicates that the results are significant at P-value < 0.05

A significant difference between ISA and GSA (log rank test < 0.0222) was found in terms of the time of exclusive breast feeding practice. The Kaplan-Meier graph showing that the survival probabilities for exclusive breast feeding practice among adolescent mothers from GSA were significantly higher compared to them of ISA (Figure 16).

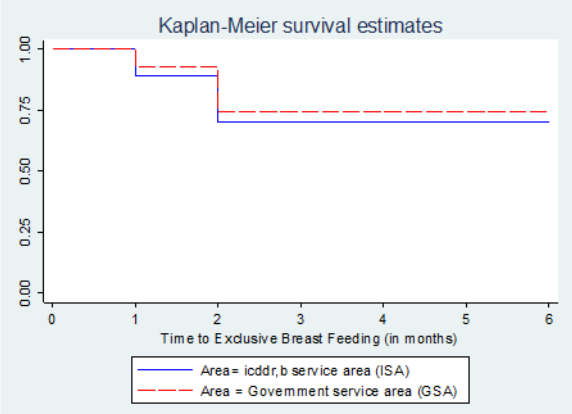


Figure 17: Cumulative survival probability of exclusive breast feeding practice in icddr,b service area (ISA) and government service area (GSA) (log rank test <0.0222)

The determinants associated with the event of exclusive breastfeeding in ISA and GSA and the findings from multivariate analysis using Cox Proportional Hazard Model are exhibited in Table 15 and Table 16 respectively.

Table 15: Bivariate Findings for predictors of EBF duration

	Exclusive breastfeeding during status (N=2947)		
	Event (n=824) (n%)	Censored (n=2123) (n%)	p-value
Area			
Control	317 (25.6%)	919 (74.4%)	0.017*
Intervention	507 (29.6%)	1204 (70.4%)	
Child sex			
Male	417 (27.9%)	1077 (72.1%)	0.952
Female	407 (28.0%)	1046 (72.0%)	
Mothers age at first birth			
<=17	169 (26.2%)	476 (73.8%)	0.492
18	253 (28.9%)	622 (71.1%)	
19	402 (28.2%)	1025 (71.8%)	

Maternal education			
No education	17 (28.8%)	42 (71.2%)	0.764
Primary	142 (29.3%)	343 (70.7%)	
Secondary and higher	665 (27.7%)	1738 (72.3%)	
Paternal education			
No education	336 (25.6%)	975 (74.4%)	0.010*
Primary	200 (32.3%)	420 (67.7%)	
Secondary and higher	288 (28.3%)	728 (71.7%)	
Religion			
Islam	744 (27.5%)	1960 (72.5%)	0.072
Hindu	80 (32.9%)	163 (67.1%)	
Asset Score			
Lowest	136 (30.9%)	304 (69.1%)	0.088
Second	168 (30.8%)	377 (69.2%)	
Middle	144 (26.9%)	391 (73.1%)	
Fourth	201 (28.0%)	518 (72.0%)	
Richest	175 (24.7%)	533 (75.3%)	

Place of delivery			
Home	288 (27.2%)	771 (72.8%)	0.488
Facility Delivery	536 (28.4%)	1352 (71.6%)	
Mode of delivery			
CS	214 (27.2%)	573 (72.8%)	0.575
Normal	610 (28.2%)	1550 (71.8%)	
History of 4+ ANC			
No	705 (27.8%)	1830 (72.2%)	0.653
Yes	119 (28.9%)	293 (71.1%)	
Repeated pregnancy			
Multiple	11 (27.5%)	29 (72.5%)	0.948
Single	813 (28.0%)	2094 (72.0%)	

Note: * indicates that the results are significant at P-value < 0.05

Bivariate findings demonstrated that there were 824 cases of exclusive breast feeding practice among adolescent mothers from both ISA and GSA. Only Service Area and Paternal Education were found to have significant relation with exclusive breastfeeding among adolescent mothers (p-value < 0.05). 29.6% of adolescent mothers in ISA experienced the case of exclusive

breastfeeding whereas in GSA the percentage is 25.6. Less than 30% of male and female children experienced the same. The distribution of categories of other covariates was found to be almost even (Table 15).

The exclusive breastfeeding among adolescent mothers is measured by adjusting the effect of Area (government area or icddr,b area), Maternal Education, Paternal Education, Asset Score, Religion, Delivery Place, Mode of Delivery, Number of Antenatal Care (ANC) Visits, Adolescent Mothers' Age at Birth, Sex of Children, Repeated Pregnancy during the study period (Table 16). The incidence of exclusive breast feeding is 15% lower for an adolescent mother residing in government area (HR: 0.85, 95% CI: 0.72 – 0.99) compared to an adolescent mother residing in icddr,b area keeping all the other variables at fixed level. This result is reverse to the findings from Kaplan-Meier survival estimates (Figure 16) where the survival probabilities for exclusive breastfeeding practice among adolescent mothers from ISA were significantly lower compared to them of GSA.

Table 16: *Multivariate Cox regression model for predictors of exclusive*	Exclusive breastfeeding during status (N=2947)	
	Adjusted Hazard Ratio (HR)	95% CI

breastfeeding duration		
Area		
Control	0.85	0.72 - 0.99
Intervention	Ref	
Child sex		
Male	1.00	0.88 - 1.15
Female	Ref	
Mothers age at first birth		
<=17	0.93	0.78 - 1.12
18	1.05	0.89 - 1.23
19	Ref	
Maternal education		
No education	1.02	0.63 - 1.66
Primary	1.03	0.84 - 1.24
Secondary and higher	Ref	
Paternal education		
No education	0.89	0.76 - 1.05

Primary	1.11	0.91 - 1.34
Secondary and higher	Ref	
Religion		
Islam	Ref	
Hindu	1.15	0.91 - 1.45
Asset Score		
Lowest	Ref	
Second	1.02	0.81 - 1.28
Middle	0.89	0.70 - 1.13
Fourth	0.94	0.75 - 1.18
Richest	0.84	0.67 - 1.07
Place of delivery		
Home	0.98	0.82 - 1.17
Facility Delivery	Ref	
Mode of delivery		
CS	0.94	0.79 - 1.12
Normal	Ref	

History of 4+ ANC		
No	Ref	
Yes	1.03	0.84 - 1.25
Repeated pregnancy		
Multiple	1.03	0.56 - 1.89
Single	Ref	

There was no statistically significant difference between male and female children's in terms of exclusive breastfeeding (HR = 1.00, 95% CI: 0.88 – 1.15). Similarly, there is no statistically significant difference between adolescent mothers who have taken less than 4+ ANC and who have taken 4+ ANC (HR = 1.03, 95% CI: 0.84 – 1.25) in provisions of exclusive breast feeding. Analogous to that, Maternal Education, Paternal Education, Asset Score, Religion, Adolescent Mothers' Age at Birth, Delivery place, and Mode of delivery have no statistically significant difference among their categories in terms of exclusive breast feeding.

CHAPTER 5

Discussion

i. Perinatal birth outcome among pregnant adolescent

The fertility rate among adolescent mothers in our study population for the last nine years ranged between 20 and 27 per 1000 adolescent women. The rate was lower than the national and global rates. The most recent national demographic and health survey data from Bangladesh has reported the adolescent fertility rate as 113 per 1,000 adolescent women in 2014 [31], however the World Bank stated a different lower number, 84 per 1,000 adolescent women in 2016 [70]. Similarly, the global data suggest that the rate was 47 births per 1000 women in 2015[32]. National or global level reporting of adolescent pregnancies often relies on survey data which is subject to recall bias, and might contribute to the different estimates [36-38]. The observed variances in adolescent fertility rates may be a result of the calculation of maternal age from date of birth recorded in a well-defined population by HDSS longitudinally.

However, the trend analysis shows that the adolescent fertility rate was on an upward trend in both the study locations. Starting from 26 and 19 respectively per 1000 adolescent women in icddr,b service area (ISA) and Government service area (GSA), the fertility rate has reached 29 in ISA and 24 in GSA per 1000 adolescent women at the end of 2015. While much improvement has been achieved in reducing the total fertility rate in Bangladesh, fertility rates among adolescents have declined at a slower pace [71]. According to earlier studies, the overall pregnancy rate was much lower in the ISA relative to the GSA from the effect of MNCH project intervention [35]. However, there is no real difference, between in GSA, in the adolescent pregnancies for decades. These findings indicate that on-going health related interventions are not sufficient to reduce adolescent pregnancy rates. In order to reduce the prevalence of adolescent pregnancies, health interventions must be coupled with comprehensive societal support for delaying the age of marriage and improving education among adolescent age groups. These efforts must be coupled with the introduction and implementation of policies targeting sexual and reproductive health rights for adolescents, and improving contraceptive access and use among this age group[72] .

In contrast to fertility rates, perinatal death rates were found to be lower in ISA, relative to GSA; the perinatal death rate per 1000 live births in GSA was higher than the ISA for the entire study period. In icddr,b area the perinatal death is 31% less than government service area. The reported low perinatal death rate in the ISA may be a result of the MNCH project interventions,

as the difference in stillbirth rates is the main cause for lower levels of perinatal death in the ISA. This project particularly worked to improve maternal health, irrespective of maternal age. Similar to our study, another study done to evaluate the impact of the MNCH project intervention has proved that residing in ISA is a strong determinant of reduced perinatal mortality [73]

The age of an adolescent mother at first birth was a significant predictor for perinatal death in our study that supports other studies [13, 74]. This study found that facility proximity reduced the occurrence of perinatal death among adolescent mothers, which is similar to other earlier studies [75-77]. Our study documented the richer the adolescent mother, lower the chance of perinatal death incident which is similar to other studies [78-80]. Probably poor family get more difficulties in timely accessing quality services. Adolescent mothers having primary and above primary education had lower chance of perinatal mortality compared to the adolescent mother with no education which is consistent with findings of other studies [81, 82]. Probably, the educated mother do not miss the chances of seeking perinatal care which is a core of continuum care that might help to avoid perinatal death compare to less educated [82]. Stillbirth death was also found to be lower among adolescent mothers of icddr,b area relative to Government area which are also similar to other global findings . This could be the effect of intensive MNCH services at icddr,b area compare with government area [73].

In addition, adolescent mother who did not gave birth yet is found to have more chance of experiencing perinatal mortality compared to mothers who had single and multi-parity which is similar to other study findings[52]. Thus increased surveillance in nulliparous adolescents is a special requirement to get better neonatal outcomes.

ii. 4 ANC and facility delivery among adolescent pregnancy

This study documented that the uptake of 4+ ANC visits and facility-based deliveries were higher among adolescent mothers residing in the icddr,b area relative to the government area. The inbuilt nature of the MNCH service delivery in the icddr,b area could be a factor contributing to this [83]. Receiving 4+ ANC visits during pregnancy is an important predictor of adolescent mothers delivering their babies in facilities for both areas; however, the association between 4+ ANC visits and receiving facility delivery were stronger in ISA than GSA in this study.

Four or more ANC visit found to be more likely to happen in ISA than GSA. This rate is much higher than other reported studies [84]. Probably quality of ANC services Improving knowledge of pregnancy danger signs, recognition and referral these three factors compel to increasing 4 ANC care and facility delivery in the ISA compare to GSA, this was observed in Matlab MNCH study [83]. For this study, adolescent mothers who practice 4+ ANC uptake during pregnancy are more likely to receive facility delivery service which is similar to other developing countries [85]. ISA is

providing more evidence based services than GSA. The list of ISA services can be found in the Matlab MNCH study[83]

Low performances of GSA compare to ISA could be the community skilled birth attendant (CSBA) programme initiated in Bangladesh during 2003 to train the Female Health Assistant (FHA) from DGHS and Family Welfare Assistant (FWA) from DGFP for six months for safe delivery, mostly home delivery which causes detract their day to day routine home visits for organizing MNCH services[86]. This was also reported increasing the number of CSBA and also decreasing the household visit by FWA and FHA in BDHS 2016[84]. However, this was not case in ISA. So, lack of contact and communication of the GSA filed workers rather busy with home delivery might reduce the performances for ANC and delivery care in GSA. Coverage of 4 ANC is quite low than national coverage[87].

Significant determinants of receiving facility delivery in both ISA and GSA were maternal education, paternal education, asset score, religion, number of ANC visits and distance from nearest facility. However, the percentage of receiving facility-based delivery was higher among ISA compared to GSA even when controlling for these factors. This suggests that icddr,b interventions in the ISA have contributed to improved adolescent maternal health behavior

As per earlier studies, educated mothers are more likely to take advantage of public health care services, seek high-quality services and have greater ability to use health care inputs that offer

improved care than women with no education [88, 89]. Findings revealed an important impact of maternal education on the practice of healthy behaviours among adolescent mothers for this study. However, this study suggests that adolescent mothers, whose husbands had higher educational levels, were more likely to receive maternal health services than others were. These findings are similar to other studies [90, 91].

For this study, the Hindu community was less likely to visit 4+ ANC and but more likely to receive facility delivery than Muslim community, though the result was insignificant (which might be a result of sampling fluctuation). These findings are inconsistent with that of an earlier study, which highlighted that Hindu and Muslim women are similar in availing of delivery care [92]. The findings revealed inequities in receiving 4+ ANC and facility delivery by socioeconomic strata in Matlab Bangladesh. The economic barriers to maternal health care are still a key determinant to accessing the services in the study area. Richest people were more likely to receive 4+ ANC visits as well as facility delivery than poor in both areas which are a common scenario across different countries of the developing world [93, 94]. This finding suggests financial barriers may influence health service utilization for adolescent mothers to achieve universal health coverage in the context of Bangladesh [95].

iii. Adolescent and abortion

Abortion data in developing country including Bangladesh is low quality and incomplete. Most of the studies reported abortion information is with recall and social bias. Most of the data reported abortion information from different surveys that has limitation for reporting respondent age and abortion information. Our study has reported surveillance data that has 60 years long duration and every birth is recorded from the beginning. This study found abortion rate is around 11%-13% that is similar to country rate. The uniqueness of this study is reporting abortion rate for adolescent population for the first time in the Bangladesh. We found the abortion rate is lower in GSA but occurrence of induced abortion is more likely in GSA than ISA. This could be accessibility of abortion services in GSA is difficult than ISA. The ISA and GSA both area provide free MNCH services but GSA providers probably put extra charges for induced abortion, so women are likely to go to the untrained providers for their easy accessibility and less cost which nearly impossible in ISA. Therefore, reported age and abortion information are robust and well known at global level. Our study found abortion rate is little higher in ISA than GSA, it is just reversed study conducted in that area 10 years earlier[64] but induced abortion rate in GSA area is higher like reported earlier study[64] that means that the situation for induce abortion didn't change for last decade. It demands in depth exploration of abortion services in GSA area. The important determinants of adolescent abortion is parents education below primary, low

economic condition and younger age which are similar with other findings [64, 96] but different with African context[97]

iv. Adolescent mother and exclusive breastfeeding

Our study documented exclusive breast feeding rate is around 30% which is far below the national average rate among all ages women (65%) but this study measured breast feeding within last 24 history which is different from our study, our study asked breastfeeding information two months interval after birth to six month of the child[98]. Another study documented that adolescent women child exclusive breastfeeding is 43%[99, 100] which is much higher than our study. Breastfeeding has many longer term health benefits for both the mother and infant such as reducing the risk of overweight and obesity in adolescence [101]. Though many factors are related to exclusive breastfeeding practice among adolescent mothers worldwide but the findings of this study indicated that the key factor contributing to breastfeeding practice is service area. probably of having MNCH-FP program in icddr,b area, practice of EBF was found to be higher in icddr,b service area. This indicates the strength of much stronger service delivery, knowledge sharing in terms of infants feeding. For our study, no difference was found between categories of other covariates such as maternal education, paternal education, religion, repeated pregnancy, delivery place, mode of delivery, sex of the child, age of mothers at birth etc. These findings

differ from study finding across different countries of the world [102]. A further understanding of the determinants of EBF practice among adolescent mothers is necessary in these areas to develop policies that will improve breastfeeding rates and allow reaching the World Health Organization goal of 90 % EBF at six months. To achieve that, mothers need to be educated about benefits of colostrum, exclusive breastfeeding, and the harmful effects of pre-lacteal feeding [103]. Ensuring that adolescent mothers receive optimal maternity care can improve breastfeeding exclusivity rates, which ultimately will lead to improved maternal and child health outcomes.

Strengths and limitations

This analysis is based on data from Matlab which has been criticized for not being representative of other rural areas of Bangladesh because of its many and long-term interventions in the field of health, population and nutrition [104]. Moreover, due to the non-flexibility of the data available, we might be missing some important contextual variables during the analysis.

The quality and robustness of this surveillance data is the main strength of this paper. The rigor of the data quality procedures and long standing follow up in nature of the HDSS has provided a unique opportunity to produce authentic results from the analysis [105].

CHAPTER 6

CONCLUSION AND RECOMMENDATION

a. Conclusions

i. Pregnant adolescent and perinatal mortality

The study has demonstrated that the rates of adolescent pregnancy per 1000 live births in the ISA and GSA are much lower than the current adolescent fertility rates in Bangladesh. This study documented that perinatal deaths are much lower in the icddr,b service area relative to the government service area although fertility rate is higher in ISA than GSA. Lessons learned from

the implementation of the MNCH interventions could inform other national efforts to improve maternal and new born health outcomes. Further studies also need to be done on causes of perinatal mortality and cost analysis in current context. Learning interventions from icddr,b service area will strengthen Bangladesh's efforts to achieve SDG 3 which is "ensure healthy lives and promote wellbeing for all at all ages".

ii. 4+ ANC and facility delivery among adolescent pregnant women

Enhanced 4+ ANC visits and facility deliveries are more likely to indicate a strong monitoring system exists at ISA than GSA. Essentially, icddr,b interventions have the potential to ensure that every adolescent mother received the best standard of care, regardless of economic status and residence of pregnant women. Though special attempt should be taken to increase people's interest in facility delivery in icddr,b area. This seems to be a support for Bangladesh's national strategic guidelines, and ultimately in the achievement of SDG 3.8 which refers essential health service should be available to all respective persons by 2030[95].

iii. Adolescent and abortion

Abortion rate is prevalent among adolescent in the study area. Specially in GSA induced abortion rate is much higher for a decade this means the government health system response has not been taken till to date.

iv. Adolescent mother and exclusive breastfeeding

To improve infant feeding behaviors, prenatal counseling addressing health knowledge and practice linking to child's health maternal benefits of breastfeeding along with the time indicated for EBF is needed. To advance maternal self-efficacy, mental health, nutrition security supporting best practices for infant feeding and childcare in Bangladesh, adequate services and financial aid are the pre-requirements. Special program should be introduced in icddr,b and government area to improve EBF practice. Policies, programs, and research should focus on improving breastfeeding strategies to support breastfeeding of infants. Without addressing the challenges regarding EBF practice among adolescents, the target of achieving universal health coverage by 2030 cannot be accomplished[95].

Policy Recommendation

	Available Strategies in National Policies of Bangladesh [45]	Policy recommendation from the current study
a. All aspects of adolescent sexual reproductive	Key Strategies: 1. Enable evidence based advocacy for comprehensive	1. Different MNCH interventions in ISA should consider

health	policy and programme development, investments and implementation; 2. Promote age appropriate comprehensive sexuality education, which are on par with international standards, through all academic and training institutions; 3. Build capacity for the delivery of age and gender sensitive sexual and reproductive health services which includes HIV/STI prevention, treatment and care; 4. Create a robust system for data collection/analysis on the sexual and reproductive health	including in national maternal health strategy for adolescent group. 2. An effective approach needs to be consider in improving 4 ANC and facility delivery coverage for adolescent pregnant women. 3. Provision of safe and friendly MR services should be available and accessible for adolescent pregnant women where and when required.

	of adolescents, including unmarried adolescents, to inform policy and programming.	
b. Mental health	Key Strategies: 1. Enable evidence based advocacy for comprehensive programme development to promote mental health among adolescents and reduce stigma against mental ill health; 2. Develop skills among adolescents to deal with stress, manage conflict and develop healthy relationships; 3. Develop the capacity of the health sector to address mental health issues as per the	

	provisions of primary mental healthcare and to screen for anxiety, stress, depression and suicidal tendencies; 4. Promote school and facility level interventions which include counselling and management of mental health disorders through linkage with the national mental health programme; 5. Create a robust system for data collection/analysis on mental health issues including substance use, to inform policy and programming.	
c. Social and Behavior Change	Key Strategies: 1. Development of messages and	

Communication (SBCC)	materials for communication and advocacy through sound research; 2. Utilize ICT (including call centres) and media to reach adolescents, key community members, parents and guardians; 3. Develop the capacity of respective institutions and systems to design, plan, implement and monitor SBCC interventions.	
d. Health Systems Strengthening	a. Leadership and Governance: Key Strategies: 1. Capacity building of health personnel in strategic leadership positions to develop and manage	This study has computed adolescent pregnancy age from birth for the first time in Bangladesh. The other reported age is from mostly

	services for adolescents; 2. Strengthen partnerships with all relevant actors at the highest level – both government and non-government – to deliver effective services which meet adolescent health needs; 3. Provide leadership in mainstreaming adolescent SRH services at all levels of service provision according to the ESP. b. Healthcare Financing: Key Strategies 1. Evidence based advocacy to increase budgetary allocation to provide SRH information and	surveys that are possibly erroneous. So, policy makers should consider this reported adolescent pregnancy rate during national resource allocation and program design for adolescent pregnant women.

	services at national, district and sub-district level to adolescents; 2. Establish mechanisms to mobilize financial resources through effective partnerships with Development Partners and the private sector; 3. Improve efficiency and accountability in resource allocation and utilization. c. Health Workforce: Key Strategies: 1. Capacity building of health providers to be sensitive to the needs of all adolescents, including those who are	

	unmarried, through pre service, in service and on the job training; 2. Provide health service personnel with training on counselling for adolescents and capacitate them to adopt non-judgemental attitudes when working with adolescents; 3. Strengthen quality assurance and monitoring mechanisms to ensure consistent quality in the delivery of services. d. Health Information System: Key Strategies: 1. Strengthen the Health Management Information System	

	(HMIS) to collect age and gender disaggregated data on issues which pertain to adolescents; 2. Engage in evidence based advocacy using the data from the HMIS to provide improved and more effective services to meet the health needs of adolescents; 3. Ensure the effective use of the HMIS data to continuously improve the quality of care and service delivery. e. Service Delivery:	

	Key Strategies: 1. Strengthen the service delivery mechanism to ensure the quality of care and comprehensiveness along with other essential dimensions; 2. Establish minimum standards for delivery of services to be adhered to by the Government, NGOs and the private sector.	
e. Breast feeding practice	NA	Special efforts should have initiated for adolescent women friendly exclusive breastfeeding program to improve EBF coverage.

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Abbreviation used

ANC	Antenatal Care
ARI	Acute Respiratory Infection
BCG	Bacillus Calmette–Guérin
BDHS	Bangladesh Demographic Health Survey
CBDT	Children Birth Date
CCID	Child Current Identification
CHRW	Community Health Research Worker
CI	Confidence Interval
CID	Current Identification
CIDA	Canadian International Development Agency
CS	Caesarean Section
CSL	Children Serial
CSBA	Community Skilled Birth Attendant
CRID	Children Registration Identification
DFID	Department for International Development
DGFP	Directorate General of Family Planning
DGHS	Directorate General of Health Services

EBF	Exclusive Breast Feeding
FHA	Female Health Assistant
FRA	Field Research Assistant
FRO	Field Research Officer
FRS	Field Research Supervisor
FVR	Field Visit Record
FWA	Field Welfare Assistant
FWC	Family Welfare Centre
FWV	Family Welfare Visitor
GDP	Gross Domestic Product
GIS	Geographic Information System
GoB	Government of Bangladesh
GSA	Government Service Area
HDSS	Health and Demographic Surveillance Site
HH	Household
HR	Hazard Ratio
HRO	Health Research Officer
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh

IPV Inactivated Polio Vaccine

IRB Institutional Review Board

ISA icddr,b Service Area

LB Live Birth

LBW Low Birth Weight

LMPDT Last Menstrual Period Date

MCH-FP Maternal and Child Health – Family Planning

MMR Maternal Mortality Ratio

MNCH Maternal, Neonatal and Child Health

MO Medical Officer

MR Menstrual Regulation

MRID Mother Registration Identification

MUAC Mid-Upper Arm Circumference

NIPORT National Institute of Population Research and Training

OGSB Obstetrical and Gynecological Society of Bangladesh

OPV Oral Polio Vaccine

OR Odds Ratio

PCV Pneumococcal Conjugate Vaccine

PENTA Pentavalent Vaccine

PNC Postnatal Care

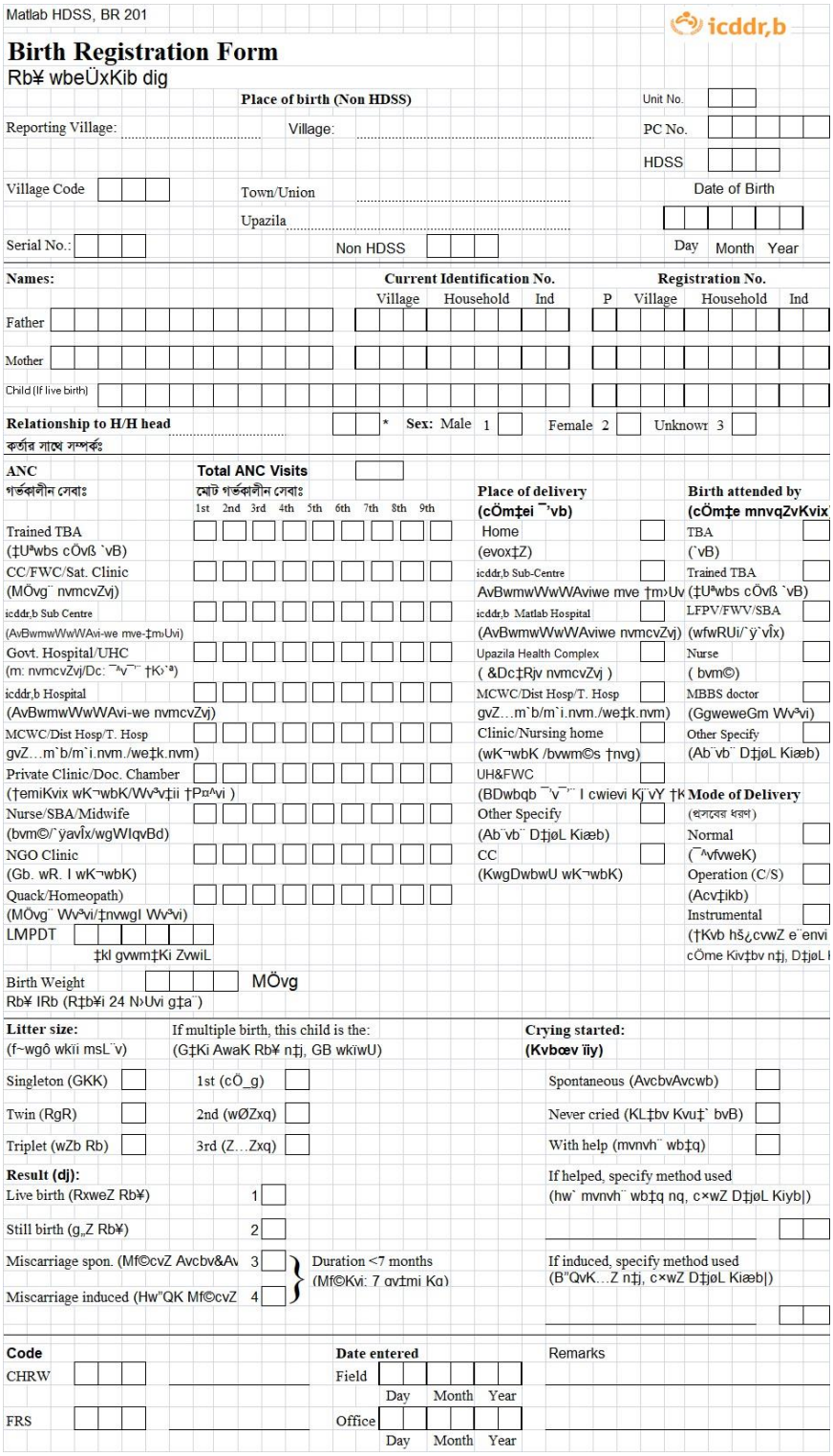
PNM Perinatal Mortality

PRM Project Research Manager

RID Registration Identification

RKS Record Keeping System

Annex :1-5



Matlab HDSS, BR 201

icddr,b

Birth Registration Form

Rb¥ wbeÜxKib dig

Place of birth (Non HDSS)

Unit No.

Reporting Village: ..... Village: .....

PC No.

HDSS

Village Code

Town/Union .....

Date of Birth

Upazila .....

Serial No.:

Non HDSS

Day Month Year

Names:

Current Identification No. — Village Household Ind

Registration No. — P Village Household Ind

Father

Mother

Child (If live birth)

Relationship to H/H head ..... *

Sex: Male 1 Female 2 Unknown 3

কর্তার সাথে সম্পর্কঃ

ANC

গর্ভকালীন সেবাঃ

Total ANC Visits

মোট গর্ভকালীন সেবাঃ

1st 2nd 3rd 4th 5th 6th 7th 8th 9th

Trained TBA (‡UªwbscÖvß `vB)

CC/FWC/Sat. Clinic (MÖvg¨ nvmcvZvj)

icddr,b Sub Centre (AvBwmwWwWAvi-we mve-‡mÞUvi)

Govt. Hospital/UHC (m: nvmcvZvj/Dc: ¯^v¯¨¨ †Kv`ª)

icddr,b Hospital (AvBwmwWwWAvi-we nvmcvZvj)

MCWC/Dist Hosp/T. Hosp gvZ…m`b/m`i.nvm./we‡k.nvm)

Private Clinic/Doc. Chamber (†emiKvix wK¬wbK/Wv³v‡ii †P¤^vi)

Nurse/SBA/Midwife (bvm©/`ÿavÎx/wgWIqvBd)

NGO Clinic (Gb. wR. I wK¬wbK)

Quack/Homeopath) (MÖvg¨ Wv³vi/‡nvwgI Wv³vi)

LMPDT ‡kl gvwm‡Ki ZvwiL

Place of delivery (cÖm‡ei ¯¨'vb)

Home (evox‡Z)

icddr,b Sub-Centre AvBwmwWwWAviwe mve †mÞUv (‡UªwbscÖvß `vB)

icddr,b Matlab Hospital (AvBwmwWwWAviwe nvmcvZvj)

Upazila Health Complex (&Dc‡Rjv nvmcvZvj)

MCWC/Dist Hosp/T. Hosp gvZ…m`b/m`i.nvm./we‡k.nvm)

Clinic/Nursing home (wK¬wbK /bvwm©s †nvg)

UH&FWC (BDwbqb ¯¨'v¯¨¨ I cwievi Kj¨vY †K

Other Specify (Ab¨vb¨ D‡jøL Kiæb)

CC (KwgDwbwU wK¬wbK)

Birth attended by (cÖm‡e mnvqZvKvix)

TBA (`vB)

Trained TBA (‡UªwbscÖvß `vB)

LFPV/FWV/SBA (wfwRUi/`ÿ`vÎx)

Nurse (bvm©)

MBBS doctor (GgweweGm Wv³vi)

Other Specify (Ab¨vb¨ D‡jøL Kiæb)

Mode of Delivery (প্রসবের ধরণ)

Normal (¯^vfvweK)

Operation (C/S) (Acv‡ikb)

Instrumental (†Kvb hš¿cvwZ e¨envi cÖme Kiv‡bv n‡j, D‡jøL

Birth Weight MÖvg

Rb¥ IRb (R‡b¥i 24 N›Uvi g‡a¨)

Litter size: (f~wgô wkïi msL¨v)

Singleton (GKK)

Twin (RgR)

Triplet (wZb Rb)

If multiple birth, this child is the: (G‡Ki AwaK Rb¥ n‡j, GB wkïwU)

1st (cÖ_g)

2nd (wØZxq)

3rd (Z…Zxq)

Crying started: (Kvbœv iiy)

Spontaneous (AvcbvAvcwb)

Never cried (KL‡bv Kvu‡` bvB)

With help (mvnvh¨ wb‡q)

Result (dj):

Live birth (RxweZ Rb¥) 1

Still birth (g„Z Rb¥) 2

Miscarriage spon. (Mf©cvZ Avcbv&Av 3

Miscarriage induced (Hw¯QK Mf©cvZ 4

Duration <7 months (Mf©Kvi: 7 ay‡mi Kg)

If helped, specify method used (hw` mvnvh¨ wb‡q nq, c×wZ D‡jøL Kiyb|)

If induced, specify method used (B"QvK…Z n‡j, c×wZ D‡jøL Kiæb|)

Code

CHRW

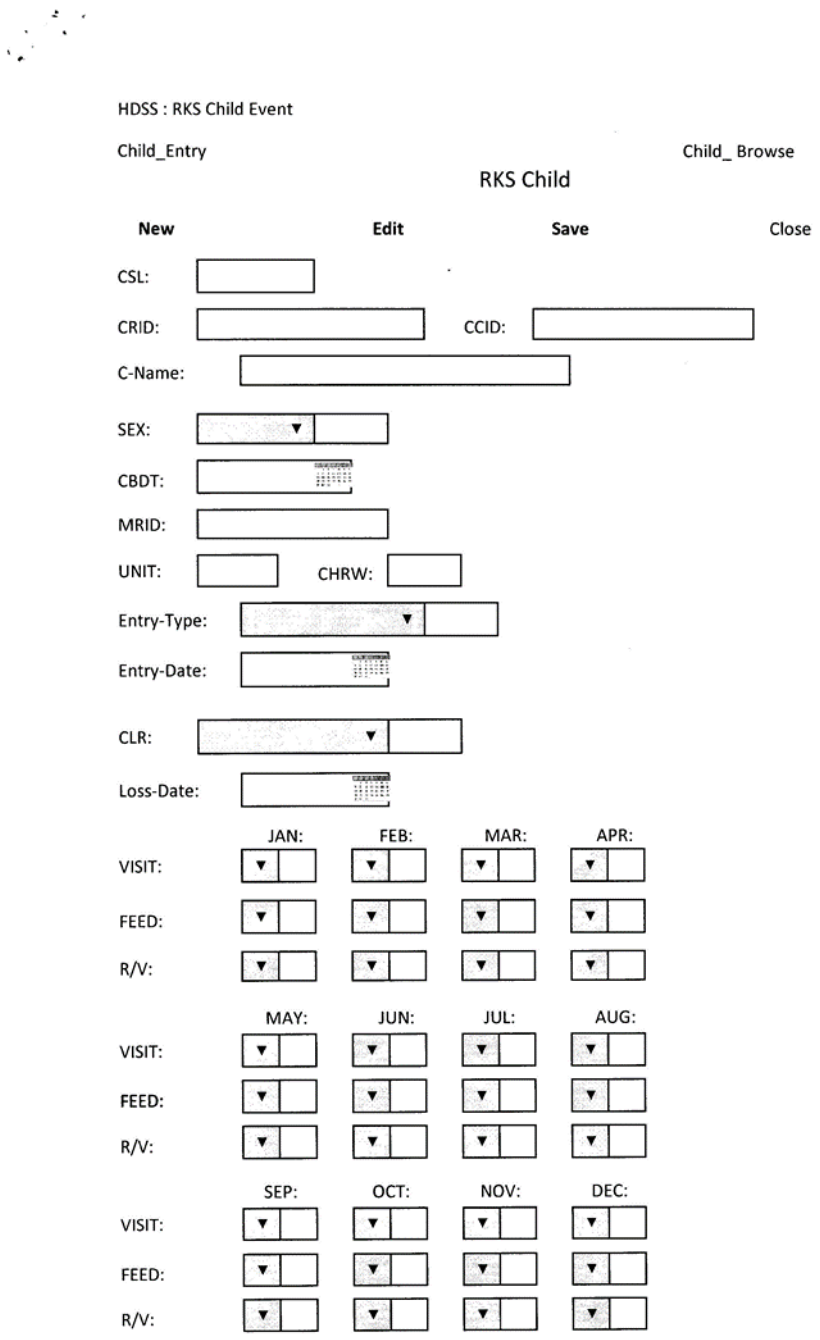
FRS

Date entered

Field Day Month Year

Office Day Month Year

Remarks


HDSS : RKS Child Event
Child_Entry
Child_ Browse
RKS Child
New
Edit
Save
Close
CSL:
CRID:
CCID:
C-Name:
SEX:
CBDT:
MRID:
UNIT:
CHRW:
Entry-Type:
Entry-Date:
CLR:
Loss-Date:
JAN:
FEB:
MAR:
APR:
VISIT:
FEED:
R/V:
MAY:
JUN:
JUL:
AUG:
VISIT:
FEED:
R/V:
SEP:
OCT:
NOV:
DEC:
VISIT:
FEED:
R/V:

	C/R	Date:
BCG:		
PENTA-1:		
PENTA-2:		
PENTA-3:		
PCV-1:		
PCV-2:		
PCV-3:		
OPV-1:		
OPV-2:		
OPV-3:		
OPV-4:		
IPV:		
Measles Rubella (MR):		
Measles-2:		
VITA-1:		
VITA-2:		

Is the birth registered?:

Date of registration:

PNC-Visit: Total PNC Visits:

First Visit:	day:	
Second Visit:	day:	
Third Visit:	day:	
Fourth Visit:	day:	

International Center for Diarrheal Disease Research, (icddr,b)

Mohakhali, Dhaka -1212

Consent Form

Title of the project: Matlab Health and Demographic Surveillance System (HDSS)

Principal Investigator and unit Head: Dr. Peter Kim Streetfield

We have come from Matlab Health and Demographic Surveillance System (HDSS). We usually collect long term data from the permanent residents living in 142 villages (117 villages of Matlab (North and South) upazilla under Chandpur district and 25 villages of Daudkandi upazilla under Comilla district) on birth-death, arrival-departure, marriage-divorce, break down of joint families into nuclear families, changes in the position of family leadership etc. We also collect information from the married as well as eligible women residing in those areas on reproductive health related issues, choice/use of family planning methods and current residential address of husbands. In case of child birth (both alive/dead), we ask about the Ante natal care (ANC) and delivery related information (e.g place of taking ANC, place of delivery, who attended during delivery and mode of delivery). Data are also collected on feeding pattern of newborn babies. Moreover, in case of abortion, we collect information of abortion.

On the basis of the information from the respondents, we prepare an annual scientific report every year and use it for the research initiatives of icddrb. Other than this, the collected information are used by Government of Bangladesh (GoB) to formulate national strategies and

development initiatives, government and non-government research institutes and different universities of home and abroad.

As the head of the house/a married and eligible woman or a mother/caregiver of a child, you are invited to provide information on the above issues for our health and demographic surveillance related activities. We will collect data every two monthly and it will take 10-15 minutes for each interview.

Your participation in the study is completely voluntary, you can withdraw your participation any time during the study and you have the sole authority to decide for or against your participation. We would keep all information confidential. The papers containing the information will remain with us at icddr,b in a locked cabinet and no one except the people involved with this research will be able to see the information. Refusal to take part in or withdrawal from the surveillance will involve no loss of care, benefits or attention in icddr,b Matlab/ Dhaka hospital or any government hospital. Do you have any question? Yes/No

If you have any query, you can call Md. Taslim Ali, Senior Manager, HDSS-Matlab , Climate Change and Health, Health System and Population Studies Division or can directly call 01714006132.

We will happily provide you further information about the surveillance, if any, now or at a later time. If you think, you faced any loss or difficulty due to providing information in this surveillance, you can contact Dr. Peter kim Streetfield, Principal Investigator and unit Head, HDSS, Dhaka (Tel-8810024) or icddr.b's IRB Secretariat to Mr M. A. Salam Khan, Phone No: 9886498/ Mob-01711428989) to ask about your rights for taking part in Health and Demographic Surveillance System (HDSS).

Are you interested to take part in Health and Demographic Surveillance System (HDSS)? Yes/No

CID									

RID									

_____ _____

Signature or left thumb impression of participant Date

_____ _____

Signature or left thumb impression of the witness Date

_____ _____

Signature of the PI or his/her representative Date

International Center for Diarrheal Disease Research, (icddr,b)

Mohakhali, Dhaka -1212

Assent Form (Married and eligible women of 11-17 years of age)

Title of the project: Matlab Health and Demographic Surveillance System (HDSS)

Principal Investigator and unit Head: Dr. Peter Kim Streetfield

We have come from Matlab Health and Demographic Surveillance System (HDSS). We usually collect long term data from the permanent residents living in 142 villages (117 villages of Matlab (North and South) upazilla under Chandpur district and 25 villages of Daudkandi upazilla under Comilla district) on birth-death, arrival-departure, marriage-divorce, break down of joint families into nuclear families, changes in the position of family leadership etc. We also collect information from the married as well as eligible women residing in those areas on reproductive health related issues, choice/use of family planning methods and current residential address of husbands. In case of child birth (both alive/dead), we ask about the Ante natal care (ANC) and delivery related information (e.g place of taking ANC, place of delivery, who attended during delivery and mode of delivery). Data are also collected on feeding pattern of newborn babies. Moreover, in case of abortion, we collect information of abortion.

On the basis of the information from the respondents, we prepare an annual scientific report every year and use it for the research initiatives of icddrb. Other than this, the collected information are used by Government of Bangladesh (GoB) to formulate national strategies and development initiatives, government and non-government research institutes and different universities of home and abroad.

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Your participation in the study is completely voluntary, you can withdraw your participation any time during the study and you have the sole authority to decide for or against your participation. We would keep all information confidential. The papers containing the information will remain with us at icddr,b in a locked cabinet and no one except the people involved with this research will be able to see the information. Refusal to take part in or withdrawal from the surveillance will involve no loss of care, benefits or attention in icddr,b Matlab/ Dhaka hospital or any government hospital. Do you have any question? Yes/No

If you have any query, you can ask me or call Md. Taslim Ali, Senior Manager, HDSS-Matlab , Climate Change and Health, Health System and Population Studies Division or can directly call 01714006132.

We will happily provide you further information about the surveillance, if any, now or at a later time. If you think, you faced any loss or difficulty due to providing information in this surveillance, you can contact Dr. Peter kim Streetfield, Principal Investigator and unit Head, HDSS, Dhaka (Tel-8810024) or icddr.b's IRB Secretariat to Mr M. A. Salam Khan, Phone No: 9886498/ Mob-01711428989) to ask about your rights for taking part in Health and Demographic Surveillance System (HDSS).

Are you interested to take part in Health and Demographic Surveillance System (HDSS)? Yes/No

CID									

RID										

_____ _____

Signature or left thumb impression of participant Date

In my presence, the consent form was described to the above participant. The participant provided consent after understanding all the issues related to this surveillance. I am also providing consent for her participation as a guardian.

_____ _____

Signature or left thumb impression of the guardian Date

_____ _____

Signature or left thumb impression of the witness Date

_____ _____

Signature of the PI or his/her representative Date

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PUBLICATION	1. Nisha MK, Raynes-Greenow C, Rahman A, Alam A (2019) Perceptions and practices related to birthweight in rural Bangladesh: Implications for neonatal health programs in low- and middle-income settings. PLOS ONE 14(12): 0221691. https://doi.org/10.1371/journal.pone.0221691 2. Rahman, A, Austin A, Anwar, I, Taneepanuschul S. Comparing Trends of Perinatal Mortality in two rural Areas of Matlab, Bangladesh. Journal of Health Research.2019 (epub ahead) 3. Rahman A, Begum T, Ashraf F, Akhter S, Hoque DME, et al. (2019) Feasibility and effectiveness of electronic vs. paper partograph on improving birth outcomes: A prospective crossover study design. PLOS ONE 14(10): e0222314. https://doi.org/10.1371/journal.pone.0222314 4. Begum T, Nababan H, Rahman A, Islam MR, Adams A, Anwar I. (2019) Monitoring caesarean births using the Robson ten group classification system: a cross-sectional survey of private for-profit facilities in urban Bangladesh. PLOS ONE. 2019;14(8): e0220693. 5. van der Heijden J, Gray N, Stringer B, Rahman A, Akhter S, Kalon S, Dada M, Biswas A. 'Working to stay healthy', health-seeking behaviour in Bangladesh's urban slums: a qualitative study. BMC Public Health. 2019 May 17;19(1):600. doi: 10.1186/s12889-019-6750-0.

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AWARD RECEIVED

1. Saving Lives at Birth grant award by Grand Challenge Canada in 2014
2. Best poster award at Kyoto University Public Health Conference in 2018