

Factors Associated with Infant and Under-five Mortality in Myanmar



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บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)  
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จุฬาลงกรณ์มหาวิทยาลัย  
**CHULALONGKORN UNIVERSITY**

ปัจจัยที่เกี่ยวข้องกับการเสียชีวิตในเด็กแรกเกิดและเด็กอายุต่ำกว่า 5 ปีในประเทศเมียนมาร์



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หล้า หลีน มวี : ปัจจัยที่เกี่ยวข้องกับการเสียชีวิตในเด็กแรกเกิดและเด็กอายุต่ำกว่า 5 ปีในประเทศเมียนมาร์ (Factors Associated with Infant and Under-five Mortality in Myanmar) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร.ธัชพันธ์ โกมลไพศาล, หน้า.

หนึ่งในความตั้งใจของประเทศเมียนมาร์คือลดอัตราการเสียชีวิตของเด็กเพื่อที่จะบรรลุเป้าหมาย Millennium Development Goal ที่ตั้งเป้าให้ประเทศมีอัตราการเสียชีวิตของเด็กอายุต่ำกว่า 5 ปีให้น้อยกว่า 25 คนต่อเด็ก 1,000 คน ภายในปี ค.ศ. 2030 งานวิจัยชิ้นนี้ศึกษาปัจจัยกำหนดอัตราการเสียชีวิตของเด็กในพื้นที่ต่างๆของประเทศเมียนมาร์

ผลการศึกษาแสดงให้เห็นว่า เด็กทารกที่ได้รับนมแม่มีโอกาสเสียชีวิตน้อยกว่าเด็กที่ไม่ได้รับร้อยละ 11.7 เด็กแรกเกิดที่เป็นเด็กฝาแฝดมีโอกาสเสียชีวิตมากขึ้น ร้อยละ 8.1 การใช้ยาคุมกำเนิดของมารดา ลำดับการเกิดและขนาดตัวของเด็กแล้วแต่เป็นปัจจัยสำคัญที่กำหนดการเสียชีวิตของเด็กแรกเกิด

การศึกษายังพบด้วยว่า เด็กแรกเกิดที่เกิดในพื้นที่ภูเขาและพื้นที่แห้งแล้งมีโอกาสเสียชีวิตมากกว่าเด็กแรกเกิดที่เกิดในพื้นที่ริมฝั่งทะเล ร้อยละ 2.6 และ 2.1 ตามลำดับ ในขณะที่เด็กแรกเกิดที่เกิดกับมารดาที่มีฐานะดีมีโอกาสเสียชีวิตน้อยกว่าเทียบกับเด็กแรกเกิดที่เกิดกับมารดาที่มีฐานะยากจน คิดเป็นร้อยละ 4.4 สำหรับเด็กที่เกิดในพื้นที่แห้งแล้ง เด็กแรกเกิดที่เกิดกับมารดาที่มีระดับการศึกษาตั้งแต่ทุติยภูมิขึ้นไปมีโอกาสเสียชีวิตน้อยกว่าเด็กแรกเกิดที่เกิดกับมารดาที่ไม่มีการศึกษาหรือมีการศึกษาระดับปฐมภูมิจึงคิดเป็นร้อยละ 4.4 สำหรับเด็กที่เกิดในพื้นที่เตลต้าและเด็กแรกเกิดที่เกิดในเขตเมืองมีโอกาสรอดชีวิตมากกว่าเด็กแรกเกิดที่เกิดในเขตชนบทสำหรับเด็กที่เกิดในพื้นที่ภูเขา

ผลการศึกษานี้บ่งชี้ว่าปัจจัยสำคัญที่กำหนดอัตราการเสียชีวิตของเด็กแรกเกิดในประเทศเมียนมาร์มีความแตกต่างกันในสี่ภูมิภาค และเน้นย้ำความสำคัญของหลายภาคส่วนในการลดอัตราการเสียชีวิตดังกล่าว

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Myanmar is committed to achieve unfinished agenda for reducing child mortality, fourth indicator of Millennium Development Goals (MDGs) and global target to achieve under-five mortality rate 25 per 1000 live births in 2030. Moreover, under-five mortality varies across states and regions within the country and the study aims to explore determinants of mortality across different health care planning zones. The results showed that infants who were breastfed had lower risk of death by 11.7 percent comparison with children who were not, and twin or multiple births were more likely to die by 8.1%. Moreover, short preceding birth interval, mothers with no using contraceptives, birth order, size of baby after delivery, caesarean born child were found to be statistically significant predictors of infant mortality. Furthermore, the study found regional disparities and infant from Hilly and Dry zones more like to die by 2.6% and 2.1% in comparison with infants from Coastal zone. In additionally, infants of mothers residing in rich household wealth were less likely to die by 4.4% than those of infants from poor wealth in Dry zone, infants of mothers belonged to secondary education were less likely to die by 4.4% than those infants of mothers with no education or primary level in Delta zone, urban infant tends to survive than rural infant in Hilly zone. Finally, the findings from this study showed that determinants of infant mortality vary across the four zones and overall sample and highlight multi-sectoral coordination to improve infant survival in Myanmar.

Field of Study: Health Economics and      Student's Signature .....

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## Acronyms

3MDG	Three Millennium Development Goals Fund
ASEAN	Association of Southeast Asia Nations
AMW)	Auxiliary midwife
BEmOC	Basic Emergency Obstetric Care
CemOC	Comprehensive Emergency Obstetric care
EPHS	Essential package of Health Services
EU	Enumeration Units
FRHS	Fertility and Reproductive Health Surveys
GDP	Gross Domestic Product
GIS	Geographic Information System
GRP	Gross Regional Product
GNI	Gross National Income
HDI	Human development index
HMIS	Health management information system
IHLCA	Integrated Household Living Conditions Assessment Survey
IMR	Infant mortality rate
LB	Live Births
LBW	Low Birth Weight
LIFT	Livelihoods and Food Security Trust Fund
MCCT	Maternal and Child Cash Transfer
MCH	Maternal and Child Health
MDGs	Millennium Development Goals
MDHS	Myanmar Demographic and Health Survey
MMR	Maternal Mortality Rate
MNCH	Maternal, Newborn, Child Health Care
MOHS	Ministry of Health and Sports
NLD	National League Democracy
OOPE	Out-of-pocket expenditures



ORS	Oral Rehydration Salt
PSU	Primary Sampling Units
RHC	Rural Health Center
SBA	Skilled birth attendant
SDG	Sustainable Development Goals
SHU	Station Hospital Units
SRMNAH	Sexual, reproductive, maternal, newborn and adolescent health
U5MR	Under-five mortality rate
UHC	Universal Health Coverage
UNIGME	Inter-agency Group for Child Mortality Estimation
WASH	Water and Sanitation



## CHAPTER 1

### INTRODUCTION

#### 1.1 Problem and Significance

The survival rate of under-five children can determine the quality of health care system, strength of social and economic development and presence of strong social policies within the countries. Measuring infant and under-five mortality rates (IMR and U5MR) is one of human development indicators in 8 Millennium Development Goals as well.

In Myanmar, under-five children composed of 11.67% of total population was reported by Central Statistical Organization of Myanmar in 2008. According to the 2014 national censuses data, they constitute 10% of entire population in Myanmar. Myanmar is one of the countries with unfinished agenda in 2015 with a target to achieve 43 per 1000 live births (LB) and actual attainment of 52 per 1000 LB and it means every 52 under-five children died every 1000 LB within a year. It is a measurement for not only child health and well-being but also the overall achievement of Sustainable Development Goals (SDG) of each country. Reducing neonatal mortality rate to as low as 12 deaths per 1000 Live Births (LB) and under-five mortality rate to decline 25 deaths per 1000 LB from all countries by 2030 is imperative in achieving SDG.

Behind the national figure of under-five mortality rate in Myanmar, there are regional disparities among different states and regions. The highest U5MR is Magway with 89 deaths per LB comparing with Mon State which has 43. Regions with four highest under-five mortalities rate are Magway and Ayeyarwaddy divisions and Chin and Rakhine States. Among them, Rakhine has long-term internal conflict between ethnic minorities, and all four regions need further development in infrastructure and geographic barriers is one of significance for utilizing of public services Infant and under 5 mortalities foreshadow life expectancy. In Mon and Yangon with lowest infant mortality rates, life expectancy are higher with 71.7 and 71.2 respectively. But, in

Magway an average person is expected to live only to 60.6 years of age. (The Republic Of The Union Of Myanmar, 2015)

Investing in the health of children can have a huge positive impact on economic development of the country itself by helping them to become healthier and more productive adults who will drive the economic growth of the country. Poor health especially in early years of childhood permanently impairs them over the rest of their live. For instance, a study comparing between malaria attacks on children done in Sri Lanka indicated that, a child who suffered malaria for five times were 15% lower in cognitive test score than a child with three times malaria episodes. Moreover, children born in poor families are less healthier and thus attention care or intervention should be prioritized to get positive changes in intergenerational poverty for each country.(Belli, Bustreo, & Preker, 2005)

Universal Health Coverage (UHC) is defined by World Health Organization as a system where all people are ensured access to needed health care services without suffering from financial hardship. To achieve UHC or to improve health and reduce the gap of inequalities in health, various aspects such as social, economic, environmental and political factors are needed to be taken into consideration. (Huda, Tahsina, Arifeen, & Dibley, 2016)

The recent changes in economic, political and national health strategic plans emphasize reaching UHC in 2030 and will help to reduce under-five mortality from regions and states where further effort is necessary to know associated factors of infant and under-five mortality in each region. Thus, it is important to do detailed analysis on economic disparities and overall associated factors with child survival so that it can address health inequalities factors or regional disparities and help design a health care plan to achieve UHC in Myanmar.

## 1.2 Definition of under-five mortality

### 1.2.1 Under-five Mortality

Under-five mortality is defined as the probability of dying between birth and before five years of age. But, in this study, we will analyze under-five mortality as infant and child mortality and definitions are described as below.

### 1.2.2 Infant Mortality

Infant mortality is defined as the probability of dying before the first year of age.

According to the KR file, infant mortality is ranging from 0 to 11 months of age.

### 1.2.3 Child Mortality

Child mortality is defined as the probability of dying between first year and fifth year of age. In another words, the probability of dying between exact 12 months of age to 59 months of age.

### 1.2.4 Infancy period

It is the period between birth to before first birthday of life.

### 1.2.5 Early childhood

It is defined as the age between exact one year and five years or from 12 months of age to before 60 months of age.

## 1.3 Research Questions

1. What are the associated factors that influence infant and child mortality in Myanmar?

## 1.4 Research Objectives

### 1.4.1 General Objectives

1. To assess the main determinant factors of infant and child mortality by using of secondary data of Myanmar demographic health survey in the period of between 2015 and 2016.
2. To determine the magnitude of each factor influencing infant and child mortality after adding midwife per 1000 population and Gross Regional per capita in Myanmar.

#### 1.4.2 Specific Objectives

1. To determine how biodemographic factors of child level such as sex, twin, birth interval and birth order affect infant mortality in Myanmar.
2. To determine how biodemographic factors of child level such as birth interval and birth order affect child mortality in Myanmar.
3. To analyze how biodemographic factors of maternal level such as age of mother at first birth and not using of contraceptive affect infant and child mortality in Myanmar?
4. To assess effects of environmental factors such as accessibilities to clean water and latrine affect infant and child mortality in Myanmar.
5. To investigate how nutrition factors such as breast feeding and size of the baby after birth affect infant mortality in Myanmar.
6. To determine how socioeconomic factors namely mother's education, father's education, occupation of father, unemployment condition, and household wealth status affect infant and child mortality in Myanmar.
7. To assess the effects of delivery factors such as institutional delivery, skilled birth attendant, and caesarean section affect infant mortality in Myanmar.
8. To determine the effects of regional factors such as distance to health facility, urban, ecological zone or health care planning zone, Gross Regional per capita, midwife health per 1000 population on infant and child mortality in Myanmar.

#### 1.5 Scope of the study

The scope of this study is based on the proximate factors and maternal factors such as age of mother at birth, usage of contraceptive; child factors such as sex of child, twin, birth order, birth interval; environmental factors namely access to safe drinking water and latrine; nutrition factor for breast feeding and size of the baby after birth; delivery factors- institutional delivery, skilled birth attendant, and delivery by caesarean section. The individual socioeconomic factors are education attainment of mother, father, employment condition of the mothers, and occupation status of the fathers at the individual level; wealth status for household level and distance to health facility, residence, region, ecological zone, Gross Regional Product (GRP) per capital,

and supply side factors on states and regions midwife per 1000 population at the community level are included for the analysis by using of secondary data of Myanmar Demographic and Health Survey MDHS 2015-2016. The unit of analysis will be child level characteristics with his or her mothers, fathers, household and regional characteristics.

#### 1.6 Possible benefits

UHC which means all people having access to essential health care services without suffering from financial burdens is a common global goal in the world. And, it is one of the committed sustainable development goals to reach in 2030, and government needs sufficient funds or investment to achieve the goals. However, developing countries like Myanmar have limited resources to achieve the target of UHC. According to 20:80 theory asserted by Italian economist Vilfredo Pareto, if the government address main or critically basic root causes of the problems by 20 percent, 80 percent of the remaining problems will be already solved. In addition, recommendation from previous studies done by factors associated with infant and under-five mortality by extracting of 3 rounds data of Fertility and reproductive health surveys and 2014 censuses data, the two studies highlighted more studies on socioeconomic factors associated on under-five mortalities and regional disparities in Myanmar.(Ko Ko & Sawaengdee, 2014) (Ko Ko M, 2017) That's why this study will address factors based on conceptual framework of Mosley and Chen model on socioeconomic and proximate factors influencing under-five mortality especially in Myanmar. The study will provide information to policy makers on prioritization of health intervention programs which can reduce disparities issues by individual aiming to improve child survival which will benefit social protection services to children under five-year of age and utilize this information in designing better health care interventions.

## CHAPTER 2

### BACKGROUND INFORMATION

#### 2.1 General information about Myanmar

Myanmar, officially known as the Republic of the Union of Myanmar is situated in South-East Asia region with as many as 135 ethnic groups living in diverse geographic regions. Its neighboring countries are Bangladesh, India, China, Laos, and Thailand and surrounded by Bay of Bengal on the west and by Andaman sea on the south respectively as shown in figure 1. There are over 100 local dialects and languages and Myanmar language is an official one.(Ministry of Health, 2014) Yangon, which is formerly known as Rangoon was the capital of Myanmar until 2006. Now, Nay Pyi Taw, a newly built city 320 km north of Yangon, is the official capital but Yangon remains the largest and is the commercial capital of Myanmar.(Aung-Thwin, Tung, & Steinberg, 2018) It covers an area of 676577.2 square kilometers and neighboring countries are China, India, Thailand and Bangladesh. It is the second largest country in Southeast Asia and a member of Association of Southeast Asia Nations (ASEAN). It lies between 09°32' N and 28°31'N latitudes and 92°10' E and 101°11' E longitudes. After nearly five decades of dictatorship and military rule, a Civilian government was elected in 2011 and now, Myanmar is moving towards democratic system under the rule of National League Democracy (NLD) party. As a developing country, there are many challenges and obstacles facing the country, but concerted efforts must be made to develop policies to address these issues.

The table 1 shows the development indicators of Myanmar and Gross National Income (GNI)per capita has increased dramatically since 1990. Life expectancy rate also has increased 7 years in 2016 from baseline 59 in 1990. Furthermore, the under-five mortality rate is declining year by year as well.

Table 1: Selected indicators

	1990	2000	2010	2014	2016	Source
Population, total (millions)	40.63	46.1	50.16	-	52.89	World Bank
Population growth (annual %)	1.5	1.2	0.7	-	0.9	World Bank
Poverty headcount ratio at national poverty lines (% of population)	..	..	25.6	-	19.4	World Bank
Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population)	..	..	..	-	6.5	
GNI per capita, PPP (current international \$)	480	1,040	3,650	-	5,530	World Bank
Life expectancy at birth, total (years)	59	62	65	-	66	World Bank
Fertility rate, total (births per woman)	3.5	2.9	2.4	-	2.2	World Bank
Births attended by skilled health staff (% of total)	46	57	71	-	60	World Bank
Mortality rate, under-5 (per 1,000 live births)	116	90	64	-	51	World Bank
Immunization, measles (% of children ages 12-23 months)	68	84	88	-	91	World Bank
Life Expectancy at birth (both sexes)				66.8		2014 censuses



Life Expectancy at birth (Male)				63.9		2014 censuses
Life Expectancy at birth (Female)				69.9		2014 censuses
Infant mortality rate (deaths per 1,000LBs)				62		2014 censuses
Under-five Mortality Rate (deaths per 1,000LBs)				72		2014 censuses
Maternal mortality ratio (deaths per 100,000LBs)				281		2014 censuses

Source: World Development Indicators (World Bank) and 2014 Censuses of Myanmar

Figures in blue refer to periods other than those specified.

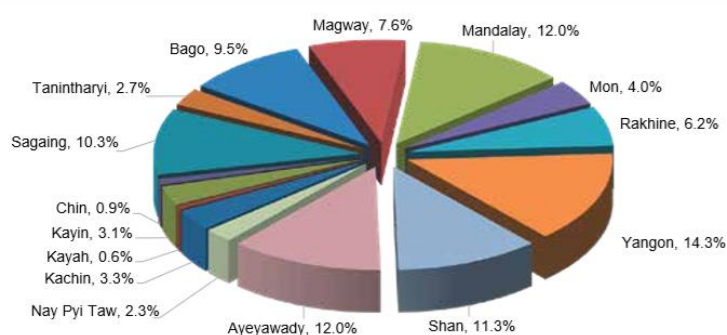
Figure 1: Administrative Map of Myanmar



### 2.1.1 Geographic context of Myanmar

It is a Union of (7) states and (7) divisions and (1) Union Territory called Nay Pyi Taw and was administered by President. It has divided into of 74 Districts, 330 Townships, 398 Towns, 3065 Wards, 13,619 Village Tracts and 64,134 Villages in 15 regions. From 2008 constitution, (5) self-administrative zones and (1) self-administrative division was established. Among states and regions, the largest proportion of a population lives in Yangon which accounted 14.3% (7.3 million), followed by Mandalay and Ayeyarwaddy as the second position with 11% each (6 million) and Shan state with 11.3% (5.8 million) as shown in figure 2. The remaining population which is approximately 26 million is distributed unevenly in 11 states and divisions. (Ministry of Labour & UNFPA) The major ethnic groups are Kachin (12 races), Kayah (9 races), Kayin (11 races), Chin (53 races), Bamar (9 races), Mon (1 race), Rakhine (7 races) and Shan (33 races). According to the 1983 population census data, 89.4 % of the population is Buddhist. The remaining are Christian 4.9 %, Muslims 3.9 %, Hindu 0.5% and Animists 1.2%. (Ministry of Health, 2014)

Figure 2: Proportion of union population in geographic regions



### 2.1.2 Demographic context

The 2014 Myanmar population and census report were released and as per analyzed data total population was around 51.5 million with the annual growth rate of 0.85. Compared to previous round of censuses data, the total and child dependency ratios has been decreasing meanwhile old dependency ratio has been increasing as

shown in table 2. Moreover, based on 1983 census, Myanmar's population has increased. The population density is around 76.1 square kilometers. 28.6 percent of the population is made of children under 14 years of age and 5.8 percent consists of elderly population which is defined as 65 years and above group. The largest percentage of population, 65.6 percent, is made up of those from 15 to 64 years of age. The ratio of male and female was 48.22 percent and 51.78 percent respectively. The rural population is around 70 percent whereas remaining resides in the urban area. Myanmar has the biggest proportion of economically productive age portion. There are 8 major ethnicities such as Bamar, Chin, Kachin, Kayar, Kayin, Mon, Rakhine and Shan. From 2014 census, the proportion of under-five children is nearly 10 percent of total population.(The Republic Of The Union Of Myanmar, 2015)

*Table 2 Population of different ages and dependency ratio in Myanmar*

	1973			1983			2014		
	Union	Urban	Rural	Union	Urban	Rural	Union	Urban	Rural
<b>Broad Age Group</b>									
Total	100	100	100	100	100	100	100	100	100
Under 15 years	41.5	40.7	41.7	38.6	35.7	39.5	28.6	24.1	30.6
15 - 64 years	54.8	55.7	54.6	57.5	60.5	56.5	65.6	69.9	63.8
65+ years	3.7	3.3	3.8	3.9	3.8	4	5.8	6	5.7
<b>Dependency Ratio</b>									
Total Dependency Ratio	82.2	79.1	83.3	73.9	65.3	76.9	52.5	43.0	56.8
Child Dependency Ratio	75.6	73	76.4	67.1	59	69.9	43.7	34.4	47.9
Old Dependency Ratio	6.7	6.1	6.9	6.8	6.3	7	8.8	8.5	8.9
Aging Index	8.8	8.3	9	10.2	10.8	10	20.1	24.8	18.6

Source: The 2014 Myanmar Population and Housing Censuses: The Union Report.p.21

### 2.1.3 Economic context

Myanmar is a country with abundant natural resources and is strategically located between the world's two largest economies namely China and India have a long coastal line for trading among ASEAN countries. It also has high percentage of population made up of productive age. Gross Domestic Product (GDP) of 8.5 percent from 2010 to 2014 and then per capital is around \$1203. But, macroeconomics instabilities such as high inflation rate, weakness in revenue collection, poor

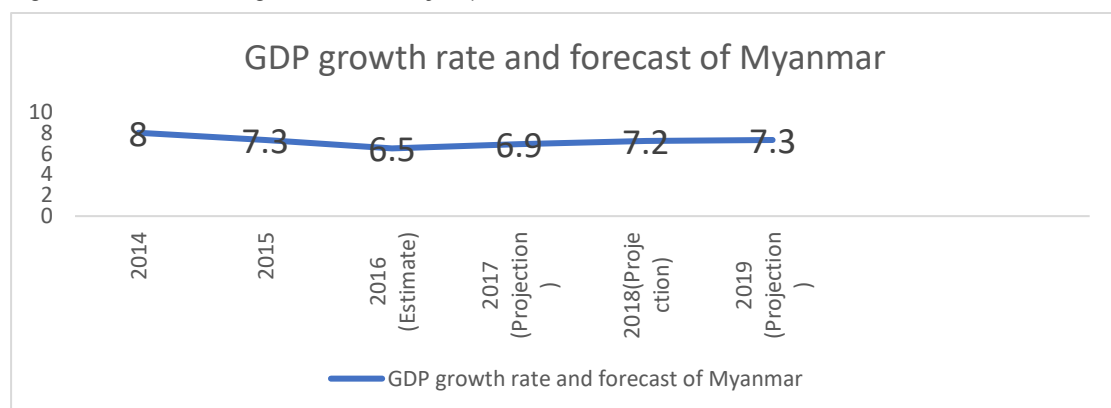
infrastructure and lack of qualified human resources in development sectors stand Myanmar as 144 out of 188 for human development index (HDI) of 2016. which measures life expectancy, educational attainment and adjusted real income.(United Nations Development Programme, 2016) Human development index (HDI) is also performance indicator for economic development and GDP growth rate and forecast of Myanmar economy was shown in figure 3. (T. World Bank, 2017) Now, economic policies of the country are moving towards sustainable agriculture into an industrialized country. (Ministry of Health, 2014)

Findings from two rounds of Integrated Household Living Conditions Assessment Survey (IHLCA) in 2005 and 2010 suggests poverty rate of the whole country was in a decline from 32.1 % to 25.6%. Anyhow, in microeconomics or household levels, nearly one-third of the population still lives under the poverty line. Among states and regions, Chin state is one of the most under-developing state and 73 percent of households is under the poverty line which is highest poverty rate followed by Rakhine state with 44 percent. (Ministry of National Planning and Economic Development, SIDA, UNDP, & UNICEF, 2010)

#### 2.1.4 Social Development

A civilian government was elected in 2011 and changes were seen in social development such as health and education sectors to improve access and equity of social services within the country and health and education facilities were upgraded within five years period. (Ministry of Health, 2014)

Figure 3: Real GDP growth rate of Myanmar



## 2.2 Myanmar Healthcare System

Currently, the Ministry of health and sports (MOHS) is the main provider of providing preventive, promotive, curative and rehabilitative services to the entire population. There are seven departments under the ministry of health and sports. Both public and private sectors act as primary health care service providers in both rural and urban areas.

Myanmar has parallel health care system with ethnic health organization which is providing health care in conflict present regions for decades and there have changes found since a ceasefire agreement makes coordination two health care systems for providing health care services to the needy communities. (Davis & Jolliffe, 2016)

### 2.2.1 Health workforce distribution among state and division

Investment in human capital is also one of the important components in upgrading the health of the population. To reduce under-five mortality rate, children delivery by professional healthcare personal save lives of both mother and children. In 2014, the human resources for health, doctors, nurses, and midwife was 16.4 per and an increase from 14.9 in 2010–11. However, the 2006 World Health Report stated that countries with fewer than 22.8 doctors, nurses, and midwives per 10,000 population were unlikely to be able to provide even the most basic health services and it is still below than the standard. (MOHS Ministry of Health and Sports, 3MDG, & UNFPA, 2017)

70 percent of the population reside in the rural area and Rural Health Center (RHC) is the main health center supervised by township health departments and there are Health Assistance, Lady Health Visitor, Public Health Supervisor I, Midwife, Public Health Supervisor II are assigned at health facilities. Among them, midwives are the key health staff who is providing basic primary health care services including child health care at the primary level. For the villages where there has no health facility, volunteer health workers are served primary health care services and they all are supervised and monitored by midwives and Public Health Supervisor II. Among volunteer health workers, assisting mothers during delivery time with providing home-based newborn

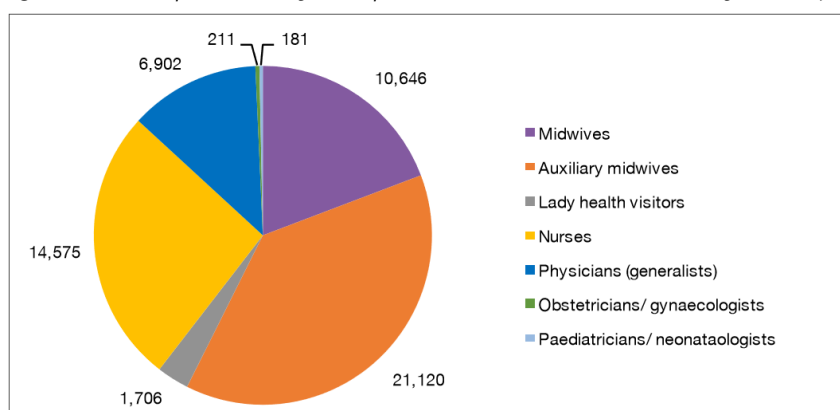
care was included in six months training curriculum of Auxiliary midwifery course. As information provided in table.3, the number of health staff are increasing on these years at both primary and secondary level of healthcare services. (Ministry of Health, 2014)

*Table 3 Availability of human resources*

HUMAN RESOURCES FOR HEALTH		1988-89	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14*
TOTAL	NO.	12,268	23,740	24,536	24,435	28,077	29,832	31,542
DOCTORS (		4,377	9,383	9,728	10,450	11,675	12,800	13,099
PUBLIC/PRIVATE)		7,891	14,157	14,808	15,985	16,402	17,032	18,443
NURSES		8,349	22,885	24,242	25,644	26,928	28,254	29,532
HEALTH ASSISTANTS		1,238	1,822	1,845	1,883	1,893	2,013	2,062
LADY HEALTH VISITOR		1,557	3,238	3,278	3,344	3,371	3,397	3,467
MIDWIVES		8,121	18,543	19,051	19,556	20,044	20,617	21,435
HEALTH SUPERVISOR I		487	529	529	541	612	677	652
HEALTH SUPERVISOR II		674	1,484	1,645	2,080	1,718	1,850	4,998

Source: Health in Myanmar (2014) p.143 \* Provisional actual

Figure 4: Composition of the public sector SRMNAH workforce by headcount, 2014



Sources: Obstetricians/gynaecologists: estimates based on Myanmar's figures from the 2014 State of the World's Midwifery report<sup>60</sup>. Other cadres: Health Management Information System, 2014.

As shown in figure 4, even though MOHS did not recognize Auxiliary midwife (AMW) as skilled birth attendance, but they were counted as health workforce in providing of sexual, reproductive, maternal, newborn and adolescent health (SRMNAH) services. Nearly 38 percent of the human workforce is from AMW. Even though properly trained volunteers are counted in there, there are not sufficient human resources to cover 80 percent of skilled birth attendance for the whole nation. However, the information on human resources could not cover from private sector and ethnic health care organization which are providing services in conflict-affected area or Southeast of Myanmar.

## 2.2.2 Healthcare facilities

The backbone of the health care system is township health department. Normally, it covers a population of 100,000 to 300,000 and provides both primary and secondary healthcare to the coverage population. Under the management of Township or District Medical Officer are Urban Health Centre, Maternal and Child Health, from four to five RHCs, and one to three Station Hospital Units (SHU). In one RHC, there are four to five Sub-Rural Health Centers. Health Assistance is the mainly responsible person at RHC level. At the tertiary level, specialized health care personnel such as Obstetrician/ Gynecologist and Pediatrician take care for referral and

emergency patients at tertiary hospitals which are mostly located in the capitals of states or divisions.

As can be seen in table 4, the number of hospital beds nearly doubled from 1988 to 2013 with the building of 379 new hospitals during this period of time. Meanwhile, there is not much change in maternal and child health centers providing care for the urban area of township levels, and only 347 new RHCs were expanded in past two decades. It showed that government spends less on primary care than secondary care. MOHS has plans to continue expanding of both human resources and health facilities to cover essential packages of health services (EPHS) especially Maternal, Newborn, Child Health Care (MNCH) as universal health care throughout the country. (MOH, CHD, DOPH, & UNICEF, 2014)

In 2013, according to the annual hospital statistics reports, allocation of health finance for station hospitals are more than half of 16, 25 and 50 bedded hospitals except Yangon and Nay Pyi Taw regions as shown in figure 5.

*Table 4 Health facilities in Myanmar from 1988-2014*

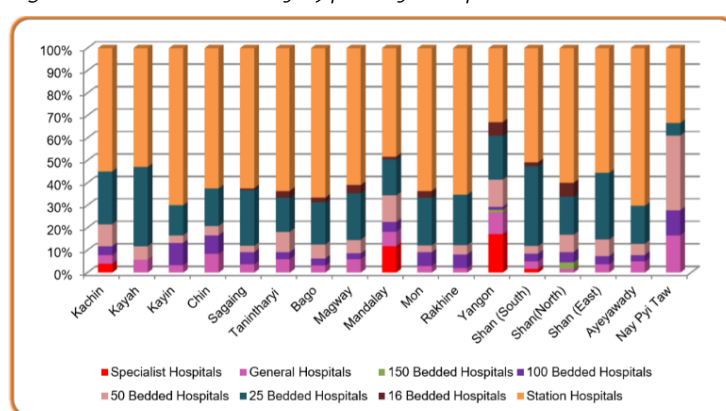
Health Facilities	1988- 89	2008- 09	2009- 10	2010- 11	2011-12	1012- 13	2013- 14
Hospitals (Public)	631	846	871	924	987	1,010	1056
Ministry of Health	617	820	844	897	921	944	988
Other Ministries	14	26	27	27	66	66	68
<b>Total No. of Hospital Beds</b>	25,309	38,249	39,060	43,789	54,503	55,305	56748
No. of Primary and Secondary Health Centers	64	86	86	86	87	87	87
No. of Maternal and Child Health Centers	348	348	348	348	348	348	348
No. of Rural Health Centers	1,337	1,481	1,504	1,558	1,565	1,635	1684



No.of Health Team	School	80	80	80	80	80	80	80
No.of Medicine Hospitals	Traditional	2	14	14	14	14	16	16
No.of Medicine Clinics	Traditional	89	237	237	237	237	237	243

Source: Ministry of Health, Health in Myanmar 2014.p.144

Figure 5 Distribution of types of hospitals across States and Regions



In Myanmar, both public and private hospitals provide acute, chronic as well as rehabilitative treatment and care to patients. If mental health is also taken into consideration, Myanmar has 0.6 hospital beds per 1000 population. According to the data of HMIS in 2013, distribution of hospital beds and discharges were inequitable distribution across states and region.

With the perspective of utilization and hospital beds, Mandalay, Kachin, Naypyitaw, Kayah and Yangon regions are two beds per 1000 population as well as utilization are also double than national average whereas Chin State has low utilization of services, but hospital occupancy is double than national average. (Sein et al., 2014)

### 2.3 Healthcare Expenditure in Myanmar

According to the information from National Health Plan (2017-2021), allocation of the health sector in Myanmar is 3.65 percent of total government expenditure which is very low compared to international standard and WHO recommendation of using 5%GDP on health to achieve health outcomes. (World Health Organization & William, 2013) To have coverage of 90% Maternal and Child Health (MCH) services, the

expenditure on health sector should be more than 5% of GDP. Historical investment in health care sector has been less since 1975 when only 0.8 percent of GDP was used. It further fell to 0.4 percent in 1995/1996 and then in 2011/2012, the total amount was only 0.3 percent of GDP.

Table 5 shows that government investment in health sector and the allocation of GGE was 1.03% and it equivalent to US\$ 1.60 per capita in 2010/2011 and it increased into 3.38% in 2014/2015.

Therefore, the health outcomes of Union of Myanmar are still poor and the government needs to invest more to achieve national goals of health care system as well as to reach globally defined standards. (G. World Bank, 2015)

Findings in literature agreed that both public and private expenditure on health is positively related with reducing of death and mortality of infant, but public health care sector is more strongly influenced to improve the result.

The National League Democracy government is trying to increase health allocation fund as indicated by data obtained from National Health Account of Ministry of Health and Sports from 2012 to 2015 as can be seen in figure 6 below. There are three sources of funding namely public, private and external. Public funding comes from general revenue and it goes through Ministry of Health and Sports and other ministries for health related programs. Private funding is contribution that comes from individuals or households. External sources are mainly obtained from development partners (DPs) to run health care program within the country. 60% of the international aids fund was used in Mother and Child program and (MOHS Ministry of Health and Sports, 2016) fighting against communicable diseases in Myanmar. Recent quality study on Out of Pocket Expenditure (OOPE) in Myanmar recommends to introduce reaching essential health care packages (EHCP) to the population with higher financial protection because the study found that forty percent of income was gone for healthcare. Therefore, if needy population access essential health care thus can reduce catastrophic expenditure of households. It will be implemented by close coordination among different actors in health, outside of health and communities by bottom-up

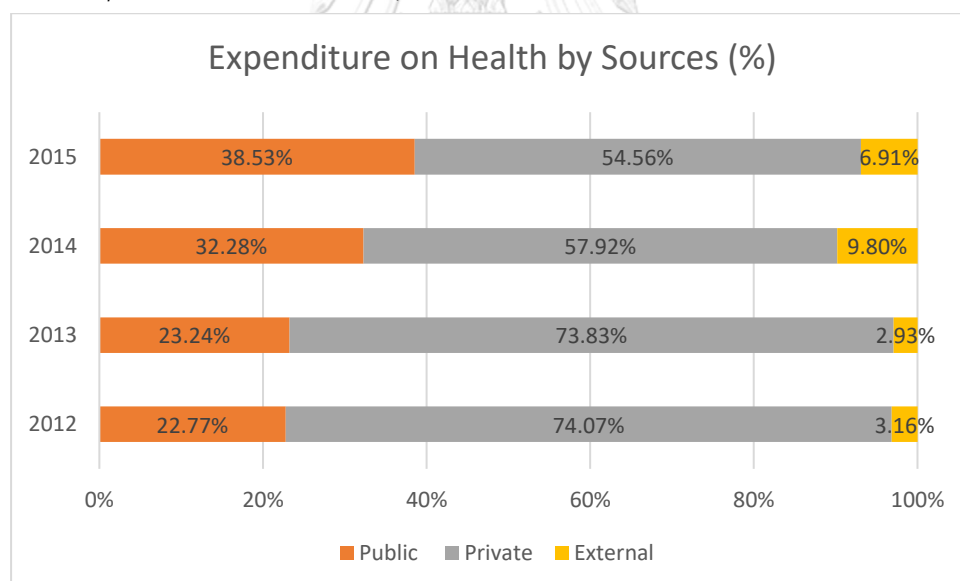
planning rather than top-down methods which were still used today. (Save the Children, World Bank, & 3MDG, 2017)

Table 5: Government Health Expenditure by %GDP and %GGE

Financial year	Government Health Expenditure as % Domestic Product (GDP)	Government Health Expenditure as % General Government Expenditure (GGE)
2010-2011	0.20	1.03
2011-2012	0.21	1.05
2012-2013	0.76	2.82
2013-2014	0.89	3.15
2014-2015	0.99	3.38

Source: Health in Myanmar (2014) p.14

Figure 6: Expenditure on Health by Sources (%)



Source: National Health Account: Ministry of Health and Sports (2012-2015)

Then, tracking of where the money goes also identifies whether the fund was used properly to achieve goals of health care system in Myanmar. From the table 6, hospitals taken up around 70 percent of expenditure. For primary care or health

promotion and preventive care purposes, an average of only 2 percent as average was spent from 2006 to 2010.

*Table 6: Government Healthcare Expenditure by Provider sources*

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	-07	-08	-09	-10	-11	-12	-13	-14	-15	-16
Hospital	65.59	70.55	70.32	67.89	69.39	69.8	56.5	54.3	62	63.2
Ambulatory care	17.23	17.3	17.54	17.01	14.43	14.63	13.3	14.3	18.5	17.9
Retail sale and medical good	3.85	3.87	3.84	3.79	3.45	3.86	16.6	20.7	11.3	8.5
Provision and administration of public health programs	2.06	2	2	2.51	1.5	1.65	1.9	1.5	0.7	2.4
General health administration	0.69	0.53	0.51	0.5	2.46	3.14	0.3	0.6	3.1	3.9
Health-related services	2.59	1.85	1.98	1.82	1.81	2.23	3.1	3.1	1.9	1.5
Rest of the world	3.99	3.9	3.8	6.48	6.69	4.69	8.2	5.6	2.6	2.5

Source: Health in Myanmar (2006-2011) and National Health Account, MOHS (2012-2015)

## 2.4 Child Health Outcomes in Myanmar

### 2.4.1 Child Mortality Rate of Myanmar among ASEAN region and global

Infant mortality rate (IMR) is a good estimate of health status of the population. For the first time in 30 years, a nationwide survey on IMR is carried out in Myanmar in 2014. Under-five mortality rate is nearly two times higher than that of Southeast Asia region and twelve times higher than the developed world. If socioeconomic status of Myanmar is improving in the future, the mortality rate is also declining too. If Myanmar is going to make progress in socioeconomic conditions in the future, IMR is expected to decline accordingly.

ASEAN statistical report of under-five mortality rate among ASEAN countries against Millennium development goals shows that Myanmar is still one of the countries which did not achieve goals in 2015 as shown in table 7.(Secretariat, 2017)

*Table 7: Under-five Mortality status of ASEAN nations*

Country	1990	1995	2000	2005	2010	2015	Target
Brunei Darussalam	10	10	10	10	7	10	3
Cambodia	181	135	124	83	54	35	60
Indonesia	97	81	55	45	42	26	32
Lao PDR	170	150	131	98	76	86	57
Malaysia	17	13	8	9	8	8	6
Myanmar	130	82	76	71	35	52	43
Philippines	80	67	49	34	36	31	27
Singapore *	8	5	4	3	3	3	3
Thailand	13	12	12	11	10	9	4
Viet Nam	58	52	45	27	24	22	19

**Note\*** Data of Singapore refer to resident population

Source: ASEAN Statistical report on MDGs 2017.p.36

#### 2.4.2 Difference among States and Regions

According to the analysis of the 2014 census data within the country, the under-five mortality rate is highest as 62 per 1000 live births and expected life at birth is 64.7 which is lowest among ASEAN region. While comparing among states and regions, health disparities were seen between underdeveloped and well-developed regions. For example, infant mortality rate in Magway is highest with 89 per 1000 live births. Meanwhile Mon State has 43 per 1000 live births. The four highest under-five mortalities rate regions are Magway (108 per 1000 LB), Ayeyarwaddy divisions (105 per 1000LB) and Chin (90 per 1000 LB) and Rakhine State (75 per 1000 LB) in figure 8. Then, children who are born or live in Mon and Yangon tend to live up to 71.7 and 71.2 in each. But, for children who are from Magway are expected to live only up to 60.6 years of age. All three child health outcomes in terms of Infant Mortality, Child mortality and under-five mortality rate are shown in table 8.

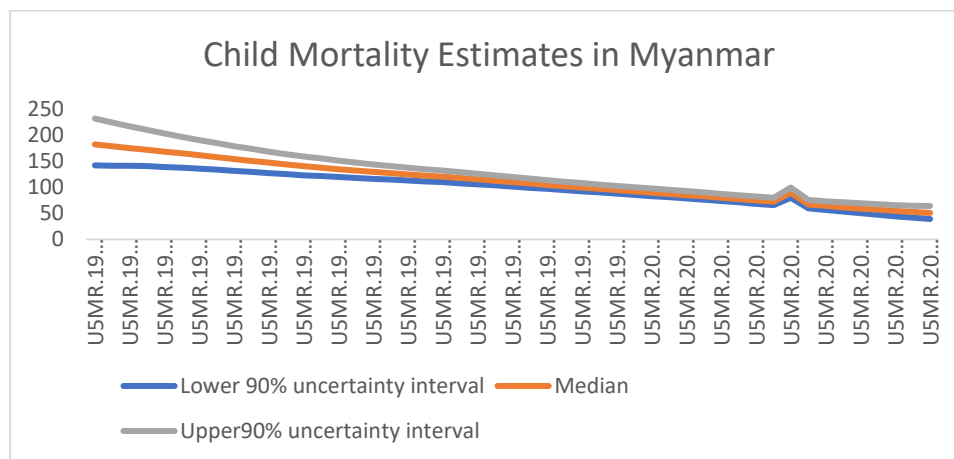
In 1999, Central Statistic Organization conducted nationwide mortality survey. The data shows infant mortality rate and U5MR were 60 and 78 respectively. The study also found out regional disparities. According to the survey result, Mandalay region was best child outcome with IMR and U5MR with 39 and 47 respectively and worst outcomes in Shan East.(Sein et al., 2014)

The national wide multiple cluster survey was conducted in 2009/2010 and their findings on reasons of child mortality were such as i) inequitable distribution of child health services among regions, ii) neonatal deaths decline and it could be affect from scaling up of newborn care, iii) the factors which could not control under Newborn and child health such as education level of the mother, birth spacing practices of parents, inadequate infrastructure of Water and Sanitation Hygiene (WASH) in the communities where they live, iv) increasing urbanization with poor urban affect survival of the children. (MOH, DOPH, CHD, WHO, & UNICEF)

For countries where under five HIV prevalence is 5% or more than that of adult population (15-49 years), United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) used cohort study with the consideration of bias in AIDS data for

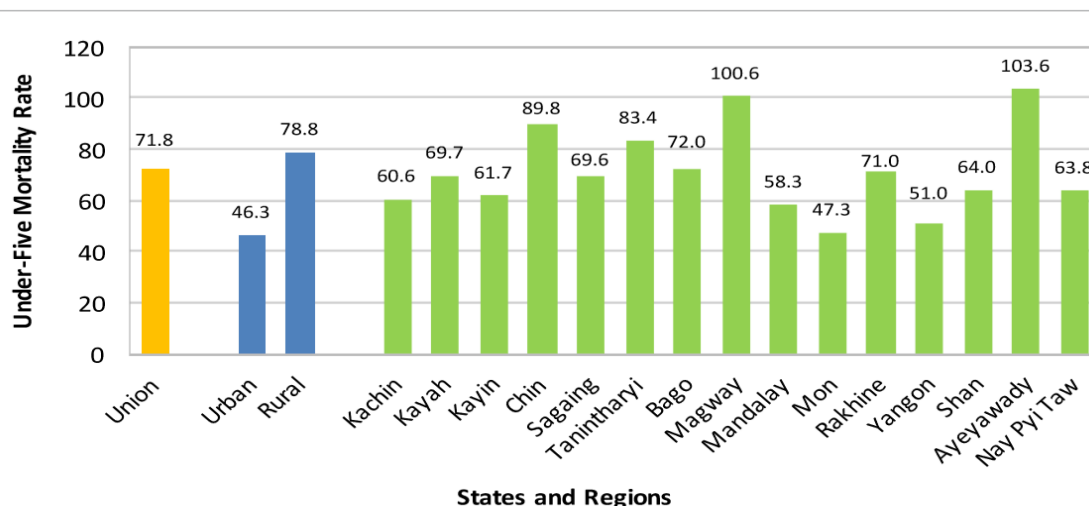
estimation of under-five mortality trends. According to the notes; upper and lower bounds refer to the 90 percent of uncertainty interval for estimation and can be found in figure 7. (UNICEF, World Health Organization, World Bank Group, & United Nations, 2017)

Figure 7 : Child Mortality Estimates in Myanmar



Source: [www.childmortality.org](http://www.childmortality.org)

Figure 8 Under-five mortality rates by States and Regions in Myanmar



Source: 2014 Censuses report

Table 8: Infant, child and under-five mortality rates by urban/rural place of residence and state and region

Area	Infant mortality Rate	Child mortality Rate	Under-five mortality rate
Union	61.8	10.0	71.8
Urban	41.0	5.3	46.3
Rural	67.2	11.6	78.8
Kachin	52.8	7.8	60.6
Kayah	60.1	9.6	69.7
Kayin	53.6	8.0	61.6
Chin	75.5	14.1	89.6
Sagaing	60.0	9.6	69.6
Tanintharyi	70.8	12.6	83.4
Bago	61.9	10.1	72.0
Magway	83.9	16.7	100.6
Mandalay	50.3	8.1	58.4
Mon	41.9	5.4	47.3
Rakhine	61.1	9.9	71.0
Yangon	44.9	6.1	51.0
Shan	55.5	8.5	64.0
Ayeyawady	86.2	17.4	103.6
Nay Pyi Taw	55.4	8.4	63.8

Source: Thematic report on mortality by 2014 censuses pg.12





## CHAPTER 3

### LITERATURE REVIEW

The literature review related with this topic were obtained from Chulakorn University, Office of Academic resources website, Google search engine, google scholar, PubMed, JSTOR, Springer, Sciencedirect, lancet, documents from website, MOHS website, and reports. Keywords used for this study are determinants of infant and child mortality, under-five mortality, regional disparities, and Myanmar.

#### 3.1 Global and regional overview of under-five mortality

Globally, U5MR has been reduced progressively since several decades ago. In 1990, U5MR was 93 per 1000 LB and it declined to 41 in 2016. In terms of the number of children dead, it was reduced to 5.6 million in 2016 from 12.6 million in 1990.(UNICEF et al., 2017) According to the statistics 5.9 million of under-five children were dead from preventable diseases and 43 percent of death were from contagious and communicable diseases with diarrhea, pneumonia, sepsis and malaria and all are the most leading causes for under-five mortalities especially in developing countries. Mostly, the environmental contamination is high and drinking water supply at household levels are not enough quantity and quality makes more exposure to that diseases. Malnutrition is one of the underlying factors which contribute 50 percent of mortalities rate and it enhances in equalities among poor and rich countries.(United Nations, 2017)

The year 2015 was target for MDGs and according to the analysis, Southeast Asia region is one of the regions which need to improve child survival in the future from unnecessary preventable diseases. 31% of under-five children deaths are from Southeast Asia regions and around 1.9 million of children.(You et al., 2015) Myanmar is one of the reported high rate of mortality in maternal, infant, and child mortality among ASEAN countries and progress on child survival is slow and results show as inequalities of child health outcomes within region. Pneumonia and diarrhea account 30.65% and neonatal deaths contribute 38.97% in SEA. (Acuin et al., 2011) According

to data from 193 countries, improving access to water and sanitation is negatively associated with infant and under-five mortality. (Cheng, Schuster-Wallace, Watt, Newbold, & Mente, 2012)

Cohen et.al (2017) did a study on the impact of multisectoral health determinants on child mortality 1980–2010 based on countries wide data from 1990, the baseline year for MDG. Altogether 52 variables were identified including health and non-health sectors and countries were grouped into baseline conditions of 1990 into high, moderate, low and very low under-five mortalities. Univariable and multivariable regression models were used. To control outliers and variation across over time, MM estimation was applied. In all four categorized countries, immunization against Diphtheria, Pertussis, and Tetanus was statistically associated with  $\alpha=0.1$ .(Cohen, Murray, Jack, Arscott-Mills, & Verardi, 2017) In high and moderate mortalities countries, governance, Gross Domestic Product (GDP) per capita, Health Financing, Immunization, education, and nutrition are associated in declining of child mortalities. Among them one study from cross-sectional and time series data from 1972 to 1988 done by Schultz, P. T., 1993 at the micro level by comparing across low-middle income (LMC) countries and education and nutrition factor on calories intake are associated factor in reducing rate of child mortalities at individual mothers from LMC. (Schultz, 1993)

In 1984, Mosley & Chen's framework explained about causes of "proximate" factors of child mortality are associated with differentials in socioeconomic characteristics at individual, household and community levels. (Mosley & Chen, 1984) After that, many of the studies conducted consideration of these three levels and investigation on socioeconomic (SE) inequalities in child mortality. One study did two main objectives to cover inequalities in SE and determinants of child mortality in 60 LDCs. This analysis shows that same findings in previous studies such as income, vaccination and expenditure on health associated with mortality with the addition of access to electricity especially in urban area. This study investigates the determinants between urban and rural and children from rural areas are higher rate mortality than urban ones. (Wang, 2003) Another study did magnitude of socioeconomic inequalities at country level and it can be influenced by global level such as international aids,

debts flow, trade, and commercial opportunities. The causes of inequalities at country level are rule of law on social protection programs such as education and health for citizens, public spending on these sectors under government policies. The interaction of proximate inequalities and social stratification such as out of pocket expenditure of Household level depends on government health expenditure for its citizens for their welfare. (Houweling & Kunst, 2009) A study did individual and community-level effect of under-five mortality in Sub-Saharan area, which is highest rate of mortality in the world. This study also found the previous result such as 1% increase proportion of fully immunized children, the mortality rate decreased into 17-79% in half of the countries. Moreover, mothers with secondary education decrease the rate of mortality. (Boco, 2010) A very strong association on maternal education and child mortality also found in the analysis of 915 national wide censuses and surveys from 175 countries between 1970 and 2009 showed that 4.2 million of reducing deaths of under-five deaths out of 8.2 million of children was associated with improvement of education level of reproductive women around the world. (Gakidou, Cowling, Lozano, & Murray, 2010)

Although developing countries are trying to achieve global goals of reducing infant and child mortality rate, reduction of child mortality is fastest among wealthiest countries. And, government spending on health also decrease child mortality at the country level. (Pritchett & Summers, 1993)

One econometric study analyzed human resources for health and three health outcomes such as IMR, U5MR and Maternal Mortality Rate (MMR) with controlling gross national income (GNI), adult female literacy and absolute income poverty across the countries. The study confirmed the essential of health personnel distribution for achieving health outcomes even though the strength of association was different based on different regions and human resources deficit regions showed larger impact on health. That's why further study which emphasizing within-country analyses should be conducted. Related with under-five mortality, human resources for health was more significant in children above 12 months or after infant because infancy child could

tolerance infection by breast feeding and behaviors of mothers. (Anand & Bärnighausen, 2004)

Whereas, health care services availabilities such as availabilities of staffs at health facilities, accessibilities of skilled birth attendant (SBA), fertility, malaria prevalence are Water and Sanitation Hygiene (WASH) are the variables which associated only in countries with lower mortalities. Thus, the study suggested the deployment of multisectoral needed to be considered higher mortalities countries to achieve SDGs, global target of reducing under-five mortalities of 25 per 1000 LB by 2030. (Cohen et al., 2017)

### 3.2 Overview of under-five mortality in Myanmar

Under-five mortality disparities at national level indicate the socioeconomic development and health care system of the country. (Boco, 2010) Myanmar remains one of the country with unfinished agenda for MDGs in 2015 with 52 deaths per 1000 LBs (Secretariat, 2017) but it is moving forward to achieve UHC in 2030 with improving access and reducing of financial burdens to receive health care services. (MOHS Ministry of Health and Sports, 2016) In 2014, Ministry of Health did analysis on causes of U5MR by using of a standard verbal autopsy to 958 respondents whose had loss of children under five years old age. To cover the whole country of Myanmar, stratified multi-stage sampling method was used. The most leading causes of child mortality in Myanmar are varied between less than 28 days child called neonate and above 28 days. According to the findings, the main causes of neonate mortality were Prematurity/ Low Birth Weight (LBW) 36%, Birth Asphyxia 26%, Neonatal Jaundice 15%, Neonatal Sepsis (12%) etc. The main causes of death for under-five children with 28 days and above were Acute Respiratory Tract Infection (ARI)/Pneumonia 28%, Beri Beri 17%, Diarrhoea 16%, Central Nervous System (CNS) infection 10%, Septicemia 9%. Male is higher chance of mortality than female in Myanmar. Neonate death contributes 48% of total death and all could be preventable if the children were born at health facilities which are providing quality of care. It is also important to strengthen healthcare system of the existing status of the 36.2% of institutional delivery to reverse the condition of nearly 70% institutional deliveries to reduce neonatal mortality. From this study, there

was no socioeconomic correlation and did geographic and socio-demographic determinants of child mortality and found differentials among the rural and urban as well as within the regions in the country. (MOH et al., 2014)

One study concluded that reasons of reducing rate of under-five mortality rate are the function of social and economic development factors such as quality of nutrition intake, living conditions, infrastructure, access to water supply, medical care etc. For the health care reducing the cost of good health can also support saving lives of under-five children from least developing worlds. (Preston, 1980)

UNICEF did a research on factors associated with infant and child morbidity especially on diarrhea and receiving Oral Rehydration Salt (ORS) treatment and then the likelihood of child mortality by extracting of 2001 Fertility and Reproductive Health Surveys (FRHS). The study found that age of child from 6 months to 23 months, sex of the child, type of toilet using at the household level were associated with episodes of diarrhea. Then, the household level characteristics such as household with modern facilities, materials used for roof, accessing electricity and water sources were strong predictors of receiving ORS treatment. Among the findings, the clear result was the association of birth interval and under-five mortality. The child who delivered before 24 months had a higher risk of death before age of five by 2.5 times compared to interval of child birth interval with 36 months and older. The study recommended to do further study on risk factors between infant and child, consideration of anthropometric measures such as size of child, weight and height, utilization of health care services by the mothers. (United Nations Children's Fund, 2015)

By using of three rounds data 1997, 2001 and 2007 of Fertility and Reproductive Health Surveys (FRHS), a study focusing on neonatal, post-neonatal, infancy, child and under-five mortalities rates of selected ethnic differentials in Myanmar. The study did descriptive analysis with using of Geographic Information System (GIS) for locating of reproductive health care services in Myanmar. According to the result, children from Rakhine were higher risk of deaths than other Kachin, Kayah, Shan ethnic groups. There were disparities of child mortalities among all selected ethnic groups to union because socio-economic development was low in these groups. From this study, education

level of the mother, development plan for regions, accessibilities of mass media, access to electricity, antenatal care by skilled professional, immunization coverage and diarrhea episodes were risk factors associated with children from ethnic groups. Furthermore, children from ethnic groups were more accessing to reproductive services and health facilities, living standard and socioeconomic development were more likelihood to reduce child mortalities in those regions. (Ko Ko & Sawaengdee, 2014)

Min Ko Ko et.al (2017) did an ecological analysis of community-level socioeconomic factors of infant and under-five mortality by using of 2014 national census data with township level, community-level effect and findings concluded that community providing safe water and sanitation supplies and electricity supply in urban have more impact than promoting of female education and employment. To do further analysis of child survival in Myanmar, the researcher suggested using individual or household level socio-economic determinants in the future. (Ko Ko M, 2017)

The analysis of determinant factors of child mortalities are evidence-based for policy makers to develop strategic planning on both health and non-health sectors based on results from the study and consideration of local context are important to achieve the goals of health care system within the countries as well as reaching the global target. That's why it is much worthy to study on determinants factors of under-five mortality and it can support in planning and implementation of cost-effectiveness health programs based on results and provide evidence based result on how to solve the problems together with other sectoral that also contribute child mortality in the country.

### 3.3 Risk Factors associated with under-five mortality

Most of the developing countries investigated determinant factors of under-five mortality, from birth to before fifth year of birthday by using of national wide data such as censuses, surveillance, and DHS which covering regional level, urban and rural areas. The studies on under-five mortalities were conducted by using various methodologies but explanatory variables which mostly used the framework of Mosley and Chen used for developing countries. In this framework, there are both proximate

and socioeconomic factors that determine under-five mortality. This model is the basic conceptual framework for studying determinants of individual, household and community level factors of under-five mortality.

Moreover, Individual determinants factors are importance in determining factors associated with mortality. It is also accessing how far effectiveness of the distribution of health care services and it can help in designing of health programs for improving child survival.(Wang, 2003) While comparison between developed and developing countries, socio-demographic factors are main determinants on child mortality in former countries, whereas socio-economic, medical care, environmental factors are main factors for latter ones. (Shantikumar, 2014)

### 3.3.1) Age of mother at first birth

Different studies used age of mother into age of mother at first birth, and age of mother in identifying teenage pregnancy and high-risk mother of old age in under-five mortality. (Bedada, 2017) (Nattey, Masanja, & Klipstein-Grobusch, 2013) (Van Malderen, Van Oyen, & Speybroeck, 2013) (Lartey, Khanam, & Takahashi, 2016) (Kanmiki et al., 2014)

Among these studies, one study done in Ethiopia found that children whose mothers had more than 20 years of age of first birth were reduced risk of death before age 5 by 16.9% with (Odds Ratio (OR) 0.844) comparing with the children whose mothers age of births less than 20 years old, controlling other variables in the model. (Bedada, 2017) Moreover, children born to younger mothers (< 20 years of age) during their birth are more likely to die before age 5. (Huda et al., 2016) The same finding was observed in Ethiopia and 10 African countries such as the survival rate of under-five children with whose mothers are in older age because they have better experiences on child care than younger mothers. However, individual analysis from 28 DHS, children whose mothers older than 35 years or more are higher risk of died before age 5 than mothers who are 20 years old and below in two countries of Sub-Saharan. (Boco, 2010) According to the findings overall inequality on under-five mortality, only birth interval and birth order are predictors of inequality rather than the other explanatory variables including age of the mother at first birth. (Van Malderen et al., 2013) The similar finding

was found in Ghana using of Ghana Essential Health Intervention project and 3975 women with 15-49 were participated in cross-section study done in 2011. The result showed that women's age between 35 and 49 had a 56% of more likelihood for under-five mortality with  $p < 0.001$ . (Kanmiki et al., 2014)

Women delivered birth at older age had greater chance of having low birth weight and premature baby as well as increased risk of complication to the mothers. (Iram & Butt, 2008)

### 3.3.2) Maternal education

Most of the studies pointed out that education of mothers was strong associated factor for under-five mortality and educated mothers have lower chance of decreasing mortality rate. (Bedada, 2017) (Huda et al., 2016) (Gakidou et al., 2010) (Kanmiki et al., 2014)

The probabilities of dying before age 5 reduced as increasing level of mother education in Ethiopia. The study set higher-educated mother as reference category. By comparing mother's education level between non-educated and higher education level, odds of death before age 5 was 2.1. The risk of dying was 89.1% and 38.7% increased for mother with primary and junior education (OR=1.891) or secondary education (OR=1.3871), respectively, as compared with children of mothers with higher education. (Bedada, 2017)

For a mother with primary education was 63% and (OR=1.63), mother with no education was 80% increase in the odds of deaths than higher-educated mother. (OR=1.80). (Antai, 2011a)

Another study done in Northern Ghana found that maternal education was strong factor of influencing under-five mortality in either bivariate or multivariate analysis. In this analysis, mother without formal education also defined as no-education was reference category and the study poised that a mother who got primary and junior education was 0.45% (OR=0.55) less likely to have under-five death than mother finished formal education. To those mothers who secondary education was 0.76% (OR=0.24) less likely to have under-five children death than mother with no



education. (Kanmiki et al., 2014) Moreover, the utilization of health care services pattern of educated mothers are more than non-educated mothers (Huda et al., 2016) in terms of accessing prenatal care by doctor, hospital delivery and child immunization (Antai, 2011a) and they are healthy, nourished, empowered women with intend to resources effectively and efficiently for caring of their children. (Nattey et al., 2013)

One study from Zambia found contradict findings that increased odds of neonatal deaths occurred babies belonged to mothers with secondary or higher education level mothers compared with babies with no education mothers. The suggestions from this study was that it could be unmeasured factors such as maternal nutrition and environmental factors and the percent of mothers who finished higher education level was low compared to no education mothers. (Lukonga & Michelo, 2015)

One study from China examined the causal effect of mother's education on child health outcome of Height for age Z score in 2140 adopted children after controlling of income, environmental status, socioeconomic, and number of siblings in families. The findings conclude that education of mothers was main effect of child health especially in post-natal period and there was no difference between their own and adopted children. (Chen & Li, 2009)

A study on parental education effect on child health was done in Great Britain with longitudinal study with 17,000 children who born on March 1958. The study found that there was little evidence on causal effect of education of both parents on child health. The education reform of reinforcing general secondary education in 1947 and their conclusion was that quantity of education rather than quality was importance because parents who finished high education level transfer positive intergenerational child health outcomes. (Lindeboom, Llena-Nozal, & van Der Klaauw, 2009)

Two studies in both Bangladesh and Ghana found an association of under-five mortality and education of either father or mother. Father's education was also strong association and children whose fathers had tertiary-level education were 15-19% reduced risk of premature death in neonate, infant and under five periods. This finding

is consistent with a study from Ghana and a child born with father whose had tertiary education was 1.5 [Expo (-0.405) = 1.5] times less likely to die and their risk was reduced. In Ghana, they had the system of participation father of pregnant women in health education session as well. (Lartey et al., 2016) (Huda et al., 2016) Both studies found that increased in the education of both parents reduced the risk of under-five mortality because educated parents are likely to have the knowledge to protect their children, knowledge on the how to nurture the children and intend to affect both directly or indirectly to improve child health outcomes. In Tanzania, father education was not associated with under-five mortality in both univariate and multivariate analysis. (Nattey et al., 2013) According to the findings from the overall and wealth related inequality of under-five mortality by using of multivariate regression with Gini coefficient and mortality concentration index and father's education did not contribute to both wealth related and over-all inequalities to under-five mortality. (Van Malderen et al., 2013)

#### 3.3.4 Mother's employment

The employment condition of mothers also determine the amount of income to the family meanwhile it also affect time taking care and breast feeding to her children. Mother's employment condition was one of determinants factors in neonate, infant and child mortality in Parkistian. (Iram & Butt, 2008) But, study in 2007 and 2011 Bangladesh DHS found that there was no association between mother's employed condition and child mortality. In this study, they used multilevel logisitc model on community, household and individual level and mother's employment condition was one of the independent variables such as the mother's age at birth, employment status within 12 months, father and mother education status, the mother's participation in decision-making process related on child health. Among them, mother's age and participation on child health were significant factors for child mortality. (Huda et al., 2016)

#### 3.3.5 Father's occupation

Occupation of parents was considered only in determining the factors associated with neonate (less than 28 days of birth). In one of the study in Indonesia investigated occupation of both parents into categorizing of three such as 1) mother without a job with father's employed, 2) mother and father employed, 3) father's unemployment determinant factors of neonatal mortality and the results showed that odds of neonatal death were higher for infant whose both parents are employed OR= 1.84 with p-value of 0.000, neonate born from father unemployment had higher risk of death with (OR= 2.99) p-value of 0.02. This analysis of considering employment status of both parents after controlling of wealth index. The presence of job of the father had associated factor by improving household income. But, neonate child needs care and if the mother needs to go outside of home for work, it adversely affects the care of the child during this critical period. (Titaley, Dibley, Agho, Roberts, & Hall, 2008)

### 3.3.6 Sex of the child

A study in Ethiopia observed that even though under-five children are the same age, male percent of child mortality was 7.9% whereas female as 6.6%. While male as the reference category, the risk of death of under-five female children was significantly different from the same aged male in 16% (OR= 0.8405), controlling of other factors as constant.(Bedada, 2017) Female children had a higher chance of survival than male children as well in Sub-Saharan countries. (Boco, 2010) In Myanmar, being a female is higher chance of survival than male. (MOH et al., 2014)

### 3.3.7 Birth Order and Birth Interval

At the individual level, one study which is using DHS data from 13 African countries to investigate determinant factors of under-five mortality with the perspective of overall and wealth-related inequality by using the methodology used multivariate logistic regression model with Gini and concentration index. The result showed that birth order and interval contributed the most influenced factor for inequality of child mortalities in most of the countries with  $p < 0.001$ . (Van Malderen et al., 2013) A study in Ghana also found the similar result as the hazard of childhood

mortality was increased for children born less than 2 years after a previous sibling was 1.7 [ Exp (0.517) = 1.7] times than children born 3 years after a previous sibling. The studies from Sub-Saharan countries and India are consistent with above findings such as the higher birth order and short interval are positively associated with child mortality. (Boco, 2010) (Whitworth & Stephenson, 2002) Mothers can't provide proper care if birth interval is too close among first and next child. It can affect to the twin children, they are lower chance of survival.(Lartey et al., 2016)

### 3.3.8 Breastfeeding

One of factors associated with under-five mortality in Ethiopia are children who have history of breast feeding are positively associated with survival than non-breast-fed children. (Ayele, Zewotir, & Mwambi, 2017) If the child has shorter duration of breast feeding, it increased the risk of deaths for infant. (Whitworth & Stephenson, 2002) In Ghana, one of the cross-sectional survey on under-five mortality was done with the interview of 200 mothers who had experiences of child mortality. The data was analyzed with logit model on the explanatory variables of only clinical and environmental related factors such as Parity, use of treated bed nets, diseases on malaria and anemia, use of child vaccine and exclusive breast feeding. The results showed that exclusive breast feed child had lower odd ratios of (OR=0.018) compared with no exclusive breast feeding of (OR=0.025). (Darkwah, Boachie-Yiadom, & Tawiah, 2014)

World health organization (WHO) also recommended to promote exclusive breastfeeding to reduce the child mortality mainly in developing countries. The definition of exclusive breastfeeding is to provide breastmilk only to children under six months (no water and food). Moreover, providing early initiation of breast feeding, the first breastmilk from the mother which is also called colostrum is recommended for newborn child. There are protective benefits for both mothers and children from breastfeeding. Children who had longer duration of breastfeeding promote development in cognitive and sensory development and increase resistance to fight infection against childhood illness such as diarrhea and acute respiratory tract infection and increased attachment between mothers and children. Moreover, mothers who

provided breast milk are decreased chance of breast cancer. One of the qualitative study on barriers to exclusive breastfeeding in Ayeyarwaddy division, which is also part of delta region found that mothers have knowledge on breast feeding but adherence on this practice is low. One of the main barriers is mothers, their husbands, their grandmothers believe that providing breastmilk is not enough and need extra solid food and water for newborn baby. Related with the mothers, they need to return on their work away from home and it is also barriers for the mothers. According to the study, most mothers responded that decision related with breast feeding and child feeding was made by themselves.(Thet et al., 2016)

#### 3.3.9) Skilled birth attendant

At the individual level, logistic regression method was used in analysis of predictors for under-five mortality in Ghana with the explanatory variables of maternal age, duration of exclusive breast feeding (before 6 months of age of children), skilled birth attendant, highest level of education, place of residence, family planning, access to drinking water, birth interval, marital status. Then, at the multivariate logistic analysis, skilled birth attendant was strong predictor of under-five mortality among other explanatory variables. The remained variables were statistically significant at ( $p=0.05$ ) except maternal marital status. (Acheampong & Avorgbedor, 2017)

The results from Pakistan contradicts with the above finding such that neonatal mortality is higher risk of deaths to the child who delivered in hospital. It is the fact that most of the emergency mothers were delivered at the hospital meanwhile institutional coverage is low in there. (Iram & Butt, 2008)

Another study in comparing the main determinants of overall inequality and economic disparities in under-five mortality in 13 African countries, methodologies were used multivariate logistic regression and decomposition of Gini coefficient and concentration index, and birth order and interval was statistically significant in under-five mortality and study did not find out association of skilled birth attendance and under-five mortality. (Van Malderen et al., 2013)

### 3.3.10) Other Associated or Risks Factors

Apart from above findings, children who were from families using contraceptive methods are increasing risk of odd of deaths by 75.4% than children from contraceptive user's families, other variables remain as constant. (Ayele et al., 2017) In bivariate analysis in Ghana, women who were using contraceptive had a 14% less likelihood to have under-five mortality than who did not practice contraceptive methods (Kanmiki et al., 2014) and the lower utilization in contraceptive methods increase the number of children born by the women and proper using of methods reduce the fertility rate and it was influenced by education status of the mother, religion, place of residence, age of mothers in first sex and marriage and marital status. (Ngalinda, 1998) A study from India shows that risk of infant deaths is related with death of previous siblings and high parities. (Whitworth & Stephenson, 2002)

In Ghana, the analysis of clinical and environmental factors revealed the association factors such as grandmultigravita parity (OR=2.243), anaemia (OR=12.073) and malaria (OR=12.182) increased odds of death of under-five mortality in this district. The other two significant factors of U5M were use of treated bed net (p=0.000) and immunization (p=0.001) respectively at 1% significant interval. (Darkwah et al., 2014) Religious of their mothers is also associated factor for child mortality in Kenya. (Omariba, Beaujot, & Rajulton, 2007) Mothers in Monogamous marriage were 22% less likely to have under-five mortality than Polygamous women. (Kanmiki et al., 2014) Tetanus injection during pregnancy time is one of statistically significant factor among other socioeconomic variables during infant and childhood mortality. But, it is more powerful in infant mortality in Pakistan. (Iram & Butt, 2008)

One study from Stockholm on reducing of diarrhoea mortality argued that improved access to safe water through distribution of pipe line was more effective in reducing of mortality of children under two years. In there, all interventions are regulated by strong sanitation laws and policies which facilitated reaching of pulic interventions in all segments of population in Stockholm and no more differentials between poor and rich groups. (Burström, Macassa, Öberg, Bernhardt, & Smedman, 2005)

### 3.3.11) Household level factors

The relationship between household socioeconomic conditions and childhood mortality provide strong evidences in empirical studies with disparities across within or between nations. (Houweling & Kunst, 2009) Therefore, to narrow the gap of child health outcomes, exploring causes of inequalities in socioeconomic condition is important. (Wagstaff et al., 2004)

To investigate the effect of another non-health sector, economic is very much important in analyzing the problem and most of the studies used household index in economic models. In this study, economic condition of household wealth will include as household level factor.

To distinguish short-run and long-run, the studied use both household expenditure and household wealth and improving household wealth is larger effect on child health. (Fakir, 2016)

In Pakistan, Integrated Household survey was conducted and income of the household is negatively associated with child mortality in there. Comparing with infant and childhood mortality, household income is strongly affect on neonatal period and it could be the fact that higher income household could compensate health care cost in earliest stage of child, neonatal period and it disappears at later stage of child's life. The study used Sequential probit model which controls unobserved variable follows multivariate normal distribution. (Iram & Butt, 2008)

One study in Bangladesh used methodologies of multilevel multivariate analysis on socioeconomic determinants of under-five mortality and the finding showed that neonate, infant, and under-five from poorest household had 30-38% higher odds of dying than from wealthiest households with the p-value of 0.05. (Huda et al., 2016)

Another study in Tanzania conducted the extent of the relationship between socio-economic status of household level and under-five mortality with the perspective of inequality of health outcomes between poorest and least poor quintile mortality rate ratio by using of mortality concentration index from the national wide

data of Rufiji DHS, Tanzania by adjusting of maternal education, and age. To get the mortality rate, the study used Kaplan-Meier survival incidence estimation method. To investigate the risk factors, Poisson regression was applied. It was found that the children from poorest household were a higher incidence of death by 2.4. Then, children born from poorest households had decreased the risk of mortality by 52%, [Incidence rate ratio (IRR)= 0.48%; 95%CI 0.30 – 0.80]. Health inequality was shown with mortality concentration index [- 0.16;95%CI (-0.24, -0.08)]. (Nattey et al., 2013)

A study from Ghana using of four national wide cross- sectional DHS data from 1993 to 2008 and they investigated wealth effect of child' survival probabilities with extending of standard Weibull hazard model with gamma frailty. The study pointed out there had 2 % of difference of survival probabilities between poorest and richest households. When wealth was set as dummy category to avoid non-linear effect, and risk of death from poorest household are double than richest ones, holding other factors remain as constant. There will be many reasons for this issues. In 2003, Ghana started to establish National Health Insurance scheme and having insurance is not enough to increase survival of children from poorest households and increasing household wealth will be a complementary factor. For instance, poorest households couldn't afford to expense other medical costs which were not under the scheme and access to health care services are not equal comparing with the richest family. (Lartey et al., 2016)

From the other studies, the household level factors which associate with child mortality are access to electricity, availability of safe water, and good latrine. (Huda et al., 2016) (Wagstaff et al., 2004) and lower level of household indoor pollution. (Van der Klaauw & Wang, 2004) Also, the children from family size more than 5 members are increased risk of deaths before age of 5 than family members lower than 5. (Bedada, 2017) Moreover, accessibilities of health care services from households also influenced by travel time, road infrastructure, transportation system, climate and location of the household or geographic regions. (Wagstaff et al., 2004) In Bangladesh, households which using poor road conditions is higher risk of mortality than good road conditions. (Huda et al., 2016)



### 3.3.12) Community level factors

One study did analysis of the relationship between community characteristics and individual and household attributed factors in Brazil. The study pointed out importance role of community attributes in influencing on results of different child outcomes. That is why community characteristics involved in two factors in determining of child mortality. The first ones is analyzing factors of differentials in mortality among regional disparities. The second thing is that community characteristics were influenced by attributing of the socioeconomic status of the household level. (Sastry, 1996)

Whitworth and Stephenson (2002) poised that the two neonate children with similar conditions may differ in their risk of mortality based on the regions where he or she was borned. The differentials in community factors such as provision of ante-natal care, obstetric care, environmental conditions which are affecting to the children. Mostly, the individual from same communities are similar traditional culture practices, beliefs and customs. (Whitworth & Stephenson, 2002)

The community level factors which include in this study are from Moseley and Chen's framework. According to the literature, the unit of analysis of community level are urban/rural, villages, townships, regions within the country, and across nations etc. (Antai, 2011b) (Boco, 2010) (Ko Ko M, 2017) (Sastry, 1996)

#### 3.3.12.1) Maternal Education

Higher level of maternal education intends to increase proximate factors for child survival. (Wagstaff et al., 2004) At the community level, the regional variations of under-five mortality was conducted by using of individual and community level Cox Proportionate hazard analysis and the region where proportion of prenatal care by doctors and proportion of hospital delivery are the community with high percentage of educated mother. (Adedini, Odimegwu, Imasiku, Ononokpono, & Ibisomi, 2015) (Adedini et al.) But, in Myanmar, one study did ecological analysis of township level factors on IMR and U5MR and the result showed that literacy condition of mother and occupation are not associated with under-five mortality. (Ko Ko M, 2017)

### 3.3.12.2) Skilled birth attendance(SBA)

One of the study in Indonesia which explored determinants of neonatal mortality rate and community in where getting assistance from skilled health workers with more than 87.5% coverage decreased 60 % of neonatal death compared to the community where SBA is less than 25%. At the community level, the proportion of skill birth attendant was also associated with neonatal mortality. (Titaley et al., 2008) The above finding was supported by multilevel analysis of under-five mortality in Nigeria and the community where low percentage of prenatal care by doctor were increased risks of mortality and it also indicated receiving quality care for both mother and child. Some studies found that mothers who used prenatal care by doctor also increased ways of delivery by doctor. (Adedini et al., 2015)

### 3.3.12.3) Hospital Delivery

A study was conducted based on regional disparities in childhood mortality in Nigeria by using of 2008 DHS data of 28,467 representative sample of children. A technique called multilevel Cox proportional hazards analysis was used to investigate community-level characteristics for childhood mortality. The results pointed out that the risk of death were lower for children whose mothers residing in communities with high percentage of hospital delivery (Hazard Ratio:0.70, CI: 0.61 – 0.81,  $p < 0.05$ ). (Adedini et al., 2015)

Normally health outcomes between urban and rural children are different and one study investigated urban and rural gap of malnutrition, stunting in Egypt, Jordan, and Yemen by using a technique called a Blinder-Oaxaca decomposition analysis on data from national wide data DHS. The result showed that there was urban and rural gap found only in Yemen comparing with Egypt and Jordan. In Yemen, 22.6% of women delivered in the health facility whereas 49.1% in urban. Rural households are less educated, poor housing condition, less access to safe drinking water and safe latrine and lower access to essential health care services than urban. (Sharaf & Rashad, 2016)

### 3.3.12..4) Urban/Rural

A study in Ethiopia used Cox proportionate hazard model in identifying determinants of child mortality in their life time and rural children had 18% hazard of risk of deaths from urban children.(Ayele et al., 2017) A study from Ghana showed that children from urban area had a increased trend of U5MR compared with rural children. It could be children from slums in the urban areas.(Lartey et al., 2016)

One study from determinants of child mortality in 60 LDCs and the gap between urban and rural was widen because most of the poorer households were aggregated mainly at rural area and mortality was higher in there and access to electricity is significant factor of both IMR and twice effect on U5MR in urban. This findings could be effect of reducing use of solid fuels for cooking, heating and getting light in a night time and respiratory tract infection occurrence was low as well. Moreover, electricity could use for refrigerator to keep foods and it also reduces happening of infectious diseases. Receiving immunization of children under one year was only significant for rural area. (Wang, 2003)

One study extinguished underlying factors of rural-urban gap related to infant mortality in six Francophone countries in Sub-Saharan African. The main determinant of infant mortality was from household level attribution at the rural area, including both observed and non-observed household environmental factors such as accessing portable water, quality housing conditions and accessing electricity contributed as 38% of the gap. (Van de Poel, O'donnell, & Van Doorslaer, 2009)

### 3.3.12..5) Region

The studies which were undertaken in Bangladesh, Nigeria, Ethiopia, and Brazil compared child health outcomes within community level or regions within the countries. (Adedini et al., 2015) (Bedada, 2017) (Huda et al., 2016) Results from Nigeria pointed out that the ratio of risk of death was higher for children who live in the North-east and North-west regions (HR: 1.90, CI: 1.35-2.70,  $p < 0.001$ ). Findings from descriptive analysis showed that North-east and North-west regions are the regions where children whose mothers have more than five birth orders, most of the mothers have low education level, mothers with unemployment status and poor as well as the age of the mother when first birth were younger than 18 years old. (Adedini et al., 2015)

Besides from above factors, one study from database of 193 countries showed that access to good water and good latrine are associated with both mother and child mortalities at the community level. (Cheng et al., 2012) The same finding was shown in ecological analysis of infant and under-five mortality done by using of national wide censuses data in Myanmar. (Ko Ko M, 2017) Community accessing and utilization of electricity is also associated with decreasing mortality. (Ko Ko M, 2017) (Wang, 2003)

### 3.4 Risk factors associated with Infant Mortality

The studies found that associated factors of neonate mortality, death within one month after birth is associated with prematurity, inherited conditions of the foetus and complications from the delivery. But, death after one month is heavily influenced by socio-economic and health condition at the household level and it is important to differentiate determinants factors at each level. (Mosley & Chen, 1984) Therefore, the explanatory variables used for infancy period, probability of dying before one year of age (<12 months) included delivery factors such as place of delivery, delivery assistance, mode of delivery, breastfeeding practices; infant factors such as sex of child, birth order, preceding and succeeding birth interval, size of baby after delivery. The result found that succeeding birth interval, breastfeeding and assistance during delivery were associated factors for infant mortality. (Lamichhane, Zhao, Paudel, & Adewuyi, 2017) According to the multilevel Cox proportionate analysis in Nigeria, the findings at the individual level indicated that the risks of deaths were higher for infant with child birth order fifth or above (HR:1.24, CI:0.95-1.62) (Adedini et al., 2015) and a study in Zimbabwe also found similar result showed that birth order of sixth and above with short preceding birth interval had the highest risk of died before one year of age. (Kembo & Van Ginneken, 2009) While comparing with single birth, multiple births or twin child are higher risk of mortality. (Kembo & Van Ginneken, 2009; Lartey et al., 2016) (Whitworth & Stephenson, 2002) Moreover, weight of the baby after birth was also determinants factors for neonatal period and the study from Zambia found that underweight and overweight reported infants increased odds of deaths comparing with normal weight infant. (Lukonga & Michelo, 2015)

One study in Bangladesh added Tetanus injection during pregnancy time (Abir, Agho, Page, Milton, & Dibley, 2015) and immunization is very much important for infancy period and it is one of significant factor in rural India. (Wang, 2003)

The socioeconomic condition also predictor factors for infant mortality. In Pakistan, the sequential probit model analysis result showed that education attainment level of the mother was significant in neonate and infancy period,(Iram & Butt, 2008) and the similar result was found in Bangladesh by using multilevel logistic regression and educated mothers had a lower risk of mortality by 37% in neonate period and 47% in infancy period in comparison with non-educated mothers. (Huda et al., 2016) In Zambia, the study identified infants whose mothers with no education mothers were positively relationship and increased odds of dying (aOR 3.55, CI95%, 1.26-9.94) comparing to infants born from mothers with higher educated mothers.(Lukonga & Michelo, 2015) Fathers who finished tertiary level education was also strong association factor in reducing premature death of neonate and infant in Ghana. (Lartey et al., 2016) The employment condition was also associated factors and one study poised that infant with employed parents (OR=1.84,  $p=0.000$ ); those infants with no employment fathers (OR=2.99,  $p=0.02$ ). (Titaley et al., 2008)

The experiences of previous siblings' deaths and mothers with high parities are also determinants factors for infant mortality and a study from India showed the result.(Whitworth & Stephenson, 2002) A study from Bangladesh also found the similar result and the risk of neonate, post-neonate is higher with mothers with a previous death of a sibling. (Abir et al., 2015)

Related with health care behaviors, receiving ante-natal care during pregnancy was also determinant factors for infant mortality in Pakistan.(Iram & Butt, 2008) At the community level analysis in Nigeria, the risks of deaths were significantly lower for children of mothers who are from communities with receiving prenatal care by doctor in high proportion (HR: 0.82, CI: 0.66-1.02) and mothers who delivered at the hospital (HR:0.67, CI: 0.51-0.86). (Adedini et al., 2015) And also mothers who used contraceptive methods had a lower risk of mortality in neonate, post neonatal and infancy period. (Abir et al., 2015) The participation of mother's decision on child's health is also

associated factor especially on neonate period. The child who were born to the mothers of age between 35 to 49 years old had a higher risk of death in neonate, infancy or before age 5. (Huda et al., 2016)

Children from the families with improving status of drinking water and latrine facilities are also negatively associated for infant mortality. (Cheng et al., 2012) Then, the studies showed the results of attributable factors at the household level and environmental factors such improved access to portable water, household facilities with good quality and access to electricity are associated factors for infant mortality in six Francophone countries in Sub-Saharan African. (Van de Poel et al., 2009) The neonate, and infants whose mothers with richest wealth quintiles had 30% to 38% lower risk of mortality than children who were born to mothers from poorest household wealth. (Huda et al., 2016) In Nigeria, the risk of deaths were lower for children born from rich quintile (HR: 0.73, CI:0.60-0.90). (Adedini et al., 2015)

But, a study done in Zimbabwe found contradicts with the above findings; socioeconomic variables control such as place of residence, maternal education, paternal education and wealth index are not associated with infant mortality by using of multivariate hazard analysis. (Kembo & Van Ginneken, 2009)

In Myanmar, ecological analysis of infant mortality was conducted at community-level or township level and the study identified socioeconomic factors influencing on infant mortality rate and urbanization, accessing electricity supplies, safe drinking water and latrines were negatively associated whereas cooking smoky fuel was positively associated with infant mortality. (Ko Ko & Sawaengdee, 2014) The geographic regions of children come from was also predictors of infant mortalities in both Nepal, Bangladesh, and Nigeria. (Lamichhane et al., 2017) (Adedini et al., 2015) The road condition is also significant factor for neonate and infant mortality in Bangladesh. (Huda et al., 2016)

### 3.5 Risk factors associated with child mortality

According to the literature, child mortality is defined as probability of child death from exact one year of age to five-year-old and many studies showed the results

f variation factors between infant and child mortality by bio-demographic and socio-economic characteristics. (Antai, 2011b) (Sastry, 1996) (Omariba et al., 2007)

A study done in rural Nigeria which used infant (0-11 months) and child (12-59 months) frailty models which mean a child's vulnerability to risk of death. According to the results of this study, most explanatory variables of socioeconomic factors are significantly associated with child mortality. The child of mothers who were in secondary or higher are lower risk of death by 15% (0.85,0.63,1.15) than children from mothers with no education; children from other religion are four times higher risk of death in comparison with Catholic; children from North-east and North-south are two times higher risk of death compared to children from North-central meanwhile bio-demographic variables account more for infant mortality. (Wegbom, Akinyemi, & Edet, 2018)

Kembo & Ginneken (2009) examined maternal, socio-economic and environmental characteristics to determine the associated factors of infant and child mortalities in Zimbabwe. The study employed Cox proportional hazards model by using of 2005-06 ZDHS secondary data. The findings from multivariate analysis indicated that accessing piped drinking water supplies and flushed toilets to households influenced child mortality than infant mortality. Among the two factors, accessing flushed toilet facility was influenced on child mortality and was significant and reduced relative risk of deaths by 60% ( $p < 0.01$ ). The maternal education was not significant on child mortality but an increase in maternal schooling affect a decrease in child mortality, children from mothers with completed primary and secondary education reduced relative risk of death by 24% and 41% compared to children whose mothers with no formal education. Children whose fathers completed secondary education are reduced by 33% relative in comparison with fathers with no formal education. The associated factors in infant mortality such as birth order and preceding birth intervals, age of mother and type of delivery were not strong influenced in child mortality and the results from the study confirmed that fact that endogeneous or biomedical factors were strong influenced in infancy period whereas exogeneous or

socioeconomic factors were dominant during the childhood age. (Kembo & Van Ginneken, 2009)

A study in Kenya employed Weibull and Cox models' coefficient and hazard ratio showed biodemographic, socioeconomic and environmental variables for child mortality. The findings from biologic factors were twin child, male, children born from mothers with youngest and oldest women. As related to socioeconomic factors and environmental factors, there were inverse relationship between households accessing electricity, smaller household size, and children from wealthiest families, low-pollution fuels for cooking and households accessing safe drinking water and safe sanitation and child mortality while mothers with no education are positively associated with child mortality. (Mutunga, 2011)

In rural India, according to the levels and trends of both infant and child mortalities study from three rounds of National Family Health Survey (NFHS) showed that the mortality rate was reduced in rural Scheduled Tribes from 1992 to 2006 and associated factors were nearly the same during these periods. The study used univariate and multivariate Cox proportionate hazard model. The significant factors for both infant and child mortality were birth interval, wealth status of household, and region of children come from. As biological factor, male children had a higher risk of dying in infancy period (HR=1.2, 95% CI=1.1-1.4) than female children whereas the risk of male children dying was lower at 30% (HR=0.7, 95% CI=0.6-0.7) than female children in childhood period especially in Scheduled Tribes in rural area. (Sahu, Nair, Singh, Gulati, & Pandey, 2015)

As a summary of above literature review, the conceptual framework for under-five mortality is based on Mosley and Chen's model, and WHO Social determinants of health inequalities and composed of both proximate and socio-economic factors for the studies. To determine the associated factors for below one year of age children and above one year to five years old child, mostly genetic inherited characteristics or child factor such as sex, twin, birth order, birth interval, size of the child and delivery factors, breastfeeding practices are associated with infant mortality whereas socioeconomic factors at individual level such as education attainment of the mother, father, employment status of parents, wealth status of the family, and environmental



factors such as access to clean water and latrine, and regional factors are more prominent in one year and above children.



## CHAPTER 4

### RESEARCH METHODOLOGY

#### 4.1 Conceptual framework of under-five mortality

The basic theory for this study is from Mosley and Chen's framework on social and medical science which clearly categorized determinants into "proximate" and "socioeconomic" factors for child survival especially in developing countries.

To analyze the associated factor of infant mortality, delivery factors such as institutional delivery, skilled birth attendant, infant delivered by caesarean section and genetic inheritance such as sex and twin affect mainly on infancy period and will not include these factors in assessing of determinants of child mortality.

There are many influencing factors for early childhood survival but the factors which will include in many studies at individual are maternal or paternal factors such as age at first birth, mother usage of contraceptive, mother's or father's education, father's occupation; employment condition of mother, household level such as wealth status of the mother, community level variables included as urban, rural, travelling problem to health facility, health care planning zone, midwife per 1000 population etc. And these factors are also affect on infancy period and will analyze these factors in infant mortality.

Moreover, environmental factors such as children of family access to clean water and latrine are important in under-five mortality and will involve in both infant and child mortality. (Kembo & Van Ginneken, 2009) (Mutunga, 2011).

In the conceptual framework, nutrition factor of breastfeeding is very important for child survival, but the variables used in this study, the duration of breastfeeding in months, the original variable m4 has no observation between child mortality and no breastfed children. So, nutrition factor will not be included for child mortality and will study only for infant mortality together with size of the baby after birth from the memory recall of the mothers.

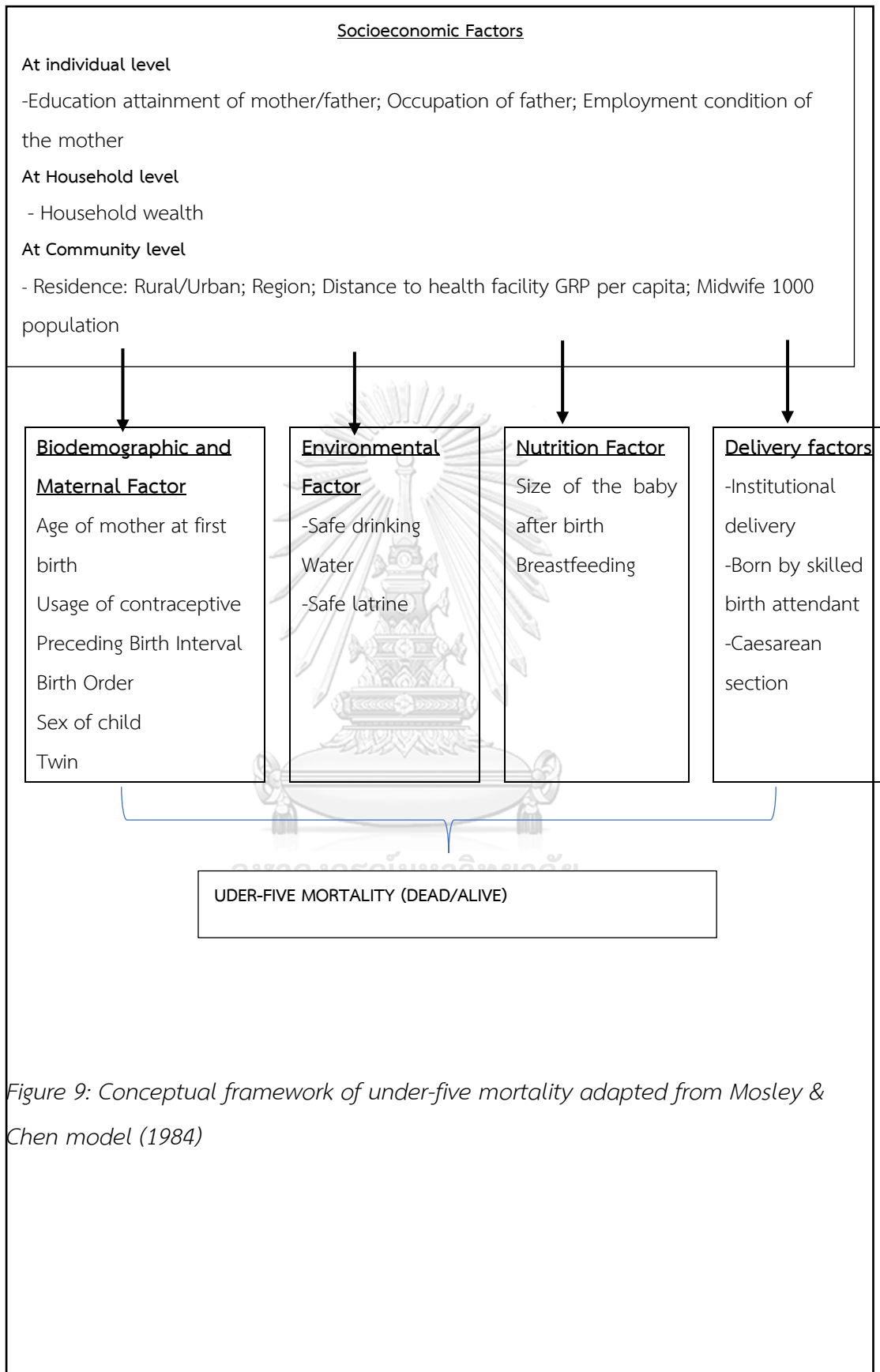


Figure 9: Conceptual framework of under-five mortality adapted from Mosley & Chen model (1984)

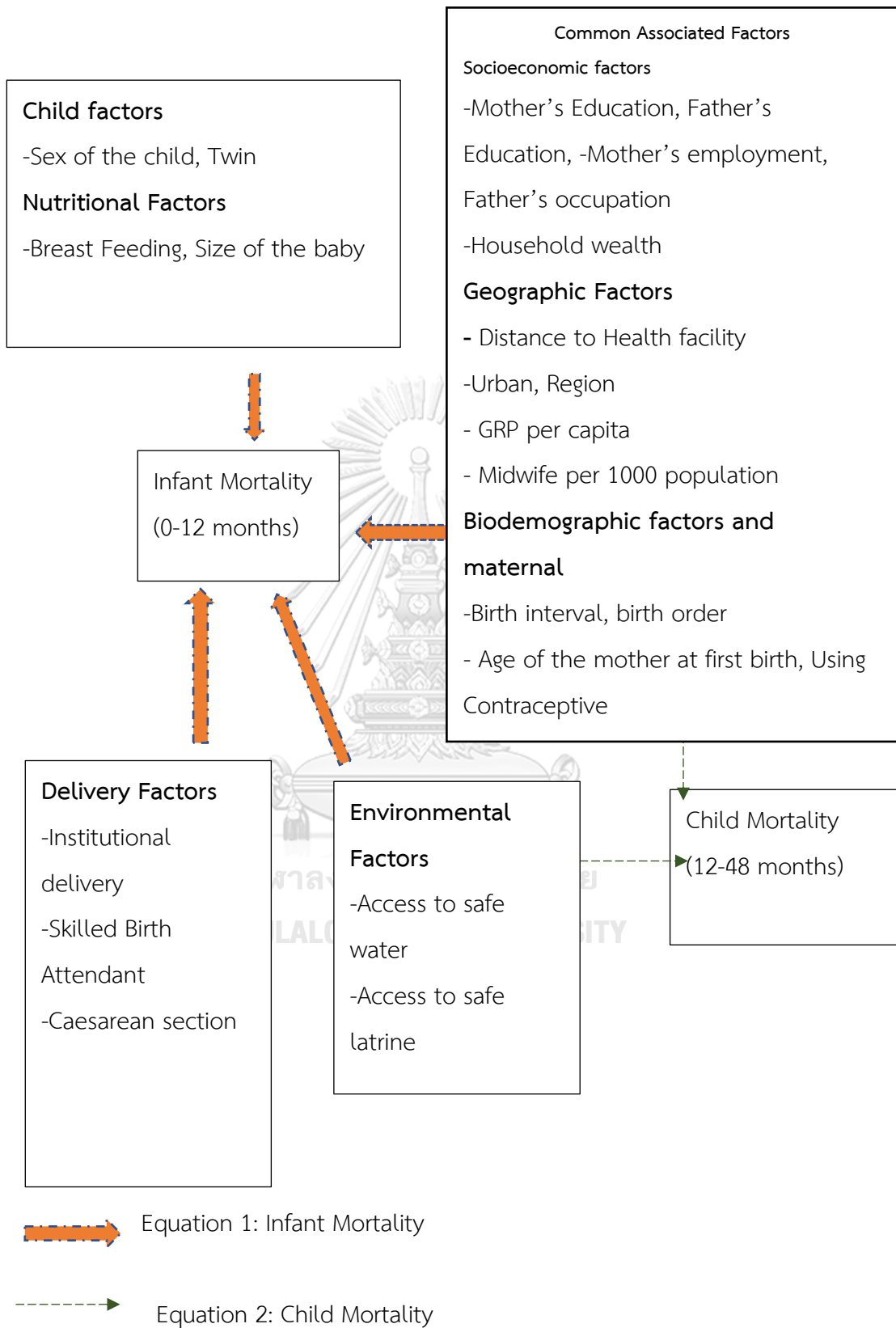


Figure 10: Conceptual framework of Infant, Early Childhood Mortality

## 4.2 Hypothesis

- ▶ Sex of child, twin, birth interval, birth order, age of the mother at first birth, mother's usage of contraceptives, breastfeeding, size of the baby, access to skilled birth attendant, institutional delivery, caesarean section, access to clean water and safe latrine contribute infant mortality in Myanmar.
- ▶ Age of the mother at first birth, mother's usage of contraceptives, birth order, birth interval, access to clean water and latrine contribute child mortality in Myanmar.
- ▶ There is association between socioeconomic factors such as mother's education, household wealth of mother, father's education, occupation of father, mother's employment status, place of residence, region, travel to health facility contribute infant and child mortality in Myanmar.
- ▶ GRP per capita contribute infant or child mortality in Myanmar.
- ▶ Midwife per 1000 population contribute infant and child mortality in Myanmar.

## 4.3 Data source

The study will use secondary data of 2015-2016 Myanmar Demographic and Health Survey (MDHS). It was a very first DHS survey within the country. It was conducted by Ministry of Health and Sports (MOHS) with the fund contributed by USAID and 3MDG fund. Technical support came from ICF. DHS program is supporting in collection of national wide data to apply in designing of health programs and it was jointly implemented by MOHS.

DHS is a complete set of data on households and demographic characteristics and up to now more than 300 surveys were conducted in over 90 countries. The information was provided by 12888 women of reproductive age between 15 and 49 years and men accounted as 4737 from 12500 households which came from 15 states and regions within the country and multi-stage sampling method was used. ((MOHS Ministry of Health and Sports & ICF, 2017)

The data of birth history of children and individual characteristics were obtained from women's questionnaires and to do the analysis of child level characteristics of infant and under-five mortality, under-five children file, KR will be used for the study. The additional data of GDP per region and bed per 1000 population was described detailed in annex 1.

#### 4.4 Survey Design

MDSH sample was done with two stages. At the first state, altogether 442 clusters, it was divided into 123 Urbans and 319 rural across 15 states and divisions and clusters was selected from 4000 Primary Sampling Units (PSU) or Enumeration Units (EU) from 2014 censuses data. After that, each cluster assigns 30 households, using of equally distributed probabilities in systematic sampling.

Among selected 13238 HHs, 12,500HHs were interviewed and response rate was about 98%. The total weighted interviewed women of reproductive age 15-49 was 12,885 out of 13,454 and response rate was 91%.

#### 4.5 Definition of variables

Dependent variables were described in section 1.2.

The below are detailed definition of some of the independent variables used in the study. The remained variables are mentioned it at the table of 4.5.2.

##### **Age of the mother at first birth**

The youngest age of the mother was 12 and for the analysis, the study will cut off teenage mothers to omit the outliers and will involve only for age of mothers  $\geq 16$  years old and the range is from 16 years old to 43 years old.

##### **Access to safe water**

It is defined as water source from piped water, public taps, stand pipes, tube wells, boreholes, protected dug wells and spring, rainwater, and bottle water. The remained sources such as unprotected well, surface from spring, unprotected spring, river/dam/lake/ponds/stream/canal/irrigation channel/ tanker truck, cart with small

tank are regarded as unsafe water source. Reference taken from final report of MDHS 2015-16. ((MOHS) Ministry of Health and Sports & ICF, 2017)

### **Access to safe latrine**

It is defined as family using flush/pour flush toilet to piped sewer system, septic tanks, pit latrine, ventilated improved latrine (VIP), pit latrines with slabs, and composting toilet and reference was from final report of MDHS as well.

### **Wealth index**

It is calculated as ownership materials, possession of the selected assets of the households namely car, bicycles, television, mobile phones, housing materials, facilities used for sanitation and sources of accessing water supply. It was given based on household numbers and it was calculated by using of principal component analysis. For the national wealth quintiles, DHS program produced wealth index of the mother by v190. To get wealth index of each health care planning zone, it was recalculated based on residence zone. After that, it was divided into quintiles and recategorized into poorest and poorer into “poor”, middle into “middle” and richer and richest into “rich” status.

### **Institutional delivery**

If the child was born in government hospital, RHC, Sub-center, MCH center, other public sector, private hospital and clinic, NGO, SUN clinic, Marie Stopes and other INGO sector etc. If delivery place in in home, other’s home and other are regarded as home delivery.

### **Gross Regional Product per capita (GRP)**

To get the data, the GDP of state and region in 2014 was divided into total population in this region. The amount was shown with US\$.

### Midwife per 1000 population.

It is defined as the ratio of midwife per 1000 population. The data obtained from Myanmar SRMNAH workforce assessment report in 2014 and it was divided by total population in each and region and multiplied by 1000.

#### 4.5.1 Dependent variables

Name	Description
<b>Individual Level</b>	
IFM (Infant Mortality)	=1 if the child died between 0 to 11 months from birth to dead or prior to interview (first birthday), alive equals to 0.
CM (Child Mortality)	=1 if the child died between 12 months to less than 60 months or prior to interview, alive equals to 0.

#### 4.5.2 Independent variables

Name	Background Variable	Description
Biodemographic and Maternal factors		
Age	V212	Age of the mother at first birth; it is continuous variable for analysis.
Noconceptive	V312	Mother with not using contraceptive currently. (1= No; 0=Yes)  Majority of mothers, 53.50% used one of contraceptive methods and interesting is that how mothers without using contraceptive methods differ from those who using one of contraceptive.



binterval	B11	<p>Preceding birth interval between the current birth and previous born child and calculated in months. For twin and first birth, 1394 missing values considered as 0.</p> <p>(1= <math>\leq</math> 24 months; 0= &gt; 24 months)</p> <p>Largest group is long preceding birth interval, 87.90% and it was used for reference group to know the result of risk group, short preceding birth interval differ from this group.</p>
Female	B4	Sex of the child (1=female; 0=male)
Twin	B0	Twin child (1= Twin or multiple birth; 0= Single birth)
Birth order	bord	Birth rank of the child and reverse from last born child;
BORD1		1 if the child birth order is 1 <sup>st</sup> rank, 0 if otherwise.
BORD2		1 if the child birth order is from 2 <sup>nd</sup> to 4 <sup>th</sup> , 0 if otherwise.
BORD3		1 if the child birth rank is greater than or equal to 5 <sup>th</sup> rank, 0 if otherwise. (omitted from estimation)
<p>The reason of omitting BORD3 is that this is the highest risk group comparing with remained two groups and can see how low group groups differ from BORD3.</p>		
Environmental Factors		
Safewater	V113	Family access to improved source of drinking water. (1=Yes; 0=No)
Safelatrine	V116	Family access to improved sanitation facilities (1=Yes; 0=No)

Nutrition Factor		
Breastfeeding	M4	Children with mother practicing breastfeeding (1=Ever and currently breastfeeding; 0=Never breastfed)
SIZE	m18	Child's weight after delivery by mother's memory recall and subjectively reported data.
Largesize		1 if the size of the baby was larger or large than average
Averagesize		1 if the size of the baby was in average
Smallsize		1 if the size of the baby was smaller than average. (omitted) One of reason to do reference group is picking up highest risk groups and set as smallsize baby as reference group.
Delivery factor Factors		
Institutional	M15	Place of delivery (1= health facility both public and private; 0=home)
SBA	M3a,m3b, m3d,m3e , M3f	Delivery assistant by skilled health personnel (1=specialists, doctor, nurses, LHV, midwives; 0=Auxiliary midwife, Traditional Birth attendant, relatives, none)
Caesarean	M17	Mode of delivery (1=Caesarean section; 0=non-Caesarean)
Socioeconomic Factors at individual level		
Moth_E secondary	V106	Education attainment of the mother (0=primary level and no education, 1=secondary and above)

Fath_E secondary	V701	Education attainment of the father (0=primary level and no education, 1=secondary and above)  (In education category, most literature used lowest education group as based and set as no education and primary education belonged parents as based)
Unemployment	V717	Employment condition of the mother within 12 months. (1=no employment; 0 for employed in any sectors)
FATHOCCU Agri Manual Business	v705	Occupation status of the father 1 for agricultural sector working as self-employed or employee, 0 if otherwise. 1 for unskilled manual workers, no work, household and domestic; “0” otherwise. (omitted) 1 for professional, managers, clerical, sales, service and skilled manual; 0 if otherwise. 1 for; 0 if otherwise. Among occupation status of the father, Manual group is the group composed with same background and it was used as based group.
Socioeconomic factors at household level		
WEALTH  Poor Middle Rich	V190  Hv271	Wealth quintiles of the mother for the whole sample. Recategorized into Wealth quintiles of the mother for each zone.  1 for poorest and poorer quintiles, 0 if otherwise.(omitted) 1 for middle quintiles, 0 if otherwise 1 for richer and richest quintiles, 0 if otherwise.

		<p>For the health care planning zone, recalculated wealth index was used for each zone and same with above categories.</p> <p>Most literature used lowest group as based group and chose poor as omitted variable.</p>
Socioeconomic factor at community level		
Urban	V025	Residence place (1=urban; 0=rural)
Travelproblem	V467d	Travelling to health facility (1= Very big and big problem; 0=No)
Hilly	V024	For the regional level: Health care planning zone 1 for Hilly region mothers reside in Chin, Shan, Kayah, Kayin and Kachin; 0 for otherwise.
Delta		1 if the mother resides in Delta zone: Ayeyarwaddy, Bago, Yangon, 0 if otherwise.
Dry		1 if the mother resides in Dry Zone, Mandalay, Magwe, Nay Pyi Taw and Sagaing, 0 if otherwise.
Coastal		1 if the mother resides in Coastal Zone, Rakhine, Mone and Taninthayi, 0 otherwise (omitted) (Mon state under Coastal is the lowest percent of under-five mortality and used Coastal zone as omitted variable to see how infants from Hilly, Delta and Dry zones differ from Coastal zone)
GRP		Gross regional per capita in 2014. As continuous variable.
MW		Midwife per 1000 population. As continuous variable.

#### 4.6 Data Analysis

To study the socioeconomic and geographic factors affecting infant and child mortality and to describe these factors, descriptive statistics will be used and described with mean, frequency and percent distribution. After that, binary logit regression analysis will be applied to determine which one of these determinants significant affect infant and child mortality in Myanmar.

#### 4.7 Binary logit model

The binary logit regression model is used for either identifying risk factors or predicting the probability of outcome successfulness. This model mostly applied in discrete choice or dichotomous outcome such as mortality (alive/dead). The results of regression analysis show the estimation of independent variables from the model for sample groups.

##### Latent Variable

The latent variable is not directly observable from the data and is assumed to affect the response variables and follows linear as

$$Y_i^* = X_i \cdot \beta + \varepsilon_i$$

We do not observe  $y^*$ . We observe is  $y$  where

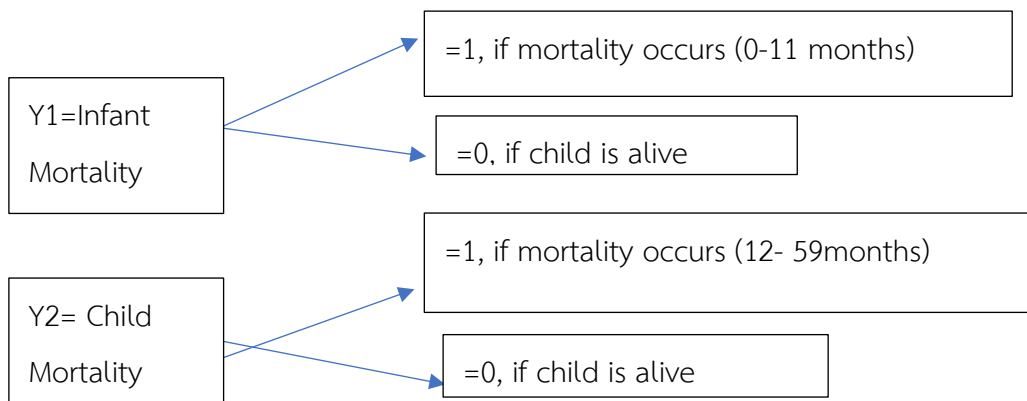
$$Y_i = 1 \text{ if } y_i^* > 0$$

$$Y_i = 0 \text{ if } y_i^* \leq 0$$

In the logit model, we will observe the value of continuous measures exceeds a threshold or not. In this study, there are 2 dependent variables such as Infant mortality and child mortality.

$$Y_i = 1 \text{ if we child death}$$

$$Y_i = 0 \text{ if we observe child is alive.}$$



When the threshold can be normalized to be zero, so we can obtain:

$$\Pr(Y_{1i} = 1) = \Pr(\varepsilon_i \leq X_i \cdot \beta)$$

If  $\varepsilon_i$  has a logistic distribution, then

$$\Pr(Y_{1i} = 1) = \frac{\exp^{X_i \cdot \beta}}{1 + \exp^{X_i \cdot \beta}}$$

$$\Pr(Y_{1i} = 0) = \frac{1}{1 + \exp^{X_i \cdot \beta}}$$

The followings are two equations which were used for the analysis and regression will be run for overall sample.

#### For overall sample

For Infant Mortality Y1

$$Y_{1i}^* = X_i \cdot \beta + \varepsilon_i = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Nocontraceptive} + \beta_3 \text{twin} + \beta_4 \text{Binterval} + \beta_5 \text{female} + \beta_6 \text{BORD1} + \beta_7 \text{BORD2} + \beta_8 \text{Breastfeeding} + \beta_9 \text{Largesize} + \beta_{10} \text{Averagessize} + \beta_{11} \text{Safewater} + \beta_{12} \text{Safelatrine} + \beta_{13} \text{Institution} + \beta_{14} \text{SBA} + \beta_{15} \text{Caesarean} + \beta_{16} \text{MOTH\_E secondary} + \beta_{17} \text{FATH\_E secondary} + \beta_{18} \text{Middle} + \beta_{19} \text{Rich} + \beta_{20} \text{Business} + \beta_{21} \text{Agri} + \beta_{22} \text{Unemployment} + \beta_{23} \text{Urban} + \beta_{24} \text{Travelpro} + \beta_{25} \text{Hilly} + \beta_{26} \text{Dry} + \beta_{27} \text{Delta} + \beta_{28} \text{GRP} + \beta_{29} \text{MW} + \varepsilon_i$$

For Child Mortality Y2

$$Y_{2i}^* = X_i \cdot \beta + \varepsilon_i = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Contraceptive} + \beta_3 \text{BORD1} + \beta_4 \text{sBORD2} + \beta_5 \text{Binterval} + \beta_6 \text{Safewater} + \beta_7 \text{Safelarine} + \beta_8 \text{Moth\_E secondary} + \beta_9 \text{Fath\_Esecondary} + \beta_{10} \text{Middle} + \beta_{11} \text{Rich} + \beta_{12} \text{Business} + \beta_{13} \text{Agri} + \beta_{14} \text{Unemployment} + \beta_{15} \text{Urban} + \beta_{16} \text{Travelpro} + \beta_{17} \text{Hilly} + \beta_{18} \text{Dry} + \beta_{19} \text{Delta} + \beta_{20} \text{GRP} + \beta_{21} \text{MW} + \varepsilon_i$$

### For health care planning zone

For Infant Mortality Y1(Each Zone)

$$Y_{1i}^* = X_i \cdot \beta + \varepsilon_i = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Nocontraceptive} + \beta_3 \text{twin} + \beta_4 \text{Binterval} + \beta_5 \text{female} + \beta_6 \text{BORD1} + \beta_7 \text{BORD2} + \beta_8 \text{Breastfeeding} + \beta_9 \text{Largesize} + \beta_{10} \text{Averagessize} + \beta_{11} \text{Safewater} + \beta_{12} \text{Safelatrine} + \beta_{13} \text{Institution} + \beta_{14} \text{SBA} + \beta_{15} \text{Caesarean} + \beta_{16} \text{MOTH\_E secondary} + \beta_{17} \text{FATH\_E secondary} + \beta_{18} \text{Middle} + \beta_{19} \text{Rich} + \beta_{20} \text{Business} + \beta_{21} \text{Agri} + \beta_{22} \text{Unemployment} + \beta_{23} \text{Urban} + \beta_{24} \text{Travelpro} + \varepsilon_i$$

For Child Mortality Y2 (Each health care planning zone)

$$Y_{2i}^* = X_i \cdot \beta + \varepsilon_i = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Contraceptive} + \beta_3 \text{BORD1} + \beta_4 \text{sBORD2} + \beta_5 \text{Binterval} + \beta_6 \text{Safewater} + \beta_7 \text{Safelarine} + \beta_8 \text{Moth\_E secondary} + \beta_9 \text{Fath\_Esecondary} + \beta_{10} \text{Middle} + \beta_{11} \text{Rich} + \beta_{12} \text{Business} + \beta_{13} \text{Agri} + \beta_{14} \text{Unemployment} + \beta_{15} \text{Urban} + \beta_{16} \text{Travelpro} + \varepsilon_i$$

### Estimation method

Nonlinear equation is estimated by the method called Maximum likelihood method and formula is given as,

$$\max L(\beta) = \prod_{i=1}^n \frac{\exp^{X_i \cdot \beta}}{1 + \exp^{X_i \cdot \beta}} \prod_{i=n+1}^n \frac{1}{1 + \exp^{X_i \cdot \beta}}$$

Because the estimated coefficient only tells us about the direction of the impact of each regression on the probability of the dead of under-five child. If we would like to find the magnitude of the impact, marginal effect needs to be calculated.

If X is a dummy variable such as gender, marginal effect is

$$\Pr(Y_{1i} = 1 \mid X = 1) - \Pr(Y_{1i} = 1 \mid X = 0)$$

If X is continuous variable like age, marginal effect is

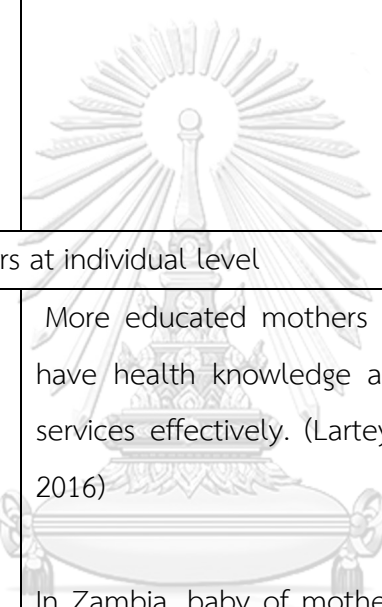
$$\frac{\partial \Pr(Y_{1i} = 1)}{\partial X}$$

Table 9: Table of expected sign

Name	Sign	Reasons
Biology and Maternal Factors		
Age	+/-	Older mothers have more experience on taking care of children than younger mothers. That's why children born with younger mothers have more risks of dying than older mothers. (Huda et al., 2016) But the child who were born to the mother's age at 35 and above had a higher risk of death. (Kanmiki et al., 2014)
Nocontraceptive	+	Mothers do not use contraceptive methods increased the fertility rate and the higher the number of child birth. It also bring short birth interval between children and decreased probabilities of survival of children.
Binterval (<24 months)	+	The interval between first and next child is too close, and the mother couldn't provide care to the children and increased risk of death.
Female	-	The biological factor of sex, female tends to survive more than male.
Twin	+	Twin child increased the risk of death than single birth because mothers provide care to single child and mostly twin children were born with birth weight lower than normal weight and increased the probabilities of death.
Bord BORD1 BORD2	- -	The biological factor of birth order also affects survival rate of children. Mothers do not use contraceptive methods increased fertility rate and increased the number of child births. Then, the higher the birth order,



		the higher the risk of child death especially in infancy period.
Environmental Factors		
Safewater	-	Source of drinking water supply especially from piped water reduce mortality of children and prevent contamination of water borne diseases in children.
Safelatrine	-	Fly proof latrine prevent fecal oral route transmission and also prevent diarrhea disease in children.
Nutrition Factor		
Breastfeeding	-	Mother's breast milk contains antibodies which fights for infection especially 6 months child and breast milks have multiple benefits for both infant and mother.
Largesize	-	Birth weight also determine the nutrition status of the children before delivery and well-nourished children are healthy and could prevent serious childhood illness.
Averagesize	-	
Delivery Factors		
Institution	-	Skilled health personnel are accredited health staff to provide emergency health care to both mother and child in prenatal, during delivery, and post-natal period. Attendance with health professional during delivery decrease risk of mortality of child. (Cohen et al., 2017)When the coverage is low, it shows positive in some literature.

SBA	-	Delivery attendants by skilled health personnel save neonatal child and the first four weeks of critical period of infant.
Caesarean	-	In emergency period of delivery, child born by caesarean section save lives of both mother and infant.
		
Socioeconomic Factors at individual level		
Moth_Esecon dary	-	More educated mothers know how to provide care, have health knowledge and they utilize health care services effectively. (Lartey et al., 2016) (Huda et al., 2016)
	+	In Zambia, baby of mothers with secondary or above education increased risk of death during neonatal period and the findings suggest that it could be unmeasured effect such as maternal nutrition, environmental factors and then, the percent of mothers who finished secondary or above education was low compare with mothers with no education group. (Lukonga & Michelo, 2015)
Fath_Esecond ary	-	Educated fathers especially who finished tertiary schools are associated with decreased risk of child mortality. As the same with educated mothers, they

<p>Unemployment</p> <p>FATHOCCU</p> <p>Agri</p> <p>Business</p>	<p>-</p> <p>-</p> <p>-</p>	<p>have health knowledge for healthy behaviors and it can affect direct or indirectly to child health outcomes. (Lartey et al., 2016)</p> <p>On the other hands, father's education is not associated with child mortality in wealth-related inequality in under-five mortality.(Van Malderen et al., 2013)</p> <p>Some literature found positively association of infant and child mortality because employed mothers could not provide care to their children in developing countries.</p> <p>Occupation of fathers show the income of the household in indirect ways and households with higher income access health care services, and they know how to take care of their children and utilize resources than households with low income families, fathers working in unskilled manual sector.</p>
<p>Socioeconomic factors at household level</p>		
<p>WEALTH</p> <p>Middle</p> <p>Rich</p>	<p>-</p> <p>-</p>	<p>Poorest households have difficulty in expensing for medical supplies and accessing to health care services, water, sanitation, and electricity comparing with richest family and inequalities in socioeconomic condition also determine mortality of under-five children. (Van der Klaauw &amp; Wang, 2004) (Wagstaff et al., 2004)</p>
<p>Socioeconomic factor at community level</p>		

Urban	-	Mothers from urban areas are more accessible to health care services, safe drinking water and electricity than mothers from rural area and it will decrease mortality of under-five children. (Van der Klaauw & Wang, 2004)
	+	On the other hand, children from urban tends to increased mortality than rural because of urban slum affect. (Lartey et al., 2016)
Travelproblem	+	Physical barrier in accessing health care facilities made reducing rate of utilization of health care and increased probabilities of child death.
Hilly	+	Two neonates born with similar health conditions but the regions where he or she from determines their health outcomes. (Sharaf & Rashad, 2016)
Delta	+	(Van der Klaauw & Wang, 2004)
Dry	+	According to the 2014 censuses data, regional disparities of under-five mortality was present in Chin, Magway and Ayeyawaddy regions and children from these regions will have more risk of deaths than other regions. (The Republic Of The Union Of Myanmar, 2015)
GRP	-	For high mortality countries, GDP is one of determinant factors among socioeconomic variables and it negatively associated with under-five mortality. (Cohen et al., 2017)

MW	-/+	For the low under-five mortality countries, human resources for health, accessing skilled birth attendants are significant for mortality. But for high mortality countries, the factors could be effect from multi-sectoral. Moreover, roles of midwives are mainly concerned for maternal and child health care for primary health care in rural area and MCH center at urban area.
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## CHAPTER 5

### RESULTS AND DISCUSSIONS

The original under-five children file (KR) of MDHS consisted of 4815 births within five years preceding the survey. This information was obtained from the interview with 12885 women with reproductive age from 15 to 49 in 13238HHs in 2015-2016. The study would like to focus determinants of children under-five years old and KR file was used for the study and to control the regional factors, the KR file was merged with the file which involved regional related variables by using STATA (13). For wealth status of the mother, KR was merged with both IR and HV files which consisted of wealth status of the mothers for each zone. Since the birth weight of the child in kilogram(s) is more precise than memory recall of the mother but there were altogether 2771 cases with missing values and did not include for the study. Moreover, health care utilization practices such as children of mothers using Antenatal care and post-natal care are key factors, but the information received was from the last-born children and 950 cases were missing and excluded for analysis. After excluding of some missing values<sup>1</sup>, the last sample consisted of 4239 (unweighted) and 3776 (weighted) born within five years prior the survey.

#### Sub sample Analysis

In Myanmar, recent studies also found the result of variations in states and regions within the country. In this study, 15 states and regions are composed according to the agro-ecological features of the country which was used for healthcare planning and national wide survey as well. The whole country can be separated into four agro-ecological zones and this type of stratification method was used in national level of

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<sup>1</sup> 131 cases were not a de jure resident during the time of interview. 87 cases excluded because children of mother who did not answer well on their partner's education attainment, 2 missing values. 10 cases for missing on mother's education and 36 cases for father's education. 191 cases for missing on mode of delivery and size of baby after delivery. To avoid the affect of teenage pregnancy, 119 cases -age of mother's at first birth was cut off at less than or equal to 16 years old.

Myanmar Poverty and Living Condition Survey in 2015 such as Hilly and mountainous zone which composed of Chin, Kachin, Kayah, Kayin and Shan states, Rakhine and Taninthayi are under Coastal zone, Delta zone contains Ayeyarwaddy, Bago, Mon and Yangon, Dry zone composed of Mandalay, Magwe, Nay Pyi Taw and Sagaing. (Ministry of Planning and Finance & World Bank, 2017)

According to the program implications for health coverage, Myanmar was divided into four by naturally marked zones such as hills and Shan plateau consists of Shan, Chin, Kachin, Kayin and Kayah, the delta zone composes of Yangon, Bago and Ayeyarwaddy besides central planes such as Mandalay, Sagaing and Magway and coastal zone made by Mon, Rakhine and Taninthayi. (Ministry of Health, 2014)

For the subsample analysis, the study will analysis factors associated with infant and child mortality at regional level by health coverage program planning<sup>2</sup>. Detailed summary statistics is displayed in annexes tables 2.1 A.1 for Coastal, 2.1 A 2for Hilly, 2.1 A 3for Delta and 2.1 A 4 for Dry zones. (Please kindly find the attached tables at annexes 2)

### 5.1 Descriptive statistics of Dependent Variables

*Table 10: Frequency and percent distribution of Infant and Child Mortality (Y1,Y2)*

Variable	Description	Unweighted (N,%)		Weighted (N,%)	
		Number	Percent	Number	Percent
Y1=Infant Mortality	Infant died from 0 to 11 months	175	90.21	146	89.55
Y2= Child Mortality	Child died from 12 to 48 months	19	9.79	17	10.45
Total= Under-five mortality	Child died from 0 to 48 months	194	100	163	100

<sup>2 2</sup> Summary statistics of independent variables used in Coastal Zone was shown Table 2.1-A-1 for Coastal Zone, 2.1 A 2 for Hilly, 2.1 A 3for delta and 2.1 A 4 for Dry Zone. To avoid the overtaking the places, it was attached at the annexes 2.

Table 10 describes unweighted data two dependent variables such as infant and child mortality from the remained sample. Among the infant dead of 175 (90.21%) died during infancy period and 19 (9.79%) died from above infant period. The unweighted data of number of under-five child death is 194 in total. Related with weighted data, it was found that 146 infants died, and 17 children died from exact one year of age to before reaching their fifth birthday. On the other hands, a total of 4045 children were alive and among the children, 853 children were from birth to before 11 months and 3205 children who were alive from exact 12 months to 60 months of age and it is shown in table 11.

*Table -11 Summary statistics of number of children who were alive*

Variable	Description	Unweighted (N,%)		Weighted (N,%)	
		Number	Percent	Number	Percent
Infant alive	Infant is alive between birth and before 11 months	840	20.77	731	20.23
Child alive	Child alive from 12 to 60 months	3205	79.23	2882	79.77
Under-five alive	Child alive from 0 to 60 months	4045	100	3613	100



Table 12: Frequency table of Infant and child mortality and survival by Healthcare coverage implication Zones<sup>3</sup>

State Region	Infant (0-11)		Child (12-48)	
	Alive n(%)	Death n(%)	Alive n(%)	Death n(%)
Coastal Zone	152(18.09)	24(13.71)	583(18.21)	4 (21.05)
Hilly and Mountainous Zone	356 (42.38)	88 (50.28)	1275(39.83)	8 (42.11)
Delta Zone	135(16.07)	28(16.01)	603(18.84)	2 (10.53)
Dry Zone	197(23.46)	35(20.00)	744 (23.12)	5 (26.31)
Total	840 (100)	175 (100)	3201 (100)	19 (100)

Table 12 above shows the infant and child death and survival by four zones. Among four zones, from Hilly and mountainous zone is the highest percent of both infant and child mortality. Coastal zone is the lowest percent in infant mortality and Delta zone is the lowest percent in child mortality.

## 5.2 Descriptive statistics of Independent Variables

Table -13 Frequency and percent distribution of the Biodemographic and Maternal Factors

Variable	Unweighted n=4239(%)	Range Minimum- Maximum	Mean	Standard Deviation
Age of the mother at first birth		16– 43 years	22.60	4.50
Age in years	4239			

<sup>3</sup> There are four zones used for health care coverage program implication in Myanmar.

	(100)			
Mothers with or without using Contraceptive		0 – 1	0.46	0.49
Without using contraceptive	2041 (46.83)			
With using one of contraceptive methods	2317 (53.17)			
Preceding Birth Interval		9 – 226 Months	0.12	0.32
Birth interval $\leq$ 24 months	537 (12.32)			
Birth interval $>$ 24 months	3821 (87.68)			
Sex of the child		0-1	0.47	0.49
Female	2011 (47.44)			
Male	2228 (52.56)			
Twin		0 – 1	0.17	0.13
Multiple births	75 (1.77)			
Single births	4164 (98.23)			
Birth order of the children		1 – 12	2.8	2.01
Birthorder1:First order	1380 (32.55)	0-1	0.32	0.46
Birthorder2 2 <sup>nd</sup> and 4 <sup>th</sup> order	2155 (50.84)	0-1	0.50	0.49
Birthorder3: 5 <sup>th</sup> order and above	704 (16.61)	0-1	0.16	0.37

The table 13 shows frequency and percent distribution of the biodemographic factors such as mother's age at first birth, mothers without using contraceptive, preceding birth interval, sex of child, twin, and birth order. According to the data, one third of the mothers were teenage pregnancy when they delivered their first-born child. The minimum age of mothers was 16 years old and the maximum age was 43 years old and it was shown in figure 11.

With respect to mothers using with or without contraceptive methods as a whole sample, 46.83% of mothers did not use any type of contraceptive methods and the remaining 53.17% used one of contraceptive methods at the time of interview. The percent of mothers who did not use any contraceptive methods from Hilly and Coastal Zones is slightly more than whole sample, 0.57% and 0.54% respectively and nearly more than half of the mothers did not practice using of contraceptives in these regions and it can be seen in figure 5.2.2.

A consideration for preceding birth interval, short birth interval, birth interval below 2 years or 24 months children were 12.32% whereas birth interval more than 24 months, long birth interval children were 87.68% for whole sample. The percent of children with short preceding birth interval is lower than whole sample in Coastal, Delta and Dry Zones and the result showed as 11.5%, 8.1% and 6.1% and the percent of preceding birth interval in Hilly zone was higher than whole sample, 17.5%.

Related with the sex, female and male ratio was 47.45% and 52.53% in each. Among the single and multiple births, 1.77% was single whereas 98.23% was multiple births. These biological factors are not much different in all four regions.

Half of the children were birth order with 5<sup>th</sup> and above and the percentage was 16.61%. The first rank child composed with 32.55% and the remained ones, 2<sup>nd</sup> and 4<sup>th</sup> order was 50.84%. In all four regions, the percent of birth order 2<sup>nd</sup> to 4<sup>th</sup> is around 50% and the percent of risk group of birth order 5<sup>th</sup> and above is lower than whole sample in Delta and Dry zones with 9.2% and 10.4% respectively.

Figure 11 Frequency distribution of age of mothers at first birth

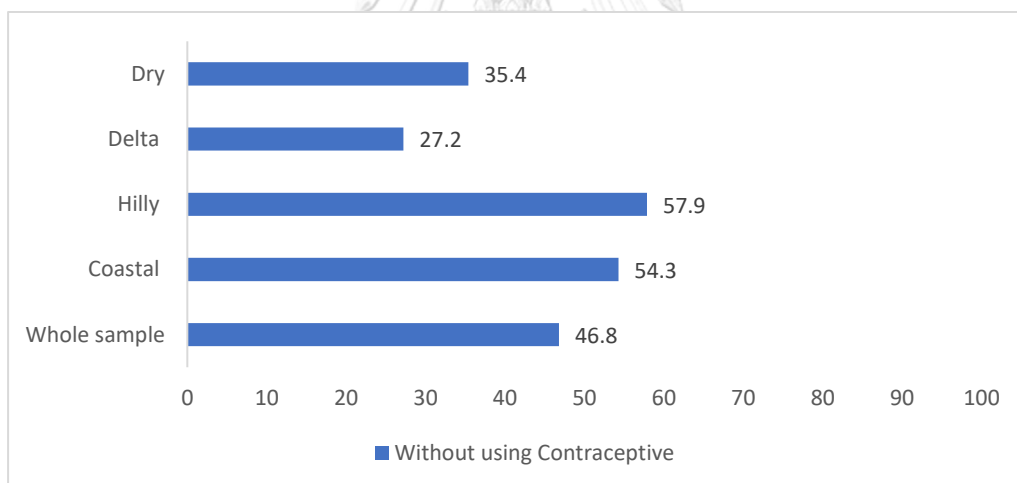
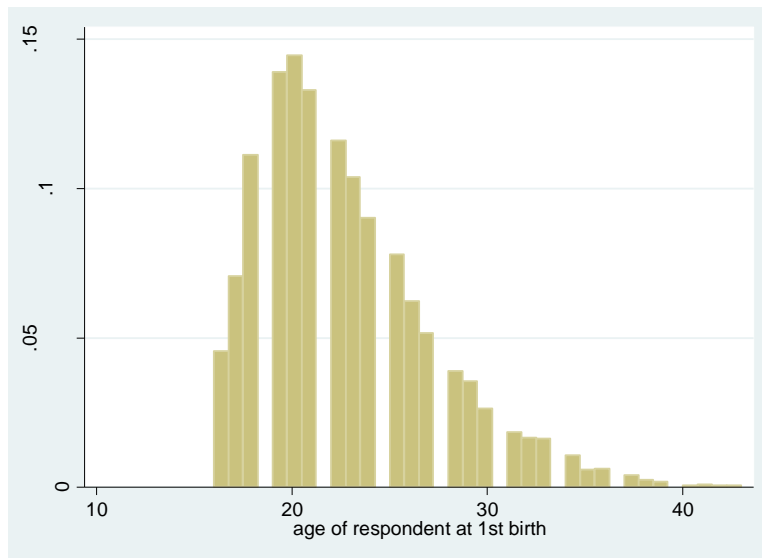


Figure 12 Percentage of Mothers who were using or without using contraceptive methods

Table 14: Frequency and percent distribution of the environmental factors

Variable	Frequency n=4239 (%)	Range Minimum- Maximum	Mean	Standard Deviation
<b>Access to safe drinking water</b>		0-1	0.79	0.40
Yes	3363 (79.33)			
No	876 (20.67)			
<b>Access to safe latrine</b>		0-1	0.53	0.49
Yes	2280 (53.53)			
No	1959 (46.47)			

Table 14 presents the percent distribution of children whose families were accessing to safe drinking water and safe latrine. Majority of the families (79.33%) accessed safe drinking water while 20.67% were not. Related with safe latrine, 53.53% or mean value of 0.53, families access safe latrine. But, in Dry zone, mean value of access to latrine is 0.67 and slightly higher than whole sample but in coastal mean value of access to safe latrine is 0.33 and lower than whole sample. In 2014, as a result of census, 70% of households reported using of improved sources of drinking water (piped water, tube well/bore hold, well or spring with protected, or bottled water/purifier) and all of the criteria are the same and MDHS report described accessing rainwater as safe water and it was found about 1.15% in MDHS data. Related with the latrine, around 53.53% utilized safe latrine while 46.47% were not. According to the 2014 census report, 14.4 percent was no latrine and it is similar with MDHS data, 15.56 %.

Table -15 Frequency and distribution of Nutritional factors

Variable	Frequency n=4239 (%)	Range Minimum- Maximum)	Mean	Standard Deviation
<b>Breastfed children</b>		0-1	0.97	0.16
Yes	4120 (97.19)			
No	119 (2.81)			
<b>Size of the baby after birth</b>				
<b>Large Size baby</b>	1016 (23.97)	0-1	0.23	0.42
<b>Average Size baby</b>	2634 (62.14)	0-1	0.62	0.48
<b>Small size baby</b>	589 (13.89)	0-1	0.13	0.34

With the respect to nutritional factors, breast feeding children and size of the baby by memory recall of the mothers are included and showed the data with percent, mean and standard deviation at table 15. Almost 97.19% was children who were breast fed by their mothers and 2.81% was no breast- fed children. In Myanmar, breast feeding rate is good enough but children receiving exclusive breast feeding is low and one of the cross-sectional study in Pan-Ta-Naw Township stated that 15% of the respondents provided only breast feeding to the child before their age of six months. (Kyι, Mongkolchati, Chompikul, & Wongsawass, 2015)

Table-16 Frequency and distribution of Delivery factors

Variable	Frequency n=4239 (%)	Range Minimum- Maximum)	Mean	Standard Deviation
Delivery Place		0-1	0.34	0.47
Institutional Delivery(public/private) and other	1480 (34.91)			
Home delivery	2759 (65.09)			
Skilled Birth Attendants		0 – 1	0.58	0.49
Yes	2490 (58.74)			
No	1749 (41.26)			
Mode of Delivery (Caesarean section)		0 – 1	0.15	0.36
Yes	675 (15.92)			
No	3564 (84.08)			

Table 16 further shows that children delivered at institution places such as public and private hospitals, clinics, and health facilities were 34.37% while home deliveries accounted as 65.63%. This figure is nearly similar with national figure of institutional delivery rate of 36.2% from 2008 to 2012. As shown in 4 tables in annex 2, the mean value of Institutional delivery in Dry and Delta regions are 0.40 and 0.45, higher than whole sample whereas 0.28 in Hilly zone and mean value of Coastal zone is similar with whole sample value, 0.33.

The skilled birth attendance (SBA) percent was 58.03%, (mean 0.58) while the percent of children delivered by non-health professionals was 41.97%. As the attached four tables in annexes 2, mean value of SBA in Dry and Delta zones are also higher than whole sample, 0.71 and 0.65 respectively. Results from mode of deliveries indicated that 15.56% of children were delivered by caesarean section while 84.44% of children were delivered by normal process. As an average, related with mean values of delivery

factors, mean value of both Dry and Delta regions are much higher than whole sample whereas Hilly and Coastal Zones are in lower status.

*Table -17 Frequency and distribution of Socioeconomic factors*

Variable	Frequency n=4239 (%)	Range Min- Max	Mean	Standard Deviation
Education attainment of the mother in secondary and above	1646 (38.83)	0-1	0.388	0.487
Education attainment of the mother in primary and no education	2593 (61.17)			
Education attainment of the father in secondary and above	1829 (43.15)	0-1	0.431	0.493
Education attainment of the father in primary and no education	2410 (56.85)			
Employment status of the mother		0-1	0.36	0.48
No employed mothers	1568 (36.99)			
Employed mother	2671 (63.01)			
Occupation status of the father				
Business or other sectors sector	1409(33.24)	0-1	0.33	0.47
Agricultural sector	1209 (28.52)	0-1	0.28	0.45
Manual sector	1621 (38.24)	0-1	0.38	0.48
Wealth Quintiles of the mother				
Poor	2213 (52.12)	0-1	0.52	0.49
Middle	774 (18.16)	0-1	0.18	0.38
Rich	1242 (29.54)	0-1	0.29	0.45



Residence			1.78	0.40
Urban	912 (21.51)	0-1	0.21	0.41
Rural	3327 (78.49)			
Travelling problem to health facility		0-1	0.31	0.46
Yes	1335 (31.49)			
No	2904 (68.51)			
Healthcare coverage planning zone				
Hilly	1727 (40.74)	0-1	0.40	0.49
Delta	768 (18.12)	0-1	0.18	0.38
Dry	981 (23.14)	0-1	0.23	0.42
Coastal	763 (18.00)	0-1	0.17	0.38
GRP per capita in state and region (2014) <sup>4</sup>	4239 (100)	\$493.69 – 2450.56	\$1118.33	496.27
Midwife per 1000 population in 2014	4239 (100)	0.1- 0.67	0.2884	0.1650

Table 17 indicated about socioeconomic factors of children of mothers, fathers and family characteristics. Analysis of both mothers and fathers in secondary or above level accomplishment, the percentage of children belonged mothers who finished primary education was higher than their fathers in whole sample as well in all four zones.

Considering employment condition of the mothers, 36.99% % were children of mothers who did not work outside of the home and 63.01% were children of employed mothers in any sector. The percentage of unemployed mothers was 47% and 42% in Coastal and Delta Zones, higher than whole sample but, the low percent was found in Dry zone and Hilly zone was nearly the same as whole sample, 0.34%.

<sup>4</sup> Exchange rate of MMK to US\$ 1<sup>st</sup> Dec 2014= \$ 1026 from central bank of Myanmar: webmail <http://forex.cbm.gov.mm/index.php/fxrate>

Results from occupation of the fathers indicated that almost more than one third of the fathers 38.24% worked in manual sector, 28.52% were in agricultural sector, 32.24% were fathers who worked as managers, professionals, and technical, clerical or sales. Among the regions, children of fathers who worked in manual workers found to be highest in Coastal zone, fathers who worked in agricultural zone is relatively high in Delta zone, 36%.

Regarding percentage of wealth quintiles of children of the mothers, poorest and poorer are recategorized into poor and it constituted the highest proportion by 52.12%, middle 18.16%, richer and richest composed as rich group and it had 29.54%. Coastal zone is the lowest percent in children of mothers from poor wealth status among four zones. The maximum mean value of poor wealth status is found in Delta zone and it showed in figure 13.

Furthermore, children from urban was 21.32% while children from rural composed with 78.68% and according to the summary statics tables in annex 2, mean value of urban in Delta zone was 0.33 and it is highest comparing with whole sample mean of 0.21 and among four regions.

With the respect to travelling problem to health facility, one third of the children of mothers 31.71% indicated about problems in going to health facilities while 68.29% had problem in travelling. As data obtained from annex 2, mean value of travelling problems in hilly regions 0.47, highest among all zones and whole sample. According to the information obtained from health care system review in Myanmar, the similar finding was found by comparison between hospital bed per 1000 population and utilization of public services especially for Chin and Kayah state and both are under Hilly zone. (Sein et al., 2014)

Related with the children from health care planning zone, hilly or mountainous zone composed of 40.74%, Delta zone 18.12%, Dry zone 23.14%, and Coastal zone 18.00%. As an analysis of the countrywide mortality survey, GDP per capita is negatively associated with under-five mortality. In this study, Gross regional per capita, GRP was used because GDP per state and level was used for analysis. The mean of GRP per capita is \$1118.33. According to the data, \$493.69 is the lowest GRP per capita and \$2450.56 is the highest amount.

When we looked at the supply side, Chin, Kayah under Hilly zone, and Yangon from Coastal zone are more than 2 beds per 1000 population comparing with Dry and Delta regions and it can be seen in table 1-A, annex1. The reasons could be geographic barriers in utilization of public health care services and Ayeywarwaddy region under Delta zone need more beds are needed to reduce the inequalities index and the figure can be seen in figure 1-A 3in annex 1. Among the health care resources, midwives are only frontline providing maternal and child health care under primary health care in rural area, 70% of population and used only MW per 1000 population for this study. Among the region, the highest distribution of midwife per 1000 population, 0.83 was found in Chin State under Hilly Zone, where under-five mortality is highest and lowest was in Yangon under Coastal zone, 0.15. (Sein et al., 2014)

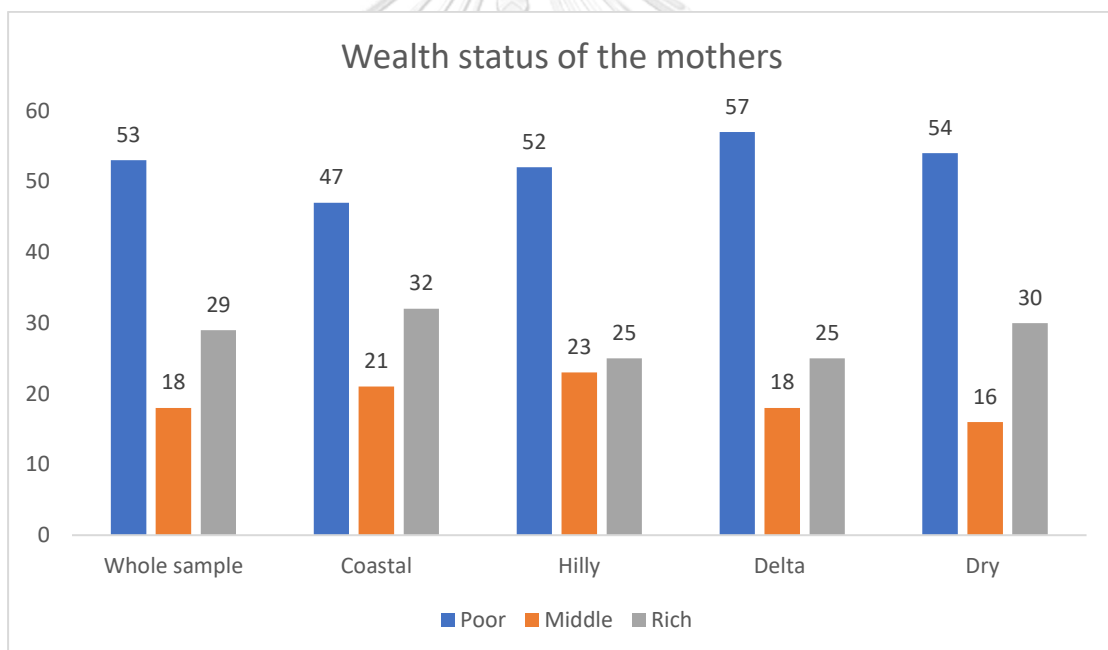


Figure 13 Wealth status of the mother

### 5.3 Test of overall significance

The F statistics used in together with p value to decide whether the equation is statistically significance overall or not.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \dots + \beta_k x_k$$

$$H_0 = \beta_1 = \beta_2 = \beta_3 = \dots = \beta_k = 0$$

$H_1$  : One of the  $\beta_i$  is not equal to Zero.

#### 5.3.1 Infant Mortality

Number of observation = 4239

F test for overall<sup>5</sup>, (29,3407) = 6.60

Prob > F = 0.0000

F test for Coastal Zone (9<sup>6</sup>,619) = 1.91

Prob > F = 0.0485

F test for Hilly Zone (24<sup>7</sup>,1258) = 6.36

Prob > F = 0.0000

F test for Delta Zone (24,672) = 1.56

Prob > F = 0.042

F test for Dry Zone (24,856) = 3.24

Prob > F = 0.0000

Therefore, P-value is less than 0.05 for overall sample and in all four zones and we can reject the null hypothesis implying that one of the  $\beta_i$  is not equal to zero. In

<sup>5</sup> The 29 variables for infant are age, nocontraceptive, twin, binterval, female, Bord1, Bord2, Breastfeeding, Largesize, Averagesize, Institution, SBA, Caesarean, safewater, safelatrine, Moth\_E secondary, Fath\_Esecondary, Middle, Rich, Business, Agri, Unemployment, urban, Travelprobelm, Hilly, Delta, Dry, GRP and MW

<sup>6</sup> For Costal zone, (6 variables) twin, binterval, breastfeeding, largesize, averagesize, Institution, SBA, Caesarean, Moth\_Esecondary are statistically significance and we do not use 18 variables are not used because their results in overall insignificance of the model.

<sup>7</sup> For Delta, Dry and Hilly zones (24variabels) age, nocontraceptive, twin, binterval, female, Bord1, Bord2, Breastfeeding, Largesize, Averagesize, Institution, SBA, Caesarean, safewater, safelatrine, Moth\_E secondary, Fath\_Esecondary, Middle, Rich, Business, Agri, Unemployment, urban, Travelprobelm are statistically significance

Coastal zone, the variables such as twin, binterval, Breastfeeding, Largesize, Averagezie, Institution, SBA, Caesarean, Moth\_Esecondary are also statistically significance and for the remained variables we couldn't reject null hypothesis that coefficients are equal to zero.

### 5.3.2 Child Mortality

Number of observation = 4239

F test for overall sample (21<sup>8</sup>,3407) = 0.78

Prob > F = 0.744

\*\* F test for overall sample (3,3407) = 2.65

Prob > F = 0.0474

The only three variables such as bitnerval, nocontraceptive, safelatrine are statistically significance for overall sample and we can reject null hypothesis that their coefficients are not equal to zero.

F test for Coastal zone (16<sup>9</sup>,619) = 0.21

Prob > F = 0.9996

F test for Hilly zone (16,1258) = 0.51

Prob > F = 0.94

F test for Delta zone (16,672) = 0.13

Prob > F = 1.000

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<sup>8</sup>The 21 variables such as age, nocontraceptive, binterval, Bord1, Bord2, safewater, safelatrine, Moth\_E secondary,Fath\_Esecondary, Middle,Rich,Business,Agri,Unemployment, urban,Travelprobelm, Hilly,Delta,Dry,GRP and MW are not statistically significance

<sup>9</sup> The 16 variables such as age, nocontraceptive, binterval, Bord1, Bord2, safewater, safelatrine, Moth\_E secondary,Fath\_Esecondary, Middle,Rich,Business,Agri,Unemployment, urban,Travelprobelm are not statistically significance

F test for Dry Zone (16,856) = 0.33  
Prob > F = 0.9951

The final sample of number of under-five children consisted of 4235. Since the data contained births and death from same mothers. Thus, we used clustered standard errors for testing of overall significance in both infant and child mortality.

According to the analysis, the variables used in the study or model is fitted for infant mortality, but the model for child mortality showed that the coefficients are not statistically different from zero.



Table 18 Binary Logit regression of Infant Mortality (0-11 months): regression coefficient, Marginal Effect estimation and significant in overall sample and four regions in Myanmar. MDHS (2015-2016)

Variables	Overall Sample	Coastal	Hilly	Delta	Dry
Age	-.0162 [-.0005] (.0231417)	0	-.05283 [-.0019] (.0388131)	-.0346[-.00089] (.0557751)	.06836 [.00156] (.0427952)
No contraceptive twin	.41503[.01285] * (.2069361) 2.6297 [.08144]*** (.4205429)	0 2.2426 [.06076]** (.8286755)	.67833 [.02467]** (.336666) 3.621 [.1317]*** (.6602058)	-.2188 [-.00567] (.6373176) 3.513[.091191]*** (1.283986)	.75914[.01735] (.542107) 2.5841 [.05908]*** (.8191613)
Bininterval	.49313 [.01527] ** (.2264858)	1.0430 [.02826] * (.5641471)	.70742[.02572]** (.2966269)	-.5548[-.01439] (.9350028)	-1.071[-.0244] (.8541688)
Female	-.0924 [-.0028] (.1877922)	0	-.2460 [-.00894] (.293826)	.70733 [.018357] (.504995)	-.5368 [-.0122] (.5030182)
BORD1	-.2374 [-.0073] (.2945793)	0	-.2757[-.01002] (.413869)	-1.609[-.04178]** (.7309862)	1.2468 [.02850] (1.05506)
BORD2	-.4430 [-.0137]* (.250499)	0	-.3659[-.01331] (.3371518)	-1.497[-.03887]** (.6593208)	.58970 [.01348] (.9969854)
Breastfeeding	-3.831[-.1177]*** (.2481242)	-2.964 [-.0803]*** (.5926398)	-4.228[- .15377]*** (.4405091)	-3.652[-.09479]*** (.691965)	-5.055 [- .11552]*** (.7522634)
Largesize	-.6234 [-.0193] ** (.2767929)	-1.602 [-.0434]** (.7352374)	-.1444[-.00525] (.4155558)	-1.527[-.0396]** (.7373287)	-1.017 [-.02327] (.7937488)
Averagesize	-.6138 [-.0190] *** (.2284092)	-.5127 [-.0138] (.5163239)	-.3387[-.01232] (.3503161)	-1.66[-.0432]*** (.5868153)	-.5231[-.01196] (.557905)

Variables	Overall Sample	Coastal Zone	Hilly Zone	Delta Zone	Dry Zone
Institution	-2339 [-.0072] (.3093328)	-5639 [-.0152] (.9865107)	.47065[.017117] (.4663101)	-.6072 [-.01576] (.8097348)	-1.350[-.03087]* (.7832505)
SBA	-4306 [-.0133] * (.2280089)	-7881 [-.0213] (.6147117)	-.6368[-.02316]* (.3728261)	-.8860[-.02299] (.6589048)	-.02827[-.00064] (.6004638)
Caesarean	-1.009 [-.0312] ** (.4363807)	-.82734 [-.0224] (1.054671)	-.6845[-.02489] (.7199575)	-1.2399[-.03218] (1.323515)	-1.3970[-.03194]* (.7012242)
Safewater	-.1434 [-.0044] (.2143865)	0	-.3003[-.01092] (.3582585)	.1155[.002999] (.6230907)	-.34199[-.00781] (.5321677)
Safelatrine	.21195 [.00656] (.2086076)	0	-.0987[-.00359] (.3225589)	.0908[.002358] (.4970984)	1.53416[.035077]** (.6291172)
Moth_E Secondary	-.1590 [-.0049] (.2354935)	-.08475 [-.0022] (.538946)	-.2425[-.00882] (.3358615)	-1.70[-.04432]**** (.5593088)	.809822 [.018516] (.5750433)
Fath_E Secondary	.27897 [.00864] (.2199184)	0	.35508[.012913] (.3297679)	.5518[.014322] (.5273285)	-.07325[-.0016] (.5217448)
Middle	.11178 [.00346] (.2325526)	0	.09431[.003429] (.3253682)	.3017[.007831] (.7359853)	-.37749[-.00863] (.6510156)
Rich	-.2989 [-.0092] (.29902)	0	-.10760[-.00391] (.4415667)	1.373[.035655] (1.180743)	-1.9039 [-.04353]** (.728593)
Business	.13864 [.00429] (.26077)	0	.34672[.012609] (.3983354)	.9112[.02365] (.6436569)	.021070 [.000481] (.5968179)
Agri	-.3764 [-.0116]* (.2378013)	0	-.2965[-.01078] (.3522144)	-.286 [-.0074] (.6755773)	-.79228 [-.01811] (.6810198)



Variables	Overall Sample	Coastal	Hilly	Delta	Dry
Unemployment	-.3989 [-.0123]* (.2097352)	0	-.4925 [-.01791] (.343857)	.2075 [.00538] (.445177)	-.44096 [-.01008] (.5221959)
Urban	-.2459 [-.0076] (.3228897)	0	-1.436 [-.05224]** (.6337719)	-.333 [-.0086] (.5228672)	.911325 [.020836] (.6053051)
Travel problem	.06021 [.00186] (.2065869)	0	-.0647 [-.00235] (.2979246)	.5716 [.01483] (.5240488)	.424650 [.009709] (.5589545)
Hilly	.85680 [.02653]** (.3868388)	-	-	-	-
Delta	.55897 [.01731] (.3596467)	-	-	-	-
Dry	.67652 [.02095]** (.3353386)	-	-	-	-
GRP	.00032 [.00001] (.000324)	-	-	-	-
MW	.32419 [.01004] (.7134427)	-	-	-	-

Robust Standard Error in Parentheses, Marginal Effect in Blanket, (\*\*\*) significant at 1%, \*\* significant at 5%, \* significant at 10%

## 5.4 Factors associated with Infant Mortality in Myanmar (Overall sample)

### 5.4.1 Maternal factors and Infant Mortality

#### **1) Mothers without using contraceptives**

The infants of mothers who did not contraceptive are more likely to die before age 1 by 1.1% in whole sample. Contraceptive methods prevent from unwanted pregnancy and it enhances child spacing and family planning and so that both parents could plan to get a child and it improves conditions of child survival. This factor is statistically significant at 90% confidence interval in overall.

### 5.4.2 Biodemographic factors and Infant Mortality

#### **1) Twin Child**

In overall sample, twin or multiple child more likely to die by 8.1% compared to singleton child and statistically significant at 99% confidence interval. Myanmar, during ante-natal care services, twin or multiple pregnancies are defined as risk pregnancies and pregnant mothers were referred by Auxiliary Midwives, and midwives or basic health staff to higher level nearest secondary or tertiary hospitals which can perform caesarean sections with well-trained health staff such as medical doctors, or Obstetrics and Gynecology specialists. Moreover, twin or multiple birth newborns are usually low birth weight than singleton child.

#### **2) Preceding Birth Interval**

Preceding birth interval, the interval period between the previous and index child is also one of the associated factors for infant mortality and it has positively relationship. The results demonstrated that infant with short preceding birth interval are more likely to die during infancy period by 1.5% than those of birth interval more than 24 months child. This result supported previous studies done infant and child mortality on diarrhea and using of ORS in Myanmar by using of 2001 FRHS data. (MOH et al., 2014)

The reasons may be the effect that mothers waited for two years before having the next child would have refilled most nutrients from body requirements, and blood loss during delivery previous pregnancy and breast feeding. The shorten birth interval is also one of the risk factors of pregnancies and the shorten the birth interval, the higher in delivery complications in the mothers than those with long birth interval.

The birth interval lower than 24 months increased risk of death in neonatal period and it is regarded as prenatal causal factors for childhood mortality. (Whitworth & Stephenson, 2002)

### **3) Birth order**

Birth order is another determinant of both infant and child mortality. The likelihood of child dying before age one increased with higher in birth order or birth rank of the child. Therefore, the lower the birth order is negatively associated with infant mortality. Related with the overall sample, the effect was found in birth order from 2<sup>nd</sup> and 4<sup>th</sup> and they decreased probability of died during infancy period by 1.3% than those birth rank of fifth and above and it is statistically significant at 90% confidence interval.

Possible explanation for this factor is that higher birth order also tends to increase necessary nutrition, care and other resources are also rise and the mother's ability to provide care to more children also decreases

The similar result was found in previous studies done in African countries. (Van Malderen et al., 2013)

#### **5.4.3 Nutritional factors and Infant Mortality**

##### **1) Breastfeeding**

This study also confirmed that current breastfeeding (at the time of interview) is the strongest predictor of infant mortality among other associated factors and the likelihood of infant mortality reduced by 11.8% than non-breastfed children and all are statistically significant at 99% confidence interval. Human milk is a safe and nutritive diet for the children to have growth and development of the infant. It is also considered as best and safe and well-nutritious food for the infants. One study done on exclusive breast feeding in PanTa Naw township, Ayeyarwaddy region, Delta zone in Myanmar and the study identified that the prevalence rate of exclusive breastfeeding

was 15% and as a globally, the rate is about 38% and 6% are never breast-fed children. Mother's breast milk prevents childhood illness such as pneumonia and diarrhea. Other advantages from breastfeeding are increasing bonding between mothers and children, promote in cognitive and psychological development as well.(Kyi et al., 2015)

## 2) Size of the baby

The study also revealed that infant with their size in large after delivery were less likely to die by 1.9 % than those having small size baby in overall sample. With the average size infant, the probabilities of died before age 1 was reduced by 1.9% than those of infant from small size after birth. To explain this, it may be the effects of pre-term or low birth weight because pre-term or low birth weight children are small in size than the average child after delivery. Most preterm or low birth weight children are lower in resistance to fight against infection because their immune system is not developed well. A study conducted in Nigeria also found that size of the baby is associated with under-five mortality. According to the hospital statistics data in 2016, disorders related to short gestation period, low birth weights and other else accounted as 24.3% of total under-five mortality cases in Myanmar.

### 5.4.4 Delivery factors and Infant mortality

#### 1) Skilled birth attendants

Assistance during delivery time is also one of the determinants for infant mortality and the study revealed that accessing skilled birth attendants decreased probabilities of died before 1 year of age by 1.3% in overall sample, and statistically significant at 90% confidence interval. The skilled health personnel (midwives, Lady Health visitors, nurses, doctors) can manage birth complication during delivery such as birth asphyxia and prematurity and if the born child did not get timely treatment which can leads to death. The coverage of maternal health care is huge gap and the proportion of skilled birth attendant in lowest was 41.2% and 88.9% from Annual hospital statistics data.(MOHS Ministry of Health and Sports et al., 2017)

According to the MDHS report, it is found that skilled birth attendants during delivery in urban areas is 88% whereas 52% in rural area. It varies with the households wealth and the percent of SBA in poorest wealth quintiles was 36% and three times 97% in richest quintiles and it can be seen in figure 1-B 3. According to the final sample (4239 births) the percent of SBA per household wealth can be seen in figure 1-B4. (MOHS Ministry of Health and Sports & ICF, 2017)

## 2) Mode of delivery: Caesarean section

Accessing caesarean together with health facility was a predictor of infant mortality. Baby who delivered by caesarean section was less like to die by 3.1% compared to their counterpart. WHO mentioned in the past three years, 2015 that the caesarean section rate which is lower than 10% means poor access to emergency care meanwhile above 15% indicating overmedicalization. But, WHO stated that caesarean section rate more than 10% is not associated with mortality reduction.

### 5.4.5 Socioeconomic factors and Infant Mortality

#### 1) Occupation status of the father, fathers working in Agricultural sector

Infants whose fathers worked in Agricultural sector are less likely to die 1.3% comparing with infants of fathers who worked in manual sector. To explain this effect is that, Agricultural sector stands as main for economy development of the country and it contributes 32% of GDP, 56% of employed workers are in this sector and majority of the population, 70% of population reside in rural area and working in agricultural sector is one of the main sources of incomes for households. According to the data from MDHS, it was reported like 28% of fathers worked in agricultural sector.

#### 2) Mother's unemployment

In general phenomenon, mothers who worked outside of the home may be more likely to access health care services and better access to nutrition for their children and for themselves. In this study, 36.99% of the mothers as total, and 37.74 % mothers

from Hilly zone have no work outside of the home in the past 12 months before the time of interview. In overall, infants of unemployment mothers are less likely to die before age 1 by 1.2 % than comparing with infants of mothers who worked outside of the home. The possible explanation is that mothers who did not work outside of the home have time to provide care to their children and more time for breastfeeding to the children.

#### 5.4.6 Geographic factor or community level factors and Infant mortality

##### 1) Urban

The place differences between urban and rural differentiate under-five mortality by the unequal distribution of health infrastructure, communication and prevention and control of diseases. The study done in Zimbabwe also found rural-urban variation in childhood mortality. (Omariba et al., 2007) In this study, residence place is determinant of infant mortality found only in Hilly region and urban infants are less likely to die 5.2% than rural child in Hilly zone and statistically significant at 95% confidence interval. The study also confirmed the findings of percent of urban in determining infant and under-five mortality in Myanmar. (Ko Ko M, 2017)

Table 18 summarize the results after adding GRP per capita and midwife per 1000 population and it showed that there has no relationship between infant mortality and these two variables. Midwives are frontline of providing maternal and child health care services especially in rural areas and according to the distribution of midwife ratio in 2011, the highest ratio was found in Chin state under Hilly Zone in where under-five mortality rate was third highest reported from 2014 censuses meanwhile 0.89 per 1000 population and the lowest was seen in Yangon region under Coastal zone, can be seen in tab1-A 3 annex1. Midwives are backbone of the maternal and newborn care for the communities living in rural area, together with lady health visitors; doctors and nurses are providing care at hospitals. WHO reported that fewer than health work force (doctor, nurse and midwife) of 22.8 per 10,000 population was not efficient or effective to provide basic health care services to entire population. Now, target to achieve at

least one midwife per one village by 2025 to ensure providing of safe reproductive health including newborn and child care because investment on midwives is cost-effective method. Therefore, when the coverage of midwife per 1000 population is improved as the target in the future, findings on association of infant mortality and midwife per 1000 population could be different from this study.

#### 5.4.7 Health care planning zone

The study found that being infant from Hilly zone and Dry Zone more likely to die during infancy period by 2.6% and 2.1% respectively than infants from Coastal zone and it is statistically significant at 95% confidence interval. Possible explanation for zone variation is that poor development in infrastructure, difficulty in travelling especially in rainy seasons and same as in remote areas, households living under poverty line, utilization of health care services and availability of essential health care services and cultural, belief and practices. Previous studies also reported ethnic differentials in under-five mortality in Myanmar (Ko Ko & Sawaengdee, 2014). While comparing between overall sample and four main zones, the findings stated that factors are varied across the zones.

##### 5.4.7.1 Factors associated with infant mortality in Coastal Zone

In Coastal zone, main predictor of infant mortality is being a twin or multiple and breastfed child. The likelihood of infant mortality increased infant with twin or multiple birth by 6.1% and short birth interval child by 2.8% compared with their relative counterpart. On the other hands, the infant mortality was less likely to occur infant who born with large size after birth and breastfed child.

Maternal and Child Cash Transfer (MCCT) is one of supported programs by Livelihoods and Food Security Trust Fund (LIFT) and target is for especially for 1000 days (from pregnancy to two years old child) to combat nutrition by consuming more on nutritious food in only in Rakhine state under Costal zone. It is one of the common malnourished problem within the country. (MOH et al.) This program is strengthening of social protection policy to reduce the problem of long term malnutrition, stunting issues sin

there.(LIFT, 2018) It was assisted by other humanitarian organizations, NGOs and Civil Society Organization (CSO) for conflict resolution, economic and social sector development. According to the analysis of child health for prioritized townships, the two states such as 4 townships for Rakhine state, 1 for Tanintharyi and 0 for Mon state. (Department of Public Health, Child Health Division, WHO, & UNICEF)

#### *5.4.7.2 Factors associated with infant mortality in Hilly Zone*

In the Hilly zone, infants of mothers who did not use contraceptive methods increased probability of death during infancy period by 2.5% than those of mothers who used contraceptive methods. Moreover, infants with short preceding birth interval were more likely to die by 2.5% than those of long birth interval. The fertility rate is also related with these two factors and according to the 2014 censuses data, total fertility rate in 5.0 per woman in Chin state and it is highest among other regions. The marginal effect of twin is highest in hilly region and according to the three delays from World Health Organization, it may be the facts that possible delay in identification of twin pregnancy during Ante-natal care services. According to the annual statistics, the coverage of four ante-natal care varies among states and regions under Hilly zone and it 58% in Chin, 51% in both Shan and Kayah, 62% in Kayin and the highest is 77% in Kachin. However, there is no data on disaggregation receiving health care services in hard to reach areas and MOHS is trying to overcome the constraints of supply side barriers such as low health infrastructure investment, human health workforce shortage, proving essential health care services up to hard to reach areas and armed conflict areas within the country.(MOHS Ministry of Health and Sports et al., 2017) According to the findings, breastfed infant, those delivered with SBA were less likely to die before one year in this zone.

Kachin and Shan states had internally displaced persons (IDP) who are staying at the camps and with the perspective of newborn and child health coverage, 31 townships under Shan and 9 townships from Kachin state set as prioritized for improving child health outcomes, out of 109 townships as total. (MOH et al.)



Therefore, among four zones, rural-urban difference is more apparent in this zone and urban infants were less likely to die by 5.2% than those of rural infants and statistically significant at 5%.

#### *5.4.7.3 Factors associated with infant mortality in Delta Zone*

According to the results, twin child, birth order, breast feeding, size of the baby, education level of the mothers were the determinants of infant mortality in Delta Zone.

While comparing with overall sample, the two factors such as birth order and education level of the mother is statistically significant only in this zone.

Most studies showed that the education of the mothers is one of the associated factors for under-five mortality. (Bedada, 2017) (Kanmiki et al., 2014) (Wagstaff et al., 2004)

One study in Myanmar analyzed determinants of both infant and under-five mortality by using of 2014 censuses that the study found that literacy level of the mothers by whether the mothers had no effect on under-five mortality. (Ko Ko M, 2017) In this study, education levels of mothers by mothers who received below or equal to secondary education level as explanatory variables and the results showed that infants of mothers whose secondary or above education are less likely to die 4.4% compared to children of mothers whose education with primary or no education especially in Delta zone. The result is statistically significant at 1%.

The probabilities of death before age one increased to twin or multiple birth by 9.1% than those of single birth child. Breastfed infants were less likely to die by 9.5% than those of infants with no breastfeeding. Furthermore, infants with large size after birth were less likely to die by 3.9% and average size after birth by 4.3% than those of infants with small size baby.

#### *5.4.7.4 Factors associated with infant mortality in Dry Zone*

The findings from the study showed that institutional delivery, infants delivered by caesarean section, infants of family accessing safe latrines, infants of mothers residing in rich households were determinants of infant mortality only in Dry zone.

The delivery place of infant is one of determinant factor for infant mortality and infants who delivered at institution places were less likely to die by 3.1% than those of infants delivered at home. Unassisted births had a greater risk of infant mortality and delivering at institutional places ensure the accessibilities emergency care either mothers and children when both of them are facing with delivery complications. According to the data, the percent of institutional delivery is 40% in Dry zone and 45% in Delta zone.

Moreover, infants born by caesarean section lower risks of death by 3.2% than those infants born by normal deliveries. In Myanmar, access to comprehensive emergency obstetric care is inadequate in some regions and, the overall caesarean section rate is lowest in Chin state, part of Hilly region, 2.8%, followed by Rakhine state as 3.4% that is under Coastal zone and the highest rate is 14.7% in Sagaing, Dry Zone and it can be seen in 1-A 4. Therefore, it may be concluded that the regions where limited access to caesarean section are not significant at all such as Coastal and Hilly zones and significant was seen in Dry zone where caesarean section rate is high. (MOHS Ministry of Health and Sports et al., 2017)

In this study, wealth status of the mother was recategorized into three levels such as poor, middle and rich and same as in another studies. (Bedada, 2017) The wealth status is only the associated factor in Dry zone and infants of mothers residing in rich households were less likely to die before age 1 by 4.4 % comparing with their counterparts, poor wealth status. Infants from poor families couldn't spend their limited resources on well-being of their children meanwhile wealthier families afford resources needed for providing care or receiving care.

The study found unexpected sign on infants of families accessing safe latrine are more likely to die by 3.5% than infants of families whose are not in Dry zone. According to

the data, 67.18% accessed safe latrine in dry zone. This finding could be largely due to data discrepancy. However, further research is needed to clarify on this finding in Dry zone.



Table 19 Binary Logit regression of Child Mortality (12-48 months): regression coefficient, Marginal Effect estimation and significant in overall sample and four main zones in Myanmar, MDHS (2015-2016)

Variables	Overall Sample	Coastal	Hilly	Delta	Dry
Age	0	0	0	0	0
No contraceptive	1.0798 [.0047979]* (.541277)	0	0	0	0
Binterval	1.0740 [.004772]* (.5184925)	0	0	NA	NA
BORD1	0	NA	0	NA	NA
BORD2	0	0	0	NA	NA
Safewater	0	0	0	0	0
Safelatrine	-.8690 [-.0038612] (.5075064)	NA	0	0	0
Moth_E Secondary	0	0	0	NA	0
Fath_E Secondary	0	NA	0	NA	0
Middle	0	0	0	NA	NA
Rich	0	0	NA	NA	0
Business	0	0	0	NA	0

Variables	Overall Sample	Coastal	Hilly	Delta	Dry
Agri	0	0	0	0	0
Unemployment	NA	0	0	NA	0
Urban	NA	0	0	0	NA
Travel problem	0	0	0	0	0
Hilly	0	-	-	-	-
Delta	0	-	-	-	-
Dry	0	-	-	-	-
GRP	0	-	-	-	-
MW	0	-	-	-	-

(“0” means the variables have observation, but they are insignificant for child mortality, NA means no observation)  
 (\*\*\*) significant at 1%, \*\* significant at 5%, \* significant at 10%)

## 5.5 Factors associated with child mortality (12-48 months) in Myanmar

The table 19 summarizes the factors associated with child mortality from the final sample size consisted of 19 number of children (4 from Coastal, 8 from Hilly, 2 from Delta and 5 from Dry) who were died between 12 months to before reaching their fifth years of birthday, only 0.45% of child death occur in the data. Therefore, when the study would like to analyze determinants of child mortality by four main zones, it was found that there has no enough observation for analysis for some variables per region.

### 5.5.1 Maternal Factors and child mortality

#### 1) Not using contraceptive methods

The results show that children of mothers who did not use contraceptive methods are more likely to die during childhood period from exact one year to before five years old by 0.4% compared to their counterparts in overall sample. For each region, the factor is insignificant.

### 5.5.2 Biodemographic factor and child mortality

#### 1) Short Preceding birth interval

The children with an interval of lower than or equal to 24 months had higher risk of death before age 5 by 0.4 % than children with long birth interval and it is statistically significant at 10%.

To sum up, the study used MDSH 2015-2016 to identify factors associated with infant and child mortality in Myanmar. According to the findings, mother's usage of contraceptive, twin or multiple birth, short preceding birth interval and birth order, breastfeeding, size of the baby, access to skilled birth attendant, caesarean section contribute infant mortality in overall sample and access to institutional delivery is associated with infant mortality only in Dry zone and statistically significant at 90%

confidence interval. However, sex of the child and age of the mother at first birth did not contribute infant mortality in all four zones and overall sample.

The mother's usage of contraceptive and short preceding birth interval is associated with child mortality. The age of the mother at first birth and birth order were not statistically significant for child mortality.

Finally, the study found that there is no association between GRP per capital and midwife per 1000 population in both infant and child mortality.

#### 5.6 Limitations of the study and recommendation for further study

As using of cross-sectional data, the limitations of the study were at the time of child death and the data obtained from survey were not the same event. Furthermore, the study would like to use the important variables in infant and child mortality such as number of maternal Ante-natal care visit, post-natal care, BMI, child health factors such as immunization status, receiving Vitamin A and birth weight in kilograms but the observations are less and did not include in this study. The percent of child mortality, from 12 months to 48 months was 9.95% and the F test for child mortality is not statistically significance for overall except three variables and the factors associated with child mortality couldn't explain very well from used explanatory variables.

Therefore, for the next study, it is recommended to study more on factors associated with child mortality from exact one year to before five-year old. In Myanmar, as 64% of under-five children are anemic or iron deficiency anemia, some nutrition related anthropometry indicators are not included in this study as well. Furthermore, some of the household attributes are not included such as low pollution, garbage disposal, and access to electricity. Furthermore, the main causes of under-five mortality such as malaria, Tuberculosis, HIV,AIDS, Pneumonia, Diarrhea could not control for analyzing of one year and above children.

## CHAPTER 6

### CONCLUSION AND RECOMMENDATION

#### 6.1 Conclusion

The long duration of conflict, and weakness on political commitment on social protection policies made one of the countries which need to continue unfinished agenda of reduction under-five mortality rate. This study found that biodemographic, nutrition, delivery, maternal variables such as infants who were breastfed, large or average size baby, infants delivered by caesarean section, infants of mothers who were not using contraceptive methods, short preceding birth interval, infants live in Hilly and Dry zone were more likely to die before one-year age and statistically significant at 95% confidence interval.

Breastfeeding is one of key factors of infant mortality in four zones in Myanmar and according to the national strategies of newborn and child health development (2015-2018), early initiation of breast feeding is key intervention up to rural communities along with the advocacy and policy enforcement on code of marketing for breast milk substitute for child survival program. Promoting of breast feeding together with improving of 1000 days nutrition programs for malnourished children are important because nutrition enhance physical and cognitive development of the children and which will provide huge impact on labor economy of the country.

Twin or multiple births had higher risk of death than singleton child and strengthening of referral system by early referral of high pregnancies such as twin child could save lives of infant deaths in all four zones. This finding suggested that if it is very important to identify risk pregnancies at the community level and promoting of community-based referral system and ensuring that mothers, parents and families have enough health information to go hospital without delay and reducing of out of pocket payment for the families who couldn't afford for hospitalization. According to the WHO's three delays in seeking health care services, delay in reaching health care facilities is not only supply side but also lack of health knowledge and transportation barriers.



In Coastal zone, nutrition program and early referral of twin pregnancy and health education or promotion on right time to conceive next child are key factors for promoting child survival. When we look at the three regions under Coastal zone, Rakhine state has 4 prioritized townships for improving child health and MCCT program is implementing to reduce stunting rate by LIFT program and supporting on strengthening of social protection policy by development partners will support infant survival in this zone.

In Hilly zone, total fertility rate 5.0 per woman in Chin state and 40 prioritized townships for improving child health in Shan and Kachin state. Therefore, parental education on knowledge about family planning together with accessing contraceptive methods will decrease risk of infant mortality. In this zone, accessing and utilization of contraceptive methods and knowledge on family planning could save lives of infants or improving health of mothers who are in IDP camps and remote areas. Moreover, urban infant tends to survive than rural infant and inter-sectoral collaboration between health and other sectors will help in reducing urban-rural gap. In this region, many sectoral areas need to be strengthen but prioritization of programs with evidence-based findings will support in utilization of resources effectively and efficiently together with conflict resolution and reconciliation will support in socioeconomic determinants which affect on child health in this region.

The maternal education is statistically significant and improving maternal education will decrease risk of infant death in Delta zone. Infants of mothers with secondary education were less likely to die than those of mothers completed primary or no education level and improving and strengthening rights of accessing education for all or completing at least secondary education is importance for this region. Moreover, the lower the birth order, the more likely to die before one year of age and it is importance to deliver key messages on using of contraceptives methods for birth spacing. Large size and average size baby tends to survive and education on how to eat well-nourished food with nutrition program will increase health of infant in this region.

In Dry region, institutional delivery is associated with infant mortality at the level of 90% confidence interval. The government has commitment on 80% access to

skilled birth attendance coverage at the national level. According to the previous studies done in rural area of Myanmar, the main reasons of lack of access to services and acceptance of traditional birth attendants in rural area. The urban women from most of the regions are accessible to SBA and but may not true for children of mothers who resides in rural areas. The unexpected sign of using safe latrine was found and need to do further study on it. Only in this region, infants of mothers from rich household wealth were less likely to die and it is important to design livelihood programs for poor households which effect on reducing of poverty in this region.

## 6.2 Recommendations

- 1) Dissemination of advantages of breastfeeding by using of various types of Information, Education and Communication materials and health education or key messages to mothers, fathers, families and communities across the country.
- 2) Early identification of twin or multiple births at the community level because this groups are risk groups for infant mortality and the government or development partners working on child health should emphasize to get timely referral to health facilities.
- 3) Improving health knowledge on nutrition and birth spacing and support to get the basic elements of nutritious foods and contraceptives methods by strengthening of supporting of currently implementing social protection policy in Coastal zone.
- 4) For Hilly zone, educating on best time of taking pregnancy (age and birth interval). That message should be delivered to the husbands of the mothers or male involvement in reproductive health so that they will know and practice of considering birth interval. Moreover, utilization of contraceptive methods by reproductive women or men aged in this region and strengthening of reaching essential reproductive health care services to most vulnerable groups in this region. Rural development program by

intersectoral collaboration will support on urban-rural gap of infant mortality in this zone.

5) For Delta zone, support on improving maternal education and educate mothers, fathers and communities on how to get and prepare nutritious food and birth spacing to save lives of infants.

6) For Dry region, strengthen and sustain on livelihood programs for infants of families from poor wealth status. Increase accessibilities of institutional deliveries in urban and rural areas and barriers in utilization of services need to be explored.

7) Economic development for low income family, solving issues on bad road conditions, infrastructure development plan for zones to reduce regional disparities and developing of targeted interventions or regional child healthcare plan to address factors which contribute infant mortality by separate zones meanwhile continuing of national child development plan.

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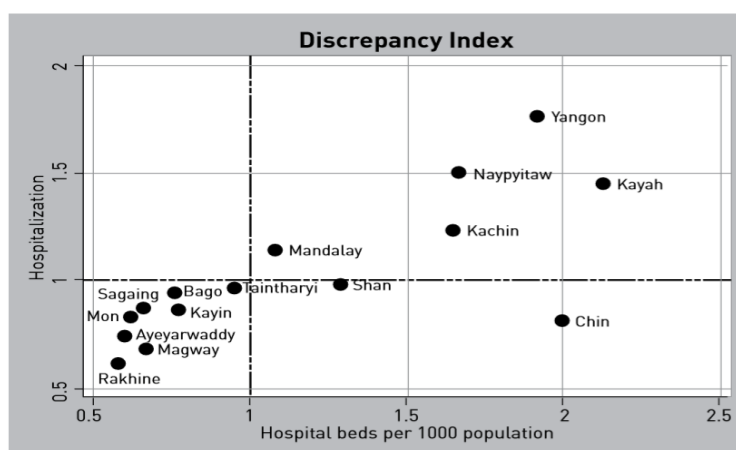


## APPENDIX 1

Table 1-A 1 Variables used for the study

Indicator	Source
Gross Domestic Product per state and region in 2014	Republic of The Union of Myanmar, Pyantan, No.8, Volume 68, 20 Feb 2015
Total population in state and region	2014 censuses data
Number of midwife in 2014	Myanmar SRMNAH workforce Assessment, pg.49
Distribution of hospital beds and discharge per 1000 population in 2014	<a href="http://mohs.gov.mm/Main/content/publication/hospital-hospital-statistics-report-2014-16">http://mohs.gov.mm/Main/content/publication/hospital-hospital-statistics-report-2014-16</a>
GDP per capita in 2014	<a href="https://tradingeconomics.com/myanmar/gdp-per-capita">https://tradingeconomics.com/myanmar/gdp-per-capita</a> \$1266.1

Fig 1-A 2 Scatter of showing Discrepancy index of hospital beds and hospital utilization



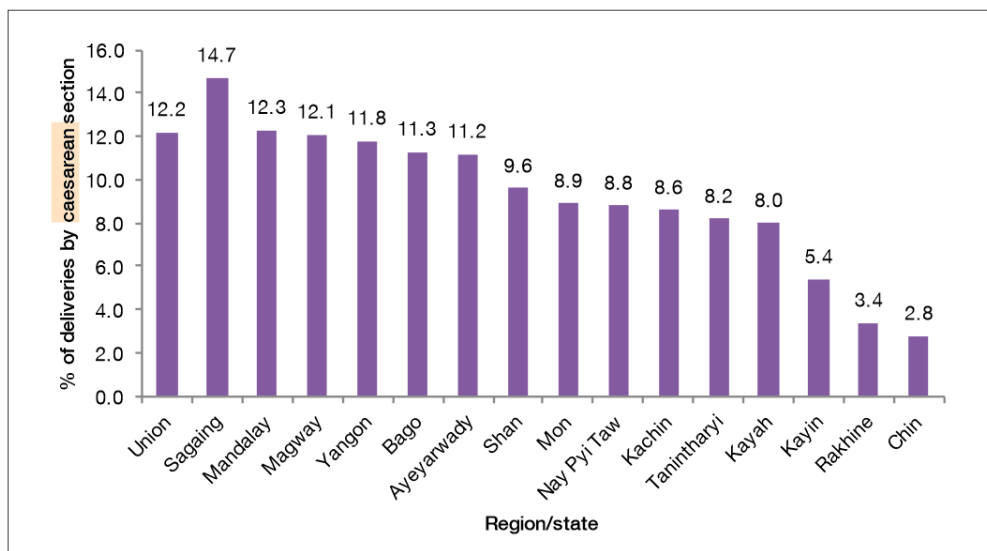
Source: Health Management Information System, Department of Health Planning, MOH 14 July 2013

Table 1-A 2 Number of midwives and GRP per capita in States and Regions

Region/State	Total Population 2014	No. of midwife in 2014	Midwife per 1000 population	GRP per capital
Kachin	1,689,654	418	0.25	894.8
Kayah	286,738	155	0.54	774.6
Kayin	1,572,657	339	0.22	702.2
Chin	478,690	321	0.67	493.7
Sagaing	5,320,299	1210	0.23	1324.9
Taninthayi	1,406,434	301	0.21	2450.6
Bago	4,863,455	1109	0.23	1039.8
Magway	3,912,711	1085	0.28	1529.3
Mandalay	6,145,588	1004	0.16	1076.2
Mon	2,050,282	430	0.21	1263.9
Rakhine	3,188,963	669	0.21	903.6
Yangon	7,355,075	728	0.10	1854.0
Shan	5,815,384	1183	0.20	699.5
Ayeyarwaddy	6,175,123	1488	0.24	1416.5
NayPyitaw	1,159,341	206	0.18	1214.2

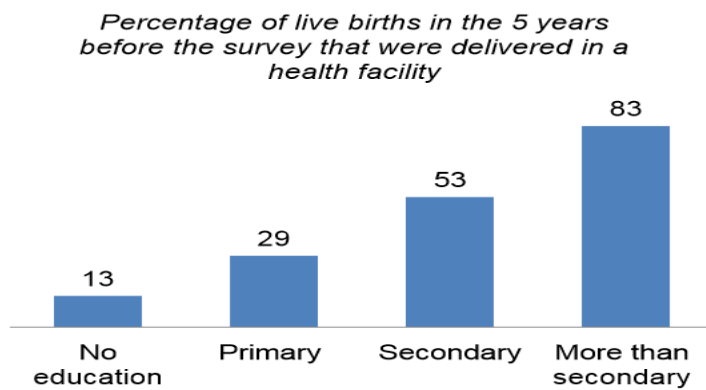
Source: Myanmar SRMNAH workforce assessment pg.49 and Pyan Tan

Fig 1-A 4 Caesarean section rate, by region/state,2014



Source: Myanmar SRMNAH workforce assessment pg.11

Fig 1-B 1 Percent of Institutional delivery from MDHS final report(n=4815)



Source: Myanmar Demographic and Health Survey 2015-2016 (pg.124)



Fig 1-B 2 Percent of skilled birth attendants by education level of the mother from final sample<sup>10</sup> of the study(n=4239)

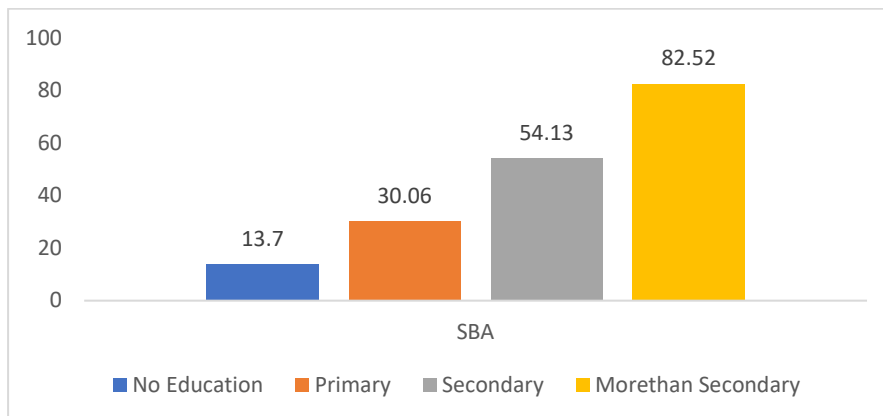
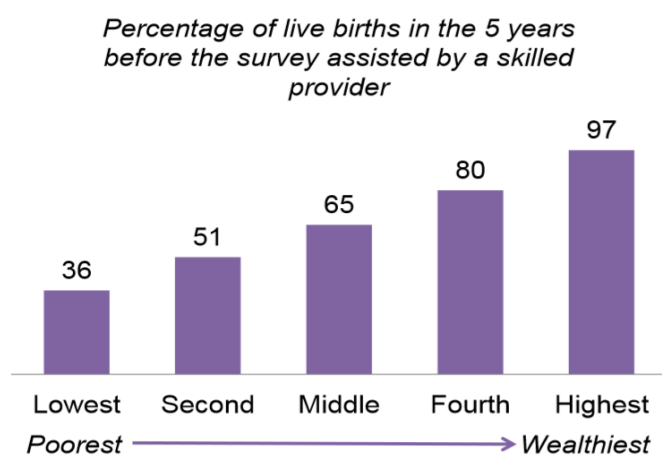


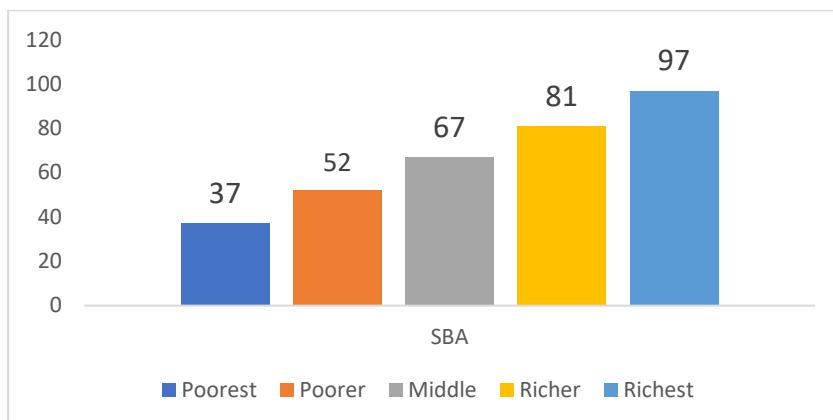
Fig 1-B 3 Percent of Skilled birth attendants by household wealth



Source: Myanmar Demographic and Health Survey 2015-2016 (pg.126)

<sup>10</sup> Final sample consisted of 4239 births after cleaning of missing values. To describe the percent of institutional delivery by education level and percent of SBA by household wealth used weighted data because final DHS data showed the percent with weighted data.

Fig 1-B 4 Percent of delivery assistance by wealth quintiles of the households from final sample of the study (n=4239)



## APPENDIX 2

Table 2.1 A 1 Summary statistics of Independent variables of Coastal Zone

Variable	Obs	Mean	Std. Dev.	Min	Max
Age of the mother at first birth	763	22.3211	4.55476	16	42
Mothers with not using contraceptive	763	.5439056	.4983953	0	1
Twin	763	.0209699	.1433773	0	1
Short Birth Interval	763	.1153342	.3196344	0	1
Female	763	.4809961	.4999665	0	1
birthord1: First order	763	.3158585	.4651618	0	1
birthord2: 2 <sup>nd</sup> to 4 <sup>th</sup>	763	.5124509	.5001728	0	1
birthord3: 5 <sup>th</sup> and above	763	.1716907	.3773588	0	1
Breastfeeding	763	.9685452	.1746578	0	1
Largebaby	763	.2975098	.4574626	0	1
Averagebaby	763	.5478375	.4980328	0	1
smallbaby	763	.1546527	.3618105	0	1
Institution delivery	763	.3342071	.4720219	0	1
Skilled birth attendants	763	.5661861	.4959251	0	1
Caesarean Section	763	.1441678	.3514902	0	1
safewater	763	.7627785	.4256582	0	1
safelatrine	763	.3368283	.4729357	0	1
Mother's Education: Secondary and above	763	.2961992	.4568794	0	1
Father's Education: Secondary and above	763	.3800786	.4857243	0	1
Wealth: poor	763	.474443	.499674	0	1
Wealth: middle	763	.2096986	.4073605	0	1
Wealth: rich	763	.3158585	.4651618	0	1
Father occupation:business and others	763	.2988204	.4580412	0	1
Father occupation: Agricultural sector	763	.1349934	.3419407	0	1
Father Occupation: Manual	763	.5661861	.4959251	0	1
Unemployment of mother	763	.4705111	.4994571	0	1
urban	763	.1507208	.3580112	0	1
Travel problem to reach health facility	763	.2647444	.4414864	0	1

Table 2.1 A 2 Summary statistics of Independent variables in Hilly Zone

Variable	Obs	Mean	Std. Dev.	Min	Max
Age of the mother at first birth	1727	22.12449	4.230075	16	41
Mothers with not using contraceptive	1727	.5790388	.4938563	0	1
Twin	1727	.015634	.1240909	0	1
Short Birth Interval	1727	.1754488	.3804606	0	1
Female	1727	.4724957	.4993875	0	1
birthord1: First order	1727	.2750434	.4466655	0	1
birthord2: 2 <sup>nd</sup> to 4 <sup>th</sup>	1727	.4939201	.5001078	0	1
birthord3: 5 <sup>th</sup> and above	1727	.2310365	.4216178	0	1
Breastfeeding	1727	.9733642	.1610632	0	1
Largebaby	1727	.2350898	.4241777	0	1
Averagebaby	1727	.6091488	.4880824	0	1
smallbaby	1727	.1557614	.3627341	0	1
Institution delivery	1727	.2802548	.4492537	0	1
Skilled birth attendants	1727	.4933411	.5001005	0	1
Caesarean Section	1727	.1111754	.3144403	0	1
safewater	1727	.7568037	.4291369	0	1
safelatrine	1727	.5940938	.4912088	0	1
Mother's Education: Secondary and above	1727	.4140127	.4926934	0	1
Father's Education: Secondary and above	1727	.4226983	.4941314	0	1
Wealth: poor	1727	.5182397	.4998119	0	1
Wealth: middle	1727	.2264042	.4186249	0	1
Wealth: rich	1727	.2553561	.4361875	0	1
Father occupation:business and others	1727	.3022583	.4593696	0	1
Father occupation: Agricultural sector	1727	.3659525	.4818358	0	1
Father Occupation: Manual	1727	.3317892	.4709921	0	1
Unemployment of mother	1727	.3474233	.4762895	0	1
urban	1727	.1916618	.3937224	0	1
Travel problem to reach health facility	1727	.417487	.4932874	0	1

Table 2.1 A 3 Summary Statistics of Independent variables in Delta Zone

Variable	Obs	Mean	Std. Dev.	Min	Max
Age of the mother at first birth	768	23.01823	4.92734	16	43
Mothers with not using contraceptive	768	.2721354	.4453493	0	1
Twin	768	.0182292	.1338663	0	1
Short Birth Interval	768	.0807292	.2725963	0	1
Female	768	.5039063	.5003106	0	1
birthord1: First order	768	.3893229	.4879145	0	1
birthord2: 2 <sup>nd</sup> to 4 <sup>th</sup>	768	.5182292	.4999932	0	1
birthord3: 5 <sup>th</sup> and above	768	.0924479	.289846	0	1
Breastfeeding	768	.9648438	.1842946	0	1
Largebaby	768	.1914063	.3936644	0	1
Averagebaby	768	.7109375	.4536224	0	1
smallbaby	768	.0976563	.2970428	0	1
Institution delivery	768	.4518229	.4979979	0	1
Skilled birth attendants	768	.6510417	.4769514	0	1
Caesarean Section	768	.2018229	.4016223	0	1
safewater	768	.8072917	.394683	0	1
safelatrine	768	.4401042	.496723	0	1
Mother's Education: Secondary and above	768	.4127604	.4926513	0	1
Father's Education: Secondary and above	768	.484375	.5000815	0	1
Wealth: poor	768	.5690104	.4955374	0	1
Wealth: middle	768	.1835938	.3874048	0	1
Wealth: rich	768	.2473958	.4317799	0	1
Father occupation:business and others	768	.3867188	.4873157	0	1
Father occupation: Agricultural sector	768	.2565104	.4369914	0	1
Father Occupation: Manual	768	.3567708	.4793585	0	1
Unemployment of mother	768	.4205729	.4939727	0	1

urban	768	.3372396	.4730755	0	1
Travel problem to reach health facility	768	.2721354	.4453493	0	1

Table 2.1 A 4 Summary Statistics of Independent variables in Dry Zone

Variable	Obs	Mean	Std. Dev.	Min	Max
Age of the mother at first birth	981	23.33843	4.477796	16	43
Mothers with not using contraceptive	981	.3537207	.4783677	0	1
Twin	981	.0183486	.1342771	0	1
Short Birth Interval	981	.0611621	.2397496	0	1
Female	981	.4495413	.4977011	0	1
birthord1: First order	981	.3720693	.4836033	0	1
birthord2: 2 <sup>nd</sup> to 4 <sup>th</sup>	981	.5229358	.4997284	0	1
birthord3: 5 <sup>th</sup> and above	981	.1049949	.3067032	0	1
Breastfeeding	981	.9775739	.1481403	0	1
Largebaby	981	.2405708	.4276481	0	1
Averagebaby	981	.6299694	.4830588	0	1
smallbaby	981	.1294597	.3358793	0	1
Institution delivery	981	.401631	.4904781	0	1
Skilled birth attendants	981	.7196738	.4493877	0	1
Caesarean Section	981	.2222222	.4159518	0	1
safewater	981	.8705403	.3358793	0	1
safelatrine	981	.6717635	.4698109	0	1
Mother's Education: Secondary and above	981	.3955148	.4892104	0	1
Father's Education: Secondary and above	981	.4454638	.4972704	0	1
Wealth: poor	981	.5433231	.4983736	0	1
Wealth: middle	981	.1518858	.3590933	0	1
Wealth: rich	981	.304791	.4605537	0	1
Father occupation:business and others	981	.3690112	.4827831	0	1
Father occupation: Agricultural sector	981	.2823649	.4503796	0	1

Father Occupation: Manual	981	.3486239	.4767777	0	1
Unemployment of mother	981	.2915392	.4547031	0	1
urban	981	.2110092	.408233	0	1
Travel problem to reach health facility	981	.2069317	.4053128	0	1



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