WHAT IS THE ASSOCIATION BETWEEN MATERNAL EDUCATION AND CHILDHOOD MORTALITY, CHILDHOOD ILLNESSES AND UTILISATION OF CHILD HEALTH SERVICES IN MYANMAR?

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I declare that this thesis is my own work

and has not been submitted for the award of a higher degree elsewhere

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ABSTRACT

Background: Health equity is strongly linked with underlying socioeconomic differentials. Maternal education is widely regarded as a core social determinant of child health though there are controversies around its independent beneficial effect. Myanmar has limited evidence regarding social determinants of child health in general and the effect of maternal education. The present thesis examined whether there is an association between maternal education and child health and identified pathways of influence through which maternal education exerts its effects.

Method: The nationally representative Demographic Health Survey 2015-2016 of Myanmar was analysed. Stepwise logistic regression was used to assess an independent effect of maternal education on childhood mortality, morbidity and health services utilisation among children under five. Multivariate models were developed adjusting for possible demographic and socioeconomic confounding factors relating to parental socioeconomic circumstances and characteristics of the household and community. Mediation analysis was conducted employing four-step regression method to identify pathways of influence of maternal education.

Results: Maternal education had a significant independent effect on infant mortality, under-five mortality and pneumonia treatment. It had some effects on neonatal mortality, child stunting and full vaccination, but the effects were not independent as they were accounted for by household wealth status and geographic residence. Maternal education was not associated with the occurrences of diarrhoea and pneumonia and receiving appropriate treatment for diarrhoea among children. Maternal education channelled its effects on child health through four pathways: maternal health knowledge, income, health-related behaviour, and autonomy.

Conclusion: Maternal education is an important social determinant of childhood health in the study context. Government policies should focus on ensuring equitable access to education and health services across different population groups, strengthening health-related knowledge and behaviour of girls and women who do not have formal education and boosting economic status of the country populations.

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CHAPTER 1

INTRODUCTION

1.1 Overview

The chapter outlines the background of the present study introducing a global overview of child health, specifically highlighting the extent of child mortality across and within countries. The chapter then explores the distribution pattern of the major causes of child mortality followed by utilisation of child health services. Evidence related to the effect of maternal education on child health in the contexts of both high and low-income countries is briefly discussed. The chapter then provides a contextual background of the study setting, Myanmar, together with some limitations in health policies and evidence gaps which are critical to inform and strengthen policy formulation. The research question and objectives are then described followed by a brief overview of the methodology and methods employed by the thesis. Theories, concepts and the conceptual framework underpinning the study are elaborated, and finally, an overview of the thesis chapters is described.

1.2 Background

1.2.1 Global child health

The reduction of childhood mortality is one of the globally committed goals stated in both the Millennium Development Goals (MDG) and Sustainable Development Goals (SDG) (Bishai et al., 2016; Griggs et al., 2013; UNICEF, 2015). Target 4A of the MDG goal number 4 describes that all countries should aim to reduce the under-five mortality rate by two-thirds between 1990 and 2015, while Target 3.2 of the SDG goal number 3 aims to reduce neonatal mortality worldwide to 12 per 1,000 live births and under-five mortality rates to 25 per 1,000 live births by 2030 (Nilsson et al., 2016; Sachs, 2012). Because of the tremendous efforts of the global community, the world has seen the achievement of the MDG target 4A with a decline in child deaths by over fifty per cent from 1990 to 2015 (UNICEF, 2016). The total under-five deaths globally reduced from 12.6 million (93 deaths per 1,000 live births)

in 1990 to 5.6 million (41 deaths per 1,000 live births) in 2015 (UNICEF, 2016b). Nevertheless, this reduction was largely attributed to the decline of child mortality in high and middle-income countries, masking the still high rates of child mortality in many low-income countries (You et al., 2015). Some low-income countries experienced a slight reduction of under-five mortality during the same period while some encountered a reversal of the situation. Out of 64 low-income countries which contributed to 97% of the global under-five mortality, only 13 reached the MDG target of reducing mortality by half between 1990 and 2015, while the rest of the countries did not meet the targets (UNICEF, 2016b).

Some countries especially those in Sub Saharan Africa and Southern Asia even reversed the trends with increased rates of child mortality. The disparity between high and low-income countries is still paramount. For instance, in low-income countries, one child in 13 dies before the age of five, whereas, in high-income countries, the proportion is only one in 189 (UNICEF, 2017). In terms of regional disparities, in 2017, Sub-Saharan Africa has the highest rate under-five mortality with 76 deaths per 1,000 live births, followed by Southern Asia, Oceania (excluding Australia and New Zealand) and North Africa with 48, 44 and 31 deaths per 1,000 live births respectively (UNICEF, 2018). Those regions also have very slow annual rate of decline of child mortality compared to other regions. For instance, Sub Saharan Africa has the slowest rate of reduction of 3.3% per year during the period of 1990-2017 while Eastern Asia has the highest rate of decline with 6.7% per year. Australia and New Zealand have the lowest under-five mortality with 4 deaths per 1,000 live births, followed by 5, 7 and 9 deaths per 1,000 live births in Europe, Northern America and Eastern Asia.

Child health inequities within countries are also of grave concerns. The pattern of disparities in child mortality and morbidity within countries portray that children of more affluent population groups experience fewer deaths and illnesses than those of disadvantaged ones. The differentials are based on social inequities in income, occupation, education, ethnicity and geographic residence. For instance, in India, the under-five mortality rate among the poorest population group was 2.5 times higher than that of the richest ones (Singh et al., 2011), while in Nigeria, the under-five mortality rate of South West region was 89 per 1000 live births while that of the Northern region was 222 (Adedini et al., 2015).

In low-income countries, 60% of child deaths is attributed to communicable diseases, including vaccine-preventable ones (Sonego et al., 2015). The global analysis conducted by the World Health Organisation (WHO) indicates that the two leading causes of under-five mortality in low-income settings are pneumonia and diarrhoea, with the former leading to 16% of total child deaths and the latter resulting in 9% (WHO, 2017). Though childhood undernutrition is not a direct cause, it indirectly contributes to almost half of under-five mortality through increasing susceptibility to infections among children, worsening the severity of major childhood illnesses and contributing to the higher risk of mortality from other childhood diseases (Pelletier et al., 1995; Chirande et al., 2015; Bishai et al., 2016).

Access to and utilisation of effective preventive and curative child health services including immunisation is critical to minimise the occurrence of infectious diseases and to prevent their consequences (Sonego et al., 2015). Nevertheless, children living in certain segments of the population particularly those who are disadvantaged by a range of socio-economic differentials tend to have a higher incidence of preventable illnesses, yet, their access to and utilisation of health services is limited (Pinzon-Rendon et al., 2016). For instance, children from wealthy families are more likely to get fully vaccinated than those from low-income families. Consequently, children from disadvantaged population groups are more likely to suffer illnesses and die before their fifth birthday than those from better-off families. The disparity across and within countries is so persistent that the United Nations has called for its member states to continue concerted efforts to address inequities in child mortality (UNICEF, 2016b).

Since the extent of disparities related to early loss of life is linked with social context and varies with underlying social gradients, understanding fundamental social determinants of child health has become critical (Marmot and Allen, 2014; Marmot et al., 2008). Health and disease have been traditionally explained through individual-level risk factors such as age, sex, weight, smoking, diet, blood pressure and alcohol consumption (Lerer et al., 1998). A closer examination of some individual risk factors through the perspective of social determinants reveals that they are clustered around some societal factors (Marmot and Wilkinson, 1999; Braveman, 2006). For instance, deprived populations are more likely to be exposed to hazardous working and living environments compared to more affluent ones,

and they tend to have lower income, education level and poorer access to health services (Cheng et al., 2015). Societal factors such as income level and education status stratify population groups, leading to differential exposure, differential vulnerability and differential access and utilisation of health services resulting in inequities of morbidity and mortality (Marmot et al., 2006; Siegrist and Marmot, 2006).

According to McCartney et al. (2013, p.221), 'health inequities are systematic differences in the health of people occupying unequal positions in society'. Health inequality generally refers to any measurable differences in the health of individuals or population groups, while health inequity is a type of health inequality among population groups occupying unequal positions in the society (Regidor, 2004a). Health inequality is unavoidable while health inequity is avoidable and preventable. For instance, the variation in mortality between young and old age groups is health inequality whereas mortality differentials across race, religion, employment or income are examples of health inequity (Arcaya et al., 2015). Since all those characteristics underpinning health inequity are socially created and amplified in societies and are amenable to interventions through equitable social arrangements, they are considered unjust and unacceptable (Diderichsen et al., 2001; Mackenbach, 2012). It is critical for a society to identify context-specific social determinants of health so that suitable measures can be formulated to address health inequities. The present thesis aims to explore the relationship between one of the social determinants of child health in a unique context where such evidence is not existent.

1.2.2 Maternal education and child health

Maternal education is regarded as an important social determinant of child health, particularly in low-income countries. Since the 1980s, empirical studies have examined the effect of mother's formal education on child health in different contexts. Some studies reported an independent relationship between maternal education and several child health outcomes demonstrating that children born to mothers with no or limited education had increased risks of childhood illnesses, undernutrition and premature deaths than those of better-educated mothers (Kuruvilla et al., 2014; Moestue and Huttly, 2008a; Cleland et al., 1992; Guldan et al., 1993; Cleland et al., 1992; Cleland, 2010; Cochrane et al.,

1982). The evidence related to the effect of maternal education on different child health outcomes in the context of low-income countries is discussed in detail in Chapter 2.

In the context of high-income countries, very few studies have examined the relationship between maternal education and child health. Available studies mostly focused on the effect of maternal education on childhood mortality only, and there have been very limited studies that assessed other aspects of child health outcomes such as morbidity and undernutrition. In most studies, the effect of maternal education was not assessed separately as a study factor, but it was examined as part of the overall socioeconomic status of the mother (Arntzen and Nybo Andersen, 2004; Alio and Salihu, 2005; Arntzen et al., 2008; Arntzen et al., 2004; Cnattingius et al., 1992).

In addition to exploring the effect of maternal education on child health, understanding the mechanisms of influence through which maternal education imparts its effects on child health is critical. Some studies conducted in low-income contexts have indicated that educated mothers had a higher level of health knowledge than uneducated mothers contributing to their adopting healthy behaviours leading to better child health outcomes (Briscoe, 1991; Glewwe, 1999; Vikram et al., 2012). Educated mothers have better employment opportunities and higher earnings through which more nutritious food and quality health services can be provided to their children (Gakidou et al., 2010; Vollmer et al., 2016). Some studies indicated that education promotes empowerment and autonomy of women which in turn improves their assertiveness and independence in adopting better health care practices and utilising optimal health services for their children (Frost et al., 2005; Boyle et al., 2006). The pathways of influence through which maternal education exerts its effects on child health may differ across different contexts given varied sociocultural systems across countries. Thus, ascertaining the pathways of influence which are inherent in a specific context is important for effective policy recommendations.

On the other hand, the reported effect of maternal education on child health claimed by some studies is not valid since they employed bivariate analysis methods which did not adjust for the effects of possible confounding factors and the effect cannot be taken as an independent one (Goodburn et al., 1990; Arya and Devi, 1991; Gupta et al., 1991; Hoa et al., 1997; Gokhale et al., 2002; Kunwar and Pillai, 2002; Paterson et al., 2004). Some studies conducted in developing countries asserted that the effect of

maternal education attenuated and even disappeared after the adjustment for household wealth status by multivariate analysis (Hobcraft, 1993; El-Sayed and Galea, 2012). Based on such findings, Desai and Alva (1998) asserted that maternal education does not have an independent effect on child health and it is merely an intermediate variable masking the relationship between household wealth and child health. According to Houweling et al. (2007), accessibility to health services also confounds the relationship between maternal education and child health. It was claimed that the utilisation of health services is more related to availability and accessibility of quality health care services and those in need of healthcare will use the services regardless of their education status if the services are readily available (Singh et al., 2011).

It is also probable that the relationship between maternal education and child health outcomes may vary across different contexts because the ability of women to exercise their rights to education and the quality of education they receive differ across diverse sociocultural structures rooted in various countries (Millard, 1994). Context-specific evidence is critical as to whether maternal education has an independent effect on child health, while it is also important to understand how maternal education operates its effect in a specific context so that evidence-based policies can be formulated.

1.2.3 Contextual information of the study setting

Myanmar is a lower middle-income country in South-East Asia with a population of 51 million, of which 70% live in rural areas (MOIP, 2015). Its economy is largely based on agriculture, and 40% of the population engages in agricultural work (MOPF, 2010). The employment to population ratio among 15-64 years of both sexes is only 64.4% (MOIP, 2015) indicating that almost one-third of the country's population does not engage in gainful employment. According to the World Bank analysis, the proportion of the population below the poverty line reduced from 32.1% in 2004, through 25.6% in 2010 to 19.4% in 2015 (MOPF, 2015). Politically, Myanmar was ruled by the military dictator governments for almost five decades since 1962, and a democratically elected government is established only in 2016.

Figure 1.1 shows the trends of under-five mortality rates in the ten countries of the South-East Asia region in the past two decades (UNICEF, 2017). All countries showed a similar pattern of mortality reduction during 1996-2016. Myanmar experienced a steady decline in under-five mortality from 100 deaths per 1,000 live births in 1996 through 75 deaths per 1,000 live births in 2000 to 50 deaths per 1,000 live births in 2016 (MNPED and MOH, 2011; DHS and MOH, 2017). However, Myanmar has the second highest under-five mortality in the South-East Asia region.

Figure 1.1: Trends of under-five mortality in South-East Asian countries (deaths per 1,000 live births) (Source: MNPED and MOH, 2011; DHS and MOH, 2017; UNICEF, 2017)

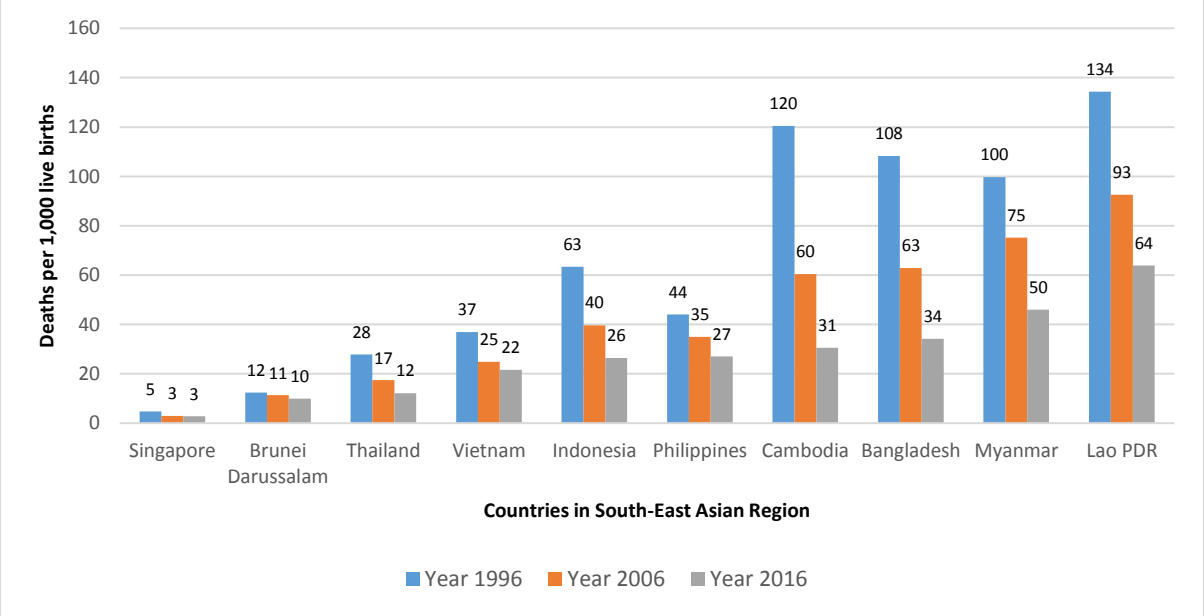
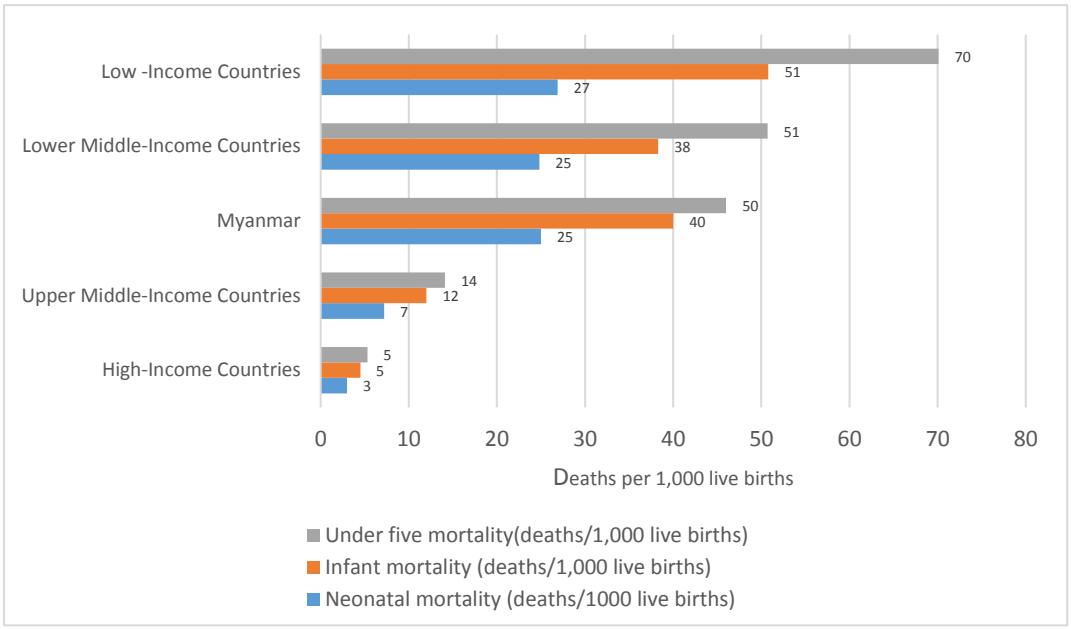


Figure 1.2 compares the childhood mortality rates of Myanmar in 2016 against the groups of countries categorised according to the World Bank classification based on their national income levels (UNICEF, 2017; World Bank, 2018). Myanmar, a lower middle-income country, has the similar child mortality situation as other countries in the same category. Although Myanmar has better outlook of child mortality than those in the low-income group, it still needs to go a long way to catch up the status of upper middle-income and high – income countries.

Figure 1.2: Comparison of childhood mortalities (deaths per 1,000 live births) in 2016

(Source: UNICEF, 2017; World Bank, 2018)



In addition to having high levels of child mortality in the region, health disparities within the country are of grave concerns for Myanmar. According to the Myanmar 2015- 2016 Demographic Health Survey (DHS), the under-five mortality rate among the wealthiest quintile was 17.2 per 1,000 live births whereas that of the poorest ones was 62.4, while the under-five mortality rate of urban areas was 29 deaths per 1,000 live births while that of rural area was 53 (DHS and MOHS, 2017). The same survey reported that the incidence of suspected pneumonia and diarrhoea was 3% and 7% respectively among children living in the poorest households, whereas they were 1.8% and 5% among children living in the richest households.

Over the past few decades, Myanmar had a very low investment in social sectors including health and education. According to the World Health Organisation (WHO) data, from 2000 to 2014, Myanmar's Current Health Expenditure (CHE) as the percentage of Gross Domestic Product (GDP) was only 1.9% and the CHE per capita was United States Dollar (USD) 20 (WHO, 2018). After 2015, the country's CHE out of GDP was doubled to 4.9 % and the CHE per capita raised to USD 59 (WHO, 2018). Even with this improvement, Myanmar is currently standing as one of the countries in the South East Asia

Region having lowest national investment in the health sector (Table 1.1). There remains a long way for the country to reach the internationally committed goal of allocating 15% out of the country's GDP for health as stated in the WHO's Abuja Declaration 2001 (WHO, 2011; Carr, 2018).

Table 1.1: Comparison of key health sector indicators across South East Asian countries

(Source: WHO, 2018; ADB, 2016)

Country	Current Health expenditure as % of GDP (2016)	Current health expenditure per capita (USD) (2016)	% of Out-of-pocket expenditure for health (2016)	Ranking of Gender Inequality Index[1](2015)
Bangladesh	2.6	32	71	111
Lao PDR	2.8	53	45	no data
Myanmar	**4.9**	**59**	**74**	**80**
Cambodia	6	70	59	104
Indonesia	3.3	112	48	110
Vietnam	5.7	117	43	71
Philippines	4.4	127	53	96
Thailand	3.8	217	11	79
Brunei Darussalam	2.6	812	6	no data
Singapore	6.3	2280	36	11

Myanmar practices the cost-sharing scheme for health services utilisation at public health facilities. According to that scheme, people need to cover expenses for medicine for the treatment while the government provides equipment, infrastructure and human resources in public health facilities (Jakab and Krishnan, 2004). Poor people who cannot afford are to be supported by hospital pooled funds contributed by the government and collected from better-off patients. However, there has been a widespread mismatch between demand and supply to access the pooled funds by the poor populations mainly due to low level of public health expenditure by the government (DHP, 2012). Private health facilities are more common in urban than rural, and the cost of treatment at private health facilities is a bit more expensive than that in public facilities (DHP, 2015). Most rural poor people are thus relying on public health services. There is no nationwide health insurance scheme and the current social security system covers only government employees of certain ministries which are about 1.2% of the total

[1] The gender equality index of 185 countries were ranked in a descending order with the country having the best gender equality ranked at 1st while the country with the worst gender equality at 185th.

population of the country (DHP 2015; DHP, 2016). The majority, especially those working in the informal sector, are not covered by any form of health insurance. As a result, there is no viable system in place to protect poor people from health care expenses, and financially deprived population groups face challenges in accessing quality health care services. Consequently, the country has a very high proportion of out of pocket expenditure (OOP) for health which was nearly 85% from 2000 to 2015 and reduced to 74% after 2016 (WHO, 2018). Still, Myanmar is a country with the highest OOP among the ten countries in the South East Asia Region (Table 1.1).

Regarding the role of women in the country, the global gender analysis conducted in 2015 ranked Myanmar as 80th out of 185 countries[2] (ADB, 2016) demonstrating better performance towards gender equality and realisation of women's rights compared to few other countries in the South-East Asia region (Table 1.1). Myanmar has institutional mechanisms to promote gender equality including the Constitution and legal frameworks which allow equal participation of women and men in political and economic activities (ADB, 2016). For instance, women can vote and participate in the general election and there is no restriction for women to pursue higher education or high-ranking positions in public or private sectors. However, the labour force participation rate of persons between 15 -64 years is 85.2% for men and 50.5% for women; and, mid-management level officers of 31 ministries of the government represent 63% of men against 37% of women (MOIP, 2017).

The education statistics of the country show slight inequality in the literacy rates between men and women. However, access to formal education is equal across boys and girls for all levels. The 2014 Census data demonstrates that male literacy rate was 92.6% while female literacy rate was 86.9%; the primary school attendance for boys and girls were 70.7% and 71.7% respectively; the secondary school attendance rates were 68.2% and 67.9%; and, those pursuing higher education were 9.8% and 10.1% respectively for boys and girls (MOIP, 2017). However, enrolment and dropouts of both boys and girls along the continuum of primary, secondary and higher education are remarkable. In general, about 30% of children, both boys and girls, did not attend the primary level, 32% of those who did primary did not

[2] The gender equality index of 185 countries were ranked in a descending order with the country having the best equality ranked at 1st while the country with the worst gender equality at 185th.

reach the secondary level, and almost 90% of those who pursued secondary did not get to the higher level of education.

In the health sector, the country amended its National Health Plan (NHP) in 2016 aiming to achieve the Universal Health Coverage by 2030. With the new NHP, Myanmar has committed to raise its national health spending to improve utilisation of health services through the reduction of the out of pocket health expenditure of its population. The strategic focus of health interventions is adjusted formulating Essential Package of Health Services in alignment with the disease epidemiology of the country (MOHS, 2016). Nevertheless, the provisions of the NHP still do not give sufficient attention to underlying causes of health disparities and social determinants of health. For instance, it does not address critical intersectoral collaboration between health and other sectors including education. One of the main reasons for undermining social determinants of health in national health plans could be mainly attributed to the lack of robust evidence regarding the association between social determinants and health in the country context.

There have been very few studies which examined the association between maternal education and child health. For instance, a few studies demonstrated that children of poorly educated mothers were more likely to have diarrhoea and undernutrition (U et al., 1992; Khin et al., 1992; Thet et al., 2016; Zhao et al., 2012) while two other studies asserted that educated women were using prenatal care services more than less educated ones (Sein, 2012; Zaw et al., 2012). However, those studies employed the bivariate data analysis methods whose findings can be spurious since there could be confounders obscuring the relationship (Bland, 2002). Mya et al., (2019) used the multivariate analysis methods in assessing the determinants of feeding practices and nutritional status of children aged 6-23 months in Myanmar where maternal education was examined as one of the possible predictor variables. None of the studies conducted in the country examined maternal education as a study factor, and it was used merely as one of the socio-economic background variables in exploring association with a range of child health outcomes. In the context of Myanmar, there have been no studies that assess the independent association between maternal education and child health outcomes controlling for possible confounding effects.

In order to address some of the evidence gaps, it is warranted to have a study that examines an independent effect of maternal education on child health outcomes in the context of Myanmar. It is envisaged that research findings from such a study can contribute to some of the present knowledge gaps making policy recommendations to promote equity-focused child health strategies.

1.3 Research question and objectives

The present research attempts to examine whether maternal education has an independent effect on child health when controlling for the effects of possible confounders in the context of Myanmar. Further, the study explores possible pathways of influence of maternal education on child health.

The research question and research objectives are formulated as below.

- Research Question: Is there an independent association between maternal education and child mortality, child morbidity and child health services utilisation in Myanmar, and if so, what are the pathways of influence?
    - Objective 1: To determine whether there is an independent association between maternal education and child mortality, child morbidity and child health services utilisation in Myanmar,
    - Objective 2: To explore the pathways of influence through which maternal education imparts its effects, and,
    - Objective 3: To examine interaction effects or effect modification of the possible effect of maternal education on child health outcomes.

The present thesis used data from the Demographic Health Survey (DHS) conducted in Myanmar in 2015-2016 (DHS and MOHS, 2017). The DHS is a nationally representative survey undertaken with the support of the United States Agency for International Development (USAID). To address the research question and objectives, the present thesis assessed whether maternal education had an independent effect on nine child health outcomes or dependent variables related to mortality, morbidity, undernutrition and health services utilisation.

Potential confounding factors at individual, household and community levels were identified and included in the analysis and the multivariate method was employed to control for the effects of confounding. With this approach, the effect of maternal education was separated from those of the confounding factors since it is immersed in the overall socio-economic situation which could also affect the dependent variables, child health outcomes. The pathway analysis was conducted to identify possible pathways of influence through which maternal education imparts its effects on child health outcomes.

1.4 Theoretical framework underpinning the research

1.4.1 Underlying concepts and theories

Some of the prominent theories which attempt to elucidate underlying mechanisms of health inequities include health selection theory, cultural theory, behavioural theory, life course theory and structural theory (McCartney et al., 2013; Power and Matthews., 1997).

'Health selection' is one of the concepts of explaining health inequity asserting that disparities in health status are due to self - selection of individuals on certain sociodemographic characteristics either voluntarily or involuntarily (Regidor, 2004). The theory refers to a situation where people who belong to particular groups either by occupation or geographic residence tend to have similar health outcomes. The variation of health outcomes among populations originates from a similar level of exposure to certain risk factors and subsequent occurrence of similar illnesses (Canning and Bowser, 2010). The cultural theory proposes that health outcome differentials among different population groups are partly attributed to some cultural practices adopted by certain population groups (McCartney et al., 2013). For instance, in communities where female genital mutilation is a cultural practice, women tend to experience increased incidence of obstetric complications leading to higher maternal mortality (Diop and Askew, 2009).

The behavioural theory links individual-level behaviours such as smoking, exercise, alcohol consumption with the occurrence of diseases associated with these behaviours. This theory asserts that

health inequities are contributed by the prevalence of such behaviours across different social groups (Bartley, 2016). Nevertheless, the behavioural theory does not explain the reasons why certain behaviours are concentrated in specific population groups (Wilkinson and Marmot, 2003). For instance, smoking habit is generally more common in poorly educated populations which could be due to their limited health knowledge, psychosocial deprivation and targeted marketing of the cigarette industries (McCartney et al., 2013). A mere focus on the behaviours tends to neglect critical perspectives of how and why people acquire such behaviours which are more important to inform policy interventions (Browne and Jenkins, 2012).

The life course perspective suggests that health inequities originate from diverse experiences of different individuals in early life (Ben-Shlomo and Kuh, 2002). This theory asserts that adverse circumstances experienced during early life including intrauterine experiences and exposures to health-damaging factors accumulate and cause long-lasting impacts on the health status of the person throughout every stage of his or her life (WHO, 2016). The life course theory can be applied in connection with another concept of 'linked lives' or 'intergenerational theory' which explores how disadvantageous life experiences in the first generation can transcend to the next generation (Kahn et al., 2005). The combination of the life course theory and intergenerational perspective could partially explain possible interconnectedness between poor education of mothers in one generation and ill health of her children in subsequent generation (Godfrey et al., 2010).

The structural theory contends that health inequities are dictated by underlying socioeconomic determinants which influence differential distribution of resources including services, goods, power, income and opportunity resulting in differential access and utilisation of health services and differential health outcomes (Marmot et al., 2008, Siegrist and Marmot, 2006, Blas and Kurup, 2010). Evidence from various settings indicates that health inequities tend to increase as structural disparities of different population groups become wider (Arcaya et al., 2015). In any societies, people from the highest socioeconomic stratum are the ones who usually enjoy better health status and those from the lowest socioeconomic level are the least benefited (Braveman, 2006). Since health inequity is systematically instigated and augmented through structural factors that control the distribution of resources and

opportunities, it should be modified through formulating and implementing effective policies and strategies that promote equitable distribution of resources (Diderichsen et al., 2001). Developing such policy frameworks requires an in-depth understanding of the extent of health inequities, and how social determinants derive those (Whitehead et al., 2001).

The structural theory is particularly relevant in low-income settings including Myanmar where resources are not adequate to provide equitable social services (Marmot and Allen, 2014). In many low-income countries, social protection systems, such as universal access to health or education, are deficient and collection of both formal and informal user fees are widespread. Consequently, the population groups which are financially deprived cannot afford to utilise quality services and are thus systematically excluded from accessing the services. Populations having better access to resources have better opportunity to benefit from social services resulting in better health and education outcomes, while disadvantaged populations are restricted from quality services leading to worse outcomes (Marmot et al., 2008).

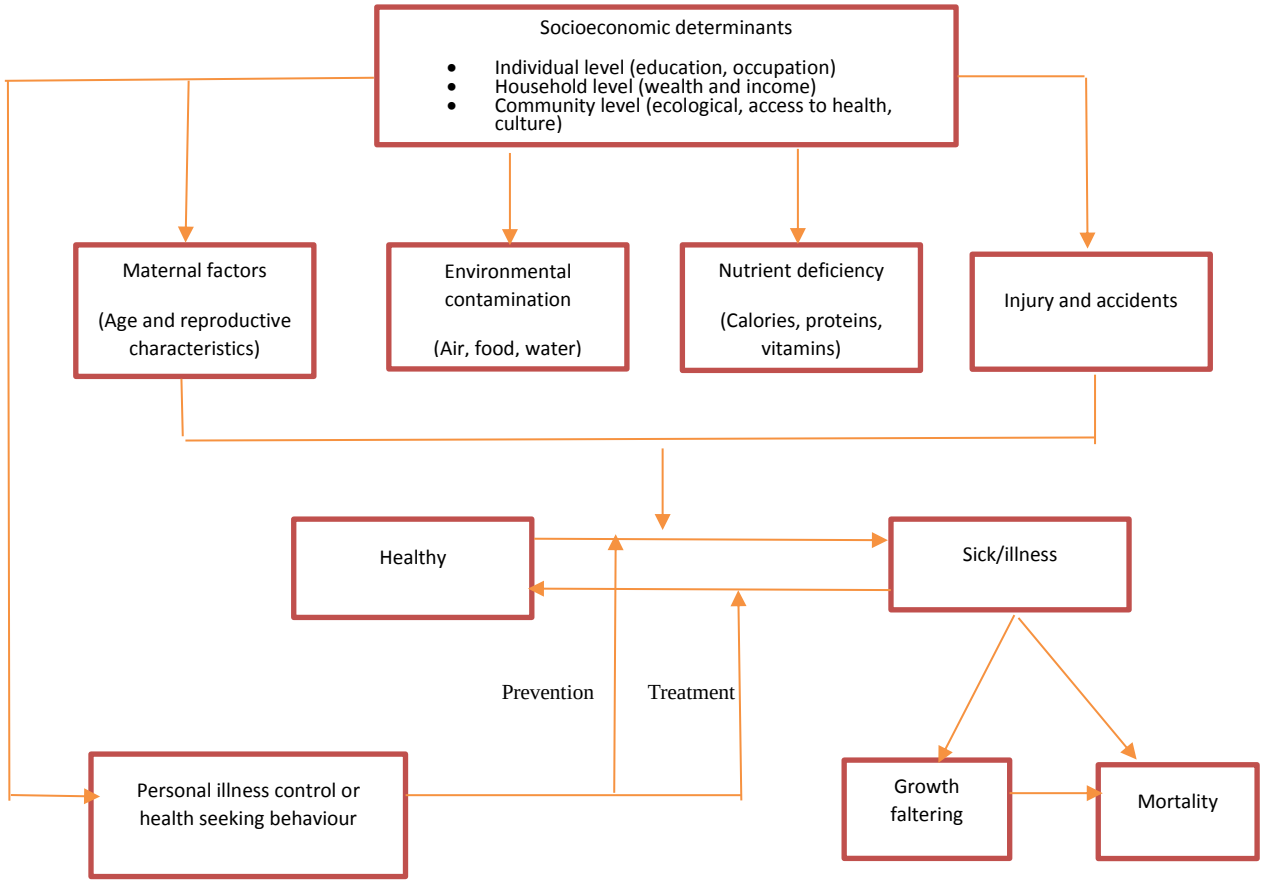
1.4.2 Conceptual model that underpins maternal education and child health

The structural theory contends that the relationship between structural determinants and health outcomes has a third set of variables lying on the pathway between them as mediators dictating the direction and route of the relationship (Baron and Kenny, 1986). In line with this proposition, the relationship between maternal education on child health outcomes can be mediated by one or more intermediate factors lying on the causal pathways influencing levels and status of child health outcomes (Arcaya et al., 2015). Ascertaining the nature and position of those mediators is critical since this will help understand how maternal education operates and how child health disparities are derived. Furthermore, this understanding helps in designing relevant policy interventions to modify the pathways mediating the relationship (Frost et al., 2005). For instance, if health-related knowledge of mothers is a major pathway through which maternal education channels its effects on child health, appropriate measures should be designed and instituted to enhance mothers' health knowledge. If income is a more

critical pathway, strategies to promote income generation for mothers can be formulated and instituted (Glewwe, 1999).

The mechanism through which maternal education impacts on child health is best comprehended through the Mosley and Chen conceptual model (Mosley and Chen, 1984). This model is specifically exploring the role of different social determinants on child health while appropriately positioning intermediate variables or proximate determinants on the causal pathway. Mosley and Chen (1984) asserted that social determinants operate through a collective group of mediators in imparting their effects on child health outcomes. Due to its comprehensive and logical pathways of the model, since its introduction in 1984, the model has been applied by many authors as a critical conceptual framework in exploring the relationship between social determinants and child health (Hill, 2003). For instance, out of the 56 studies selected for the literature review of the present thesis, 14 explicitly mentioned their adoption of the Mosley and Chen model. As indicated in Figure 1.3, the model is structured in a way that social determinants affect five groups of proximate determinants at the intermediate level which in turn influence three main child health outcomes: morbidity, undernutrition and mortality.

Figure 1.3: The Mosley and Chen model (Source: Mosley and Chen, 1984)



At higher level. the Mosley and Chen model groups socioeconomic determinants into three categories: individual-level variables including occupation and education of fathers and mothers; household level variables comprising income and wealth; and, community-level variables that entail ecological and cultural settings, political economy and access to health systems. These variables are relevant to the present research. For instance, at the individual level, the factors including occupation and education of father can have effects on the relationship between maternal education and child health, so is the family income at household level. At the community level, the residential status of the family in urban or rural areas can influence accessibility to health systems since, in low-income countries, people living in urban areas can generally have better access to health services than those resided in rural areas

At the intermediate level, the model has five groups of proximate determinants: 1) maternal factors (age, parity, and birth interval); 2) environmental contamination (air, food, and water); 3) nutrient deficiency (calories, proteins, and vitamins); 4) injury and accident; and, 5) personal illness control or

health-seeking behaviour. The model states that the first four proximate determinants have a direct influence on child health status while the last proximate determinant, personal illness control, affects utilisation of health care services which further determines the onset of illness or recovery. Except for injury, the other four proximate determinants of the model are well applicable to the present research. Maternal reproductive health variables, particularly age, parity and number of children ever born, are essential factors that can influence morbidity and mortality of children during pregnancy and childbirth (Jolly et al., 2000, Duckitt and Harrington, 2005). Educated mothers are more likely to adopt birth spacing and maintain the recommended interval between child births (Greenspan, 1993; Basu, 1994). Amongst the factors that can result in environmental contamination, indoor air pollution due to use of biomass fuel in cooking can increase the risk of getting pneumonia among children (Bruce et al., 2000) while insanitary latrines and unsafe water supply can lead to child diarrhoea (Waddington et al., 2009). Similarly, compared to uneducated mothers, educated mothers are more likely to provide adequate nutrients to children by adopting recommended feeding practices and providing nutritious foods (Mokori et al., 2013). Finally, health-seeking behaviour or personal illness control of individuals, commonly represented by the level of utilisation of preventive or curative health services, is a critical determinant of child health status.

There are three types of child health outcomes or dependent variables in the model: child morbidity, child undernutrition and child mortality, which are congruent with the dependent variables of the present research. The Mosley and Chen model is well suited for use as a conceptual framework for this study, and it informs critical phases of the study in selecting appropriate variables, considering confounders and interpreting key findings.

1.4.3 Conceptual model for the present study

Figure 1.4: Conceptual model of the present study

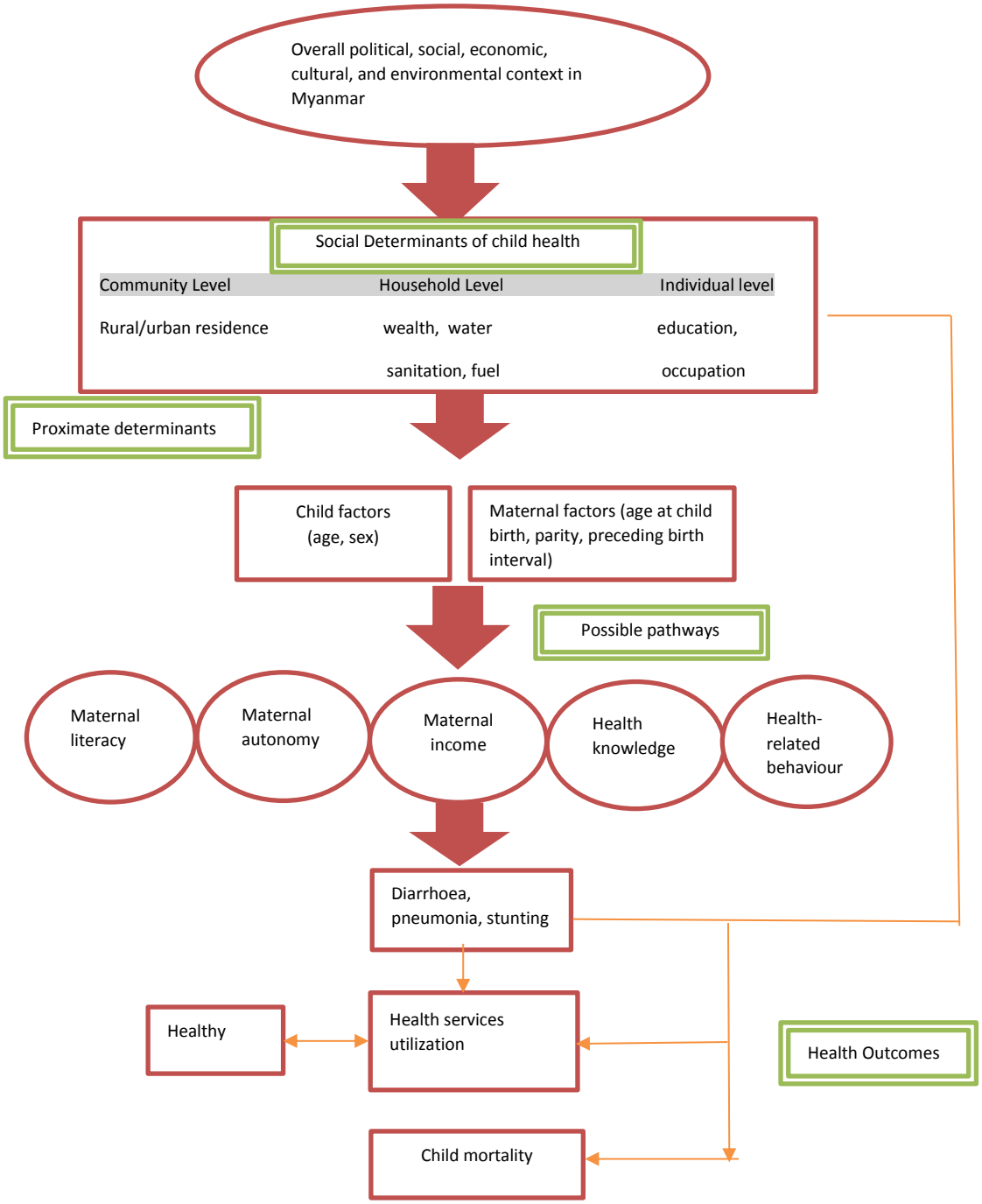


Figure 1.4 depicts the conceptual model for the present research adapting the Mosley and Chen model described above. The adapted model comprises a vertical chain of four categories: socioeconomic determinants; proximate determinants; pathways of influence and child health outcomes. The arrows

are placed between the categories to demonstrate conceptual interconnectedness between them, while the heads of the arrows indicating the directions of influence of one category over another.

The first category, social determinants, is influenced by overall political, economic, social, environmental and cultural contexts of the country. The social determinants are broken down into three levels: community, household and individual levels. For instance, at the community level, the residential status of the family in urban or rural region is included; at the household level, household wealth status, water supply, sanitation, cooking fuel and living with the grandmother of the children are registered; while at individual level, educational and occupation status of fathers and mothers are collected.

The second category is the proximate determinants including maternal reproductive behaviours and child factors. The term proximate determinant is taken from the Mosley and Chen model to reflect the proximity of the determinants to the child health outcomes. For the present research, maternal reproductive factors are represented by the variables such as maternal age at first childbirth, preceding birth interval, and parity; and, child factors by child's age and sex.

The third category, 'possible pathways', includes maternal literacy, maternal autonomy, maternal income, health-related behaviour and health knowledge. It is assumed that maternal education exerts its effects on child health through these pathways. One of the objectives of the present study is to test the validity of this assumption. In the current conceptual model, one of the proximate determinants of the Mosley and Chen model namely personal illness control is divided into two factors: health-related behaviour and health services utilisation. The former is related to adoption of healthy behaviour including feeding practices and personal hygiene, while the latter refers to health services utilisation. The last category comprises utilisation of child health services for preventive and curative care, child morbidity, undernutrition, and child mortality. A two-way arrow is placed between 'health services utilisation' and 'healthy' to indicate a back and forth relationship while another arrow reflects the situation may ultimately progress to mortality.

1.5 Thesis structure

The thesis is composed of five chapters.

Chapter 2 describes the approach taken in the systematic literature review of the present study, key findings of the literature review, gaps in the previous studies and how the present thesis is expected to fill some of the gaps to contribute to the knowledge base.

Chapter 3 outlines the research methodology and methods of the present thesis. It sets out underlying philosophical foundations and how they shape and inform the selected methodology. The chapter also provides a brief description of the primary study, its datasets and representativeness, formulation of key variables for the data analysis and statistical methods employed in each step of the data analysis.

Chapter 4 elaborates on the findings and results produced from the data analysis which includes descriptive analysis, bivariate analysis, multivariate analysis and pathway analysis. The findings related to the effect of maternal education are grouped and presented as per the research questions and health outcomes. The quantitative findings generated from the data analysis are presented as summary tables.

Finally, Chapter 5 explains, interprets and discusses the main findings in linkage with the evidence produced from other studies providing possible reasons for the variation of some of the findings. The chapter discusses the strengths and limitations of the present study and then describes policy implications and recommendations.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter begins with the outline of the objectives of the systematic literature review followed by the literature review questions that guided the review process. A list of electronic databases from which the papers were extracted for the review is also presented. The chapter then provides an overview of the approaches and methodologies taken in the literature search, review and selection including inclusion and exclusion criteria. The tools used in categorising and synthesising literature review findings and in conducting the critical appraisal are discussed. The chapter then reports review findings in response to the review questions classifying synthesised information into respective child health outcome categories: childhood mortalities, childhood morbidities and health services utilisation. Further, the findings related to the confounding issues around the relationship between maternal education on child health are discussed followed by summary findings related to the pathways of maternal education. Finally, the gaps identified from the previous studies are described stating how the present thesis attempted to address some of those gaps.

2.2 Literature search and review process

2.2.1 Objectives and review questions

The focus of the literature review was to examine available literature to ascertain whether maternal education has an independent beneficial effect on different child health parameters net of other factors. Understanding sociodemographic and economic factors that could have confounding effects on the relationship between maternal education and child health is critical in designing the subsequent empirical study so that relevant variables are identified and their possible effects adequately adjusted by the analysis. The review also synthesised possible pathways of influence through which maternal education may exert its effect on child health.

The literature review sought to answer three broad questions.

(i) Does maternal education have an independent beneficial effect on different child health outcomes in the context of low and middle-income countries?

(ii) What possible confounding factors need to be considered in examining the effect of maternal education on child health?

(iii) Through which pathways does maternal education influence child health?

The studies for the literature review were selected from four electronic databases: PubMed (US National Library of Medicine), Ovid, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus.

2.2.2 Inclusion and exclusion criteria

The search strategy of the review was prepared with predetermined inclusion and exclusion criteria, and the search terms were developed with appropriate operators.

Key inclusion criteria for the review comprised of empirical studies conducted between 1990 and 2017 in low- and middle-income countries and those that employed multivariate methods in data analysis in examing the effect of maternal education on the three groups of child health outcomes as below:

a) Childhood mortality
   - Neonatal mortality - death within 28 days of age;
   - Infant mortality - death within one year of age;
   - Under-five mortality - death within five years of age;

b) Child morbidity among children under five years of age
   - Stunting- children whose height for age is less than two standard deviations of the median benchmark of a reference population;
   - Wasting - children whose weight for height is less than two standard deviations of the median parameter of a reference population;

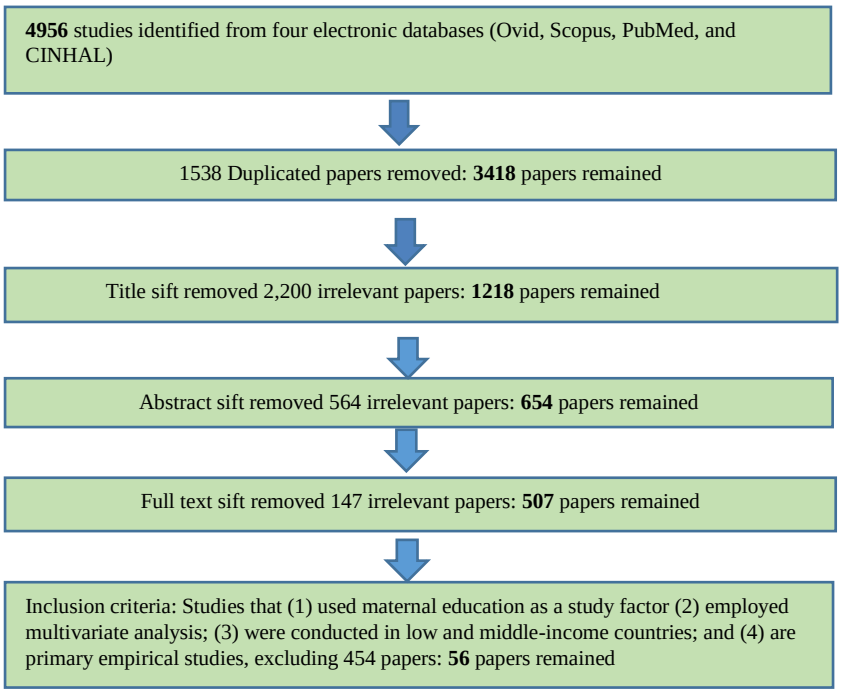
- Underweight - children whose weight for age is less than two standard deviations of the median benchmark of a reference population;
- Children who had diarrhoea;
- Children who had pneumonia;

c) Utilisation of curative and preventive child health services

- Receiving appropriate treatment for diarrhoea among under-five children who had diarrhoea;
- Receiving appropriate treatment for pneumonia among under-five children who had pneumonia;
- Full vaccination

The literature search did not restrict on operational definitions used by different studies in defining the dependent variables. For instance, the studies that examined the effect of maternal education on child undernutrition used any of the two reference populations in calculating undernutrition parameters: one produced by the National Centre for Health Statistics or another by the WHO International Growth Reference (De Onis, 2006). However, the search included studies that used either of these reference populations. Similarly, the studies defined diarrhoea or pneumonia among children under-five in different ways and the search did not restrict to any definition of the illnesses. Potentially relevant studies were screened through several steps including title sift, abstract sift, and full text sift. At the final stage of the selection, 56 papers that used maternal education as a study factor were selected. Figure 2.1 summarises the literature search and review process. Details of the search strategy can be found in Annex 1, Page 153.

Figure 2.1: Summary of the literature search



2.2.3 Extracting information from the selected papers

The main approach taken in conducting the literature review was 'narrative synthesis' whereby write-ups and text reported in the selected papers are reviewed, synthesised and appraised. Quantitative estimates such as the 'effect sizes' of maternal education reported by the selected studies were examined to address the first objective of the literature review. It was, however, not feasible to employ the meta-analysis method to summarise all the effect sizes of the selected studies to produce a single pooled estimate given different study designs and analytical methods used by the studies (Sutton et al., 2000). For instance, in the 56 papers included in the review, there are 43 cross-sectional surveys of different sizes and scope; eight longitudinal studies; and five studies that used data from surveillance systems and population-based registries (See Annex 2, Page 161). The information related to possible confounding issues and the pathways of influence were explored in the selected studies and relevant findings extracted to address the second and third objectives of the review.

The data extraction and subsequent critical appraisal was conducted using the data extraction tool and the critical appraisal tool for observational studies developed by the British Psychological Society (BPS) (BPS, 2007). The BPS developed quality assessment tools based on the criteria, concepts and appraisal methods to assess the quality of different studies including experimental studies, systematic reviews, controlled trials, case control studies, case series studies and cross-sectional observational studies. The main objectives of the BPS in developing these tools are to standardise the synthesis and appraisal process of studies related to mental health and psychology (BPS,2017). The BPS tools were selected for the literature review of the present study because they are comprehensive in capturing information from cross-sectional surveys. The BPS' data extraction tool and the critical appraisal tool were merged into one single matrix in Excel facilitating grouping and sorting of the 56 selected studies by different characteristics including study background, sample size, study design, methodology, analysis methods and key findings. The integrated matrix of the BPS tools also facilitated the critical appraisal since all the background characteristics of the selected studies and the checklists to appraise them were on the same matrix. Annex 2 (Page 157) provides the list of 56 studies selected by the literature search together with some of the key characteristics of each study. The critical appraisal of the selected studies was undertaken focusing on several criteria including whether the study outcomes were appropriate for the study objectives; how study factors and outcomes were measured; possible bias related to selection, measurement or reporting; and, generalizability and reliability of the reported findings, and so on. Summative evaluation of the studies concerning their quality was made based on those parameters and low-quality studies were recorded on the same matrix but were not discarded from the review since it is needed to examine different methodologies used by the selected studies.

2.3 Findings of the literature review

2.3.1 Does maternal education have an independent beneficial effect on different child health outcomes in the context of low and middle-income countries?

Table 2.1 summarises different child health outcomes and the effect of maternal education on them as reported by the selected studies. The 56 selected studies assessed the effect of maternal education on a total of 93 child health outcomes, as some studies examined more than one outcome.

Table 2.1: Effect of maternal education on child health outcomes reported in the 56 selected studies[3]

No	Child Health Outcomes	Effect of maternal education				
		Beneficial effect	No Effect	Mixed Effect (e.g. effect observed in rural but not urban areas)	Multi-country studies with mixed effects across different countries	Total
1	Neonatal Mortality	4	4	0	2	10
2	Infant mortality	6	1	3	2	12
3	Under-five mortality	13	2	0	0	15
4	Stunting	11	1	2	2	16
5	Wasting	2	1	2	0	5
6	Weight for age	7	1	0	3	11
7	Full immunisation	8	0	2	1	11
8	Diarrhoea occurrence	2	2	1	0	5
9	Pneumonia occurrence	1	1	0	0	2
10	Diarrhoea treatment	2	1	1	0	4
11	Pneumonia treatment	2	0	0	0	2
	Total	58	14	11	10	93

[3] Some studies examined more than one child health outcome.

2.3.1.1 Childhood mortality

Overall relationship

Among the 56 studies identified by the review, 23 examined childhood mortality. Out of ten studies that examined the effect of maternal education on neonatal mortality, four were found to have a net beneficial effect (Buor, 2003, Basu and Stephenson, 2005, Kamal, 2012, Fonseca et al., 2017); four reported no effect (Stuebing, 1997; Goldani et al., 2002; Macassa et al., 2003; Makate and Makate, 2016) while two multi-country studies reported mixed results in different countries (Bicego and Boerma, 1993; Uchudi, 2001). Out of 12 studies that examined infant mortality, six reported an independent beneficial effect of maternal education (Rao et al., 1996; Goldani et al., 2002; Buor, 2003; Gokhale et al., 2002; Song and Burgard, 2011; Makate and Makate, 2016); one reported no effect (Macassa et al., 2003); three reported mixed effects meaning that independent effect was found only in mothers who had completed secondary education (Pena et al., 2000; Uchudi, 2001; Basu and Stephenson, 2005); while two multi-country studies reported varying effects across different countries (Bicego and Boerma, 1993; Desai and Alva, 1998). Out of 15 studies that assessed under five mortality, 13 found an independent beneficial effect (Ahmed and Kamal, 2016; O'Toole and Wright, 1991;Tulasidhar, 1993; Mellington and Cameron, 1999; Goldani et al., 2002; Buor, 2003; Breierova and Duflo, 2004; Monden and Smits, 2013; Greenaway et al., 2012; Akter et al., 2015; Grepin and Bharadwaj, 2015; Makate and Makate, 2016; Blackstone et al., 2017) while two reported no effect (Macassa et al., 2003; Ali and Elsayed, 2017).

Variation of the effect

The net effect size of maternal education was reported by some studies. A study that analysed data from 17 developing countries claimed that a one-year increase in mothers' education translated into 7 to 9 percent reduction of child mortality (Bicego and Ties Boerma, 1993). Based on a study conducted in Malawi, Makate and Makate (2016) asserted that one additional year of schooling of mothers contributed to a reduction in infant mortality by 3.22 percent and that of under-five mortality by 6.48 percent. Another study conducted in Zimbabwe reported that children of mothers who completed secondary schooling were 12 percent less likely to die than those of mothers who completed primary

education, and an additional year of schooling further reduced their risk of dying by 21 percent (Grepin and Bharadwaj, 2015). The incremental effect of secondary education over primary education was supported in another study conducted in Burundi where the relative risk of child mortality was 0.43 among mothers who had secondary education and 0.90 for those with a primary education compared to 1.0 for those without education (O'Toole and Wright, 1991).

Out of the three types of childhood mortality, the protective effect of maternal education seems to be stronger in reducing infant mortality and under-five mortality than in reducing neonatal mortality since half of the studies that examined the effect of maternal education on neonatal mortality revealed no effect (Breierova and Duflo, 2004; Macassa et al., 2003; Makate and Makate, 2016). One possible explanation is that the effectiveness of the care provided to pregnant mothers and newborns during childbirth and neonatal period is largely dependent on the availability of the essential maternal, obstetric and new-born health care services which are still inadequate in many developing countries (Bicego and Boerma, 1993). This finding is partially supported by a comparative analysis of the mortality between biological children and adopted children in China which affirmed that the independent effect of maternal education is more substantial in the post-natal nurturing compared to the neonatal period in both groups of children (Chen and Li, 2009).

2.3.1.2 Child undernutrition

Overview of the relationship

Among the 56 studies identified by the review, a total of 19 studies assessed the effect of maternal education on child undernutrition outcomes. The effect of maternal education on stunting was examined by 16 studies, and 11 found a beneficial independent effect (Lomperis, 1991; Joshi, 1994; Glewwe, 1999; Frost et al., 2005; Boyle et al., 2006; Moestue and Huttly, 2008; Semba et al., 2008; Chen and Li, 2009; Abuya et al., 2012; Devkota and Panda, 2016; Vollmer et al., 2016); one reported no effect (Abuya et al., 2011); two reported mixed effects such as the effect was found with secondary education but not with primary (Maddah et al., 2007; Makoka and Masibo, 2015), while two multi-country studies reported varying effects across different countries (Bicego and Boerma, 1993; Desai and Alva, 1998).

The effect of maternal education on wasting was assessed in five studies, out of which two were found to have a net beneficial effect (Lomperis, 1991; Vollmer et al., 2016); one reported no effect (Joshi, 1994) and two reported mixed effects (Maddah et al., 2007; Makoka and Masibo, 2015). The effect of maternal education on low weight for age was examined in 11 studies out of which seven found an independent beneficial effect (Lomperis, 1991; Ruel et al., 1992; Basu and Stephenson, 2005; Boyle et al., 2006; Moestue and Huttly, 2008; Devkota and Panda, 2016; Vollmer et al., 2016); one reported no effect (Fakir and Khan, 2015); and three reported mixed effect (Reed et al., 1996; Maddah et al., 2007; Makoka and Masibo, 2015).

Variation of the effect

There was mixed evidence reported by the papers regarding the differential effect of maternal education on acute undernutrition (wasting and low weight for age) and chronic undernutrition (stunting). Earlier studies conducted in Colombia by Lomperis (1991) and in Lesotho by Ruel et al. (1992) stated that maternal education was associated with a reduction of all three forms of child undernutrition. Nevertheless, those studies were conducted on small samples of malnourished children recruited from health facilities and institutions and did not represent the larger population of the settings. More recent analyses, particularly the studies that used data from nationally representative surveys, found that the effect of maternal education varied across different nutrition outcomes (Abuya et al., 2011; Devkota and Panda, 2016; Makoka and Masibo, 2015). Higher maternal education was found to have a protective effect from chronic or long-term undernutrition, and its effect was less pronounced in short-term or acute undernutrition (Vollmer et al., 2016; Frost et al., 2005). In a study conducted in Indonesia and Bangladesh, maternal education at secondary level was associated with a reduction of the odds of stunting (chronic undernutrition) by 4-5 percent in both countries while its effect was inconclusive on acute undernutrition (Semba et al., 2008).

2.3.1.3 Child immunisation

Overview of the relationship

Among 11 studies that examined the effect of maternal education on full immunization of children, eight found an independent beneficial effect (Streatfield et al., 1990; Becker et al., 1993; Huq and Tasnim, 2008; Abuya et al., 2011; Aslam and Kingdon, 2012; Greenaway et al., 2012; Vikram et al., 2012; Onsomu et al., 2015); two reported a mixed effect (Parashar, 2005; Nankabirwa et al., 2010); and one multi-country study reported a mixed effect across different countries (Desai and Alva, 1998).

Variation of the effect

A study conducted in the Philippines reported that the estimated odds of full immunisation increased by 12 percent with each additional year of mothers' education indicating that higher level of maternal education is associated with chances of children receiving a complete immunisation (Becker et al., 1993). This finding was supported by a Ugandan study where only 46 percent of the infants whose mothers had primary education were fully vaccinated compared to 65 percent of the infants whose mothers had secondary education (Nankabirwa et al., 2010). Another study in Kenya also reported that, compared to children of mothers with no education, children of mothers with primary education were 2.17 times more likely to get fully immunised while those whose mothers had secondary education were 50 percent less likely to miss any vaccination (Abuya et al., 2011). These findings agree with the studies conducted in Kenya, Indonesia and Ghana where mothers with higher level of education had better knowledge about immunization, were aware of the country immunization schedules and were more likely to have their children fully vaccinated than those with no education (Streatfield et al., 1990; Greenaway et al., 2012; Onsomu et al., 2015). Conversely, a Brazilian study reported that the immunisation coverages of children were not much different by maternal education levels in developing countries because the immunisation campaigns were intensively mobilised by governmental authorities targeting more disadvantaged communities (Barata et al., 2012).

2.3.1.4 Diarrhoea and pneumonia among children and receiving the appropriate treatments

Overview of the relationship

The present review found that the effect of maternal education on the occurrence of child diarrhoea was examined in five studies where two found a net beneficial effect (Mahalanabis et al., 1996; Basu and Stephenson, 2005); two reported no effect (Gokhale et al., 2004; Hatt and Waters, 2006); and the remaining one reported a mixed effect (Dargent-Molina et al., 1994). There were only two studies that assessed the effect of maternal education on pneumonia, out of which one found an independent beneficial effect (Hatt and Waters, 2006) and the other no effect (Basu and Stephenson, 2005). Concerning the treatment of diarrhoea, four studies examined the effect of maternal education on taking appropriate treatment for diarrhoea. Two studies were found to have an independent beneficial effect (Becker et al., 1993; Basu and Stephenson, 2005); one reported no effect (Gokhale et al., 2002); and the other reported mixed effect (Huq and Tasnim, 2008). Two studies assessed the education effect on utilising appropriate health services against pneumonia and both studies found an independent beneficial effect (Basu and Stephenson, 2005; Sreeramareddy et al., 2006).

Variation of the effect

Maternal education level remained the most consistent and essential determinant of receiving an appropriate treatment for diarrhoea and had a beneficial effect on the severity of child diarrhoea minimising the risks of having severe dehydration due to diarrhoea among infants (Becker et al., 1993; Ryland et al., 1998). According to a study in the Philippines, the protective effect of maternal education against diarrhoea was more pronounced for women who completed secondary school with 6.8 fewer cases of diarrhoea in children compared to women with no education (Dargent-Molina et al., 1994). In relation to the occurrence of diarrhoea, a study in Bangladesh found that seven or more years of maternal education was associated with a 54 percent reduced risk of severe dehydration due to diarrhoea in their children (Mahalanabis et al., 1996). Contrary to the above beneficial effects of maternal schooling, Hatt and Waters (2006) reported a higher incidence of respiratory illnesses among children of highly educated mothers. Similarly, according to the studies conducted in Nepal and India, improved utilisation of health services for pneumonia was found with increased level of education (Basu and Basu, 1991; Sreeramareddy et al., 2006; Ryland et al., 1998).

2.3.2 What possible confounding factors need to be considered in examining the effect of maternal education on child health?

Confounding factors are the variables which are associated with both independent and dependent variables and tend to confuse the relationship between them resulting in overestimation or underestimation of the effect sizes (Webb, 2011). It is critical in examining the association between a dependent variable and an independent variable to identify the factors that could have such confounding effects and address the issue through an appropriate analytical approach so that a net effect of the study factor can be elicited (Dargent-Molina et al., 1994). The literature review identified some confounding factors which are likely to influence the relationship between maternal education and child health outcomes.

2.3.2.1 Family income

Earlier studies conducted in Burundi and India indicated that the effect of maternal education on child mortality reduced by 50 percent when family income was adjusted by the analysis indicating that family income contributed half of the effect of maternal education (Goodburn et al., 1990; O'Toole and Wright, 1991). Based on a pooled analysis of nationwide survey data from 22 developing countries, Desai and Alva (1998) found that maternal education did not have an independent protective effect on child health outcomes as its effect became negligible when family income was controlled for in the analysis. Another multi-country analysis of 17 developing countries reported that the effect of maternal education on receiving the appropriate treatments for pneumonia and diarrhoea significantly reduced after controlling for family income indicating family income as a critical predictor of differential access and utilisation of child health services (Bicego and Boerma, 1993).

Mixed evidence was also found in relation to differential effects of maternal education across different income groups. Several studies conducted in India, Nicaragua, Lesotho and Latin America reported that the effect of maternal education had the highest impact on childhood mortality and stunting in the lowest income groups as demonstrated by its larger effect sizes compared to other income groups (Goodburn et al., 1990; Pena et al., 2000; Hatt and Waters, 2006; Ruel et al., 1992; Kikafunda et al.,

1998). In a study in Bangladesh, Mahalanabis et al. (1996) asserted that maternal education in affluent households contributed to the reduction of infant mortality by four percent while its effect on poor households accounted for 35 percent reduction. Authors have suggested that ensuring universal attendance and completion of primary school among girls from poor households will revert one-third of child mortality in developing countries (Grepin and Bharadwaj, 2015).

Nevertheless, contradictory findings were reported in some other studies. In a study in Benin, Reed et al. (1996) claimed that an association was not found between maternal education and child health outcomes in the poorest and richest groups, while a strong and significant association was found with the intermediate-level income group. This finding indicated that the positive effect of maternal education brought its maximum impact when households had some level of resources, and it had less effect on the households with limited or ample resources. On the other hand, Dargent-Molina et al. (1994), based on a study conducted in the Philippines, also asserted that the protective effect of maternal education is greater among economically better-off mothers as compared to more financially disadvantaged mothers. Similarly, some multi-country analyses found that the effect of maternal education was more pronounced in better-off families than poorer ones implying that positive effects of maternal education on child undernutrition are apparent only when resources are adequate (Reed et al., 1996; Frost et al., 2005). A similar finding was reported in Latin America by Hatt and Waters (2006) in their analysis of the association between maternal education and child diarrhoea and pneumonia. In addition, the authors found that higher education in poor mothers returned less beneficial effects compared to the same level of education in rich mothers.

2.3.2.2 Geographical accessibility to health services

In the selected studies, geographical accessibility to health services was represented by urban/rural residence of the populations as a proxy. The urban/rural residence status was found as a confounder in the relationship between maternal education and child health as it contributed to the reduction of the effect sizes of maternal education on child health outcomes when it was adjusted by the multivariate analysis (Desai and Alva, 1998; Grepin and Bharadwaj, 2015; Makoka and Masibo, 2015; Onsomu et al., 2015). However, there were some variations reported by some of the selected studies. In an

Indonesian study, Mellington and Cameron (1999) reported the variation of the maternal education effect between urban and rural areas: a year of maternal schooling contributed to reduction of child mortality by 1.7 percent in rural areas and 2.3 percent in urban areas implying its stronger effect in urban areas. Other studies, however, found that the effect of maternal education was weaker among urban populations, but it was stronger in informal urban slums and rural settings (Grepin and Bharadwaj, 2015). According to a study in India, analysing differentials of child health outcomes by geographical residence revealed that the rural-urban differentials were larger in the group of mothers with no or lower level of education whereas such differentials were smaller among mothers with higher education status (Gokhale et al., 2002).

2.3.2.3 Paternal (father's) education

In some of the selected studies, paternal education was found to be confounding the effect of maternal education on child health outcomes (Vollmer et al., 2016; O'Toole and Wright, 1991; Breierova and Duflo, 2004; Becker et al., 1993). A study conducted in Bangladesh and India found that paternal education is more important than maternal education contributing more substantial independent beneficial effect on child health (Semba et al., 2008). The claim probably originated from the fact that, in most developing countries, the father is the only breadwinner in the family and father's education represents social status which is directly related to family income. On the other hand, an Indonesian study indicated that both maternal education and paternal education exert the same level of independent effect on child health (Breierova and Duflo, 2004). Nevertheless, many studies argued that the effect of paternal education on child health was much lower than that of maternal education claiming that its effect was only half of the effect of maternal education in reducing child mortality and child undernutrition (Rao et al., 199; Akter et al., 2015; O'Toole and Wright, 1991; Desai and Alva, 1998; Semba et al., 2008). Macassa et al. (2003) reasoned that, compared to fathers, mothers in low-income contexts spend much of their time with their children as the main caregivers having better opportunity to contribute to health and wellbeing of their children.

2.3.2.4 Maternal reproductive factors

The review identified that women's reproductive factors have confounding effects on the relationship between maternal education and child health. These factors include mother's age at child birth, mother's parity and birth interval between the children. Women under the age of 17 and those over 35 are denoted as high-risk mothers for pregnancy because of their increased risk of getting obstetric complications which could affect health status of both mother and child during pregnancy and childbirth (Jolly et al., 2000). The number of children ever born or parity of mothers is associated with major obstetric complications including pre-eclampsia which could result in increased risk of neonatal death (Ananth et al., 1996, Duckitt and Harrington, 2005). Birth interval between child births is also a critical maternal factor since shorter birth interval can have serious implications on the birth outcomes affecting both the health status of mother and newborn. It is recommended to have a minimum interval of 24 months between births since shorter intervals are associated with early childhood mortality and maternal mortality (Binka et al., 1995; WHO, 2015).

2.3.2.5 Other factors

Some of the selected studies used occupation of father and mother, living with mother-in-law in the same household, and age and sex of child as possible confounders of the relationship between maternal education and child health (Vikram et al., 2012b; Makoka and Masibo, 2015b; Devkota and Panda, 2016; Vollmer et al., 2016; Gupta et al., 2015; Streatfield et al., 1990; Becker et al., 1993b; Macassa et al., 2003b; Basu, 1994). The review found that the confounding effects of these variables on the relationship between maternal education and child health varies across different studies and child health outcomes. In most cases, there was a minimal reduction of the effect size of maternal education when these factors were controlled for by the analysis.

2.3.3 Through which pathways does maternal education influence child health?

The review identified only three studies that quantitatively tested the plausibility of possible pathways of influence of maternal education on child health (Glewwe, 1999; Frost et al., 2005; Vikram et al.,

2012). Major pathways identified by the three studies were maternal income, mothers' health knowledge, maternal autonomy and mother's health-related behaviour.

From the health economics perspective, maternal education derives its protective effect by improving two types of efficiencies namely allocative efficiency and productive efficiency. The former is related to mothers' knowledge and decision-making in behavioural choices, and the latter is concerned with better returns for investment (Hatt and Waters, 2006). Educated mothers improve allocative efficiency through making appropriate behavioural decisions which are informed by their higher level of health-related knowledge compared to uneducated mothers. On the other hand, educated mothers improve productive efficiency through labour force participation and increased family income leading to better access to health and nutrition services (Fakir and Khan, 2015). Levine et al (2011) argued that girls acquire from schools not only health knowledge diffused through established academic curriculum but also, they receive understanding of formal communicative languages which are commonly used and shared in bureaucratic institutions including schools and health facilities contributing to their interpretation of health messages aiding improved health seeking behaviour.

Many authors widely accept that the education-health related knowledge gradient is the most plausible explanatory pathway through which maternal education exerts its effect on child health (Vikram et al., 2012; Frost et al., 2005; Glewwe, 1999; Ahmed et al., 2000). According to Makoka and Masibo (2015), compared to uneducated mothers, educated mothers had a higher level of health knowledge related to causes of diseases, preventive measures and treatment. However, formal education may not be the only source from which mothers obtain health knowledge. Glewwe (1999) argued that formal education does not provide all health knowledge the mothers need to nurture their children. Health-related information also comes to mothers via their improved literacy skills, better access to mass media, and broader social networks while the education level of mothers helps them to absorb, retain and apply the knowledge (Aslam and Kingdon, 2012). Furthermore, education is much to do with transforming the attitude of women enhancing their receptiveness to new ideas and information related to modern health care (Frost et al., 2005). According to Stuebing (1997), in addition to knowledge and literacy, girls learn social

skills at school, mainly how to interact with bureaucratic institutions which are critical for them to deal in their later life with similar institutions including health facilities.

Another pathway of influence is family income. Higher maternal education raises family income because of mothers' participation in better paid employment which helps the family pay for direct and indirect fees in accessing health services and having better living standards (Grepin and Bharadwaj, 2015). In addition, Vollmer et al. (2016) emphasised the effect of assortative mating whereby women with higher education level are likely to get married to men with same or higher level of education contributing to the overall improvement of family economic status and health services utilisation.

In addition, educated women are more likely to adhere to health-related behaviours including adoption of recommended birth spacing practices resulting fewer children compared to uneducated women reducing risks of obstetric complications (Abuya et al., 2012). The evidence demonstrates that short birth intervals and high parity are strongly associated with adverse maternal and child health outcomes (Akter et al., 2010).

Maternal autonomy is another pathway. Education confers mothers with more autonomy, and they become more independent, assertive and empowered rejecting traditional ways of thinking and adopting modern preventive and curative health practices (Goodburn et al., 1990). For instance, educated mothers may not wait for their husband or elders to make decisions about their child's health (Kamal, 2015).

2.4 Important issues related to maternal education

2.4.1 Counterintuitive effects

A dose-response relationship between mother's schooling and child health outcomes is a common phenomenon reported by many studies included in the review, with improved child health outcomes being found in mothers with higher level of education. However, this linear relationship was not true in certain settings where a U-shaped relationship was observed between maternal education and child health outcomes. It means that an increased incidence of morbidity and mortality was reported among the children of mothers in the lowest and highest level of education groups, while those with moderate

level of education having better child health outcomes. Reed et al. (1996) and Maddah et al. (2007) found increased prevalence of child undernutrition among mothers with no education and highly educated mothers in Benin and Iran respectively. Hatt and Waters (2006) also reported high incidence of respiratory infections among children of mothers with no education and highly educated mothers in Latin America. In an Indonesian study, Streatfield et al. (1990) reported very low immunisation coverage among children of uneducated and highly educated mothers.

Several studies from low income settings pointed out that highly educated mothers tend to engage in formal employment and are less likely to ensure exclusive breastfeeding of new-born children and were more likely to use formula feeding (Moestue and Huttly, 2008; Ahmed et al., 1992; Ahmed, 1991). Other authors suggested that highly educated mothers were more likely to engage in paid employment and cannot dedicate enough time in taking care of children to improve their health and nutrition (Fakir and Khan, 2015). Another possible explanation is that highly educated women tend to marry late and have children in later age increasing risks of acquiring pregnancy-related complications contributing to adverse health outcomes during delivery and child birth (Santos et al., 2016). From the methodological perspective, Hatt and Waters (2006) reasoned that highly educated mothers were more accurate than poorly educated mothers in reporting health status of children and in recalling dates of occurrences of diseases and deaths, which can contribute to having relatively higher estimates of child morbidity and mortality reported by better educated mothers.

2.4.2 Variation of thresholds

There is no clear demarcation regarding how many formal school years a woman needs to enable the transformation of her education level into positive health outcomes in her children. Such a benchmark can vary across different settings given diverse education systems, quality of education and degree of women's autonomy to decide by themselves in seeking health care for their children. However, the threshold of maternal education level is a vital policy discourse for prioritisation particularly in determining the level of universal education in resource-poor settings (Basu and Stephenson, 2005). Studies conducted in Benin, Zimbabwe and Bangladesh suggested that completion of secondary

education was a threshold since there was no meaningful difference of the effect size between mothers having no education and those with primary education on child health outcomes (O'Toole and Wright, 1991; Grepin and Bharadwaj, 2015; Akter et al., 2015). Similarly, Makoka and Masibo (2015) reported that more than ten years of schooling, which was equivalent to the completion of secondary level, was required to effectuate a reduction of stunting among under-five children in Malawi, Tanzania and Zimbabwe. This high threshold level is probably due to poor quality of education in developing countries at primary level. This fact was supported by an analysis by Greenaway et al. (2012) in Ghana which found that only 45 percent of mothers who had completed primary school had full reading skills and the positive association with child mortality was found mainly in those mothers who could read.

Nevertheless, a study in India reported that the effect of maternal education was beneficial to mother's health knowledge and health services utilisation even at lower education levels (Vikram et al., 2012). Similarly, based on an analysis of 17 developing countries, Bicego and Ties Boerma (1993) claimed that, regardless of the education level, the odds of child immunisation rose with a one-year increase in maternal education although the level of increase was higher in mothers who had completed secondary education. Vikram et al. (2012) suggested that, despite a mismatch between formal education level and literacy skills among mothers with limited education, having a little education was still beneficial to mothers since schooling improves social networks of mothers which in turn contributed to improved uptake of health services. Mellington and Cameron (1999) contended that both primary and secondary education had a significant effect on the reduction of under-five deaths eliciting that an additional year at primary level decreased the likelihood of child death by 1.9 percent while a year in secondary level reduced child death by 2.6 percent in Indonesia. Makate and Makate (2016) reported higher estimates in Malawi with 3.2 percent reduction of under-five deaths for one-year schooling even at primary level.

2.5 Limitations of the studies included in the review

The review identified some limitations of the included studies regarding methodology which could explain some of the variations in findings. Few studies that reported a beneficial effect of maternal education were found very weak in study design and methods resulting in poor quality. For instance,

Gokhale et al. (2002) employed an ecological study design in examining the effect of maternal education on child health. The limitation of the ecological study design is that it examined mothers' education status and child health outcome variables at the community level and the study did not assess the association between actual pairs of mothers and their children and thus the effect generated from those studies can be spurious and misleading.

Another issue is the selection bias emanating from the way study participants were recruited. Ruel et al. (1992) recruited study participants from clinic attendants at a few rural health centres in one district, while Gupta et al. (1991) selected a sample of clinic attendants at community clinics in urban slum setting of one city. Nankabirwa et al. (2010) selected rural communities situated near the main roads for the study to ensure accessibility by the data collection teams. Generalizability of the findings from those studies to other settings even in the same country can be limited due to inadequate representativeness of the sample populations. Further, Gupta et al. (1991) recruited only 74 pairs of children and their mothers in their study assessing the effect of maternal education on child undernutrition, where the sample size was too small to allow for subgroup analyses such as a comparison of mothers with secondary education against those with primary education.

The review focused on the studies that employed multivariate analysis methods that controlled for the effects of potential confounding factors. As discussed in previous sections, there are confounding factors which influence the association between maternal education and child health. An analysis that attempts to find an independent effect of maternal education on child health should address those factors by including them in the analysis as independent variables so that their effects are controlled for, and the independent effect of maternal education separated. However, the extent of independent variables included in the analysis as possible confounders to adjust for was not consistent across the selected studies. Some studies, such as Bicego and Boerma (1993) and Devkota and Panda (2016), selected independent variables based on a theoretical framework in a systematic way taking into consideration a wide range of factors which might influence child health outcomes. Nevertheless, some studies controlled for a limited number of variables. For instance, Becker et al. (1993) and O'Toole and Wright (1991) did not include family income or household wealth as independent variables in their analysis.

Given that household wealth is such an important confounding factor of the relationship between maternal education and child health, excluding it from the analysis could affect the validity of the effect sizes of maternal education. Multivariate analyses that control for a limited number of independent variables may not adjust for all possible effects of socio-demographic factors. As a result, findings generated from such analyses may be overestimating the effect of maternal education.

There were very few studies that examined the effect of maternal education on diarrhoea and pneumonia and receiving appropriate treatments and synthesising information out of a small number of studies was difficult. Further, comprehensiveness of the health outcome assessment among the selected studies is another limitation. The present literature review found that the selected studies examined the effect of maternal education on one or two health outcomes such as vaccination or stunting or infant mortality. Few studies focused on more than one dependent variables in one group of health outcome such as childhood mortality. Very few studies explored the effect of maternal education on more than one group of child health outcomes such as child mortality, morbidity or health services utilisation in the same study. Hence, comparison of findings related to the effect of maternal education on more than one outcome group can be made only through reviewing several studies conducted in different country settings. However, the ability to make valid comparison across different studies is limited given that the studies were conducted in diverse contextual and sociocultural settings.

2.6 Conclusion

As elaborated by the literature review, the evidence related to the effect of maternal education on different child health outcomes is mixed across different studies conducted in different settings. While most studies reported an independent beneficial effect of maternal education on child health outcome parameters, some reported contradicting findings. Some studies did not find an independent effect while some reported a U-shaped effect of maternal education where poor child health outcomes were prevalent in mothers with no education and in those with higher education level. Among the studies that reported an independent beneficial effect of maternal education, the magnitude of the effect varied from one study to another. Moreover, the review also noted the variation of the effect of maternal education

across different sub-population groups, such as rural and urban, in the same setting. Thus, it is difficult to conclude with a straightforward answer to the first review question, ‘does maternal education have an independent beneficial effect on child health?’ Broader issues such as women's autonomy to make decisions to seek health care for their children, diverse education systems, and quality of education contribute to the variation of the effect across different settings.

Regarding the second review question, the literature review has identified that household wealth level, rural/urban residential status, paternal (husband’s) education level, maternal reproductive health factors such as parity, age at child birth and preceding birth intervals are key factors confounding the effect of maternal education on child health outcomes. Most of the studies included in the review took into account of those factors as possible confounders though it was not consistent across all the studies. In relation to the third review question, the review has found that maternal education operationalised its effects on child health through improved maternal health knowledge, health-related behaviour, better networking skills, improved literacy level, higher level of confidence and stronger autonomy among them.

CHAPTER 3

METHODOLOGY

3.1 Overview

This chapter outlines how the study attempts to answer its research questions followed by a brief discussion of the philosophical foundations of the study. The primary data source of the present thesis is extensively discussed, and advantages and disadvantages of the secondary data analysis are presented in the backdrop of the primary data. It is supplemented with the data quality assessment of the primary data. A detailed description of the variables used in the data analysis are elaborated, and the extent of correlation among the independent variables are discussed. The data analysis approaches employed in all the stages of the data analysis are elaborated and, finally, the measures taken to ensure an ethical research are deliberated.

3.2 Philosophical underpinnings

The primary research question of the present study is whether maternal education has an independent effect on child health and through which pathways maternal education possibly exerts its effects. To answer the research question, the study operationalises the abstract concepts like education and health into measurable phenomena such as education levels and mortality and morbidity status. For instance, the study defines maternal education level as mothers' completed years of formal education while child health status as mortality, incidence of childhood diseases and utilisation of child health services. The study then attempts to find association between these measurable parameters by employing quantitative data analysis methods.

The philosophical foundations of the present thesis informed the way the research question is conceptualised to address. The ontological perspective of the present study is objectivism which contends that social phenomena and their meanings are independent of social actors with a strong belief in the universality of social existence (Krauss, 2005). Ontology is the study of the nature of existence

and is concerned with whether social matters are to be observed as subjective or objective means (Moon and Blackman, 2014). The epistemological standpoint of the present thesis is positivism which affirms that factual knowledge about an existence can be obtained only through objective observation or measurement which is independent of the observed objects (Sale et al., 2002; Crossan, 2003). Epistemology is a philosophical standpoint concerned with knowledge and what is known to be true about an existence while it highlights the theory of knowledge and different sources of knowledge (James, 2012).

Under the influence of the positivist paradigm and its overarching philosophical ideologies, the present research conceptualises social phenomena including education and health status as quantifiable, measurable, independent and comparable (Weaver and Olson, 2006). Consequently, the research employs the quantitative research methodology to address the research questions and objectives (James, 2012). In exploring the relationship between social matters, the quantitative research methods and data analysis approaches are used to elicit an independent effect of maternal education on child health. For instance, the present research employs the quantitative household survey data where social matters are defined and measured in a precise manner using standardised survey questionnaires and quantitative variables.

In addition, the research enables a comparison of the quantified social matters across different subgroups examining associations among them. In doing so, the research compares the proportion of child health outcomes among children of uneducated mothers and those of educated mothers trying to elicit the association between mothers' education level and child health outcomes. The research then examines strengths of the associations and makes inferences of the relationships in a deductive approach applying appropriate statistical tests (Krauss, 2005). In addition, the data analysis attempts to control for possible confounding effects of intervening variables which could have influence over the relationship between maternal education and child health.

3.3 Primary Data

3.3.1 Source and nature of the primary data

The present study examined the effect of maternal education on child health employing secondary analysis of a nationally representative survey, the Demographic Health Survey (DHS), conducted in Myanmar in 2015-2016 (DHS and MOHS, 2017). DHS is a standardised survey implemented by the DHS Programme with the support from the United States Agency for International Development (USAID) in over 90 low- and middle-income countries (DHS, 2012). The survey design, methodology, variable definitions, survey questionnaires, data processing and data analysis methods are standardised by the DHS Programme to enable comparison of the survey findings across different countries. The DHS survey was conducted in Myanmar with technical and financial support from the DHS Programme and USAID in collaboration with the Ministry of Health (DHS and MOHS, 2017). The primary purpose of the Myanmar DHS survey was to update social, demographic and health indicators of the country and to assist the country in monitoring and evaluating the national health programmes. The DHS reported issues related to maternal and child health, family planning, HIV/AIDS, health knowledge and behaviour, health services utilisation, and childhood and maternal mortality.

The DHS survey used three sets of questionnaires: a Household Questionnaire; a Women's Questionnaire; and, a Man's Questionnaire that are standardised questionnaires of the DHS Programme (DHS, 2012). The Household Questionnaire collected sociodemographic information about all household members including children, housing characteristics, and measurements of child anthropometry (weight and height). The Woman's Questionnaire gathered data from all women aged 15-49 years residing in the selected households. The information included socio-demographic backgrounds, birth history, child mortality, family planning, fertility preferences, antenatal care, delivery, postnatal care, breastfeeding, infant feeding practices, vaccination, childhood illnesses, HIV/AIDS, STD, and domestic violence. The Man's Questionnaire was addressed to men in the same age groups residing in half of the selected households collecting the same information as the Woman's Questionnaire except birth history, delivery and children (DHS and MOHS, 2017).

3.3.2 Data quality and representativeness of the primary data

3.3.2.1 Representativeness and generalisability

The Myanmar DHS survey is a nationally representative survey that employed a two-stage cluster sampling method stratifying all fifteen states and divisions (provinces) of Myanmar. The survey sample size and sampling methods were adjusted to enable representativeness of the estimates of key indicators at the national level and all fifteen states and divisions (DHS and MOHS, 2017). The sample selection of the survey represented the country population since the master sampling frame was taken from the National Population Census conducted in 2014. The master frame consisted of all households countrywide and internally displaced populations living in temporary settlements. The first stage sampling selected 442 clusters or communities from a master sampling frame of 4000 primary sampling units generated by the National Population Census. At second stage sampling, a fixed number of 30 households was selected from each of the identified clusters resulting in 13,260 households (DHS and MOHS, 2017). Based on the sampling proportions or fractions applied during the sampling process at different levels, i.e., cluster level, household level, and individual level, the DHS Programme calculated sampling weights at respective levels and incorporated them in calculating indicator estimates (DHS and MOHS, 2017). With this approach, the DHS Programme enabled the DHS Myanmar survey datasets to produce nationally representative estimates by adjusting the analysis with sampling weights (DHS, 2012) so that the findings produced by the DHS survey were representative of the entire country.

3.3.2.2 Response rates

Out of 13,260 households selected for the DHS survey, 12,780 houses were occupied, out of which 12,500 were interviewed yielding a 98% response rate (DHS and MOHS, 2017). In the interviewed households, 13,454 women were found to be eligible being in the targeted age range (15-49 years), out of which, 12,885 were interviewed resulting in a 96% response rate. 4,737 men were questioned out of 5,218 eligible men (15-49 years) with a 91% response rate. The survey provided information about

22,989 children ever born to interviewed women, and 4,815 children who were born in the past five years, both including dead children.

A very high response rate in community-based surveys is a common phenomenon in Myanmar. For example, the national Multiple Indicator Cluster Survey conducted in the country in 2010 had a 99% overall response rate (MNPED and MOH, 2011). An analysis of the DHS surveys conducted in low- and middle-income countries indicated that they had very high response rates typically above 90% (Corsi et al., 2012), which the authors associated with high level of confidence in the survey by respective communities. The high response rates of the surveys in Myanmar could be partly attributed to the fact that 70% of the total population who live in rural areas (MOIP, 2015) tend to comply with the requests made by the survey teams compared to the urban people. The Myanmar DHS survey reported that the household response rate was 98.3% in rural and 96.5% in urban; the women's response rate was 96.7% in rural and 93.7% in urban; and, the men's response rate was 92.2% in rural and 87.4% in urban (DHS and MOHS, 2017). This lower response rate of men in urban can be probably because men in urban areas are out of their homes engaged in employment.

3.3.2.3 Comparison of the primary data with other national data sources

To assess data quality of the primary survey, some of the key indicators reported by the 2015-2016 Myanmar DHS were compared against the data produced by previous national surveys and censuses. In Table 3.1, child mortality data of the primary survey was assessed examining the estimates of neonatal, infant and under-five mortality reported by various data sources in Myanmar during the past three decades including the data generated by the national population censuses conducted in 1983 and 2014. It is found that the child mortality data produced by the primary survey which is indicated in the bottom row in Table 3.1 are in alignment with the downward trends of the previous mortality estimates. The trend of under-five mortality is more conclusive because of the data availability of the same over the past three decades while other neonatal mortality and infant mortality were not reported in all the surveys and censuses conducted in the country.

Table 3.1: Trends of childhood mortalities reported by different data sources in Myanmar

Data Source	Year	Childhood mortalities (number of deaths per 1,000 live births)		
		Neonatal Mortality	Infant Mortality	Under five mortality
Population Census	1983	na	108	128
Population Change and Fertility Survey	1991	na	103	117
Fertility and Reproductive Health Survey	1997	na	63	106
National Mortality Survey	1999	na	na	77
Fertility and Reproductive Health Survey	2001	44	80	95
Under Five Mortality Survey	2002	na	na	66
Fertility and Reproductive Health Survey	2007	34	65	76
Multiple Indicator Cluster Survey	2009-2010	na	61	67
Population Census	2014	na	55	57
Demographic Health Survey	**2015-2016**	**23**	**42**	**52**

Furthermore, a comparison of several sociodemographic indicators was made against the Myanmar Population Census conducted in 2014 (MOIP, 2015). Table 3.2 demonstrates that the data generated from the DHS survey is similar to those reported by the National Population Census indicating a high quality of the survey.

Table 3.2: Comparison of social and demographic information between National Population Census 2014 and Myanmar DHS 2016 (Source: MOIP, 2015; DHS and MOHS, 2017)

Indicators	National Population Census (2014)	Myanmar DHS (2016)
Urban-rural ratio	30:70	22:78
Sex ratio (number of males per 100 females)	93	85
Proportion of children under 15 years of age	28.6%	29.0%
Proportion of households with electricity	52.4%	55.6%
Household size	4.4	4.2
Proportion of households that use firewood for cooking	69.2%	61.2%
Proportion of households that use tap water/piped water	9.0%	9.5%
Proportion of households with a TV	50.0%	57.0%
Proportion of households with a radio	35.5%	33.9%

As indicated in the DHS survey report, high data quality of the primary survey is reflected by high response rates, very few missing data, acceptable standard errors of key indicators, and reasonable age distribution around specific events such as deaths, marriages, and births, (DHS and MOHS, 2017). This high level of data quality was mainly contributed by strict quality control measures adopted by the DHS Programme throughout the survey. For instance, the survey ensured robust supervision systems during the data collection fieldwork and data processing and adopted double data entry approaches to minimise errors during the data processing stage. The survey conducted the standardised trainings of data collectors to harmonise data collection procedures among hundreds of data enumerators (DHS and MOHS, 2017).

3.3.2.4 Controlling Recall Bias

In any study that involves asking study participants to recollect past events or experiences, accuracy and completeness of the information can be affected by many factors including intentional and unintentional errors in responding to survey questions by the respondents (Manesh et al., 2008). Unintentional errors can be due to memory loss, while intentional errors may be related to having to recall unpleasant past events including illness and death. The DHS survey minimised the effect of recall bias by setting different reference periods to address a range of survey questions. For instance, in exploring mothers' experience about receiving maternal and child health services, the questions were limited to those mothers who had delivered children in the past five years (DHS and MOHS, 2017). These include questions related to whether and how mothers received antenatal care, what type of health workers attended antenatal care and delivery, which services they received during the interaction with health workers. In recalling child morbidity events such as diarrhoea and pneumonia, the DHS survey set the recall period of two weeks asking the interviewed mothers whether their children had related symptoms within fourteen days prior to the day of data collection (DHS, 2012). The DHS Programme considered the two-week recall period as an optimal balance between controlling recall errors and obtaining sufficient sample size of children having diarrhoea (DHS, 2012; Boerma et al., 1991).

3.3.3 Advantages and disadvantages of secondary data analysis

According to Hox et al. (2005), one of the main disadvantages of the secondary data analysis is that data collected for a primary study may not be optimal for another study because two studies can have different research objectives. It is also very likely that the research framework of a second study can be constrained based on data availability in the primary study (Cheng and Phillips, 2014). Nevertheless, this limitation was not applicable to the present thesis since the Myanmar 2016 DHS survey covered comprehensive information related to the present thesis. The rich data of the primary study on various topics related to health and other social sectors at individual, household and community level allowed the researcher to address the research questions and its objectives using a single data source.

Another possible limitation of the secondary data analysis is related to data quality of primary data. In most cases, a researcher conducting the secondary analysis were not involved in conducting the primary study, and data quality issues are usually out of control of the researcher (Kiecolt and Nathan, 1985). Nevertheless, the researcher can examine documentation of primary studies such as research methods, data collection tools, response rates, standard errors of the estimates and missing data, and assess robustness and data quality of the primary study. For the Myanmar DHS survey, the data quality was assessed as elaborated in Section 3.3.2.3 and it was found that the primary study has acceptable data quality. The researcher familiarised himself with variable definitions, naming systems and coding schemes of the primary data so that use and interpretation of the variables were consistent between the primary study and the present thesis. Being a standardised international survey programme, the DHS programme adopts the same coding schemes and variable definitions across all the DHS surveys conducted in over 90 low and middle-income countries in line with the 'Standard DHS Recode Manual' (DHS, 2012; DHS, 2013). These manuals and guidelines facilitated the researcher to have a better understanding of the DHS datasets and variables.

One of the major strengths of the DHS data is its large sample size representing the entire country's population. Since the research question of the present study is set at national scale to find whether maternal education has an independent effect on child health in Myanmar, only the findings from an

analysis of a nationally represented sample can be taken as valid and relevant answers to the research question. In addition, the Myanmar 2016 DHS is the only updated data available at this scale in the country. Another advantage of using the DHS data is its strict quality control measures. The DHS employed several quality assurance mechanisms to crosscheck and validate the collected data, and only reliable data are entered, cleaned and processed (DHS, 2013). As a result, the final datasets shared by the DHS Programme for the secondary data analysis are of high quality and have very few missing values.

Another main advantage of the secondary data analysis is the efficiency in terms of saving cost and time in undertaking a research because it does not need to go through primary field data collection (Cheng and Phillips, 2014). While the cost of fresh data collection can be varying in different contexts, it usually incurs a substantial portion of the total cost of a study. On the other hand, it is not ethical to collect new data while existing available data can serve the purpose. In addition to cost-effectiveness, a secondary data analysis contributes to saving the amount of time required for a study. All the critical steps of any research to obtain final datasets including preparation, data collection, data entry, data processing and cleaning can be a lengthy process. Key phases of designing and conducting a survey may take several months or even years depending on the scope of the study, however, the secondary data analysis can bypass these stages.

3.4 Datasets of the present study

The DHS Programme shared the researcher with the raw datasets of the Myanmar 2016 DHS to use for academic purpose. The approval letter and link to download the datasets can be seen in Annex 4, Page 191. Since the DHS Survey produced several datasets of households, women, men and children, to address the research questions of the present study, it was required to prepare integrated datasets for the present thesis extracting relevant variables from different datasets. For instance, child mortality data were in one dataset that covered information about all children ever born to the respondents (mothers aged 15-49 years) while data related to child morbidities such as stunting, pneumonia and diarrhoea were provided in another dataset which consisted of information on children who were born by the

interviewed mothers during the past five years. While data about mothers was in the 'Women Dataset' and data about fathers (or partners) was in the 'Men Dataset', data related to the confounding variables at family level were in the 'Household Dataset'. Out of several data files produced by the Myanmar DHS survey, five main datasets were prepared for the present thesis by extracting and integrating relevant variables from different datasets using unique identifiers such as code numbers of clusters, households and individuals. Table 3.2 provides an overview of the three integrated datasets used for the present study.

Table 3.2: Five datasets used in the analysis

No	Dataset	Dependent variables	Number of Mothers	Number of Children	Number of children after multiple births excluded*
1	Children ever born by interviewed mothers	Neonatal mortality	7,796	22,562	22,140
2	Children born by interviewed mothers excluding those who were born within a year prior to the survey data collection	Infant mortality	7022	n/a**	19,663
3	Children born by interviewed mothers excluding those who were born within five years prior to the survey data collection	Under-five mortality	5,824	n/a**	16,309
4	Children born by interviewed mothers during past five years before the survey	Stunting, Occurrence of pneumonia Occurrence of diarrhoea Treatment of diarrhoea Treatment of pneumonia	3,861	4,815	4726
5	Children aged 12-23 months	Full Immunization	907	917	907

*Numbers are unweighted

** Datasets 2 and 3 are subsets of Dataset 1 and multiple births are excluded from Dataset 1.

Dataset 1 was used to find the association between maternal education and neonatal mortality. The dataset covered mortality information about all children ever born by the interviewed women aged 15-49 years. The dataset also included information on characteristics of women, children, households and partners or husbands of respective women.

Dataset 2 was used to find the association between maternal education and infant mortality. The dataset was extracted from the dataset 1 and covered mortality information about all children ever born by the interviewed women excluding those who were born within a year prior to the survey data collection. The reason for this exclusion was that this cohort of the children under one year old did not have a full exposure to be counted as infant death.

Dataset 3 was used to find the association between maternal education and under-five mortality. The dataset was extracted from the dataset 1 and covered mortality information about all children ever born by the interviewed women excluding those who were born within five years prior to the survey data collection. The reason for this exclusion was that this cohort of the children under five-year-old did not have a full exposure to be counted as under-five death.

Dataset 4 was used to find the association between maternal education and child morbidity which comprised of child stunting, pneumonia, diarrhoea, receiving appropriate treatment for pneumonia and diarrhoea, and information about women, children, households and partners or husbands. The DHS survey collected the above data only from the mothers who had delivered children during the past five years.

Dataset 5 was used to examine the association between maternal education and full immunisation status of children. Following the definition of the DHS programme, the data was collected from mothers who had children in the age group of 12-23 months only (DHS, 2012).

All children born as multiple births such as twins and triplets were excluded from the analysis since they had a higher risk of mortality and morbidity after birth compared to singletons (Singh and Kumar, 2013). As a result, 422 children from the dataset 1, 89 children from the dataset 4, and ten children from the dataset 5 were discarded respectively.

3.5 Description of the variables included in the analysis

The systematic literature review, the Mosley and Chen model and the conceptual model of the present thesis extensively discussed in Chapter 1 informed the selection of variables to address the research

questions (Mosley and Chen, 1984). In preparing the variables for data analysis, some variables were transformed and recoded while some were used as they were in the original DHS datasets shared by the DHS Programme.

3.5.1 Dependent variables

Nine dependent variables were identified as below to address the research objective of examining whether maternal education has independent effect.

Childhood mortality

1. neonatal mortality;
2. infant mortality;
3. under-five mortality;

Child undernutrition

4. stunting among children under five;

Pneumonia and receiving appropriate treatment

5. pneumonia among children under five;
6. receiving the appropriate treatment for pneumonia;

Diarrhoea and receiving appropriate treatment

7. diarrhoea among children under five;
8. receiving the appropriate treatment for diarrhoea; and,

Receiving full vaccination.

9. Full vaccination among children aged 12-23 months.

Childhood mortality: Binary variables were constructed for using data on age at death of the children. Neonatal mortality was denoted as 1 if the child died before 28 days of age and 0 otherwise; infant mortality as 1 if the child died before one year of age and 0 otherwise; and, under-five mortality as 1 if the child died before five years of age and 0 otherwise.

Child undernutrition: Out of the three main parameters of child undernutrition (stunting, wasting, low weight for age) available in the DHS datasets, only stunting was selected as an outcome variable for child undernutrition for the multivariate analysis because it is concerned with chronic undernutrition which is more related to social, cultural and economic background characteristics whereas other two parameters, wasting and low weight for age, are more concerned with acute undernutrition which can be largely contributed by short-term illnesses (WHO, 2006). The survey collected weight and height of the children born in the past five years before the survey, and respective z-scores were generated for height for age (stunting) using the WHO international reference population (WHO, 2006; DHS, 2013). A binary variable was created for stunting in comparison with the median benchmark of the reference population: 1 for those children whose height for age was less than two standard deviations of the median (stunting) of the reference population and 0 otherwise.

Diarrhoea and receiving the appropriate treatment: Diarrhoea among children under five was defined as those who had loose motions three times or more in a day within two weeks before the data collection (DHS, 2013). This information was collected from mothers or caregivers of children under five years of age. A binary variable was created denoting 1 for those children who had diarrhoea and 0 otherwise. The survey further asked mothers about the treatment received for the children with diarrhoea. Out of the different response options, receiving oral rehydration salt or homemade fluid to children for the treatment for diarrhoea was regarded as having received the appropriate treatment (DHS, 2013). A binary variable was created denoting 1 for children who received the appropriate treatment and 0 otherwise.

Pneumonia and receiving the appropriate treatment: Pneumonia among children under five was defined as those who had cough and rapid breathing which was not related to blockage at nose or throat within two weeks preceding the survey (DHS, 2012). A binary variable was created representing children who had those symptoms as 1 and 0 otherwise. The appropriate treatment for pneumonia was defined as those who had pneumonia receiving treatment from skilled health care providers such as doctors, midwives and nurses (DHS and MOHS, 2017). Those children with pneumonia who received the appropriate treatment were taken as 1 and 0 otherwise.

Receiving full immunisation: Children aged 12-23 months who received all types of childhood vaccination as recommended by the national immunisation guidelines of Myanmar are termed as fully immunised. The vaccines include Bacillus Calmette–Guérin (BCG), polio, diphtheria-tetanus-pertussis (DTP), hepatitis B, measles and rubella vaccines (DHS and MOHS, 2017). The information was collected from both vaccination cards and mothers' recall. The mothers were initially asked to show the vaccination cards, and information was collected from the cards if they were available. If the vaccination cards were not available, mothers were asked to recall whether the child had received all recommended vaccinations by probing one after another (DHS, 2012). According to the definition of this indicator, the information was collected from mothers who had children aged between 12 and 23 months only (DHS and MOHS, 2017). A binary variable was created with 1 for children who received full immunisation and 0 otherwise.

3.5.2 Study factor

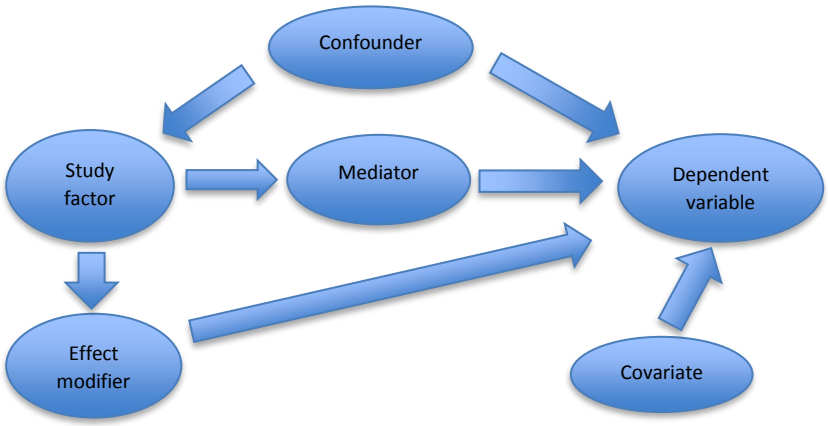
The study factor is the highest formal education level of mothers. The DHS survey measured the education level of all interviewed mothers using the highest number of years of completed formal education (DHS and MOHS, 2017). The number of completed years were grouped into four categories in line with the country's education system. Those who did not have formal education at all were denoted as 'no education'; those who studied at primary level (Grade One to Five) as 'primary'; those who studied at secondary level (Grade Six to Eleven) as 'secondary'; and, those who studied above secondary level as 'higher'. Grouping mothers' completed years of education as per the national education scheme enabled the examination of the threshold effect of maternal education on child health outcomes by mothers' education level (Basu and Stephenson, 2005; Vikram et al., 2012).

3.5.3 Independent Variables

Independent variables to be controlled by the multivariate analysis in eliciting the effect of maternal education on child health were identified as informed by the literature review. In screening possible confounders to include in the analysis, the relationship among the study factor, dependent variables and

independent variables was considered. Figure 3.1 summarises four types of possible relationship among the variables. The arrow heads in the diagram represent the direction of the relationship.

Figure 3.1: Confounder, mediator, effect modifier and covariate (Source: Kelson, 2014)



Confounders, by definition, are the variables that are associated with both dependent variable and study factor while they are not on the pathway between the former and the latter (Webb, 2011). On the other hand, mediators are the ones lying on the causal pathway between the study factor and the dependent variable mediating the effect of the former on the latter (MacKinnon et al., 2000). Inclusion of mediating variables or mediators in the multivariate analysis as independent variables can reduce the effect size of the study factor masking or diminishing its independent effect on the dependent variable (Richiardi et al., 2013). In the present research, possible mediators such as maternal occupation and mother's parity which could be lying on the causal pathway between maternal education and child health outcomes were not included in the multivariate analysis although they were used as potential confounders in other studies identified by the literature review.

While some variables were standing out as possible confounders or mediators, some were found to be having multiple roles depending on the context and the way the relationship among the variables is conceptualised. For instance, paternal education could be conceptually regarded as a possible confounder since it could influence both maternal education and child health. On the other hand, it could be regarded as a mediating variable since educated women are more likely to get married with educated

men. However, the current analysis did not reveal such a strong pattern since only 48 % of women with higher education had husbands or partners at the same education level.

The household wealth status variable could be associated with maternal education and child health as a possible confounder in a way that women from more prosperous families could have better access to education while wealth also can lead to improved utilization of child health services. On the other hand, household wealth could also be a mediator lying on the pathway between maternal education and child health since better-educated women could contribute to improved household income which in turn enables better access to quality health care for their children. Nevertheless, the 'household wealth status' variable was included into the analysis as a possible confounder since it is important to control for its effects on child health outcomes and it is not easy to determine from the survey data to what extent the family wealth comes from mothers' education level.

Mother's parity could be a mediator in the relationship between maternal education and child health since, compared to uneducated ones, educated mothers may be more likely to adopt birth spacing practices and have fewer children which could result in better child health outcomes. Parity was excluded from the multivariate analysis.

Some variables can contribute to the relationship between maternal education and child health through effect modification or interaction. Effect modifiers are the variables that influence the established effect of the study factor on the dependent variable changing magnitude or direction of the relationship (Bland, 2002). A good example of an effect modifier is the residential status of the family either residing in urban or rural since it can modify the effect of maternal education on child health. For instance, a beneficial effect of high maternal education on child health could be enhanced due to the family's urban residential status where health facilities are more accessible than in rural, while the effect could be reduced if they live in rural regions where access to quality health services is limited. The reverse can be true for uneducated mothers who live in urban areas where the family can readily access health services regardless of mother's education level. On the other hand, rural/urban residence can be conceptualised as a confounder too due to its influence over both maternal education and child health.

Covariates are the variables that are strongly associated with the dependent variable but are not associated with the study factor (Kelson, 2014). Examples of the covariates in the present research are age and sex of the children. While these variables are associated with their health status, it is not very plausible for them to influence maternal education. The variables such as the use of safe water supply, safe sanitation facilities, and biomass fuel in cooking can be either covariates or mediators. Although mothers' education level may influence the use of safe water and sanitary latrine, the choice of these facilities can depend on the households' affordability. These variables were thus excluded in the analysis because of their strong association with household wealth status and they should not be analysed in multivariate models as independent variables together with household wealth (al-Mazrou et al., 1991; Shukr et al., 2009; Ntenda et al., 2014; Moschovis et al., 2013).

Some variables used in the studies included in the literature review were initially considered as possible confounders but excluded from the multivariate analyses of child mortality because of their recent nature. The data related to children ever born by the interviewed mothers aged 15-49 years could span over thirty years before the survey while the variables such as father's occupation, mother's occupation and living with grandmother (mother or mother-in-law) could be reflecting the present status of the families. Predicting the events such as child deaths that happened long time ago using the current status variables may not be conclusive and thus such variables were excluded from the analysis.

Independent variables used in the multivariate analysis are as below:

Paternal education: The education level of all interviewed fathers was measured by the DHS survey as the highest number of years of completed formal education which was categorised into four groups as per the national education system (DHS and MOHS, 2017). The coding was performed in the same way as maternal education mentioned above.

Paternal occupation: The primary survey collected information on the employment status of both mother and father. The employment groups are: no work, professional/managerial, clerical/sales, agricultural self-employed, agricultural employee, unskilled labour and skilled labour. A categorical variable was developed with those employment groups being coded accordingly. Paternal occupation

was excluded from the mortality analysis since it reflects the current status and child mortality data spanned for almost three decades prior to the survey data collection. However, it was included in the analysis related to child morbidity and health services utilisation which are of more recent nature and use the data of children born within five years prior to the survey.

Maternal reproductive characteristics: The literature review identified that maternal reproductive characteristics which could influence child health are maternal age at childbirth, parity of mother, and preceding birth interval (Kilfoyle et al., 2016; Nusair et al., 2016; Brown et al., 2015). However, as discussed above, mother's parity was excluded from the analysis.

- Maternal age at child birth in continuous variable was transformed into a categorical variable with four group: under 19 years, 20 – 29 years and 30 and above, and coded accordingly.
- Preceding birth interval in the number of years in the original dataset was converted into a categorical variable with three groups: no preceding birth; preceding birth less than two years; and two years and above.

Children's characteristics: Age of child as at the time of the survey data collection and the child's sex were included.

- Age of the child was transformed into a categorical variable with five groups denoting 1 for children who are under one year, 2 for those who are between one and two years, 3 for those between two and three years, 4 for between three and four years, and 5 for between four and five years.
- Child's year of birth was included in the analyses to control for the variation of child mortality patterns over time.
- Sex of the child was denoted as a dichotomous variable with 1 for male and 0 for female.

Household wealth status: The DHS survey did not collect household income because of poor reliability of the income information reported in the household surveys in the developing countries (DHS, 2012). The survey instead collected the number and type of the asset items owned by the households as observed by the survey team and calculated household wealth level (DHS, 2012). The asset items ranged

from television, bicycle, motorcycle, car and radio to toilet facilities and materials used for roof, floors and walls of the dwellings. The factor analysis was used to calculate the score or wealth index of each household which were then ranked and grouped into five wealth quintiles to represent the wealth level of the surveyed households.

Urban-rural residential status of households was represented with a binary variable denoting 1 for urban residents and 0 for rural ones. The sampled areas and households of the primary survey were allocated into urban or rural regions in line with the master sampling frame produced by the National Population Census 2014 (DHS and MOHS,2017).

3.5.4 Proxy variables for pathway analysis

The analysis examined five possible pathways of influence through which maternal education might impart its effect on child health. The pathways are maternal health knowledge, maternal literacy, maternal health-related behaviour, maternal autonomy and maternal income. Proxy variables were selected from the DHS datasets to represent the pathways.

- Mother's knowledge about the illness symptoms of children which require immediate medical attention was used as a proxy variable for maternal health knowledge. These symptoms include difficulty in breathing, convulsions, passing blood in stool, skin rashes, being unable to drink and continuous vomiting. A binary variable was created with 0 for the mothers who did not know any of the above symptoms and 1 for those who knew at least one symptom.
- Literacy status of the respondents was selected to represent maternal literacy. The DHS survey assessed the ability of mothers in reading a paragraph in local language. The mothers who could read the full paragraph were taken as literate or else otherwise, and a binary variable was created accordingly (DHS, 2017).
- Mothers having taken antenatal care during their last pregnancy for at least four times was designated as a proxy for mother's health-related behaviour since antenatal care is free of charge in the study setting. Minimum four times of antenatal care is recommended by World Health Organisation (WHO) to have positive outcomes for both mother and child (Chalmers et

al., 2001). A binary variable was developed with 0 for the mothers who had not used the recommended four times of antenatal care during their last pregnancy and 1 for those who had. This information is not available in the dataset 1 (children ever born to the interviewed mothers) and thus the behaviour pathway was not tested for the relationship between maternal health-related behaviour and childhood mortalities.

- As a proxy variable for maternal autonomy, the mother's report of whether she could decide by herself for her child to receive medical treatment was selected. Those who reported that they did not need to discuss with husbands or partners for medical treatment of her children were taken as being autonomous or else otherwise.
- For maternal income, since the primary survey DHS did not collect income information of the mothers, household wealth level was used as a proxy assuming that mother's level of education contributed to household wealth level.

3.6 Statistical analysis

In preparation of the statistical analyses, missing data were assessed and appropriately addressed in all the three datasets and the degree of correlation among independent variables examined. Main statistical analyses were descriptive, bivariate, multivariate and pathway analyses. Sampling weights were incorporated in the data analysis to ensure national representativeness of the findings. The IBM SPSS Complex Samples version 25.0 was used for statistical analyses.

3.6.1 Addressing missing data

Missing data is critical in any statistical analysis since it can introduce errors to the findings unless appropriately addressed. If missing data are not identified and treated, statistical packages by default automatically exclude missing values resulting selection bias to the survey sample with incorrect inferences (Allison, 2002). It is thus critical to detect the amount of missing data and the pattern of missingness and address appropriately prior to data analysis (Graham, 2009). For the present research, the extent of missing data in the three datasets was assessed using the descriptive analysis of each

variable included in the analysis, followed by exploring the patterns of missingness by multivariate methods. Based on the patterns of the missing data identified, missing values were imputed accordingly.

In the dataset 1 (children ever born), the descriptive analysis showed that only four independent variables had few missing values which were less than 10 in each variable. Binary variables were created for the variables with the missing values (1=missing, 0=observed) and the association between them and other variables was assessed using logistic regression having the missing variable as a dependent variable (Little and Rubin, 2014). It was found that the missing values were not associated with other variables and hence the pattern of missingness was determined as 'missing completely at random' (MCAR) (Little, 1988). Since the pattern is MCAR and the missing values were of a small number, the listwise deletion method was undertaken for the dataset 1 removing all the cases with missing values (Little and Rubin, 2014). This approach took out a total of 18 cases from the dataset 1(0.07% of total cases).

Dataset 2 and 3 were not screened for missing data as they are subsets of the dataset 1.

In the dataset 4 (children born in the past five years), 349 out of 4570 cases, 7.63 % of the children under five years of age, did not have data related to stunting. The DHS report mentioned that data entry and data processing of anthropometric measurement (height and weight) of the children were strictly controlled and unreliable measurements were not entered and listed as missing in the original DHS datasets (DHS and MOHS, 2017). To address this, the pattern of the missing data was examined as above recoding the stunting variable into a 'missing' binary variable with 1 for missing values and 0 for observed. The logistic regression on the 'missing' binary variable with other variables in the same dataset revealed that the missingness was significantly associated with some variables including maternal education level, child's sex, household wealth level and place of residence (urban or rural). More missing values were observed in the cases (children) with lower maternal education, rural residence, younger age of child and poor household. Thus, the pattern of the missing data in the dataset 2 was determined as 'missing at random' (MAR) (Horton and Kleinman, 2007; Allison, 2002). In addition to the stunting variable, four independent variables were showing missing values in the dataset

2. The extent was below 10 missing cases in each variable. Nevertheless, these missing data were not associated with other variables in the dataset.

Considering the magnitude and patterns of the variables with missing data in the dataset 2, the multiple imputation (MI) method was applied to impute possible values for the missing data (Schafer, 1999). The MI method is recommended to use in a situation like MAR where the variables with missing data are associated with other variables in the model. The key advantage of the MI method is that it retains the correlation among all the variables (Sterne et al., 2009). Applying the MI method, five regression models were built with each model generating possible values for the missing data of the stunting variable and others in the dataset 2. Pooled data of the five regression models were taken to replace all the missing values in the dataset (Schafer, 1999).

In the dataset 5 (vaccination), the descriptive statistics did not detect any missing value of the variables included in the analysis. This completeness could be contributed by a much smaller sample size of the target population (children aged 12-23 months) for child immunisation.

3.6.2 Assessing correlation among independent variables

The degree of correlation among the selected independent variables was assessed before conducting the multivariate analyses. Entering highly correlated predictor variables into regression model could result in erroneous findings around regression coefficients and standard errors of the study factor (Mukaka, 2012). The correlation between the pairs of the independent variables was tested by generating Spearman's rank correlation coefficients. The pairs of independent variables that had highest correlation coefficients were reported in Table 3.3.

Table 3.3: Pairs of the independent variables with high Spearman's correlation coefficients in the three datasets* (ranked from largest to smallest)

Pairs of Independent Variables	Dataset 1	Dataset 4	Dataset 5
Maternal education and father's education	0.53	0.54	0.48
Wealth status and place of residence	-0.48	-0.5	-0.55
Wealth status and father's education	0.37	0.42	0.42
Father's education and place of residence	-0.32	-0.34	-0.35
Maternal education and place of residence	-0.31	-0.39	-0.39

*Datasets 2 and 3 are not included as they are subsets of the dataset 1

The pairs of independent variables which had the highest level of Spearman's correlation coefficients were maternal education and paternal education, household wealth status and urban/rural residence, maternal education and household wealth status, maternal education and urban/rural residence. The signs of correlation coefficients indicate the direction of the relationship being either positive or inverse relationship. According to the 'Rule of Thumb in Interpreting Correlation Coefficients', two of the above pairs were moderately correlated (correlation coefficient 0.50-0.70) while none of them demonstrated high correlation (0.70 – 0.90) nor very high correlation (correlation coefficient 0.9-1.0) (Lee Rodgers and Nicewander, 1988; Taylor, 1990). Since there are no highly correlated pairs of the independent variables and the moderate level of correlation among independent variables does not have implications on regression analysis, it is acceptable to include all the selected independent variables into the regression models (Taylor,1990).

3.6.3 Descriptive analysis and bivariate analysis

The descriptive analysis examined the distribution of all variables included in the analysis from the three datasets reporting frequencies and percentages. The bivariate analysis between the independent variables and dependent variables used Chi square tests reporting bivariate associations and related statistical significance.

3.6.4 Multivariate Analysis

Logistic regression was applied in examining the effect of maternal education on nine child health outcomes. Possible confounding factors were controlled in the analysis producing nine statistical models as shown in Table 3.4. While the same set of independent variables were included in all the nine statistical analyses, a few variables were specific to child health outcomes as indicated in Table 3.4.

Table 3.4: Nine statistical models

<table>
<tr><th>Statistical model and dependent variable</th><th>Dataset used</th><th>Independent Variables[4]</th></tr>
<tr><td>Model 1 – neonatal death</td><td>Dataset 1
(Children ever born by interviewed mothers)</td><td rowspan="5"><u>Study Factor</u>
Maternal education

<u>Individual level</u>
Husband/partner’s education
Husband/partner’s occupation (Model 4-9)
Maternal age at child birth
Preceding birth interval
Sex of child
Age of child (Model 4-8)
Year of birth of child (Model 1-3)

<u>Household level</u>
Household wealth status

<u>Community level</u>
Urban/rural residence</td></tr>
<tr><td>Model 2 – infant mortality</td><td>Dataset 2
(Children ever born by interviewed mothers excluding those who were born within a year prior to the survey data collection)</td></tr>
<tr><td>Model 3 - under-five mortality</td><td>Dataset 3
(Children ever born by interviewed mothers excluding those who were born within five years prior to the survey data collection)</td></tr>
<tr><td>Model 4 – stunting
Model 5 - diarrhoea
Model 6 - pneumonia
Model 7- appropriate treatment for diarrhoea
Model 8 - appropriate treatment for pneumonia</td><td>Dataset 4
(Children born five years before the survey)</td></tr>
<tr><td>Model 9 – full immunisation</td><td>Dataset 5
(Children aged 12-23 months at the time of the survey)</td></tr>
</table>

[4] Some independent variables were included only in the models specified in parenthesis.

Since all the nine dependent variables were binary ones, and independent variables being categorical in nature, a form of generalised linear modelling, the stepwise multiple logistic regression method, was employed (Bland, 2002; Hosmer Jr.D. W et al., 2013). With the application of the maximum likelihood method, observed data were fitted into the logistic regression models estimating the probability of the event adjusting for independent variables. The likelihood ratio test was used in testing regression coefficients, and standard errors of the coefficients were generated (Rossi, 2010). The equation of multiple logistic regression with binomial error distribution and a logit link function is as below (Hosmer Jr.D.W. et al., 2013):

$$\text{Ln}(P) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots + \beta_n x_n + \sum$$

Ln = logit transformation

P = probability of an event (e.g. death of child)

α = intercept constant

β = regression coefficient

x = independent variable

$\sum$ = error term

While α represented the level of the dependent variable, the sign and extent of regression coefficient (β) indicated direction and magnitude of the effect size. Adjusted odds ratios of all the independent variables were reported exponentiating regression coefficients (exp (β)). For categorical variables, the lowest level was set as a reference category, and the effect sizes of other levels were reported in relation to the reference category.

In the analysis of each model, the independent variables were sequentially added to the model in five batches. The first batch consisted of the study factor (maternal education) and the dependent variable (child health outcome) only. The second batch added father's education level to the first model, while the third one included father's occupation (child morbidity and health services utilisation), preceding birth interval and maternal age at child birth to the second model. The fourth batch added child's sex,

age and year of birth to the third model, while the fifth one added household wealth status and geographic residence to the fourth model. Changes in effect sizes of maternal education and their statistical significance were assessed throughout the stepwise regression process as the batches of the variables were entered the analysis.

Furthermore, the effect modification of the relationship between maternal education and child health outcomes was examined adding interaction terms into the fifth batch of each of the statistical model of respective child health outcomes. The interaction terms were constructed pairing the study factor (maternal education) and each of the independent variables. The aim was to find out whether the effect of maternal education on child health outcomes was modified by or varied with the independent variables (Rossi, 2010).

In addition, multiple testing correction was conducted to examine the possible influence of Type I error. In assessing whether there is an independent association between maternal education and child health outcomes, as indicated above, nine statistical models were constructed using regression analysis running five significant tests in each statistical model with a stepwise inclusion of potential confounding variables resulting forty-five significance tests in total. Conducting many significance tests with a common dependent variable increases the risk of obtaining Type I error since the likelihood of producing statistically significant findings by pure chance increases with the number of significance tests (Streiner et al, 2011). To adjust for this, multiple testing correction was conducted using the Bonferroni method where the p values were altered to more stringent ones making them less vulnerable to Type 1 error (Bland et al, 1995). The p values produced by the statistical analysis were compared against the adjusted p value to determine their significance.

3.6.5 Pathway analysis

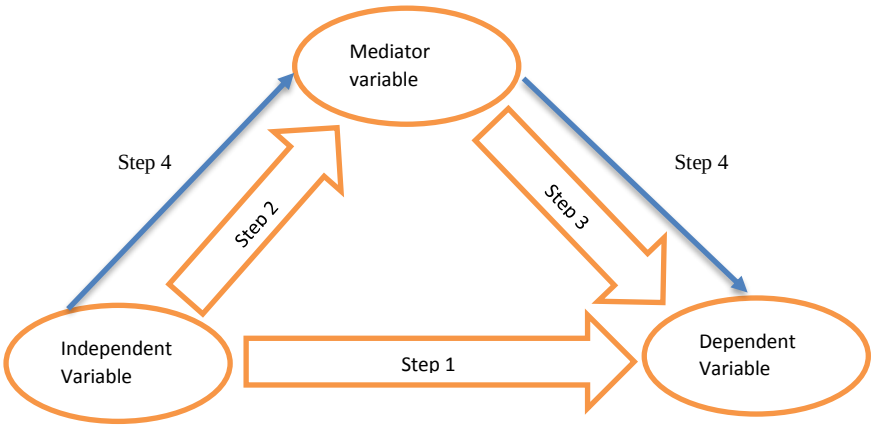
The pathway analysis examined whether possible pathways mediated the relationship between maternal education and child health outcomes. The analysis assessed five possible pathways: maternal literacy, maternal health knowledge, health-related behaviour, maternal income and maternal autonomy. The variables which were used as proxies for possible pathways were discussed in session 3.6.4.

The pathway analysis employs the four-step regression method of the mediation analysis (Baron and Kenny, 1986). This approach has been widely used and extensively referenced in the mediation literature (Hayes, 2009; Zhao et al., 2010). The Sobel Test for mediation was conducted to assess the significance of the mediation effect (Preacher and Leonardelli, 2009). According to Baron and Kenny (1986), for a variable to be mediating the relationship between an independent variable and a dependent variable, the independent variable must influence the mediating variable which in turn must be associated with the dependent variable. This approach informs the concept of comparing the magnitude of regression coefficients and statistical significance of regressions between direct effect and indirect effect. The direct effect entails the effect of the independent variable on the dependent variable, whereas the indirect effect means the effect of the same independent variable on the dependent variable through a mediator or mediating variable. In the presence of a mediator in the relationship, the independent variable should have a smaller effect compared to its direct effect on the dependent variable.

The method comprises four steps of regression modelling which are represented with arrows in the Figure 3.2:

- Step 1: A simple regression of an independent variable with a dependent variable;
- Step 2: A simple regression of an independent variable with a mediator variable;
- Step 3: A simple regression of a mediator variable with a dependent variable; and,
- Step 4: A multiple regression of both the independent variable and the mediator with a dependent variable.

Figure 3.2: The four-step mediation analysis



According to Baron and Kenny (1986), if the regression analyses in Steps 1-3 do not show statistical significance in any step, it is not necessary to continue to Step 4 since there is no mediation at all. If all Steps 1-3 are significant, the analysis proceeds with Step 4. In Step 4 or the multiple regression which includes both independent variable and mediating variable, if the magnitude of regression coefficient of the independent variable reduces from its initial value in Step 1, it can be regarded that that the pathway variable is mediating the relationship. The extent of mediation is to be further determined by the level of statistical significance. If both the independent variable and the mediator are significant in Step 4, there is partial mediation, whereas, if the independent variable which is significant in Step 1 turns out to be insignificant while the mediator is significant in the regression where both variables are included, there is a full mediation effect (Baron and Kenny, 1986). The significance of the mediation effect was assessed by the Sobel test (Sobel, 1986). The Sobel test determines whether the decrease in the effect of the independent variable after adding the mediating variable into the regression model is a significant reduction.

The Sobel test was selected for the mediation analysis of the present thesis because of the large sample size of the DHS data since the Sobel test performs best with large datasets (Preacher and Leonardelli, 2009). Further, the pathway analysis of the present research is straightforward as it aims to examine the mediating effect of a single variable at a time on the relationship between an independent variable and a dependent variable at one level. In complex mediation analyses that include estimating the effect of

multiple mediating variables at multiple levels, it is recommended to use more advanced analytical methods such as bootstrapping (Preacher and Hayes, 2004).

3.7 Research ethics

All relevant ethical considerations were strictly adhered to in undertaking the present research especially in handling the primary survey data for a secondary analysis. The ethical approval for the thesis was granted by Lancaster University's Faculty of Health and Medicine Research Ethics Committee (FHMREC) (Annex 6, Page 222). Upon the request of the researcher, the DHS Programme provided permission to use the Myanmar 2015-2016 DHS data for the doctoral research and shared the primary datasets. The approval message from the DHS programme can be found in Annex (Annex 4, Page 191).

In conducting the primary study, the DHS Programme obtained ethical approval from the Independent Review Body (IRB) of the USAID (DHS and MOHS, 2017). The documentation of the DHS survey in the main report indicated that, during the filed data collection, the DHS survey team provided a detailed explanation to household heads or responsible adults regarding the purpose of the survey. The approval was taken from the household heads or eligible adults of the selected households, whereas, the informed consent, which covered the possible use of the primary data for further analysis, was received from every respondent to participate in the survey (DHS and MOHS, 2017). Anonymity and confidentiality of the survey data were reassured to the respondents and strictly adhered by the DHS survey team throughout the data collection and data processing processes (DHS and MOHS, 2017). Ensuring the privacy of the DHS survey data, all data items related to individuals, households and clusters were recorded by the DHS Programme using unique identifiers so that it is impossible to associate the data with respective individuals or households.

For the present study, the researcher was responsible for secure storage of the primary survey data. Throughout the research process, a strong password was used to log on the encrypted laptop and external hard drive that stored the data. Since the data are owned by the DHS Programme and the researcher had

to request the access the data to conduct a secondary analysis for this thesis, any requests for data sharing from third parties will be referred to the DHS Programme.

CHAPTER 4

FINDINGS

4.1 Overview

This chapter reports key findings generated by the data analysis. The descriptive analysis provides summary statistics of the variables included in the analyses; the bivariate analysis highlights the relationship between the independent variables and dependent variables; while, the multivariate analysis examines whether the study factor, maternal education, has an independent effect on child health outcomes adjusting for the effects of possible confounders. Finally, the pathway analysis assesses the plausibility of five possible pathways in mediating the effect of maternal education on child health.

4.2 Descriptive Analysis

The descriptive statistics of the dependent and independent variables were reported in Table 4.1 and Table 4.2 respectively. In Table 4.1, the dependent variables were categorized into three child health outcome groups: childhood mortality, child morbidity and child health services utilisation. The denominators were different across the three outcome groups since the analysis used data from three different datasets.

Table 4.1 indicated that almost one tenth of the children ever born alive did not reach their fifth birthday. Specifically, 3.6% of children died before 28 days (neonatal death), 7.4% died before one year of age (infant death), and 10.3% died before five years of age. In relation to child morbidity, almost one third, 29.0%, of the children under five years of age, were stunted or not reaching ideal height for their age. 10.6% the children under five years had diarrhoea, and 5.2% had symptoms of pneumonia in the last two weeks prior to the survey data collection. Of those children who had diarrhoea, 63.0% received the appropriate treatment while 50.9% of the children who had pneumonia received the appropriate

treatment. In addition, only half of the children between 12-23 months, 54.8%, received full doses of vaccination as per the national immunisation guidelines[5].

Table 4.1: Descriptive statistics of dependent variables

Variables	Male (number)	Female (number)	Total		Sample size	Dataset
			Number	Percentage		
Child mortality						
Died before 28 days of age	425	313	738	3.6	20659	(1) children ever born
Died before one year of age	829	632	1461	7.4	19662	(2) children born one year before the survey
Died before five years of age	927	745	1672	10.3	16309	(3) children born five years before the survey
Child morbidity						
Under five children who were stunted	653	526	1179.0	29.0	4036	(4) children under five years of age
Under five children who had diarrhoea	225	202	427.0	10.6	4036	(4) children under five years of age
Under five children who had pneumonia	123	85	208.0	5.2	4036	(4) children under five years of age
Child health services utilisation						
Under five children with diarrhoea who received appropriate treatment	154	115	269.0	63.0	427	(4) children under five years of age
Under five children with pneumonia who received appropriate treatment	63	43	106.0	50.9	208	(4) children under five years of age
Children (12-23 months) who received full immunization	275	192	467.0	54.8	852	(5) children between 12-23 months

Table 4.2 summarises descriptive statistics of the independent variables in the three datasets. Some of the key findings include almost a quarter of the respondents , 24.4% of mothers and 23.3% of fathers, did not have formal education at all; 30% of fathers engaged in agricultural work and 40% worked as unskilled labour; and, 78% of the populations lived in rural areas.

The descriptive findings indicated that births were under-represented in richest households and over-represented in poorest households. This variation could be due to the assignment of household wealth indices and wealth quintiles calculated from the household dataset to the individuals of the respective households (children and women) from the individual level datasets. Since all the five datasets used in

[5] Before the age of one year, every child must complete Bacillus Calmette–Guérin (BCG), three doses of oral polio vaccine, diphtheria-tetanus-pertussis (DTP), hepatitis B, measles and rubella vaccines.

the present study are the children's datasets, the descriptive analysis resulted in an over-representation of poorest households as there were more children born in the poor households than the rich ones.

Table 4.2: Descriptive statistics of independent variables in the datasets

Variables	Dataset 1		Dataset 2		Dataset 3		Dataset 4		Dataset 5	
	Number	%	Number	%	Number	%	Number	%	Number	%
Maternal education										
No education	4309	24.4	4988	23.3	5186	23	721	17.9	124	14.5
Primary	9134	51.8	10832	50.6	11299	50.1	1845	45.7	391	45.9
Secondary	3624	20.5	4763	22.2	5147	22.8	1161	28.8	266	31.2
Higher	583	3.3	827	3.9	912	4.1	309	7.7	71	8.3
Paternal education										
No education	3726	21.1	4389	20.5	4583	20.3	715	17.7	153	18
Primary	7616	43.2	9141	42.7	9538	42.3	1697	42	321	37.7
Secondary	5421	30.7	6722	31.4	7179	31.8	1390	34.5	322	37.8
Higher	886	5	1158	5.4	1244	5.6	233	5.8	56	6.5
Paternal occupation										
No work	209	1.2	247	1.2	256	1.1	0	0	0	0
Professional/managerial	1139	6.5	1418	6.6	1507	6.7	258	6.4	63	7.4
Clerical/sales	1227	7	1480	6.9	1572	7	352	8.7	84	9.9
Agricultural self employed	3919	22.2	4699	21.9	4922	21.8	747	18.5	150	17.6
Agricultural employee	1466	8.3	1757	8.2	1827	8.1	304	7.5	53	6.2
Unskilled labour	7134	40.4	8576	40.1	9027	40	767	19	165	19.4
Skilled labour	2556	14.5	3233	15.1	3433	15.2	1607	39.8	337	39.5
Maternal age at child birth										
Under 19	6913	39.2	8061	37.7	8366	37.1	1175	29.1	235	27.6
20-29	10094	57.2	12407	57.9	13135	58.3	2494	61.8	538	63.2
30 and above	643	3.6	942	4.4	1043	4.6	367	9.1	78	9.2
Preceding birth interval										
No preceding birth	6141	34.8	7349	34.3	7734	34.3	1434	35.5	318	37.3
Less than 2 years	3333	18.9	3813	17.8	3946	17.5	379	9.4	70	8.2
Above 2 years	8176	46.3	10248	47.9	10864	48.2	2222	55.1	464	54.5
Child's sex										
Male	9199	52.1	11183	52.2	11764	52.2	2097	52	475	55.8
Female	8451	47.9	10227	47.8	10780	47.8	1939	48	377	44.2
Child age										
under 1							799	19.7		
1to 2							837	20.6		
2 to 3							780	19.3		
3 to 4							846	21.1		
4 to 5							772	19.3		
Household wealth status										
Poorest	4472	25.3	5670	26.5	5983	26.5	1206	29.9	240	28.1
Poor	4090	23.2	4932	23	5187	23	880	21.8	187	22
Middle	3735	21.2	4396	20.5	4621	20.5	671	16.6	135	15.8
Rich	3048	17.3	3664	17.1	3866	17.1	696	17.2	147	17.2
Richest	2305	13.1	2748	12.8	2887	12.8	583	14.5	144	16.9

Variables	Dataset 1		Dataset 2		Dataset 3		Dataset 4		Dataset 5	
	Number	%	Number	%	Number	%	Number	%	Number	%
Residence										
urban	3804	21.6	4580	21.4	4821	21.4	909	22.5	220	25.9
rural	13846	78.4	16830	78.6	17723	78.6	3127	77.5	631	74.1

*****'Child age' is not applicable for the datasets 1,2,3 and 5.

4.3 Bivariate Analysis

The bivariate analysis examined the relationship between every dependent variable and independent variables using Chi square tests producing statistical significance levels of the association. The association was tested in the three groups of dependent variables: childhood mortalities, childhood morbidities and health services utilisation. Table 4.3 below demonstrates the findings related to the association between childhood mortalities and independent variables, while other Tables can be found in Annex 3, Page 174.

4.3.1 Childhood mortalities

Table 4.3: Bivariate association between childhood mortalities and independent variables

Independent Variables	Neonatal mortality		Infant mortality		Under-five mortality	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
Maternal education		0.000		0.000		0.000
No education	4.7		9.8		14.3	
Primary	3.3		7.3		10.1	
Secondary	2.9		4.8		6.6	
Higher	2.3		2.6		3.5	
Paternal education		0.000		0.000		0.000
No education	4.1		9.3		13.6	
Primary	3.7		7.7		10.9	
Secondary	2.9		5.3		7.2	
Higher	3.0		4.2		5.6	
Paternal occupation		0.000		0.000		0.000
no work	2.0		5.7		8.6	
professional/managerial	2.8		4.7		6.9	
clerical/sales	2.1		4.7		6.3	
agricultural self employed	3.8		8.6		12.6	

Independent Variables	Neonatal mortality		Infant mortality		Under-five mortality	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
agricultural employee	3.7		7.1		10.6	
unskilled labour	4.0		8.1		11.3	
skilled labour	2.6		5.0		6.6	
Maternal age at child birth		0.295		0.000		0.000
Under 19	3.8		8.3		12.0	
20-29	3.4		6.5		9.1	
30 and above	3.4		6.3		8.7	
Preceding birth interval		0.000		0.000		0.000
No preceding birth	3.9		7.3		10.0	
Less than 2 years	5.8		12.4		16.8	
Above 2 years	2.4		5.2		7.7	
Child sex		0.002		0.000		0.001
male	3.9		7.9		10.9	
female	3.1		6.4		9.4	
Household wealth status		0.000		0.000		0.000
poorest	4.2		9.5		14.7	
poorer	4.0		8.3		11.4	
middle	3.4		7.1		9.5	
richer	2.9		5.1		4.0	
richest	2.1		3.4		4.7	
Residence		0.000		0.000		0.000
urban	2.0		4.1		5.5	
rural	3.9		8.0		11.5	

In Table 4.3, the bivariate analysis revealed that maternal education was significantly associated with the three mortality variables indicating that childhood mortalities reduced with the improved level of mother's education. Further, the mortality variables were significantly associated with all other independent variables except the 'maternal age at child birth' variable which was not significantly associated with neonatal mortality. A significant association was observed between father's education level and childhood mortalities in a way that children of fathers with low levels of education were more likely to die prematurely. Fathers working in the 'unskilled labour' category experienced the highest incidence of child death. Mothers who are under 19 experienced higher rates of infant and under-five mortality though there was no significant difference with the neonatal mortality. Mothers who gave birth within two years of the preceding birth experienced the highest rate of childhood mortalities. Boys

were more likely to experience premature death than girls. Finally, wealthier households and those residing in urban areas experienced fewer childhood mortalities compared to poorer or rural households.

4.3.2 Childhood morbidities

The bivariate association between childhood morbidities and independent variables can be seen in Table 1 of Annex 3 (Page 174). Stunting was significantly associated with maternal education, and it was also associated with other independent variables including father's education and occupation. The stunting rate among the children increased as the education levels of fathers and mothers decreased. The children of fathers working in the 'unskilled labour' category experienced the highest prevalence of stunting. Boys were more stunted than girls and children aged 2-3 years had the highest level of stunting. Stunting was less common among the children of wealthier families than poorer ones and in families residing in urban than those in rural areas.

The occurrence of diarrhoea was not associated with maternal education and other independent variables. It was significantly associated with household wealth status and geographic residence of the household. Children from wealthier households and those living in urban areas had less chances of diarrhoea. Similarly, the occurrence of pneumonia was not associated with maternal education, but it was significantly associated with age and sex of the child and household wealth status. Younger children were more likely to get pneumonia than older ones where those who were in the age range of 1 to 2 years old had the highest incidence of pneumonia. Boys were more likely to get pneumonia than girls. As in other health outcomes, wealthier families had fewer cases of pneumonia compared to poorer families.

4.3.3 Child health services utilisation

The association between the utilisation of child health services and the independent variables can be seen in Table 2 in Annex 3 (Page 175). Receiving the appropriate treatment for diarrhoea was not associated with maternal education, but was significantly associated with father's occupation, preceding birth interval of mothers, and age and sex of the child. The children of fathers who worked in the

professional/managerial category were the ones who received the appropriate treatment compared to children of fathers working in other categories. Boys and children aged 4-5 years received the appropriate treatment for diarrhoea compared to girls and other age groups.

Receiving the appropriate treatment for pneumonia was significantly associated with maternal education in a way that children of better educated mothers were more likely to get the appropriate treatment. Other variables which were significantly associated with the pneumonia treatment were father's education, household wealth status and urban/rural residence. Children who worked in the 'professional/managerial' category received the appropriate treatment for pneumonia significantly higher than other categories. Children from wealthier households and those lived in urban areas were more likely to get the appropriate treatment for both diarrhoea and pneumonia.

Receiving full vaccination among children aged 12-23 months was significantly associated with maternal education and all other independent variables. Full vaccination rate among children increased with improved level of maternal education, and it was highest among the children of mothers with higher level of education. Similar findings were observed with paternal education. Children of fathers who worked in the 'skilled labour' category had the highest rate of full vaccination followed by those worked in the 'professional/managerial' category. Children of mothers aged over 30 years and those of mothers who had the birth interval of more than two years in their recent birth had the highest rate of full vaccination. Boys were more likely to get fully vaccinated than girls. As above, children from wealthier families and those who lived in urban area were fully vaccinated compared to those from poorer families and rural area.

4.3.4 Maternal education and household wealth status

To examine the variation of maternal education by household wealth status, the bivariate analysis was conducted between maternal education and household wealth level. Table 4.4 depicts the association between maternal education and household wealth in the largest dataset, dataset 1. The data showed that there was a stepwise gradient of the relationship between mother's education and household wealth demonstrating that mothers in wealthier households reported higher levels of education and those from

poor families were deprived of education. Among the poorest households, almost 40% of mothers did not have formal education at all, whereas, among the richest households, it was only 9.5%. On the other hand, only 6.9% of the mothers in the poorest households had higher education level (above secondary) compared with 64.2% from the richest households.

Table 4.4: Bivariate analysis between maternal education and household wealth level

Household Wealth Level		Maternal education level				Total
		No education	Primary	Secondary	Higher	
Poorest	Count	2049	2935	364	6	5354
	Percentage	38.3%	54.8%	6.8%	0.1%	
Poorer	Count	1164	2766	725	16	4671
	Percentage	24.9%	59.2%	15.5%	0.3%	
Middle	Count	790	2390	899	61	4140
	Percentage	19.1%	57.7%	21.7%	1.5%	
Richer	Count	535	1713	1125	171	3544
	Percentage	15.1%	48.3%	31.7%	4.9%	
Richest	Count	281	775	1267	627	2950
	Percentage	9.5%	26.3%	42.9%	21.3%	
Total						20659

4.4 Multivariate Analysis

The stepwise logistic regression approach was applied to examine the effect of maternal education on the nine dependent variables generating nine statistical models. As discussed in Chapter 3, possible confounding variables at individual, household and community levels were sequentially added to the analysis in five consecutive batches. The effect modification was examined entering interaction terms into the fifth batch of each of the statistical model of respective child health outcomes. The interaction terms are the pairs of maternal education and each of the independent variable.

The multivariate effect sizes were presented in adjusted odds ratios, standard errors and p values or statistical significance levels. Model statistics on goodness of fit were reported in Hosmer Lemeshow chi square test, its statistical significance and Nagelkerke pseudo R square. Details of these analyses and variables are discussed in Chapter 3.

4.4.1 Childhood Mortalities

The effect of maternal education was examined on three types of childhood mortality. Table 4.5 depicts the effect of maternal education on neonatal mortality, and other findings are in Annex 3 (Table 3 and 4 on Page 176 and Page 177 respectively).

4.4.1.1 Effect of maternal education on neonatal mortality

In Table 4.5, the univariate analysis, batch 1, revealed a strong statistical significance of the effect of maternal education on neonatal mortality. The significance levels of maternal education, however, became gradually attenuated in subsequent batches when confounding variables were sequentially added to the analysis. In the final model where household and community level confounding factors were included in the model, the net effect of maternal education completely disappeared as the association was not statistically significant anymore. Based on this finding, it can be concluded that maternal education did not have an independent effect on neonatal mortality while the effects of possible confounding variables were held constant.

The variables which were not significant in the final model were father's education and mother's age at child birth. The predictors of neonatal mortality which were statistically significant in the final model included preceding birth interval, child's sex, household wealth status and rural/urban residence. According to the final model, mothers who had shorter birth interval were more likely to experience neonatal mortality. The data revealed that compared to mothers who had no preceding birth, those who delivered another child within two years after the previous birth had 37%% increased risk of having neonatal death. Nevertheless, mothers who had more than two years birth interval experienced 36% reduction of neonatal mortality. Girls were 20% less likely to die than boys and households in the richest quintile had 38% reduction in the odds of neonatal mortality compared to the poorest ones. Children who lived in rural areas were 65% more likely to die than those who lived in urban areas.

Table 4.5: Model 1 - Stepwise logistic regression of maternal education on neonatal mortality adjusting for potential confounders (adjusted odds ratio (standard error) p value)

Sample size – 22,140 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.000	0.000	0.001	0.003	0.074
No education	reference	reference	reference	reference	reference
Primary	0.691(0.084) 0.000	0.698(0.090)0.000	0.734(0.091)0.001	0.742(0.091)0.001	0.765(0.092)0.004
Secondary	0.590(0.106) 0.000	0.620(0.119)0.000	0.644(0.122)0.000	0.694(0.123)0.003	0.846(0.127)0.188
Higher	0.475(0.230) 0.001	0.473 (0.267)0.005	0.499(0.271)0.010	0.546(0.272)0.026	0.825(0.284)0.498
Paternal education (P value)		0.240	0.241	0.272	0.263
No education		reference	reference	reference	reference
Primary		1.050(0.099)0.623	1.057(0.099)0.576	1.050(0.099)0.626	1.078(0.100)0.453
Secondary		0.886(0.115)0.292	0.891(0.116)0.320	0.895(0.116)0.342	1.021(0.118)0.857
Higher		1.135(0.253)0.618	1.131(0.254)0.627	1.133(0.255)0.624	1.582(0.263)0.081
Maternal age at child birth (P value)			0.729	0.824	0.587
Under 19			reference	reference	reference
20-29			0.941(0.077)0.433	1.001(0.080)0.991	1.016(0.080)0.845
30 and above			0.939(0.186)0.736	1.120(0.191)0.551	1.217(0.192)0.305
Preceding birth interval (P value)			0.000	0.000	0.000
No preceding birth			reference	reference	reference
Less than 2 years			1.351(0.093)0.001	1.395(0.094)0.000	1.370(0.094)0.001
Above 2 years			0.579(0.087)0.000	0.631(0.090)0.000	0.642(0.090)0.000
Child sex (P value)				0.004	0.003
male				reference	reference
female				0.808 (0.074) 0.004	0.805(0.074)0.003
Household wealth status (P value)					0.04
poorest					reference
poorer					0.995(0.098)0.958
middle					0.829(0.109)0.086
richer					0.784(0.127)0.056
richest					0.629(0.179)0.009
Residence (P value)					0.000
urban					reference
rural					1.652 (0.128) 0.000
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	3.04	12.973	14.362	5.61
Hosmer Lemeshow Test Significance	1.000	0.694	0.113	0.073	0.691
Nagelkerke Pseudo R square	0.004	0.006	0.014	0.062	0.072

4.4.1.2 Effect of maternal education on infant mortality

Findings in Table 3 (Annex 3, Page 176) indicated that maternal education had sustained statistically significant effects on infant mortality throughout the five batches of the analysis including the final model where potential confounders, household wealth and geographic residence, were included in the analysis. According to the final model, compared to mothers with no education, those with primary education had 13% reduction in the odds of infant mortality, those with secondary education had 22% reduction, and those with higher education had 47% reduction of infant mortality. It can be concluded that maternal education had an independent effect on infant mortality while the effects of all the confounding factors are held constant.

In the final batch of the stepwise regression, preceding birth interval, child's sex, household wealth status and rural/urban residence of the family were significantly associated with infant mortality. The findings indicated that mothers with shorter birth intervals were more likely to have increased infant mortality and compared to mothers who had no preceding birth, those who gave birth to another child birth within two years of the recent birth had 55% increased risk of infant mortality. Mothers who gave birth to another child two years after the preceding birth had 31% reduction of infant mortality. There was 19% reduced risk of mortality for infant girls compared to boys. Households in the richest quintile had 54% reduction in the odds of infant mortality compared to those in the poorest quintile. Families who lived in rural areas had 32% increased risk of having infant mortality compared to those lived in urban areas.

4.4.1.3 Effect of maternal education on under-five mortality

Maternal education was consistently and significantly associated with under-five mortality throughout the five batches of the stepwise regression analysis (Table 4, Annex 3, Page 177). In the final model, compared to mothers with no education, those with primary education had 17% reduction in the odds of under-five mortality; those with secondary education had 25% reduction; and, those with higher education had 48% reduction in the odds of under-five mortality. The conclusion can be made that

maternal education had an independent effect on under-five mortality while the effects of confounding variables were held constant.

At the final batch of the regression analysis, all the independent variables were significantly associated with under-five mortality. Father's education had an independent beneficial effect on under-five mortality though its effect sizes were not as large as those of maternal education. Regarding maternal characteristics, mothers who had child birth during 20-29 years of age had a reduction of under-five deaths by 12% compared to those who had child birth before 19 years, while those who had shorter birth intervals had increased odds of under-five child deaths. Mothers who had child births within two years of recent birth had 60% increase in the odds of under-five mortality. On the other hand, girls had 15% reduced risk in the odds of under-five mortality compared to boys. The richest households had 57% reduction of under-five mortality compared to the poorest households and rural residents had 38% increase in under-five mortality compared to urban populations.

4.4.1.4 Model fitness

The Hosmer Lemeshow tests were not statistically significant across all the three regression analyses of neonatal, infant and under-five mortality indicating that the model fitness was good across the mortality models since observed data and predicted data were no different. The pseudo R square of the models reported that the batch 5 is the best compared to other batches regarding the ability to predict variability in outcome variable by predictor variables in the model.

4.4.1.5 Effect modification

Effect modification of the effect of maternal education on childhood mortalities was examined by adding interaction terms to the final model or fifth batch of the multivariate analyses. The summary findings can be seen in Table 11 of Annex 3, Page 187. The analysis found that:

- the interaction terms between maternal education and preceding birth interval and household wealth level were significantly associated with neonatal mortality;

- the interaction terms between maternal education and preceding birth interval and household wealth level were significantly associated with infant mortality; and,
- the interaction terms between maternal education and maternal age at child birth, mother's preceding birth interval and household wealth level were significantly associated with under-five mortality.

The findings indicated that the effect of maternal education on child mortality varied with and were modified by the independent variables whose interaction terms with maternal education were significantly associated with respective child mortality variables. For instance, amongst the mothers with the same level of education, those who had very close birth intervals had increased risks of having child deaths compared to those who had children in younger ages and whose birth interval was more than two years and those from the richest households had reduced risk of child death than those from the poorest households.

In summary, the analysis indicated that maternal education did not have an independent effect on neonatal mortality, but its effect was found on infant and under-five mortality. A similar pattern of the association was observed with paternal education although its effect sizes were lower than those of maternal education. Mothers who had very close birth intervals and younger age at birth had higher risk of child death. Boys were more likely to die prematurely compared to girls. Finally, children from households which were poor and from rural areas were more likely to die before the age of five.

4.4.2 Childhood morbidities

The section reports the effect of maternal education on stunting, the occurrence of diarrhoea and pneumonia among children under five years of age.

4.4.2.1 Effects of maternal education on stunting

The multivariate analysis indicated that maternal education was significantly associated with child stunting only in the first three batches of the analysis (Table 5, Annex 3, Page 178). The statistical significance completely disappeared in the fourth and final batch after adjusting for possible

confounders. With this finding, it can be concluded that maternal education did not have an independent effect on child stunting while the effects of possible confounders were held constant.

The confounders significantly associated with stunting at the final batch of the regression analysis were maternal age at child birth, preceding birth interval, child's sex and age, and household wealth status. Compared to the mothers who were 19 years of age, those between 20 -29 years were 19% less likely to get their children stunted while children of the mothers who had child births within two years of the recent births were 46% more likely to be stunted. Compared to boys, girls were 23% less likely to be stunted while children within 2-3 years of age range were most stunted followed by those in the age range of 3-4 years. Children from wealthier households had less chance of stunting than those from poorer households as the richest households had 55% reduction of stunting among children under five compared to the poorest ones.

4.4.2.2 Effects of maternal education on the occurrence of diarrhoea

The analysis revealed that maternal education was not significantly associated with the occurrence of diarrhoea among children under-five years of age throughout the five batches of the analysis (Table 6, Annex 3, Page 180). It is thus concluded that maternal education did not have an independent effect on child diarrhoea.

There was only one confounding variable that was significantly associated with child diarrhoea in the final batch which was household wealth status. The richest households had 49% reduction of child diarrhoea compared to the poorest households.

4.4.2.3 Effects of maternal education on the occurrence of pneumonia

The analysis demonstrated that maternal education had no significant association with the occurrence of pneumonia in all five steps of the analysis (Table 7, Annex 3, Page 181). It can be concluded that maternal education did not have an independent effect on the occurrence of child pneumonia.

In the final batch of the analysis, child's sex and household wealth status were significantly associated with pneumonia. Girls had 26% reduction of pneumonia compared to boys and children from the richest households had 72% reduction of pneumonia compared to those from the poorest households.

4.4.2.4 Model fitness

The fitness of the above statistical models to the data was assessed using the Hosmer Lemeshow tests. The Hosmer Lemshow tests were not statistically significant across all the regression analyses of the three morbidity variables indicating that the model fitness was good across all these models since there was no difference between observed data and predicted data. The pseudo R squares of the models indicated that, across all the five statistical models, the final model, batch 5, was the best model compared to other batches in terms of its ability to predict variability in the outcome variable by the predictor variables included in the model.

4.4.2.5 Effect modification

In examining effect modification of the effect of maternal education on childhood morbidities, the interaction terms between maternal education and the independent variables were added to the final model. The interaction term between maternal education and household wealth status was significantly associated with stunting (Table 11, Annex 3, Page 187). Although maternal education was not significantly associated with child diarrhoea, the interaction terms between maternal education and father's occupation, child's age and geographic residence were significantly associated with the occurrence of diarrhoea. No interaction terms were significantly associated with the occurrence of pneumonia among children.

The findings indicated that the effects of maternal education on stunting and child diarrhoea were modified by or varied with the independent variables whose interaction terms with maternal education were significantly associated with respective child morbidity variables. The findings can be interpreted that, of all the mothers with same level of education, children from the richest households experienced reduced risk of stunting compared from those from the poorest households.

In summary, maternal education did not have independent effect on the three types of childhood morbidities, though it had some effect on stunting. The predictor variables such as preceding birth interval, child's age and sex, and household wealth status were significantly associated with one or more the childhood morbidities. However, the effect of these variables was not consistent across the three morbidities. For instance, the children of mothers who had very close birth interval had increased risk of having stunting and diarrhoea, but the birth interval was not associated with pneumonia. Boys were more likely to be stunted than girls and get pneumonia, but child's sex was not significantly associated with diarrhoea. Nevertheless, there was a significantly reduced incidence of all the three morbidities among children of wealthier households compared to those of poorer families. Rural/urban residence was not associated with any of the three morbidities.

4.4.3 Child health services utilisation

The section reports the findings related to the effect of maternal education on health services utilisation which includes receiving the appropriate treatment for diarrhoea and pneumonia among children under five who had those illnesses and getting full doses of childhood vaccination among children of 12-23 months.

4.4.3.1 Effects of maternal education on receiving the appropriate treatment for diarrhoea

The analysis revealed that maternal education was not significantly associated with receiving the appropriate treatment for diarrhoea among children under five in all five batches of the logistic regression (Table 8, Annex 3, Page 183). Thus, it is concluded that maternal education did not have an independent effect on receiving the appropriate treatment for child diarrhoea.

Of all the confounding variables, paternal occupation, child's age and sex only were found to be significantly associated with receiving the appropriate treatment for diarrhoea among children under five. The data indicated that the children of the fathers who worked in the professional/managerial category were most likely to receive the appropriate treatment for diarrhoea followed by those of the fathers who worked in the skilled labour category. Older children were more likely to receive the

appropriate treatment compared to younger ones, and boys had 52% increased odds of receiving the appropriate treatment for diarrhoea.

4.4.3.2 Effects of maternal education on receiving appropriate treatment for pneumonia

The stepwise logistic regression revealed that maternal education was significantly associated with receiving the appropriate treatment for pneumonia among under-five children across all the five batches (Table 9, Annex 3, Page 184). It is thus concluded that maternal education had an independent effect on this outcome while all the confounding variables were held constant. The confounding variables which were found to be having significant association with the dependent variable were father's education, father's occupation, preceding birth interval, child age, household wealth status and rural/urban residence.

The analysis reveals that the children of the fathers who worked in the managerial or professional category were most likely to receive the appropriate pneumonia treatment. Children of mothers who had a preceding birth within two years had 36% reduction in the odds of receiving an appropriate treatment compared to those of the mothers who had no preceding birth. Older children were less likely to get an appropriate treatment compared to younger ones while children from richer households were more likely to receive the treatment. Children of rural residents were 45% less likely to get the appropriate treatment for pneumonia.

4.4.3.3 Effects of maternal education on receiving full doses of child vaccination

Maternal education was significantly associated with receiving full vaccination among children aged 12-23 months only in the first three batches of the stepwise logistic regression (Table 10, Annex 3, Page 185). The statistical significance however disappeared in the last two batches where maternal and child characteristics and household and community level confounding factors were added to the model. It is thus concluded that maternal education did not have an independent effect on full immunisation of the children aged 12-23 months.

The confounders which had a significant association with full vaccination in the final model were father's education, maternal age at child birth, preceding birth interval, child's sex and household wealth status. Children of the fathers who had higher education were 48% more likely to get vaccinated compared to those of the fathers who were not educated. Older mothers were more likely to have their children fully immunised compared to younger mothers while mothers who had closer birth interval were less likely to get their children immunised. Girls were found 30% less likely to receive full immunisation compared to boys. Children from wealthier households were more likely to receive full immunisation compared to those from poor households.

4.4.3.4 Model fitness

The fitness of the above models to the data was assessed using the Hosmer Lemeshow test. The Hosmer Lemeshow test was not statistically significant in most of the regression analyses, but it was found significant in three batches of the model of pneumonia treatment and in one batch of the model of full vaccination. The lack of statistical significance of the Hosmer Lemeshow test indicated that model fitness was good in those batches since there was no difference between observed data and predicted data. On the other hand, model fitness was not good in the models which are statistically significant. The pseudo R square of the fifth batches was largest across all the analyses indicating that the batch 5 is the best statistical model compared to other batches in terms of their ability to predict variability in the outcome variable by the predictor variables.

4.4.3.5 Effect modification

In examining the effect modification of the effect of maternal education on child health services utilisation, no interaction terms were significantly associated with the receipt of the appropriate treatment for diarrhoea and pneumonia, and full vaccination (Table 11, Annex 3, Page 187). Thus, it can be concluded that there was no effect modification with regards to the effect of maternal education on health services utilisation.

4.4.4 Summary findings and multiple testing correction

In summary, of all the nine statistical models run between maternal education and the nine child health outcomes controlling for potential confounders in the analysis, the stepwise logistic regression found that maternal education had an independent effect on infant mortality, under-five mortality and pneumonia treatment. Maternal education had some effect on neonatal mortality, stunting and full vaccination, however, its effects disappeared at the final stage of the regression analysis. Maternal education was not significantly associated with the occurrence of diarrhoea and pneumonia and receiving appropriate treatment for diarrhoea. Table 4.6 provides an overview of the findings of the multivariate analyses summarising significance levels of maternal education and other independent variables on respective child health outcomes observed in the final batch of the nine statistical models.

Table 4.6: An overview of associations reported in the final batches of the nine multivariate models: statistical significance (p values) and strength of association (adjusted odds ratios)

Independent Variables	Dependent variables (p values and adjusted odds ratios)								
	Neonatal mortality	Infant mortality	Under five mortality	Stunting	Diarrhoea	Pneumonia	Treatment diarrhoea	Treatment pneumonia	Immunisation
Maternal education (p value)	0.074	**0.003**	**0.003**	0.418	0.173	0.670	0.471	**0.004**	0.397
No education	reference	**reference**	**reference**	reference	reference	reference	reference	**reference**	reference
Primary	0.765	**0.874**	**0.834**	0.948	0.975	0.911	1.432	**1.333**	1.200
Secondary	0.846	**0.784**	**0.758**	0.837	0.229	0.916	1.829	**1.313**	0.952
Higher	0.825	**0.537**	**0.524**	1.028	0.770	0.560	1.286	**24.805**	1.508
Paternal education (P value)	0.263	0.108	**0.016**	0.129	0.587	**0.023**	0.163	**0.006**	**0.047**
No education	reference	reference	**reference**	reference	reference	**reference**	reference	**reference**	**reference**
Primary	1.078	0.971	**0.953**	0.780	1.180	**1.015**	1.040	**0.596**	**1.154**
Secondary	1.021	0.853	**0.803**	0.801	2.286	**1.595**	1.722	**0.760**	**1.729**
Higher	1.582	0.299	**0.919**	0.711	1.179	**2.758**	4.376	**0.214**	**1.486**
Paternal occupation (P value)	NA	NA	NA	0.815	0.289	0.400	**0.042**	**0.000**	0.579
clerical/sales	NA	NA	NA	reference	reference	reference	**reference**	**reference**	reference
professional/managerial	NA	NA	NA	0.803	0.546	0.578	**1.814**	**8.020**	1.104
agricultural self employed	NA	NA	NA	0.816	0.709	1.025	**1.326**	**0.369**	1.675
agricultural employee	NA	NA	NA	0.907	0.739	0.578	**0.389**	**0.979**	1.162
unskilled labour	NA	NA	NA	0.866	0.866	0.981	**0.370**	**0.936**	1.556
skilled labour	NA	NA	NA	0.909	0.704	0.963	**1.570**	**1.106**	1.376
Maternal age at child birth (P value)	0.587	0.131	**0.038**	**0.038**	0.383	0.638	0.542	0.219	**0.025**

Under 19	reference	reference	**reference**	**reference**	reference	reference	reference	reference	**reference**
20-29	1.016	0.911	**0.884**	**0.817**	0.925	0.858	1.285	1.054	**1.014**
30 and above	1.217	1.116	**1.096**	**0.965**	0.727	0.876	1.517	0.633	**2.226**
Preceding birth interval (P value)	**0.000**	**0.000**	**0.000**	**0.008**	0.269	0.174	**0.134**	**0.011**	**0.000**
No preceding birth	**reference**	**reference**	**reference**	**reference**	reference	reference	reference	**reference**	**reference**
Less than 2 years	**1.370**	**1.551**	**1.600**	**1.469**	0.712	1.141	1.614	**0.649**	**0.623**
Above 2 years	**0.642**	**0.695**	**0.760**	**1.011**	0.959	1.366	0.726	**0.630**	**1.780**
Child sex (P value)	**0.003**	**0.000**	**0.003**	**0.000**	0.872	**0.047**	**0.001**	0.654	**0.021**
male	**reference**	**reference**	**reference**	**reference**	reference	**reference**	**reference**	reference	**reference**
female	**0.805**	**0.810**	**0.861**	**0.780**	1.017	**0.756**	**0.485**	0.941	**0.706**
Child age (P value)	NA	NA	NA	**0.004**	0.171	**0.722**	**0.003**	**0.001**	NA
under 1	NA	NA	NA	**reference**	reference	**reference**	**reference**	**reference**	NA
1 to 2	NA	NA	NA	**1.308**	1.256	**1.036**	**1.749**	**0.950**	NA
2 to 3	NA	NA	NA	**2.427**	1.388	**1.411**	**2.954**	**0.981**	NA
3 to 4	NA	NA	NA	**1.747**	1.313	**1.425**	**2.773**	**0.610**	NA
4 to 5	NA	NA	NA	**1.551**	0.388	**0.672**	**3.959**	**0.419**	NA
Household wealth status (P value)	**0.040**	**0.000**	**0.000**	**0.000**	**0.000**	**0.007**	0.334	**0.000**	**0.000**
poorest	**reference**	**reference**	**reference**	**reference**	**reference**	**reference**	reference	**reference**	**reference**
poorer	**0.995**	**0.899**	**0.810**	**0.945**	**0.978**	**0.853**	0.929	**3.614**	**0.857**
middle	**0.829**	**0.775**	**0.682**	**0.759**	**0.665**	**0.606**	0.538	**1.144**	**2.272**
richer	**0.784**	**0.613**	**0.544**	**0.551**	**0.486**	**0.452**	0.788	**2.901**	**2.198**
richest	**0.629**	**0.468**	**0.439**	**0.453**	**0.511**	**0.281**	0.458	**1.746**	**3.934**
Residence (P value)	**0.000**	**0.003**	**0.000**	0.108	0.299	0.859	0.136	**0.010**	0.845
urban	**reference**	**reference**	**reference**	reference	reference	reference	reference	**reference**	reference
rural	**1.652**	**1.321**	**1.384**	1.207	1.189	0.960	0.575	**0.553**	0.957

As discussed in Section 3.6.4, the Bonferroni correction of the p value was conducted to adjust for possible Type I error due to multiple significance tests run by the multivariate analysis in finding association between maternal education and nine child health outcomes. In doing so, the conventional alpha value of 0.05 was divided by the number of significance tests conducted for each dependent variable in every statistical model generating a new p value of 0.01 (Bland et al, 1998). According to the Bonferroni correction, to determine if any of the associations between dependent variable and independent variable is statistically significant, the p values produced by the analysis should be lower than the adjusted p value which is 0.01 in this case. The previous analysis reported that the three significant associations using the conventional p value of 0.05 (associations between maternal education and infant mortality, under-five mortality and pneumonia treatment) had the p values of 0.003, 0.003

and 0.004 respectively which are less than the adjusted p value of 0.01. It can thus be concluded that all these associations are not due to Type I error and are truly significant associations.

4.5 Findings of the Pathway Analysis

4.5.1 Overview

As elaborated in Chapter 3, the purpose of the pathway analysis was to examine whether the effect of maternal education on child health outcomes was mediated by some possible pathways. The multivariate analysis indicated that maternal education had an independent effect on infant mortality, under-five mortality, and pneumonia treatment while it was significantly associated with neonatal mortality, stunting and full vaccination in earlier stages of the stepwise regression though the effects disappeared at the final stage. Based on these findings, the pathway analysis was conducted on the effect of maternal education on the six child health outcomes: neonatal mortality, infant mortality, under-five mortality, stunting, pneumonia treatment and full vaccination. The health outcomes which were not associated with maternal education were not tested for the pathway analysis. These outcomes include the occurrence of diarrhoea and pneumonia, and receiving the appropriate treatment for diarrhoea,

As elaborated in Session 3.6.4 of Chapter 3, five proxy variables were selected from the primary datasets to represent as pathway variables. In brief, maternal reading skill was selected as a proxy variable for literacy; maternal knowledge about at least one of the danger signs of childhood illnesses was selected to represent maternal health-related knowledge; mother's taking antenatal care at least four times during the recent pregnancy was selected to represent maternal health-related behaviour; mother's ability to decide by herself for medical treatment of her children was for maternal autonomy; and, household wealth level was for maternal income. The proxy variable related to maternal health-related behaviour was available only in dataset 2 (children born in past five years) and dataset 3 (children aged 12-23 months). Since dataset 2 and 3 (children born by the interviewed mothers) did not consist of a relevant variable that can represent mothers' health-related behaviour, the analysis thus did not cover the assessment of the behavioural pathway on the relationship between maternal education and childhood

mortalities. As discussed in Session 3.7.5, the four-step regression method was applied in the mediation analysis and the Sobel Test was conducted to examine the significance of the mediation effect.

Table 4.7 presents descriptive statistics of the pathway variables in relation to maternal education levels where all the five variables reveal a similar pattern of an increasing trend with the improvement of education level of mothers. It is particularly true for the knowledge variable where the proportion of mothers who could name children's illness symptoms increased as their education level rises. For instance, only 30.9 % of the mothers who had no education knew at least one danger sign against 91.4% of the mothers with higher education. Similarly, literacy, health related behaviour (antenatal care), maternal autonomy and wealth status improved with mother's education level.

Table 4.7: Descriptive of pathway variables by maternal education levels

Maternal education	Pathway variables (%)				
	Literate	Knew danger signs	Took antenatal care for four times	Autonomous	Richest wealth quintile
No education	7.6	30.9	31.4	88.8	5.1
Primary	70.1	58.9	52.9	93.5	5
Secondary	100	76.1	75.5	98.4	21.1
Higher	100	94.8	91.4	99.7	67.3

4.5.2 Pathway analysis of the effect of maternal education on childhood mortalities

Table 12 in Annex 3 (Page 188) presents findings related to the pathway analysis of the effect of maternal education on neonatal, infant and under-five mortality.

Neonatal mortality: The simple regression analysis (Step 1) revealed that there was a statistically significant association between maternal education and neonatal mortality. Step 2 indicated that maternal education was significantly associated with all four mediators (literacy, health knowledge, household wealth status, autonomy). Nevertheless, in Step 3 where the effect of pathway variables on the dependent variable was explored, only three variables (literacy, knowledge, wealth status) were

significantly associated with neonatal mortality, and autonomy was not significant. In step 4 or multiple regression, the magnitude of the regression coefficients of maternal education reduced in all three analyses compared to its initial values in step 1. The regression coefficient of knowledge and wealth status were statistically significant, but that of maternal literacy was not. In addition, the Sobel test was statistically significant for knowledge and wealth status. These findings indicated that the reduction of the effect of maternal education in step 4 compared to its values in Step 1 was contributed by maternal health knowledge and wealth status. Since the regression coefficients of maternal education in step 4 were still significant despite their reduction, it can be concluded that the effect of maternal education on neonatal mortality was partially mediated by maternal health knowledge and household wealth status.

Infant mortality: Simple regressions revealed that maternal education had significant effect on infant mortality (step 1) and on all the four pathway variables (step 2). In step 3, literacy, knowledge and wealth status had significant association with infant mortality, whereas maternal autonomy was not significant. The multiple regressions (step 4) reported and the Sobel Test confirmed that maternal knowledge and household wealth status mediated the effect of maternal education on infant mortality and it was a partial mediating effect since the multiple regression coefficients of maternal education in step 4 were still significant.

Under-five mortality: Maternal education was significantly associated with under-five mortality (step 1) and all the pathway variables (step 2). In step 3, the four pathway variables (literacy, knowledge, autonomy, wealth status) were significantly associated with under-five mortality. In step 4, the regression coefficients of maternal education reduced in all the four pathway variables, but only knowledge, autonomy and household wealth status were statistically significant, and literacy was not. The Sobel test also reported the significant mediating effect of knowledge, autonomy and household wealth on the association between maternal education and under-five mortality. Since the regression coefficients of maternal education were still significant in step 4, it can be summarised that the effect of maternal education on under-five mortality was partially mediated by maternal health knowledge, household wealth status and autonomy.

4.5.3 Pathway analysis of the effect of maternal education on child stunting

Table 13 in Annex 3 (Page 189) presents findings related to the pathway analysis of the effect of maternal education on stunting. In addition to the four pathways examined in the above section, maternal health-related behaviour was included in this stage.

Maternal education had a statistically significant effect on stunting (step 1) and all the five pathway variables (step 2). The pathway variables were significantly associated with stunting (step 3). Nevertheless, in step 4, the regression coefficients of maternal education reduced for only four variables: knowledge, behaviour, autonomy and household wealth, out of which only three (knowledge, behaviour, household wealth) were statistically significant. The Sobel test concurred that only knowledge, behaviour and household wealth were significant. Since maternal education was still significant in step 4 in the presence of the mediating variables, it can be concluded that the effect of maternal education on child stunting is partially mediated by maternal health knowledge, health-related behaviour and household wealth.

4.5.4 Pathway analysis of the effect of maternal education on health services utilisation

Appropriate treatment for pneumonia: Table 14 and Annex 3 (Page 188) presents the findings related to the pathway analysis of the effect of maternal education on receiving the appropriate treatment for pneumonia among children under-five who had pneumonia symptoms. In Step 1, maternal education was significantly associated with receiving the pneumonia treatment, and in Step 2, maternal education was significantly associated with maternal literacy, health knowledge, health-related behaviour and income but it was not associated with autonomy. In Step 3, maternal literacy, health-related behaviour and income were significantly associated with pneumonia treatment while health knowledge and autonomy were not. In Step 4 or multivariate analysis, only maternal health-related behaviour and income were significantly associated with the receipt of an appropriate treatment for pneumonia indicating that these two variables were mediating the effect of maternal education on the pneumonia treatment among the children under five. In addition, since the significant effect of maternal education

disappeared in in Step 4 with both mediators, it can be concluded that maternal health-related behaviour and income played a full mediation effect in this case.

Full vaccination: Table 14 in Annex 3 (Page 190) presents findings related to the pathway analysis of the effect of maternal education on receiving full immunization among children between 12-23 months. In step 1, maternal education was significantly associated with receiving full immunisation, and in step 2, it had significant effect on all the five pathway variables. In step 3, all the variables except maternal autonomy were significantly associated with full immunisation. In step 4, knowledge, behaviour and household wealth status sustained their significant association with full immunisation. It is concluded that maternal health knowledge, health related behaviour and household wealth status mediated the relationship between maternal education and full immunisation among children between 12-23 months.

4.5.5 Summary findings of the pathway analysis

The analysis indicated that maternal health knowledge and maternal income (represented by household wealth level) were the main pathways or mediators between maternal education and child health outcomes across all the analyses. Maternal health-related behaviour mediated the effect of maternal education on stunting, full vaccination and pneumonia treatment, whereas maternal autonomy mediated the effect of maternal education on under-five mortality. Table 4.7 summarises the findings of the pathway analysis. Most of the findings reported by the pathway analysis were partial mediating effects except in the case of pneumonia treatment because the pathway variable did not completely block the effect of maternal education on the dependent variables in the multiple regression analyses (step 4) where both the independent and pathway variable were entered the multivariate analysis.

Table 4.7: Overview findings of the pathway analysis

(ME = mediating effect, NO = no mediating effect, N/A = not applicable*)

Pathway variables	Dependent Variables					
	Neonatal mortality	Infant mortality	Under-five mortality	Stunting	Pneumonia treatment	Full immunisation
Literacy	NO	NO	NO	NO	NO	NO
Knowledge	**ME**	**ME**	**ME**	**ME**	**NO**	**ME**
Health related behaviour*	N/A	N/A	N/A	**ME**	**ME**	**ME**
Autonomy	NO	NO	**ME**	NO	NO	NO
Maternal income	**ME**	**ME**	**ME**	**ME**	**ME**	**ME**

* There was no proxy variable available for health-related behaviour in dataset 1

4.6 Conclusion

The multivariate analysis revealed that, after adjusting for the effects of the individual, household and community level confounders, maternal education had an independent effect on infant mortality, under-five mortality and receipt of pneumonia treatment among children under-five who had pneumonia. Maternal education was significantly associated with neonatal mortality, stunting and full vaccination the initial stages of the analysis, however, its effects disappeared in later stages when household and community level were included in the models. It was not associated with the occurrence of diarrhoea, pneumonia and receiving the appropriate treatment for diarrhoea. The pathway analysis demonstrated that maternal health knowledge and household wealth (maternal income) were the two main mediators between maternal education and most child health outcomes. Maternal health related behaviour mediated the effect of maternal education on stunting, pneumonia treatment and full vaccination while maternal autonomy mediated the effect of maternal education on under-five mortality.

CHAPTER 5

DISCUSSION

5.1 Overview

This chapter starts with a brief overview of child health in Myanmar based on the findings of the descriptive analysis of the present study followed by interpretation and discussion of the main findings reported in different stages of the data analysis. It then discusses the theoretical underpinnings of the study findings in linkage with the structural theory, the Mosley and Chen conceptual framework of child survival and the adapted conceptual model of the present study which are extensively discussed in Chapter 1. The chapter then explores strengths and limitations of the present study followed by policy implications and recommendations for the country to consider in improving health and education status of the children.

5.2 Comparison of the descriptive findings of the present study with the 2010 data

The descriptive analysis of the present study provided the statistics related to childhood mortalities (neonatal, infant and under-five mortality), childhood morbidities among children under five (stunting, diarrhoea and pneumonia) and utilisation of preventive and curative child health services (appropriate treatment for diarrhoea, pneumonia and full vaccination). Some of the key findings of the present study were compared against the data from another nationwide survey, Multi-Indicator Cluster Survey (MICS), conducted in Myanmar in 2010 (MNPED and MOH, 2010). Both the primary survey of the present study, Myanmar 2016 DHS, and the MICS 2010 survey used the same operational definitions of child health outcome indicators and were designed as nationally representative surveys in collecting population-based data. Both surveys used a stratified two-staged cluster sampling approach with a representativeness of survey estimates at national, urban/rural, and provincial levels collecting data from households and individuals. The surveys did not cover the populations living in institutions such as prisons, boarding schools, and military barracks. The MICS 2010 survey used the projected populations generated by the national population census in 1983 as a master sampling frame from which

clusters and households were sampled, while the DHS survey used a more recent sampling frame generated by the population census conducted in 2014. In addition, the MICS survey left out nineteen townships of the country from the master sampling frame before the sampling was done since these areas were severely hit by the Cyclone Nargis in 2008 and because of the security concerns (MNPED and MOH, 2010). On the other hand, there was no geographical areas left out by the DHS 2016 survey throughout the sampling process (DHS and MOHS, 2017). These reasons might have had implications on data quality of the MICS 2010 survey, and the national data reported by the survey could be underestimating the real situation in the country.

Table 5.1: Comparison of some child health outcome indicators between the MICS 2010 survey and the present study

Health outcome indicators	MICS 2010	The present study
Proportion of under five children who had stunting	35%	29%
Proportion of under five children who had diarrhoea	6.7%	10.6%
Proportion of under five children who had pneumonia	2.6%	5.2%
Proportion of children who received appropriate treatment for diarrhoea	66.3%	63%
Proportion of children who received appropriate treatment for pneumonia	69.3%	50.9%
Proportion of children who received full vaccination	88%	54.8%

Table 5.1 shows a slight reduction of stunting in the present study compared to 2010 data. The decline of stunting could be related to the overall socioeconomic development of the country during recent years, which is attested by the reduction of the proportion of the population who lived under the poverty line from 25.4% in 2010 to 19.4% in 2015 (MNPED and MOH, 2015). The findings also indicated an increase in the incidence of childhood illnesses such as diarrhoea and pneumonia and a decline in the utilisation of curative and preventive health services in the present study compared to the MICS 2010

survey. Nevertheless, as discussed above, the data quality issue of the MICS 2010 survey should be considered in interpreting the findings reported by that survey.

5.3 Interpretation and discussion of the multivariate findings

5.3.1 Maternal education and childhood mortalities

Although the bivariate analysis revealed that maternal education was significantly associated with neonatal mortality, its effect was accounted for by household wealth status and geographic residence in the multivariate analysis. The lack of the independent effect of maternal education on neonatal mortality was consistent with most of the previous studies included the literature review (Bicego and Boerma, 1993; Makate and Makate, 2016; Rustein, 1984; Stuebing, 1997; Macassa et al., 2003). However, few studies found an independent significant effect of maternal education on neonatal mortality (Kamal, 2012; Basu and Stephenson, 2005). This contradiction probably stemmed from varying contextual backgrounds of the studies. For instance, the studies that found an independent effect of maternal education on neonatal mortality were conducted in Ghana and India which are more economically stronger and more developed than Myanmar and it is assumed that mothers in those countries had better access to quality education and health services (Kamal, 2012; Basu and Stephenson, 2005).

Maternal education was significantly associated with infant mortality and under-five mortality throughout all the stages of the regression analyses, which was consistent with earlier studies conducted in different low-income settings (Grepin and Bharadwaj, 2015; Akter et al., 2015; Greenaway et al., 2012; Mellington and Cameron, 1999; Monden and Smits, 2013). The multivariate analysis also revealed that the effect size of mother's secondary education on infant and under-five mortality was larger than that of primary level, and that of higher education was greater than that of secondary level. This 'dose-response relationship' clearly demonstrated a strong and independent effect of maternal education on childhood mortality in the study context.

The multivariate effect sizes of the analysis indicated threshold effects of maternal education on infant and under-five mortality. For instance, the infant mortality rate could reduce by 13% had all mothers

been educated at primary level; while it could decline by 22% had all mothers received secondary education; and, by 47% had all mothers had higher education. Similarly, under-five mortality could reduce by 17% if all mothers had primary education; it could decline by 25% had all mothers had secondary education; and, by 48% had all mothers had tertiary education. These findings indicate the potential gains the country can benefit with improved investments in the education sector.

Similar to the finding of the present study, a few studies demonstrated that maternal education had an independent effect on infant and under-five mortality, but not on neonatal mortality (Uchudi, 2001; Goldani et al., 2002; Makate and Makate, 2016). Several authors claimed that neonatal survival was more concerned with access to quality maternity services which are fully equipped with measures needed for emergency delivery and resuscitation of new-borns immediately after birth (Bicego and Ties Boerma, 1993; Rao et al., 1996; Basu, 1994). The absence of an independent effect of maternal education on neonatal mortality in most low-income settings is probably due to limited availability and utilisation of maternal and new-born health services across the country.

The independent effect of maternal education on infant and under-five mortality and the lack of its independent effect on neonatal mortality demonstrated that maternal education is more critical during the post-neonatal life. The findings revealed that maternal education had larger effect sizes on under-five mortality compared to infant mortality indicating its stronger effect on the former. These findings probably indicate that the effect of maternal education on child mortality becomes larger as the child grows older transitioning from neonatal period to infancy and early childhood. This could probably be explained by the crucial importance of maternal education in improving maternal health-related knowledge and health-related behaviour which are critical in providing optimal care to young children. Kamal et al. (2012) asserted that domestic health care including hygiene and nutritional support provided to children by mothers at home environment improves with mothers' education level and it determines health and nutrition status of children. Compared to uneducated mothers, education may bring better health-related knowledge to mothers which enables them to provide caring and nurturing support to their young children (Frost et al., 2005a; Haque et al., 2016). This proposition is largely supported by the findings of the pathway analysis of the present study which found that maternal

education mainly mediated health-related knowledge, and behaviour in imparting its effect on child health in the study context. On the other hand, as discussed above, maternal education may not have a strong effect on child health during the neonatal period where specialised health care is an essential requirement.

5.3.2 Maternal education and childhood morbidities

Although the bivariate analysis revealed that maternal education was significantly associated with stunting among children under five, the multivariate analysis did not find an independent effect. The effect of maternal education which was significantly associated with stunting in initial stages of the stepwise regression gradually disappeared in the last batch when household wealth level was included in the analysis. The finding corroborates with two earlier studies (Maddah et al., 2007; Abuya et al., 2012), while it contradicts with many studies that found a significant independent effect of maternal education on stunting (Vollmer et al., 2016; Devkota and Panda, 2016; Makoka and Masibo, 2015b; Chen and Li, 2009; Lomperis, 1991). The studies which reported contradicting findings are based on national survey data and used similar anthropometric method in estimating child stunting. The variation of the findings across different studies could be due to different contextual backgrounds of the studies such as macroeconomic and sociocultural situation, poverty levels and food security which may contribute to the levels of child undernutrition. In the current study, the lack of an independent effect of maternal education on stunting after controlling for household wealth can be explained by the fact that, compared to maternal education, household wealth status is more related to food security, access to nutritious food and access to health services in the study context.

Both bivariate and multivariate analyses showed that maternal education was not significantly associated with the occurrence of diarrhoea and pneumonia among children under five. These findings oppose the evidence generated by earlier studies from low-income settings (Basu and Stephenson, 2005; Mahalanabis et al., 1996; Hatt et al., 2006). This contradiction was due to several factors including the use of different sources of illness data and different data collection approaches in collecting the information regarding childhood illnesses. The primary study of the present thesis used the recall

method asking the interviewed mothers to recollect memories related to their children's illnesses, and the occurrences of diarrhoea or pneumonia were determined based on the mothers' verbal accounts. Some other studies which found independent beneficial effect of maternal education on the occurrence of diarrhoea or pneumonia relied on clinic or hospital registers as data sources (Abdulkadir et al., 2016; Mahalanabis et al., 1996). The possible biases related to the recall approach are extensively discussed in the 'limitations' section of the chapter.

Although maternal education was not significantly associated with the occurrence of diarrhoea and pneumonia, the analysis found that the children of educated mothers had a higher incidence of diarrhoea and pneumonia than those of uneducated mothers. Several authors highlighted that mothers with higher level of education were more likely to engage in economic activities and may not be able to adopt exclusive breastfeeding and devote enough time to take care of their children resulting in unwanted child health outcomes (Reed et al., 1996; Streatfield et al., 1990; Maddah et al., 2007; Abuya et al., 2011). In the present study, almost two thirds of the educated mothers (65% at primary level, 57.5% at secondary level, and 64.7% at higher level) were working mothers, which could possibly contribute to higher incidence of the illnesses among their children. Nevertheless, the present thesis did not observe this counterintuitive finding in the analyses of other child health outcomes such as mortalities, stunting and health services utilisation. On the other hand, compared to uneducated mothers, educated mothers have better health-related knowledge and are more precise in recalling the illnesses among their children during the data collection (Manesh et al., 2008). This could probably result in higher incidence of diarrhoea and pneumonia among the children of educated mothers compared to those of uneducated ones.

5.3.3 Maternal education and health services utilisation

Both the bivariate analysis and multivariate analysis found that maternal education did not have a significant association with receiving appropriate treatment for diarrhoea among children. This finding contradicts previous studies which reported an independent association between maternal education and receiving treatment for diarrhoea among children. Since the children who received the appropriate

treatment for diarrhoea are the subsets of the children who had diarrhoea, the fact that maternal education was not significantly associated with the occurrence of the disease might have led to its lack of association with receiving appropriate treatments for the same. On the other hand, the sample sizes of the children who received the appropriate treatment for diarrhoea was very small. Only 269 children (out of 427 children who had diarrhoea) received the appropriate diarrhoea treatment. Small sample size may have implications on the results of the regression analyses as it could generate large standard errors, spurious effect sizes and misleading associations between the variables (Nemes et al., 2009). In addition, using the variable 'providing oral rehydration salt for diarrhoea' as an indicator of an appropriate treatment might not be a valid choice given that oral rehydration salt is very common and readily available at a very minimal cost in both rural and urban areas of the country.

On the other hand, maternal education was significantly associated with the receipt of the appropriate treatment for pneumonia. This finding corroborates with previous studies which reported an independent association between maternal education and improved health services utilisation for pneumonia (Haque et al., 2016; Basu and Stephenson, 2005; Aminul et al., 1994). As revealed by the pathway analysis, maternal education imparted its effect on pneumonia treatment of children through better health knowledge, improved health-related behaviour and better income to ensure that required health services are received in a timely manner.

Maternal education was significantly associated with the receipt of full immunisation among children of 12-23 months in the bivariate analysis and the initial steps of the multivariate analysis. However, its effect was accounted for by household wealth in the final stage of the step wise regression indicating the lack of independent effect of maternal education on full immunisation. This finding contradicts with previous studies conducted in low-income countries (Vikram et al., 2012; Greenaway et al., 2012; Aslam and Kingdon, 2012; Onsomu et al., 2015). This contradiction could be partly due to differing age ranges of children used in different studies to estimate the full vaccination variable. Some studies collected the vaccination information from all children under five years of age, whereas, in the primary survey of the present study, the DHS Programme selected the children who were of 12-23 months old (DHS and MOHS, 2017). The DHS Programme reasoned that all the childhood vaccines are to be

completed within the first year of the age of the child and collecting this information from the 12-23-month-old children could provide a more valid and reliable information capturing both completeness and timeliness the vaccination status compared to gathering the same information from all children under five (DHS, 2013). However, focusing the children within 12-23 months could result in a smaller sample size which may have implications on the regression findings.

This lack of an independent effect of maternal education on full immunisation could probably be related to social mobilisation efforts of the national vaccination campaigns in Myanmar which are attempting to fully vaccinate every single child during the recommended age range of the children (DHP, 2015; DHP,2016). However, disparities of the full vaccination status by household wealth level as reported by the present study may reject this claim.

Generally, the variation of the findings of the present study from previous studies conducted in similar low-income contexts could be due to many reasons. Low-income countries vary in their stage of socioeconomic development regarding health, education and social security systems which could contribute to access, coverage, quality and effective utilisation of health and education services resulting different levels of the association between maternal education and child health. Furthermore, socio-cultural factors deeply rooted in the countries could also critically determine the variation of the findings. For instance, countries where women are culturally regarded as inferior to men, may not demonstrate a substantial effect of maternal education on child health as mothers are culturally constrained in making decisions related to family matters including child health.

5.3.4 Theoretical underpinnings of the multivariate findings

As summarised in Table 4.6 in Chapter 4, the multivariate analysis revealed that maternal education was significantly associated with infant and under-five mortality and pneumonia treatment for children. Paternal education also demonstrated a similar pattern of association with child mortality variables though its effect sizes were smaller than those of maternal education. Household wealth level was significantly associated with most of the child health outcomes while paternal occupation was significantly associated with some. With these findings, it can be asserted that the variation of child

health was influenced by social and economic conditions of the families affirming the critical role of the social determinants of health in the study setting.

As discussed in Chapter 1, the findings of the present study suggest that the structural theory could plausibly explain the relationship between maternal education and child health outcomes. The structural theory asserts that material deprivation or poverty has substantial bearings on access and utilisation of social services in a way that privileged population groups have better access than deprived ones resulting in health inequities among population groups (Peters et al., 2008; Browne and Jenkins, 2012; Krieger, 2001). The present study reported that almost 40% of the poorest mothers had no education and only 0.1% had achieved the highest education level. On the other hand, only 9% of the richest mothers had no education and 21% had higher education. Taking the structural perspective, low-income families might not have adequate financial resources to educate their children even the primary level to pay for direct and indirect cost of schooling (Adler and Stewart, 2010; Mehrotra and Delamonica, 1998). In remote places where the number of schools are scarce especially in rural areas of Myanmar, the transportation cost is a huge barrier for families to send their children to school (MNPED and MOH, 2010). This differential access to schooling could result in differential education levels between rich and poor population groups.

The study also revealed that the pattern of health outcome disparities is similar across different social and economic factors. From the findings of the present study, the children of mothers who were poor, less educated, and of those who lived in rural areas had limitations to access quality health care services and enjoy good health. Generally, poor families in low-income settings tend to live in poor housing and unhealthy social and physical environments which can cause children to be more vulnerable to major childhood illnesses and premature mortality (Gruebner et al., 2015; Borooah, 2004). Even accessing free preventive services like childhood vaccination can pose a challenge to poor families especially in remote rural areas where vaccination posts may be sparsely located (Mathew, 2012; Unger, 2013). In addition, economically constrained parents, mostly manual labourers and daily wagers, may not want to cancel their jobs to accompany their children to health centres since the opportunity cost is high for them.

The effect of maternal education on neonatal mortality, stunting, and full vaccination disappeared when household wealth status and geographic residence were adjusted for in the final step of the multivariate analysis. The lack of an independent effect of maternal education on those child health outcomes can also be explained by the structural theory since the two key confounders, household wealth level and geographic residence, are indeed critical 'material resources' for most of the populations of Myanmar to adequately access quality health services. Being deprived of these resources tend to restrict the people from accessing quality health care services. In the context of Myanmar where the health systems cannot provide affordable and equitable quality services to its populations across different geographical areas and socioeconomic groups, disparities in health services utilisation and health outcomes are paramount. There is no nationwide social health insurance system that covers people's out-of-pocket expenditure for health. Better-off families who can afford healthcare costs can access quality services as and when needed while deprived and poor families will not be able to access the required services in a timely manner. Under these circumstances, regardless of the education levels of the mothers, household wealth status tends to become a crucial determinant on the utilisation of quality health services leading to pronounced health inequities among different income groups.

The present study found that, compared to urban residents, mothers who lived in rural areas had greater odds of having childhood mortalities and morbidities and were less likely to receive appropriate health services. Because of unequal socio-economic development across urban and rural in the study setting, urban families are more advantaged than rural populations as they tend to benefit from better employment opportunities, improved accessibility to social services, and better infrastructure and transportation networks. The availability of health services varies across different geographic regions of Myanmar in a way that well-equipped health infrastructure and competent workforce are more concentrated in urbanised areas than in rural areas. The present study reported that almost 78% of the country population reside in rural regions and consequently the disease burden of the country is larger in rural than urban. The mismatch between the availability of health services and the population in need of health care results in increasing health outcome differentials between urban and rural. The above

findings strongly support the role of social determinants particularly wealth status and geographic residence in shaping health outcome inequities of children in Myanmar.

5.4 Interpretation and discussion of the findings of the pathway analysis

5.4.1 Maternal education and its pathways

The pathway analysis revealed that maternal literacy did not mediate the effect of maternal education on any child health outcomes. The finding corroborates with a study conducted by Mellington and Cameron (1999) where literacy was not a mediator of maternal education on stunting. This finding of the present study might also indicate a disconnect between education level and literacy skills probably because of poor quality of the education. For instance, the present study found that out of all the mothers who had primary education, only 69.9% were literate, which was assessed by the primary DHS survey asking interviewed mothers to read a paragraph in local language. It shows that almost one-third of the mothers who were at primary level did not have literacy skills which could be related to the quality of primary education in the study context.

Maternal health knowledge mediated the effect of maternal education on most child health outcomes except receiving pneumonia treatment. This finding confirms the evidence generated by earlier studies on the mediating effect of maternal health knowledge (Frost et al., 2005; Basu, 1994). While educated mothers could obtain health-related knowledge directly from formal school lessons, they may also access knowledge through indirect means such as mass media and social networks as they have better access compared to uneducated mothers (Basu and Stephenson, 2005). Education also helps mothers to question traditional beliefs about health care critically looking at the traditional approaches to health and illness. Educated mothers become more receptive to new knowledge related to modern population health including disease pathology, modes of transmission and other important aspects of preventive and curative health care (Greenaway et al., 2012). On the other hand, since almost a quarter of the mothers never went to formal school as reported by the present study, efforts should be taken to improve health knowledge of the uneducated mothers. The evidence from other settings indicates that the programmes designed to improve health knowledge of uneducated mothers worked very well in

strengthening their knowledge and health-seeking behaviour resulting better child health outcomes in the long term (Goodburn et al., 1990b; Uchudi, 2001b; Buor, 2003).

Maternal autonomy mediated the effect of maternal education on under-five mortality, but not on other outcomes. Earlier studies reported that mother's education did not mediate through autonomy on stunting and immunisation (Frost et al., 2005; Makoka and Masibo, 2015). Given that maternal autonomy did not mediate other child health outcomes in the present study, the linkage between maternal education and autonomy may be weak in the study context probably because of certain cultural factors which might be inhibiting mothers to become autonomous in taking health-related decision on their own for the children.

Maternal health-related behaviour mediated the effect of maternal education on child stunting, pneumonia treatment and receipt of full vaccination. The reported finding of the behaviour pathway is consistent with previous studies (Frost et al., 2005; Basu and Stephenson, 2005; Grepin and Bharadwaj, 2015; Makoka and Masibo, 2015). Makate and Makate (2016) highlighted the critical role of education in shaping the girls' health-related norms, standards and behaviour. It was also asserted that not only the formal school curriculum but also the school environment in which girls interact with teachers and fellow students also help them acquire skills and behaviours which are important for health and hygiene (Frost et al., 2005; Haque et al., 2016).

The analysis found that maternal income mediated the effect of maternal education on all the child health outcomes. The use of household wealth as a proxy for maternal income was discussed in the limitation session of this chapter. While the multivariate analysis revealed that household wealth status is an important confounder, the pathway analysis also shows that it was also a mediator between maternal education and child health.

5.4.2 Linking the pathway analysis with the conceptual framework

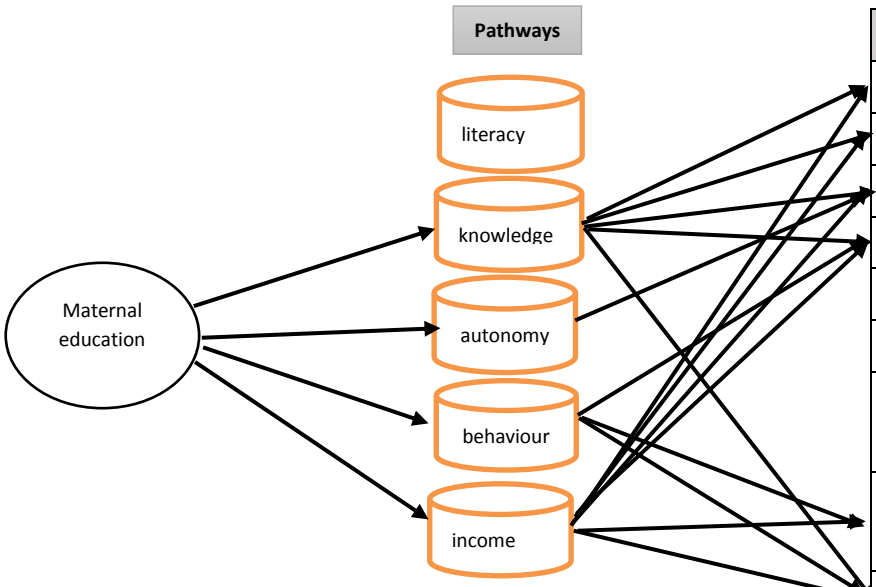
Most of the findings of the pathway analysis support the propositions of the Mosley and Chen conceptual framework which outlines possible pathways of social determinants on child health as

extensively discussed in Chapter 1. The framework asserted that the social determinants exert their effects on child health outcomes through proximate determinants or pathways which are grouped as maternal and child factors, environment, injury and health behaviour (Mosley and Chen, 1984). The present study demonstrated that socioeconomic determinants had effects on child health outcomes including mortalities, morbidities and health services utilisation. Maternal health behaviour, which was proposed by the framework as a pathway, mediated the effect of maternal education on stunting and vaccination in the present study. However, some pathways proposed by the framework are not congruent with the findings of the present study. For instance, the Mosley and Chen framework does not include pathways such as maternal health knowledge, autonomy and income which were found in the present study as the main pathways. Maternal factors of the Mosley and Chen framework are mainly biological factors such as age, number of children, and maternal reproductive factors. However, it is important to note that the present study specifically explored the pathways related to the effect of maternal education while the Mosley and Chen framework presents all possible pathways for a range of social determinants. On the other hand, the findings of the present study are in alignment with the adapted conceptual model of the present study discussed in Chapter 1. Out of the five pathways tested by the study, it was found that maternal health-related knowledge, health seeking behaviour and income were the main pathways of the effect of maternal education on child health while maternal autonomy mediated the effect on under-five mortality.

As summarised in Figure 5.1, the multivariate analysis of the study found that maternal education had an independent effect on infant mortality, under-five mortality and pneumonia treatment. It can be asserted that the beneficial effect of maternal education on child mortality was largely attributed to its effect on health services utilisation for major childhood illnesses like pneumonia. The study also found that maternal education had some gross effect on neonatal mortality, stunting and childhood immunisation since maternal education was significantly associated with them in the bivariate analysis and the initial stages of the multivariate analysis. However, these effects were not independent as they disappeared after controlling for possible confounders particularly household wealth level. In addition, the pathway analysis found that maternal education operated its effects on child health outcomes

particularly on infant mortality, under-five mortality and pneumonia treatment through three main pathways: maternal health-related knowledge, health seeking behaviour and income. Figure 5.1 shows a summary of these findings depicting the main pathways through which maternal education imparted its independent effect on some of the child health outcomes in the study setting.

Figure 5.1: Pathways of influence of maternal education and its association with health outcomes



Health Outcomes	Bivariate	Multivariate
Neonatal mortality	Association	No
Infant mortality	Association	Independent
Under-five mortality	Association	Independent
Stunting	Association	No
Diarrhoea	No	No
Pneumonia	No	No
Treatment for Diarrhoea	No	No
Treatment for pneumonia	Association	Independent
Full vaccination	Association	No

5.5 Strengths and limitations

5.5.1 Major contribution of the present study

Maternal education is regarded as one of the important social determinants of child health. Studies conducted in low-income countries found that maternal education has an independent effect on several child health outcomes (Kuruvilla et al., 2014; Moestue and Huttly, 2008; Currie and Moretti, 2003). However, some authors asserted that maternal education was merely a proxy of household financial status since maternal education lost its effect on child health when household income was effectively controlled for by the analysis (Desai and Alva, 1998; Singh et al., 2013). The present study contributed to the controversies around the subject matter by examining whether maternal education has an independent effect on a range of child health outcomes in the context of Myanmar.

The present study has filled some of the knowledge gaps in the context of Myanmar eliciting the independent effect of maternal education on infant and under-five mortality and pneumonia treatment. This is the first study ever conducted in Myanmar exploring the independent effect of maternal education controlling for possible confounding effects. Some previous studies conducted in the country reported the relationship between maternal education and child health variables employing bivariate methods, but there was no conclusive evidence related to an independent effect of maternal education on child health outcomes. In addition, there was no evidence in the country in relation to the pathways of influence through which maternal education may impart its effects on child health. The current study indicated that maternal health knowledge, autonomy, health-related behaviour and maternal income mediated the effect of maternal education on child health outcomes in the study context. In addition, the findings of the present study contributed to the theoretical underpinnings of health inequities such as social determinants of health, the structural theory, and the claims made by the Mosley and Chen theoretical framework of child survival.

5.5.2 Scope of the study

The findings and inferences produced by the present study are nationally representative since the study employed the data produced from the nationally representative DHS survey conducted in Myanmar in 2015-2016 and sample weighting was applied in the analyses. Most of the studies conducted in other low-income settings assessed the effect of maternal education on one or two child health outcomes. There has been paucity of evidence in relation to the effect of maternal education on a broad range of child health parameters in one setting. The present study examined the association between maternal education and nine child health outcomes along the spectrum of childhood mortalities, morbidities and health services utilisation furnishing the evidence related to the effect of maternal education on different child health parameters in one setting.

5.5.3 Study design

The study design of the primary study is a cross-sectional survey where data related to households, mothers and children were collected at a single point in time (Rindfleisch et al., 2008). Thus, although the research question is framed to examine the relationship between maternal education and child health, the ability of the present study to draw conclusions regarding the causality between maternal education and child health outcomes is limited since all the variables related to exposure and outcomes were collected at the same point in time.

5.5.4 Selection of proxy variables

The present study used 'household wealth level' as a proxy to represent the household financial status since the primary study did not collect income information of the respondents. The 'household wealth level' of the interviewed households was derived applying the factor analysis of household asset items which were recorded by data collectors through direct observation during the interviews (DHS and MOHS, 2017). However, there was no information collected as to whether the interviewed households owned those assets or not. In addition, to test whether maternal income is mediating between maternal

education and child health in the pathway analysis, 'household wealth level' was selected as a proxy for maternal income with the assumption that mothers with high education level earn more income contributing to household wealth status. Nevertheless, the household wealth level observed at the time of the data collection can be either a cause or consequence of maternal education. It is not possible for the present study to distinguish whether the household wealth status contributed to mothers to get higher education or whether high maternal education level resulted in the household wealth status. On the other hand, the household wealth status can also be contributed by other family members including husband or partner and the study cannot separate the extent of the wealth level specifically attributed to the mothers only.

In selecting an appropriate proxy variable for maternal health-related behaviour, it was found that most of the available variables in the datasets are not merely health-oriented behaviours, but they are related to affordability of the mothers to pursue such behaviours. The variable 'exclusive breastfeeding' could not be selected as it had a very small sample size. Finally, the variable 'taking antenatal care for four times during recent pregnancy' was taken as a proxy variable to represent the maternal health-related behaviour pathway since antenatal care is provided free of charge in the country context though there might be some transportation fees incurred to the families.

5.5.5 Recall bias

Most of the survey questions related to childhood morbidities and mortalities were responded by the interviewed mothers through recalling past events such as deaths, illnesses and healthcare usage. Generally, the quality of the recall data declines with the time passed as the longer the duration from the event, the more likely it will not be accurately recalled (Curtis, 1995; Ties Boerma and Sommerfelt, 1993). The data quality of mothers' self-reported mortality information may be affected by the omission of child death and underreporting or misreporting of the age of death (Manesh et al., 2008). While some mothers tend to omit unpleasant events such as death of their children at very early age, some do not remember the exact age of death of their children especially if the death occurred within the first month of age (Curtis, 1995; McMurray, 1997). Mothers tend to report the age of death as 'one month' instead

of the actual number of days, which could result in registering the type of death as ‘infant death' instead of ‘neonatal death' (Manesh et al., 2008) [6].

Previous studies pointed out that such omission, underreporting or misreporting of child deaths are more common among uneducated mothers than educated ones (Kamal, 2015; Bicego and Boerma, 1993). Mothers who have limited education are likely to underreport neonatal deaths, while educated mothers are precise and able to provide more accurate information. This reporting bias could lead to summary data which could possibly indicate that educated mothers have more child deaths than uneducated mothers resulting implications on the association between maternal education and child death. This bias can be identified only through conducting a post-enumeration survey which requires the survey team to return to a sample of the selected households to validate the responses provided by interviewed mothers to examine to what extent their answers are correct (Hogan, 1992). The primary study did not undertake such a follow-up assessment, and it is not possible to determine whether or to what extent the neonatal deaths reported by the survey were affected by the recall bias.

Similarly, in collecting the information about the childhood illnesses, the primary study administered the interview questions to mothers or caregivers to recall whether their children had specific symptoms related to the illnesses using a two-week reference period before the time of the data collection. Some authors pointed out that the two-week period is too long for mothers, especially for uneducated ones, to recall details about the illnesses recommending a shorter reference period instead to ensure accuracy of the mothers’ recall (Martorell et al., 1976; Fosu, 1994). Some studies recommended that there could be underreporting of illnesses if the reference period is more than three days (Boerma et al., 1991; Ties Boerma and Sommerfelt, 1993). Manesh et al. (2008) even pointed out that reporting child illnesses declined by 30% if the recall period extended beyond 48 hours. A study based on the data quality audit of a DHS survey conducted in Guatemala revealed that the proportion of under-five children who had diarrhoea collected through a two-week recall was under-reported by 22% indicating the possibility of

[6] Death within 28 days after birth is termed as neonatal death while death after 28 days until a year is defined as infant death.

memory lapse (Boerma et al., 1991). The study also found that the extent of under-reporting increased with the number of days between the occurrence of the event and day of the interview.

The ability to recall the illness symptoms can be affected by other factors including mother's health knowledge, the amount of time spent by mothers with children on daily basis and mother's childcare practices (Manesh et al., 2008). Boerma et al. (1991) cautioned that, compared to educated mothers, mothers with a lower level of education are less likely to recognise and recall the symptoms accurately which could result in under-reporting of the childhood illnesses by less educated mothers. On the other hand, educated mothers tend to recognise and recall disease symptoms more accurately than uneducated mothers which could lead to a distribution pattern where children of educated mothers having increased occurrence of the illnesses than those of uneducated ones (Boerma et al., 1991; Hatt and Waters, 2006).

5.5.6 Community-level variables

Among the independent variables controlled by the present study, there were no other community-level variables apart from the variable 'urban/rural residence' of the interviewed households. In examining the effect of maternal education on child health outcomes, the validity of the effect sizes could have been improved if additional community-level characteristics are included in the multivariate analysis. For instance, according to a study conducted in India, the average education level of women in a community had a strong effect on child mortality net of the mother's education level at individual level (Kravdal,2009). The communities in low income settings, even in the same geographic stratum of rural or urban, can have different coverages of preventive and curative services such as number of health-care facilities, number of physicians, doctors and nurses in the community, number of immunisation campaigns organised in the previous year, and so on.

5.5.7 Adjusting for possible Type I error

It is likely that the significant findings of the multivariate analysis are due to Type I error since the present study performed many significance tests in examining associations between dependent variable and independent variable. As discussed in Section 3.6.4, five significance tests were conducted for each

dependent variable with a stepwise inclusion of potential confounders into the analysis resulting a total of forty-five significance tests. The likelihood of having a significant finding increases with the number of tests performed and thus the significant findings produced from the present study could be due to pure chance or Type I error. To rule out this, as discussed in Section 4.4.4, the present study conducted the Bonferroni correction of p values and found that all the significant associations produced from the multivariate analysis were not due to Type I error.

5.5.8 Literature review

As elaborated in Chapter 2, the literature search for the systematic literature review was conducted screening the papers published between 1990 and 2017 in multiple stages. After the full text sift of the literature search, a total of 507 studies remained and with employing specific inclusion and exclusion criteria, 56 out of 507 papers were selected and the papers which were not in line with the criteria were excluded from the review. While the selected studies were thoroughly examined and their findings synthesised and reported in the systematic literature review, the discarded studies were scanned through and relevant findings incorporated as and where relevant. The discarded papers from the systematic literature review consist of , for instance, the papers that assessed the effect of maternal education on other health outcomes apart from the nine outcomes addressed by the present study; those that examined the effect of maternal literacy skills such as reading and mathematics on child health; those that assessed community wide education status on child health; those that employed maternal education as one of the socioeconomic background variables and not as a study factor; and, those that did not employ multivariate methods in data analysis.

Upon finalizing the thesis, a supplementary literature search was conducted in PubMed screening the papers published during 2018 and 2019 using the same search methodology and the inclusion and exclusion criteria. The search identified six relevant studies that reported the effect of maternal education on different child health outcomes in different contexts. An independent beneficial effect of maternal education was found on under-five mortality, stunting and full immunisation in three studies whereas other three studies reported no effect on neonatal mortality, stunting and diarrhoea among

children under five (Vikram et al., 2019; Hazan et al., 2019; Oyekale et al., 2018; Burroway et al., 2018; Hossain et al., 2018; Ali et al., 2018). It can thus be concluded that the findings from this supplementary search are consistent with the findings reported by the main systematic literature review in terms of the variability of the effect of maternal education in different settings.

In addition, some papers recommended by the viva voce examiners were also reviewed. It was found that the suggested studies were not congruent with the specific inclusion criteria of the literature search to include in the systematic literature review, however, their findings were incorporated in other sessions of the thesis as and where relevant (Levine et al., 2011; Sandiford et al., 1997; Kravdal et al.,2009; Ryland et al., Mya et al., 2019).

5.6 Conclusion

5.6.1 Policy implications on the education sector

The present study found that almost a quarter of women had no formal education, and half of the educated women were only at primary level. These proportions are similar to the education levels of the men as reported by the present study. In Myanmar, primary education is compulsory and free, and the country is strengthening supplementary measures to promote the school enrolment by abolishing school fees, provision of textbooks, stationery and school uniforms to minimise the indirect costs (UNESCO, 2018). However, given the disparities of the education levels by a range of socioeconomic and demographic characteristics as reported by the present study, it is likely that there are many geographical regions which are yet to benefit from these efforts. The country needs to raise its investment in the education sector to ensure all children, particularly girls from disadvantaged backgrounds, have a basic primary education. The criticality of the above recommendation is supported by the evidence generated by the present study which showed that maternal education at primary level resulted in a significant reduction of infant mortality by 13% and under-five mortality by 22%. As discussed in Session 5.3.2, the independent effect size of mothers' secondary education on infant and under-five mortality was almost twice as much as the effect of mothers' education at primary level. It

is critical for the country to institute measures to ensure the continuation of girls who completed the primary education to pursue secondary education and to support their completion of the secondary level.

5.6.2 Policy implications on the health Sector

Since health-related knowledge is one of the mediators through which maternal education channels its effects on most child health outcomes, Myanmar should devise strategies to strengthen health knowledge of girls and women to improve child health status. Given that almost one-third of the mothers were uneducated as reported by the present study, in addition to the school-based dissemination of health-related information embedded in the curriculums, the community-based health promotion approaches should be formulated and strengthened targeting out-of-school boys and girls. For instance, while ensuring school curriculums are continuously updated to effectively diffuse health-related knowledge among the schoolchildren, the health promotion campaigns should be organised in communities targeting rural poor girls and women where most uneducated segments of the population are concentrating. In addition, it may be beneficial for the country to study how uneducated mothers access health-related information and what type of mass media communication channels they commonly engage with, so that health messages be efficiently delivered to them through appropriate media channels.

On the other hand, since the evidence suggests that the effects of maternal education on some health outcomes were accounted for by household wealth level and geographic residence, focusing only on health education and awareness raising may not be adequate to derive positive health outcomes. Measures to improve maternal health knowledge may raise health-seeking behaviours of mothers creating demands for health services, but it may not lead to actual utilisation of services unless health facilities and services are in place and readily accessible to the populations geographically and financially. It is critical for the country to ensure availability and accessibility of health services for every segment of the country populations. For instance, the country should critically analyse the distribution of health facilities and health services vis a vis respective catchment populations and disease

burdens, so that it can optimise skill-sets and deployment of human resources and health services across diverse regions.

Furthermore, the country should also institute measures to improve income level of its poor population groups, particularly in rural areas. These measures may include but not limited to organising income generation activities, introducing affordable health insurance schemes, abolishing user fees at health facilities for the poor, subsidising the cost of drugs, medicines and commodities, providing transport allowances to alleviate transportation costs for hospital/clinic attendants especially in rural areas where health facilities are scarce, and providing cash incentive to fully utilise certain health services. These measures may stimulate and augment health-seeking behaviours of the communities and ensure effective utilisation of the health services.

5.6.3 Policy implications on data and research

Myanmar does not have robust population-based registries that can provide updated information about sociodemographic and economic characteristics and trends of its population on a regular basis. In the absence of such administrative routine data systems, it is crucial for the country to periodically undertake nationally representative surveys since they are the only means to get updated estimates about social, demographic and economic situation of the country. While such data are critical for the country to track the development of social sectors such as health and education, it is also useful for planning, monitoring and evaluation of the national policies and programmes. Furthermore, efforts should be taken to promote deeper analysis of the national survey data since it is not a common practice in Myanmar. The fact that there was no study ever conducted in Myanmar to examine the relationship between maternal education and child health outcomes using national data attests the need to strengthen the use of available data for secondary analysis.

In conclusion, maternal education is an important social determinant of child health in Myanmar as the study revealed its independent effect on infant mortality, under-five mortality and pneumonia treatment though it did not have such effect on other child health outcomes. The weakened effect of maternal education on child morbidities and health services utilisation could be probably attributed to an

increasing importance of wealth and urban/rural residence for the country's populations to effectively access and utilise quality child health services. The study expresses concerns over extensive health disparities by socioeconomic differentials in the country, and it recommends taking comprehensive measures to strengthen health-related knowledge of mothers, address rural/urban gaps in health services utilisation and improve family income to improve child health situation of Myanmar.

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ANNEXES

ANNEX 1: Search strategy of the systematic literature review

1. Overview

A systematic literature search was conducted identifying the studies published in the English language during 1990 – 2017. The search was conducted in following four electronic databases:

1. PubMed (US National Library of Medicine)
2. Ovid
3. Cumulative Index to Nursing and Allied Health Literature (CINAHL), and
4. Scopus.

The entries identified in the very first stage of the search was sifted through title sift, abstract sift and full text sift consistently employing the inclusion and exclusion criteria in every stage of selection. The studies remained were further screened using the key inclusion and exclusion criteria.

2. Review questions

The literature review sought to answer three broad questions:

(i) Does maternal education have an independent beneficial effect on different child health outcomes?

(ii) What possible confounding factors need to be considered in examining the effect of maternal education on child health?

(iii) Through which pathways does maternal education influence child health?

3. Inclusion and exclusion criteria

(a) Types of studies

There was no limitation regarding the study design as the review included any empirical studies that examined association between maternal education and the below child health outcomes employing any study designs. Empirical studies that used any design were included in the review while review studies and metanalyses were excluded from the review. Child health in this review was

operationalised as the occurrence of common childhood diseases (diarrhoea and pneumonia), child undernutrition, the utilisation of preventive health services (child immunisation) and utilisation of curative health services (pneumonia and diarrhoea) and child mortality (neonatal, infant and under-five mortality).

(b) Types of population

The studies conducted in the developing countries context were included.

(c) Types of exposure

The critical exposure parameter was the formal education level of the mothers. The categorisation of formal education varies across different contexts. The review selected the studies in which the mother's education level was included in the analysis as a study factor examining the association between maternal education and child health outcomes.

(d) Comparators

There was no typical comparator as in the intervention studies. However, in most of the included studies, the maternal education level was measured as an ordinal variable comprising of a gradient of different levels such as 'no education', 'primary', 'secondary', 'tertiary' and 'higher'.

(e) Types of outcome measures

The studies included in the review if they explored the association between maternal education and child health outcomes as below.

1.Childhood mortality

- Neonatal mortality - death within the first month of age;
- Infant mortality - death within one year of age;
- Under-five mortality - death within five years of age.

2. Child morbidity among children under five years of age

- Stunting- children whose height for age is less than two standard deviations of the median benchmark of a reference population;

- Wasting - children whose weight for height is less than two standard deviations of the median parameter of a reference population;
- Underweight - children whose weight for age is less than two standard deviations of the median benchmark of a reference population;
- The occurrence of diarrhoea - children who had diarrhoea;
- The occurrence of pneumonia - children who had pneumonia symptoms;

3.Utilisation of curative and preventive health services

- Appropriate treatment for diarrhoea among under-five children who had diarrhoea;
- Appropriate treatment for pneumonia among under-five children who had pneumonia;
- Full immunisation - children who received all types of vaccination as recommended by national guidelines.

(f) Setting/Context

Studies conducted in the context of developing countries were considered for the review.

(g) Time limits

Studies conducted from 1990 to 2017 were included.

(h) Data analysis methods

Only those studies that employed the multivariate data analysis methods were included.

4. Search terms and operators

The search terms were initially extracted as free text search terms. The terms were then validated in MEDLINE in search of key thesaurus terms or MeSH terms, Medical Subject Headings of National Library of Medicine's controlled vocabulary. The final search terms are as.

- Population – mothers (MeSH), maternal (Text Word),
- Exposure – education (MeSH), literacy (MeSH), educational status (MeSH), "maternal education" (Text Word), status maternal education (MeSH),
- Outcomes – child health (MeSH), child health (Text Word), child mortality (MeSH), child mortality (Text Word), child nutrition disorders (MeSH) , child health service (MeSH), child health services (MeSH), neonatal mortality (MeSH), infant mortality (MeSH), under five mortality (MeSH), diarrhoea (MeSH), pneumonia (MeSH).
- Language - English

Table 1: Search terms and the number of papers retrieved at the first stage of the literature search

Search and Search terms used	Number of papers retrieved at first stage search			
	PubMed	Ovid	CINAHL	Scopus
(((((("education"[Title/Abstract]) OR "schooling"[Title/Abstract]) OR "literacy"[Title/Abstract]) AND "mother"[Title/Abstract]) OR "maternal education"[Title/Abstract]) OR "maternal education level"[Title/Abstract]) OR "maternal educational status"[Title/Abstract]) AND ((((((((((("child health"[Title/Abstract]) OR "health services utilization"[Title/Abstract]) OR "immunisation"[Title/Abstract]) OR "pneumonia"[Title/Abstract]) OR "diarrhoea"[Title/Abstract]) OR "child nutrition disorders") OR "child mortality"[Title/Abstract]) OR "under five mortality"[Title/Abstract]) OR "neonatal mortality"[Title/Abstract]) OR "infant mortality"[Title/Abstract])) AND (("1990/01/01"[PDat] : "2017/12/31"[PDat])) AND English[lang])	882	1810	264	2000 Total 4956

The search was conducted in the following four electronic databases: PubMed (US National Library of Medicine), Ovid, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus.

5. Steps taken in the literature search

The comprehensive search was carried out in following steps.

i. Using the above search terms with operators limiting to publications conducted in English, a preliminary search was conducted in MEDLINE as a pilot to assess sensitivity (chance of identifying relevant studies) and specificity (likelihood of missing relevant studies) of the

search strategy before the main search. The search strategy was modified into ‘Title/Abstract' as the first attempt resulted in a substantial number of papers.

ii. The literature search was undertaken in the four electronic databases using the modified search terms.

iii. The verification of the search strategy was conducted in consultation with the supervisors

iv. A detailed and precise account of the whole search process was adequately documented in order to ensure transparency and reproducibility of the search strategy. The list of the studies identified in every step of the search and those discarded from the list were documented. with the reasons

v. The studies retrieved through the main search were screened as below.

- Title sift: Titles of all selected studies were examined, and those that are not relevant based on the title were excluded.
- Abstract sift: Abstracts of all the studies remained after the title sift were reviewed and those that were not relevant were excluded.
- Full text sift: Full texts of all the studies remained after the abstract sift were examined, and those that were not relevant were excluded. The reasons for excluding articles were documented correctly at this stage.

The articles selected at full text sift were included in the review. A flow chart was prepared and reported in the final report demonstrating the number of papers included and excluded at every stage.

6. Outputs of the literature search

The number of studies selected at each stage of the literature search from the respective databases can be seen in Table 1. After the full text sift, 507 papers were identified at the first stage of the literature search.

Table 2: Number of studies at each stage of the literature search

Items	PubMed	Ovid	CINAHL	Scopus	Total
Number of studies at the first stage search	882	1909	264	1901	4956
Number of studies after removing duplicates	880	1003	234	1301	3418
Number of studies after title sift	643	720	56	393	1812
Number of studies after the abstract sift	427	160	19	48	654
After full text sift					507

The identified 507 studies were further screened using the below criteria to select the studies that: (1) used maternal education as a study factor; (2) employed multivariate analysis; (3) were conducted in low and middle-income countries; and (4) are primary empirical studies. This screening sifted 56 studies to be included in the systematic literature review. Figure 1 shows an overview of the literature search process.

Figure 1: Summary of the literature search process

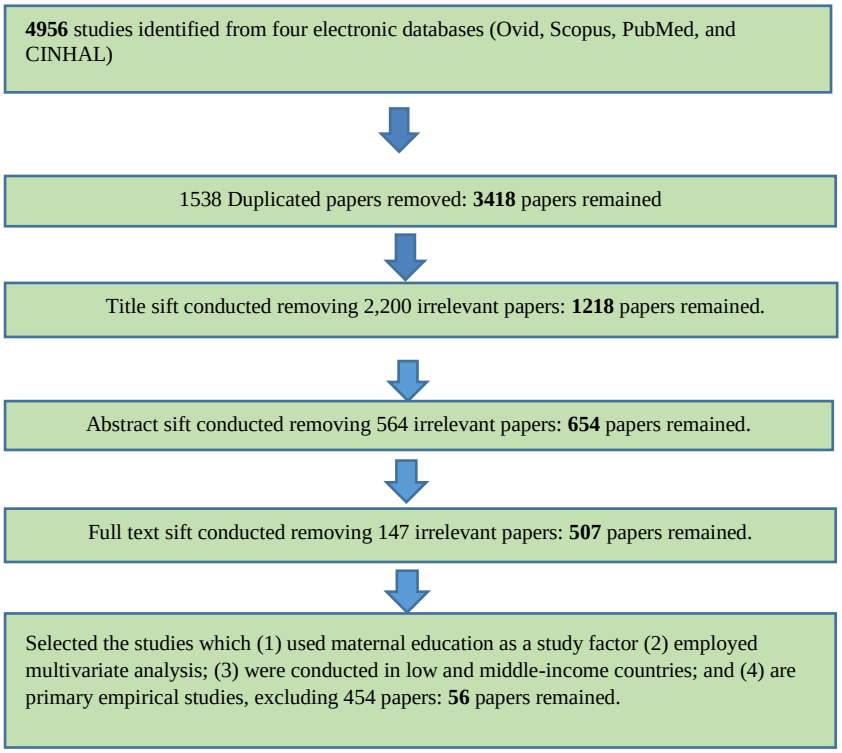


Table 3-5 shows the breakdown of the initial 507 studies by the three main screening criteria: context, data analysis methods and use of maternal education as a study factor.

Table 3: Number of studies by context

Context	Number of papers
High-Income Countries (HIC)	96
Low and Middle-Income Countries (LMIC)	404
Both Low and Middle-Income Countries (LMIC + HIC)	7
Total	507

Table 4: Number of studies by context and data analysis methods

	LMIC or HIC			Total
	HIC	LMIC	LMIC /HIC	
bivariate analysis	27	87	1	115
review or meta-analysis	4	21	4	29
multivariate analysis	65	296	2	363
Total	96	404	7	507

Table 5: Number of studies using maternal education as a confounder or a study factor

	Frequency
Confounder	393
Study factor	114
Total	507

ANNEX 2: List of studies included in the literature review

#	Title of the study	Authors	Journal	Country	Data Source/ Sampling method	Sample Size	Child Health Outcome	Effect of maternal education on child health outcome
1	Maternal Education and Child Immunization.	STREATFIELD, K., SINGARIMBUN, M. & DIAMOND, I. (1990).	Demography, 27(3), 447-455.	Indonesia	The study interviewed all mothers having children under five years of age in two selected villages in one subdistrict. The methodology did not describe the sampling approach taken in selecting the two villages.	540 children under five	Immunisation	Beneficial effect
2	Underlying and Proximate Determinants of Child Health: The Cebu Longitudinal Health and Nutrition Study.	Briscoe, J. 1991.	American Journal of Epidemiology, 133(2), 185-201.	Philippines	A longitudinal study using a stratified single- stage sampling approach selecting 17 urban and 18 rural neighbourhoods. 3080 women who had single live births in the selected neighbourhoods were followed up for two years period.	3080 children under five	Diarrhoea	Beneficial effect
3	Proximate determinants of child mortality in Liberia	Ahmad OB, Eberstein IW, Sly DF	*Sci.* 1991;23 (3):313-326	Liberia	Nationwide household survey (DHS). Stratified multi-stage sampling.	5180 under five children	Under-five mortality	Beneficial effect
4	Teaching Mothers to Read: Evidence from Colombia on the Key Role of Maternal Education in Preschool Child Nutritional Health	Lomperis, A. M. 1991.	. J Dev Areas, 26(1), 25-52.	Colombia	A (baseline) household survey of a maternal and child health programme. Households were sampled from a low-income urban neighbourhood.	197 children under five	Stunting, Wasting and Weight for Age	Beneficial effect
5	Parental Education and Child Mortality in Burundi.	O'toole, J. & Wright, R. E. 1991.	J Biosoc Sci, 23(3), 255-62.	Burundi	Nationwide household survey (DHS). Stratified multi-stage sampling.	8895 children under five	Under-five mortality	Beneficial effect
6	The Mediating Effect of Maternal Nutrition	RUEL, M. T., HABICHT, J. P., PINSTR	American Journal of	Lesotho	Data were collected from all mothers who attended 9 primary health care clinics during the enrolment period. Clinics were chosen by their	921 children under two years	Weight for Age	Beneficial effect

	Knowledge on the Association between Maternal Schooling and Child Nutritional Status in Lesotho.	UP-ANDERSEN, P. & GRÖHN, Y. (1992).	Epidemiology, 135(8), 904-914.		accessibility by road and their attendance rates.			
7	The Determinants of Use of Maternal and Child Health Services in Metro Cebu, the Philippines.	Becker, S., Peters, D. H., Gray, R. H., Gultiano, C. & Black, R. E. 1993.	Health Transit Rev, 3(1), 77-89.	Philippines	A longitudinal cohort study using a stratified single- stage sampling approach selecting 17 urban and 18 rural neighbourhoods. 4629 women who had single live births in the selected neighbourhoods were followed up for two years period.	4629	Immunisation Diarrhoea	Beneficial effect
8	Maternal Education and Child Survival - a Comparative-Study of Survey Data from 17 Countries.	Bicego, G. & Boerma, J. 1993a.	Social Science & Medicine, 36(9), 1207-1227.	17 countries	Combined analysis of nationwide household surveys (DHS) from 17 countries.	The sample size varies across 17 countries (e.g. 3098 live births in Togo, 8548 in Egypt)	Neonatal mortality Infant mortality Stunting	Beneficial effect on neonatal mortality in 4 countries but no effect in 13 countries. Beneficial effect on infant mortality in 5 countries; no effect in 12 countries. Beneficial effect on stunting in 9 countries; no effect in 8 countries.
9	Maternal Education, Female Labour Force Participation and Child Mortality: Evidence from the Indian Census.	Tulasidhar, V. B. 1993.	Health Transit Rev, 3(2), 177-90.	India	1981 Population Census data.	Total number of children not mentioned. Only rates reported.	Under-five mortality	Beneficial effect

10	Association between Maternal Education and Infant Diarrhea in Different Household and Community Environments of Cebu, Philippines.	DARGENT-MOLINA, P., JAMES, S. A., STROGATZ, D. S. & SAVITZ, D. A. (1994).	Social Science and Medicine, 38(2), 343-350.	Philippines	A longitudinal cohort study using a stratified single- stage sampling approach selecting 17 urban and 18 rural neighbourhoods. Mothers who had single live births in the selected neighbourhoods were followed up for two years period.	2484 children under one year	Diarrhoea	Mixed-effect – beneficial effect among richest households only
11	Maternal Schooling and Child Health: Preliminary Analysis of the Intervening Mechanisms in Rural Nepal.	JOSHI, A. R. (1994).	Health Transit Rev, 4(1), 1-28.	Nepal	The study interviewed all mothers with children under five in one village. The sampling approach takes to select this village was not mentioned.	74 pairs of mothers and children	Stunting Wasting	Beneficial effect on stunting No effect on wasting
12	Maternal Education and Family Income as Determinants of Severe Disease Following Acute Diarrhoea in Children: A Case-Control Study.	MAHALANABIS, D., FARUQUE, A. S. G., ISLAM, A. & HOQUE, S. S. (1996).	Journal of Biosocial Science, 28(2), 129-139.	Bangladesh	Clinic-based case-control study. Children having diarrhoea for 6 days and less during one-year period. Children with dehydration signs were cases, while those without such signs were defined as controls.	284 cases and 723 controls of children 1-35 months.	Diarrhoea	Beneficial effect
13	Influence of Parental Literacy and Socio-Economic Status on Infant Mortality.	RAO, R. S., CHAKLADAR, B. K., NAIR, N. S., KUTTY, P. R., ACHARYA, D., BHAT, V., CHANDRASEKHAR, S., RODRIGUES, V. C., KUMAR, P., NAGAR	Indian J Pediatr, 63(6), 795-800.	India	Community based prospective study wherein all live births in one subdistrict during the one-year period were followed up for a year.	12,875 registered live births	Neonatal mortality	Beneficial effect

		AJ, K., PRASAD, K. N. & KRISHNAN, L. (1996).						
14	The Effects of Maternal Education on Child Nutritional Status Depend on Socio-Environmental Conditions.	REED, B. A., HABICHT, J. P. & NIAMEOGO, C. (1996).	International Journal of Epidemiology, 25(3), 585-592.	Benin	Rapid rural appraisal using purposive sampling of 23 village heads and one-third of their helmets. Sampling of 489 households was done by the random walking method.	907 children 13-36 months	Weight for age	Mixed-effect Beneficial effect on the middle socioeconomic group; no effect on the richest and poorest groups
15	Maternal Schooling and Comprehension of Child Health Information in Urban Zambia: Is Literacy a Missing Link in the Maternal Schooling-Child Health Relationship?	STUEBING, K. W. (1997a).	Health transition review : the cultural, social, and behavioural determinants of health, 7(2), 151-171.	Zambia	House to house census in an urban township (Chifubu) in the second largest city of the country. The sampling approach applied in selecting the urban township was not provided.	219 children under five	Neonatal mortality	No effect
16	Maternal Education and Child Health: Is There a Strong Causal Relationship?	DESAI, S. & ALVA, S. (1998).	Demography, 35(1), 71-81.	22 developing countries	Combined analysis of nationwide household surveys DHS from 22 countries.	Differing number of children in each country	Infant mortality Stunting Immunisation	Mixed-effect Mixed-effect Mixed-effect
17	Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco.	GLEWWE, P. (1999).	Journal Of Human Resources, 34(1), 124-159.	Morocco	World Bank's Living Standards Measurement Survey. National scale. Stratified multi-stage sampling.	1495 children.	Stunting	Beneficial
18	Female Education and Child Mortality in Indonesia.	MELLINGTON, N. & CAMER	Bull Indones Econ Stud,	Indonesia	Nationwide household survey (DHS). Stratified multi-stage sampling.	6620 children under five.	Under-five mortality	Beneficial

		ON, L. (1999).	35(3), 115-44.					
19	The Effect of Poverty, Social Inequity, and Maternal Education on Infant Mortality in Nicaragua, 1988-1993.	PENA, R., WALL, S. & PERSSON, L. A. (2000a).	American Journal of Public Health, 90(1), 64-69.	Nicaragua	Nationally representative survey assessed poverty and maternal and child health. Stratified multistage cluster sampling.	10867 children under five	Infant mortality	Mixed (beneficial among poorest households)
20	Covariates of Child Mortality in Mali: Does the Health-Seeking Behaviour of the Mother Matter?	UCHUDI, J. M. (2001a).	Journal of Biosocial Science, 33(1), 33-54.	Mali	Nationwide household survey DHS. Stratified multistage cluster sampling.	10264 under five children	Neonatal mortality Infant mortality	No effect on neonatal mortality Mixed-effect on infant mortality
21	Narrowing Inequalities in Infant Mortality in Southern Brazil.	GOLDANI, M. Z., BENATTI, R., DA SILVA, A. A., BETTIOL, H., CORREA, J. C., TIETZMANN, M. & BARBIERI, M. A. (2002).	Rev Saude Publica, 36(4), 478-83.	Brazil	Population registers- vital statistics data	119,170 livebirths	Neonatal mortality Infant mortality Under-five mortality	No effect on neonatal mortality Beneficial effect on infant mortality Beneficial effect on under-five mortality
22	Mothers' Education and Childhood Mortality in Ghana.	Buor, D. 2003.	Health Policy, 64(3), 297-309.	Ghana	Nationwide Survey DHS. Stratified multistage cluster sampling.	5643 children under five	Neonatal mortality Infant mortality Under-five mortality	Beneficial Beneficial Beneficial

23	Inequalities in Child Mortality in Mozambique: Differentials by Parental Socio-Economic Position.	Macassa, G., Ghilagaber, G., Bernhardt, E., Diderichsen, F. & Burstrom, B. 2003a.	Soc Sci Med, 57(12), 2255-64.	Mozambique	Nationwide Survey DHS. Stratified multistage cluster sampling.	9142 children under five	Neonatal mortality Infant mortality Under-five mortality	No effect No effect No effect
24	The Impact of Education on Fertility and Child Mortality: Do Fathers Really Matter Less Than Mothers?	Breierova, L. & Duflo, E. 2004. :	National Bureau of Economic Research.	Indonesia	Ecological study	10,000 children under five.	Under-five mortality	Beneficial
25	Infant Mortality in India: Use of Maternal and Child Health Services in Relation to Literacy Status.	GOKHALE, M. K., RAO, S. S. & GAROLE, V. R. (2002a).	Journal of Health Population and Nutrition, 20(2), 138-147	India	National Family Health Survey. One rural community was extracted from the national survey data for this analysis.	286 pairs of mothers and children	Infant mortality Diarrhoea Diarrhoea treatment	Beneficial No effect No effect
26	Low levels of maternal education and the proximate determinants of childhood mortality: a little learning is not a dangerous thing.	Basu, A. M. & Stephenson, R. (2005)	Soc Sci Med, 60(9), 2011-23.	India	Compiled analysis of a series of nationwide household surveys DHS. Stratified multistage cluster sampling.	61,543 live births	Neonatal mortality Infant mortality Weight for age Diarrhoea Diarrhoea treatment	Beneficial Mixed Beneficial Beneficial No effect Beneficial Beneficial

							Pneumonia Pneumonia treatment	
27	Maternal education and child nutritional status in Bolivia: finding the links.	Frost, M. B., Forste, R. & Haas, D. W. (2005)	Soc Sci Med, 60(2), 395-407.	Bolivia	Nationwide household survey DHS Stratified multistage cluster sampling.	5562 under five children	Stunting	Beneficial
28	Moving Beyond the Mother-Child Dyad: Women's Education, Child Immunization, and the Importance of Context in Rural India.	Parashar, S. 2005.	Social Science and Medicine, 61(5), 989-1000.	India	Human Development Profile Index Survey. Multistage sample design.	5623 children	Immunisation	Mixed
29	The Influence of Economic Development Level, Household Wealth and Maternal Education on Child Health in the Developing World.	Boyle, M. H., Racine, Y., Georgiades, K., Snelling, D., Hong, S., Omariba, W., Hurley, P. & Rao-Melacini, P. 2006a.	Social Science and Medicine, 63(8), 2242-2254.	42 developing countries	Nationwide household survey DHS Stratified multistage cluster sampling.	Different sample size of under-five children across 42 countries	Stunting Weight for age	Beneficial Beneficial
30	Determinants of Child Morbidity in Latin America: A Pooled Analysis of Interactions between Parental Education and Economic Status.	Hatt, L. E. & Waters, H. R. 2006.	Social Science and Medicine, 62(2), 375-386.	Latin America	Demographic Health Survey and Living Standard Measurements Surveys	DHS – 77800 under five children LSMS – 28,001	Diarrhoea Pneumonia	No effect Beneficial

31	Care Seeking Behaviour for Childhood Illness- a Questionnaire Survey in Western Nepal.	SREERAMAREDDY, C. T., SHANKAR, R. P., SREEKUMARAN, B. V., SUBBA, S. H., JOSHI, H. S. & RAMACHANDRAN, U. (2006).	BMC International Health and Human Rights, 6.	Nepal	Data collection of clinic attendants at immunisation clinics in a metropolitan subdistrict. Sampling approach of the clinics was not mentioned.	1652 children under five	Treatment for pneumonia	Beneficial
32	Height and Weight of Urban Preschool Children in Relation to Their Mothers' Educational Levels and Employment Status in Rasht City, Northern Iran.	Maddah, M., Mohtasham-Amiri, Z., Rashidi, A. & Karandish, M. 2007.	Maternal and Child Nutrition, 3(1), 52-57.	Iran	Data collection of children at all day care centres of a city.	1319 under five children	Stunting Wasting Weight for age	Mixed. Beneficial effect only on middle-income families
33	Maternal Education and Child Healthcare in Bangladesh.	HUQ, M. N. & TASNIM, T. (2008a).	Matern Child Health J, 12(1), 43-51.	Bangladesh	Household Income and Expenditure Survey .National level. Stratified multistage cluster sampling.	4387 under five children	Immunisation Treatment of Diarrhoea	Beneficial Mixed. No effect at primary level of education; beneficial effect at secondary level.
34	Adult Education and Child Nutrition: The Role of Family and Community.	Moestue, H. & Huttly, S. 2008a.	Journal of Epidemiology and Community Health, 62(2), 153-159.	India & Vietnam	Cross-sectional Survey. Few communities selected from each district.	5692 under five children	Stunting Weight for age	Beneficial Beneficial

35	Child Malnutrition and Mortality among Families Not Utilizing Adequately Iodized Salt in Indonesia.	Semba, R. D., De Pee, S., Hess, S. Y., Sun, K., Sari, M. & Bloem, M. W. 2008.	American Journal of Clinical Nutrition, 87(2), 438-444.	Bangladesh & Indonesia	National Surveillance System	590,570 children in Indonesia and 395,122 children in Bangladesh	Stunting	Beneficial
36	Mother's Education and Child Health: Is There a Nurturing Effect?	Chen, Y. & Li, H. 2009.	Journal of Health Economics, 28(2), 413-426.	China			Stunting	Beneficial
37	Maternal Education Is Associated with Vaccination Status of Infants Less Than 6 Months in Eastern Uganda: A Cohort Study.	NANKABIRWA, V., TYLLESKAR, T., TUMWINE, J. K. & SOMMERFELT, H. (2010).	BMC Pediatr, 10, 92.	Uganda	Longitudinal study	696 children followed up for 2 years since birth	Immunisation	Mixed. No effect at primary level; beneficial effect at secondary level.
38	Influence of Maternal Education on Child Immunization and Stunting in Kenya.	Abuya, B., Onsomu, E., Kimani, J. & Moore, D. 2011.	Maternal & Child Health Journal, 15(8), 1389-1399.	Kenya	DHS nationwide household survey	immunization (n = 2,169) and nutritional status (n = 5,949	Immunisation Stunting	Beneficial No effect
39	Dynamics of Inequality: Mother's Education and Infant Mortality in China, 1970-2001.	SONG, S. & BURGARD, S. A. (2011).	Journal of Health and Social Behavior, 52(3), 349-364.	China	National Family Planning and Reproductive Health Survey data	55,795 live births	Infant mortality	Beneficial
40	Effect of Mother's Education on Child's Nutritional Status in the Slums of Nairobi.	ABUYA, B. A., CIERA, J. & KIMANI-MURAG	BMC Pediatrics, 12.	Kenya	Nairobi Urban Health and Demographic Surveillance System (NUHDSS).	5156 children aged 0-42 months.	Stunting	Beneficial

		E, E. (2012a).						
41	Parental Education and Child Health—Understanding the Pathways of Impact in Pakistan.	Aslam, M. & Kingdon, G. G. 2012.	World Development, 40(10), 2014-2032.	Pakistan	Nationwide household survey DHS Stratified multistage cluster sampling.	4907 children under five	Immunisation	Beneficial
42	Understanding the Association between Maternal Education and Use of Health Services in Ghana: Exploring the Role of Health Knowledge.	Greenaway, E. S., Leon, J. & Baker, D. P. 2012.	Journal of biosocial science, 44(6), 733-747.	Ghana	Nationwide household survey DHS Stratified multistage cluster sampling.	1794 children under five	Immunisation	Beneficial
43	Maternal Education as a Determinant of Neonatal Mortality in Bangladesh.	Kamal, S. M. M. 2012.	Journal of Health Management, 14(3), 269-281.	Bangladesh	Nationwide household survey DHS Stratified multistage cluster sampling.	6058 live births	Neonatal mortality	Beneficial
44	Linkages between Maternal Education and Childhood Immunization in India.	Vikram, K., Vanneman, R. & Desai, S. 2012a.	Social Science and Medicine, 75(2), 331-339.	India	Nationally representative India Human Development Survey of 2004	5287 children under five	Immunisation	Beneficial
45	Maternal Education Is Associated with Reduced Female Disadvantages in under-Five Mortality in Sub-Saharan Africa and Southern Asia.	Monden, C. W. & Smits, J. 2013.	Int J Epidemiol, 42(1), 211-8.	31 sub-Saharan African and 4 southern Asian countries.	Nationwide household surveys DHS from 31 countries	521 551 children under five	Under-five mortality	Beneficial

46	Maternal Reading Skills and Child Mortality in Nigeria: A Reassessment of Why Education Matters	Smith-Greenaway, E. 2013	*Demography*, 50(5), 1551-1561.	Nigeria	Nationwide household survey DHS Stratified multistage cluster sampling.	12,076 children	Under-five mortality	Beneficial
47	Is There Any Association between Parental Education and Child Mortality? A Study in a Rural Area of Bangladesh.	Akter, T., Hoque, D. M., Chowdhury, E. K., Rahman, M., Russell, M. & Arifeen, S. E. 2015.	Public Health, 129(12), 1602-9.	Bangladesh	Integrated Management of Childhood Illness (IMCI) surveys	38,544	Under-five mortality	Beneficial
48	Maternal Education and Child Mortality in Zimbabwe	Grepin, K. A. & Bharadwaj, P. 2015. ..	J Health Econ, 44, 97-117	Zimbabwe	Five rounds of DHS data Stratified multistage cluster sampling.		Under-five mortality	Beneficial
49	Is There a Threshold Level of Maternal Education Sufficient to Reduce Child Undernutrition? Evidence from Malawi, Tanzania and Zimbabwe.	Makoka, D. & Masibo, P. K. 2015a.	BMC Pediatrics, 15(1).	Malawi, Tanzania, Zimbabwe	Nationwide household surveys DHS Stratified multistage cluster sampling.	4563 (Malawi) 4821 (Tanzania) 3473 (Zimbabwe)	Stunting Wasting Weight for age	Beneficial at secondary level. Beneficial at secondary level. Beneficial at secondary level.
50	Maternal Education and Immunization Status among Children in Kenya.	Onsomu, E. O., Abuya, B. A., Okech, I. N., Moore, D. & Collins-Mcneil, J. 2015.	Matern Child Health J, 19(8), 1724-33.	Kenya	Nationwide household survey DHS Stratified multistage cluster sampling.	1707 children under five	Immunisation	Beneficial

51	Socioeconomic Gradients in Early Childhood Health: Evidence from Bangladesh and Nepal.	Devkota, S. & Panda, B. 2016.	Int J Equity Health, 15, 78.	Nepal & Bangladesh	Nationwide household survey DHS Stratified multistage cluster sampling.	7505children under five	Stunting Weight for age	Beneficial Beneficial
52	The Causal Effect of Increased Primary Schooling on Child Mortality in Malawi: Universal Primary Education as a Natural Experiment.	Makate, M. & Makate, C. 2016a.	Soc Sci Med, 168, 72-83.	Malawi	Nationwide household survey DHS Stratified multistage cluster sampling.	4560 children under five	Neonatal mortality Infant mortality Under-five mortality	No effect Beneficial effect Beneficial effect
53	The Association of Parental Education with Childhood Undernutrition in Low- and Middle-Income Countries: Comparing the Role of Paternal and Maternal Education.	Vollmer, S., Bommer, C., Krishna, A., Harttgen, K. & Subramanian, S. V. 2016.	Int J Epidemiol.	62 low and middle-income countries	180 nationwide DHS surveys conducted in 62 countries between 1990 and 2014		Stunting Wasting Weight for age	Beneficial effect Beneficial effect Beneficial effect
54	Maternal education and age: inequalities in neonatal death	Fonseca SC, Flores PVG, Camargo KR, Jr., Pinheiro RS, Coeli CM	*Rev Saude Publica.* 2017;51:94.	Brazil	Mortality Information System and Live Birth Information System	154400 live births	Neonatal mortality	Beneficial effect
55	An examination of the maternal social determinants influencing under-5 mortality in Nigeria:	Blackstone SR, Nwaozuru U, Iwelunmor J.	*Global public health.* 2017;12(6):744-756.	Nigeria	DHS Nationwide household survey DHS Stratified multistage cluster sampling.	8542 children under five	Under-five mortality	No effect

	Evidence from the 2013 Nigeria Demographic Health Survey.							
56	The effect of parental education on child health: Quasi-experimental evidence from a reduction in the length of primary schooling in Egypt.	Ali FRM, Elsayed MAA.	*Health economics.* 2017;27(4):649-662.	Egypt	Seven waves of DHS surveys	345,235 children under five	Under-five mortality Stunting	No effect No effect

ANNEX 3: Tables from Chapter 3 Findings

Table 1: Bivariate association between the study factor, independent variables and childhood morbidities among children under-five

Independent Variables	Stunting		Diarrhoea		Pneumonia	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
Maternal education		0.000		0.052		0.256
No education	37.2		10.5		5.7	
Primary	31.5		10.7		5.5	
Secondary	23.1		11.7		5	
Higher	19.4		6.1		2.9	
Paternal education		0.000		0.18		0.682
No education	37.9		9.7		5.2	
Primary	30.7		11.1		4.8	
Secondary	24.7		11		5.7	
Higher	18		6.9		4.3	
Paternal occupation		0.000		0.242		0.261
No work	n/a		n/a		n/a	
Professional/managerial	26.1		11.2		5	
Clerical/sales	20.7		6.5		3.1	
Agricultural self employed	30.1		11		6	
Agricultural employee	33.9		10.9		3.6	
Skilled labour	23.8		11.1		4.9	
Unskilled labour	32.7		10.9		5.7	
Maternal age at child birth		0.000		0.087		0.165
Under 19	35.1		11.4		6	
20-29	26.9		10.7		4.9	
30 and above	25.6		7.4		3.8	
Preceding birth interval		0.000		0.455		0.149
No preceding birth	25.9		10.9		4.3	
Less than 2 years	40.4		8.7		5.3	
Above 2 years	29.3		10.7		5.7	
Child's sex		0.002		0.788		0.033
Male	31.3		10.7		5.9	
Female	26.8		10.5		4.4	
Child age		0.000		0.000		0.019
Under 1	10.3		10.3		5.1	
1 to 2	23.9		17.5		6.8	
2 to 3	41.8		11.7		6	

3 to 4	36.4		8.2		4.6	
4 to 5	33.4		5.4		3.2	
Household wealth status		0.000		0.000		0.002
Poorest	37.4		12.4		6.7	
Poorer	33.5		13		6	
Middle	27.7		10		4.6	
Richer	21		7.6		3.9	
Richest	17.2		7.4		2.7	
Residence		0.000		0.000		0.130
Urban	20.2		8.3		4.2	
Rural	31.8		11.3		5.4	

Table 2: Bivariate association between the study factor, independent variables and child health services utilisation

Independent Variables	Diarrhoea treatment		Pneumonia treatment		Full immunisation	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
Maternal education		0.195		0.010		0.000
No education	53.3		41.5		41.1	
Primary	63.3		46.5		53.6	
Secondary	68.4		58.6		56.4	
Higher	63.2		100		79.2	
Paternal education		0.092		0.077		0.000
No education	58		48.6		42.5	
Primary	60.1		42.7		48.6	
Secondary	66.7		57.6		63.7	
Higher	87.5		80		73.2	
Paternal occupation		0.033		0.005		0.014
no work	n/a		n/a		n/a	
professional/managerial	70.8		90		62.4	
clerical/sales	65.5		64.3		57.3	
agricultural self employed	62.2		28.9		53	
agricultural employee	36.4		45.5		45.3	
skilled labour	62.4		55.3		64.8	
unskilled labour	67.2		53.8		49.9	
Maternal age at child birth		0.644		0.972		0.001
Under 19	60.9		50		49.4	
20-29	63.2		50.8		54.4	
30 and above	70.4		53.3		74.4	
Preceding birth interval		0.040		0.090		0.000
No preceding birth	69.7		62.3		53.6	
Less than 2 years	69.7		45		31.4	

Independent Variables	Diarrhoea treatment		Pneumonia treatment		Full immunisation	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
Above 2 years	57.7		45.7		59.3	
Child's sex		0.014		0.929		0.042
male	68.4		51.2		57.9	
female	56.9		50.6		50.9	
Child's age		0.003		0.391		
under 1	46.3		51.3			n/a
1 to 2	61.4		54.5			
2 to 3	70		58.7			
3 to 4	71		41			
4 to 5	73.8		40			
Household wealth status		0.727		0.000		0.000
poorest	66		37		41.3	
poorer	61.4		62.3		40.6	
middle	56.7		35.5		64.2	
richer	66		70.4		64.6	
Richest	62.8		81.3		77.1	
Residence		0.13		0.000		0.000
Urban	70.7		78.4		67.4	
rural	61.4		44.7		50.4	

Table 3: Stepwise logistic regression of maternal education on infant mortality controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 19,663 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.000	0.000	0.000	0.000	0.003
No education	reference	reference	reference	reference	reference
Primary	0.726(0.060)0.000	0.770(0.065)0.000	0.824(0.066)0.003	0.831(0.066)0.005	0.874(0.066)0.042
Secondary	0.463(0.083)0.000	0.533(0.092)0.000	0.576(0.094)0.000	0.622(0.094)0.000	0.784(0.098)0.013
Higher	0.240(0.226)0.000	0.277(0.251)0.000	0.314(0.254)0.000	0.340(0.255)0.000	0.537(0.264)0.019
Paternal education(P value)		0.001	0.003	0.003	0.108
No education		reference	reference	reference	reference
Primary		0.823(0.070)0.398	0.954(0.070)0.501	0.945(0.070)0.425	0.971(0.071)0.681
Secondary		0.726(0.084)0.000	0.741(0.084)0.000	0.739(0.085)0.000	0.853(0.086)0.064
Higher		0.880(0.212)0.547	0.898(0.214)0.616	0.893(0.214)0.599	1.299(0.221)0.236
Maternal age at child birth(P value)			0.016	0.105	0.131
Under 19			reference	reference	reference

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
20-29			0.853(0.056)0.004	0.891(0.058)0.044	0.911(0.058)0.107
30 and above			0.874(0.144)0.350	1.016(0.147)0.912	1.116(0.148)0.459
Preceding birth interval(P value)			0.000	0.000	0.000
No preceding birth			reference	reference	reference
Less than 2 years			1.545(0.068)0.000	1.580(0.070)0.000	1.551(0.070)0.000
Above 2 years			0.635(0.064)0.000	0.679(0.067)0.000	0.695(0.067)0.000
Child sex (P value)				0.000	0.000
male				reference	reference
female				0.813(0.147)0.000	0.810(0.054)0.000
Household wealth status(P value)					0.000
poorest					reference
poorer					0.899(0.071)0.135
middle					0.775(0.078)0.001
richer					0.613(0.097)0.000
richest					0.468(0.138)0.000
Residence (P value)					0.003
urban					reference
rural					1.321(0.092)0.003
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	5.609	24.7	9.332	10.884
Hosmer Lemeshow Test Significance	1.000	0.586	0.002	0.315	0.208
Nagelkerke Pseudo R square	0.014	0.017	0.025	0.076	0.061

Table 4: Stepwise logistic regression of maternal education on under-five mortality controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 16,309 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.000	0.000	0.000	0.000	0.003
No education	reference	reference	reference	reference	reference
Primary	0.673(0.056)0.000	0.728(0.060)0.000	0.775(0.061)0.000	0.779(0.061)0.000	0.834(0.062)0.003
Secondary	0.421(0.080)0.000	0.508(0.089)0.000	0.554(0.090)0.000	0.574(0.090)0.000	0.758(0.094)0.003
Higher	0.214(0.232)0.000	0.266(0.256)0.000	0.303(0.259)0.000	0.318(0.259)0.000	0.524(0.268)0.016
Paternal education(P value)		0.000	0.000	0.000	0.016
No education		reference	reference	reference	reference
Primary		0.915(0.065)0.167	0.925(0.065)0.234	0.919(0.065)0.196	0.953(0.066)0.461
Secondary		0.660(0.079)0.000	0.678(0.080)0.000	0.676(0.080)0.000	0.803(0.081)0.007
Higher		0.796(0.212)0.283	0.830(0.214)0.382	0.819(0.214)0.351	0.919(0.220)0.069

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal age at child birth(P value)			0.000	0.016	0.038
Under 19			reference	reference	reference
20-29			0.812(0.052)0.000	0.859(0.054)0.005	0.884(0.054)0.023
30 and above			0.846(0.148)0.259	0.985(0.152)0.922	1.096(0.153)0.549
Preceding birth interval(P value)			0.000	0.000	0.000
No preceding birth			reference	reference	reference
Less than 2 years			1.546(0.065)0.000	1.622(0.066)0.000	1.600(0.066)0.000
Above 2 years			0.682(0.060)0.000	0.738(0.063)0.000	0.760(0.063)0.000
Child sex (P value)				0.003	0.003
male				reference	reference
female				0.861(0.051)0.003	0.858(0.051)0.003
Household wealth status(P value)					0.000
poorest					reference
poorer					0.810(0.067)0.002
middle					0.682(0.074)0.000
richer					0.544(0.091)0.000
richest					0.439(0.128)0.000
Residence (P value)					0.000
urban					reference
rural					1.384(0.088)0.000
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	2.567	4.393	14.405	12.184
Hosmer Lemeshow Test Significance	1.000	0.922	0.82	0.072	0.143
Nagelkerke Pseudo R square	0.021	0.026	0.033	0.081	0.069

Table 5: Stepwise logistic regression of maternal education on stunting among children under five years of age controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 4,726 children

Independent Variables	**Batch 1(maternal education)**	**Batch 2 (maternal & paternal education)**	**Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)**	**Batch 4 (parents' education, maternal reproductive characteristics and year of birth)**	**Batch 5 (parents' education, maternal, child, household and community characteristics)**
Maternal education (p value)	0.000	0.000	0.009	0.15	0.418
No education	reference	reference	reference	reference	reference
Primary	0.778(0.098)0.006	0.881(0.106)0.121	0.940(0.103)0.544	0.937(0.107)0.542	0.948(0.108)0.621
Secondary	0.508(0.111)0.000	0.628 (0.125)0.000	0.708(0.123)0.005	0.708(0.128)0.007	0.837(0.132)0.178
Higher	0.408(0.176)0.000	0.583 (0.209) .001	0.710(0.202)0.090	0.704(0.210)0.095	1.028(0.221)0.899
Paternal education(P value)		0.003	0.078	0.112	0.129
No education		reference	reference	reference	reference

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Primary		0.804 (0.108)0.032	0.837(0.103)0.082	0.774(0.108)0.017	0.780(0.108)0.022
Secondary		0.673(0.120) 0.001	0.755(0.117)0.016	0.723(0.122)0.008	0.801(0.124)0.074
Higher		0.546(0.221)0.006	0.635(0.230)0.048	0.567(0.240)0.018	0.711(0.247)0.167
Paternal occupation(P value)			0.087	0.166	0.815
clerical/sales			reference	reference	reference
professional/managerial			0.740(0.198)0.129	0.788(0.206)0.248	0.803(0.209)0.295
agricultural self employed			1.004(0.175)0.983	1.011(0.183)0.952	0.816(0.187)0.279
agricultural employee			1.141(0.197)0.503	1.106(0.206)0.625	0.907(0.210)0.640
unskilled labour			1.076(0.164)0.656	1.112(0.171)0.536	0.866(0.185)0.436
skilled labour			0.869(0.174)0.419	0.886(0.182)0.505	0.909(0.176)0.585
Maternal age at child birth(P value)			0.013	0.034	0.038
Under 19			reference	reference	reference
20-29			0.793(0.079)0.004	0.807(0.083)0.009	0.817(0.083)0.015
30 and above			0.799(0.141)0.113	0.873(0.147)0.357	0.965(0.149)0.810
Preceding birth interval (P value)			0.003	0.002	0.008
No preceding birth			reference	reference	reference
Less than 2 years			1.478(0.127)0.002	1.538(0.133)0.001	1.469(0.134)0.004
Above 2 years			0.799(0.141)0.113	1.011(0.084)0.895	1.011(0.085)0.900
Child sex(P value)				0.001	0.000
male				reference	reference
female				0.780(0.073)0.001	0.772(0.074)0.000
Child age (P value)				0.004	0.004
under 1				reference	reference
1 to 2				1.367(0.255)0.221	1.308(0.255)0.293
2 to 3				2.551(0.316)0.003	2.427(0.316)0.005
3 to 4				1.900(0.364)0.078	1.747(0.366)0.127
4 to 5				1.711(0.411)0.191	1.551(0.413)0.287
Household wealth status(P value)					0.000
poorest					reference
poorer					0.945(0.100)0.572
middle					0.759(0.117)0.018
richer					0.551(0.128)0.000
richest					0.453(0.168)0.000
Residence (P value)					0.108
urban					reference
rural					1.207(0.117)0.108
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	4.834	12.681	8.126	14.775
Hosmer Lemeshow Test Significance	1.000	0.565	0.123	0.421	0.106
Nagelkerke Pseudo R square	0.022	0.027	0.041	0.134	0.148

Table 6: Stepwise logistic regression of maternal education on the occurrence of diarrhoea among children under five years of age controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 4,726 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.053	0.147	0.201	0.18	0.173
No education	reference	reference	reference	reference	reference
Primary	1.017 (0.143) 0.904	0.951 (0.155) 0.747	0.958 (0.158) 0.787	0.944 (0.160) 0.721	0.975 (0.161) 0.875
Secondary	1.125 (0.152) 0.432	1.051 (0.174) 0.775	1.054(0.180) 0.772	1.003 (0.182) 0.985	1.229 (0.187) 0.271
Higher	0.558 (0.266) 0.028	0.575 (0.318) 0.082	0.588(0.315) 0.082	0.548 (0.315) 0.056	0.770 (0.331) 0.429
Paternal education(P value)		0.613	0.61	0.721	0.587
No education		reference	reference	reference	reference
Primary		1.186 (0.161) 0.289	1.200 (0.162) 0.260	1.173 (0.164) 0.331	1.180 (0.164) 0.314
Secondary		1.193 (0.175) 0.314	1.224 (0.179) 0.259	1.150 (0.181) 0.441	1.286 (0.184) 0.169
Higher		0.962 (0.343) 0.910	1.008 (0.342) 0.982	0.951 (0.343) 0.883	1.179(0.355) 0.641
Paternal occupation(P value)			0.356	0.354	0.289
clerical/sales			reference	reference	reference
professional/managerials			0.526 (0.294) 0.030	0.526 (0.299) 0.031	0.546 (0.320) 0.041
agricultural self employed			0.854 (0.224) 0.544	0.854 (0.248) 0.524	0.709 (0.285) 0.146
agricultural employee			0.840 (0.282) 0.536	0.961 (0.331) 0.905	0.739 (0.335) 0.555
unskilled labour			0.845 (0.228)0.461	0.921 (0.264) 0.756	0.866 (0.266) 0.722
skilled labour			0.862 (0.238) 0.532	0.959 (0.258) 0.872	0.704 (0.264) 0.379
Maternal age at child birth (P value)			0.168	0.186	0.383
Under 19			reference	reference	reference
20-29			0.919(0.117)0.466	0.908(0.119)0.417	0.925(0.119)0.512
30 and above			0.651(0.227)0.059	0.656(0.230)0.067	0.727(0.232)0.168
Preceding birth interval (P value)			0.401	0.362	0.269
No preceding birth			reference	reference	reference
Less than 2 years			0.756(0.207)0.177	0.742(0.211)0.157	0.712(0.212)0.110
Above 2 years			0.944(0.115)0.615	0.957(0.117)0.705	0.959(0.117)0.722
Child sex(P value)				0.859	0.872
male				reference	reference
female				1.019(0.105)0.859	1.017(0.105)0.872
Child age (P value)				0.153	0.171
under 1				reference	reference
1 to 2				1.331(0.253)0.259	1.256(0.255)0.371
2 to 3				1.479(0.253)0.259	1.388(0.339)0.333
3 to 4				1.435(0.337)0.245	1.313(0.660) 0.871
4 to 5				0.434(0.693)0.229	0.388(0.695)0.173
Household wealth status(P value)					0.000
poorest					reference

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
poorer					0.978(0.140)0.871
middle					0.665(0.170)0.017
richer					0.486(0.191)0.000
richest					0.511(0.241)0.005
Residence (P value)					0.299
urban					reference
rural					1.189(0.167)0.299
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	0.767	14.434	14.553	12.234
Hosmer Lemeshow Test Significance	1.000	0.998	0.071	0.068	0.141
Nagelkerke Pseudo R square	0.004	0.005	0.014	0.055	0.069

Table 7: Stepwise logistic regression of maternal education on the occurrence of pneumonia among children under five years of age controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 4,726 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.223	0.08	0.237	0.194	0.67
No education	reference	reference	reference	reference	reference
Primary	0.950 (0.190) 0.788	0.888 (0.209) 0.568	0.899(0.211) 0.614	0.882 (0.215) 0.561	0.911 (0.216) 0.663
Secondary	0.860 (0.210) 0.471	0.720 (0.243) 0.175	0.805 (0.249) 0.385	0.751 (0.256) 0.264	0.916 (0.263) 0.734
Higher	0.467 (0.383) 0.047	0.336 (0.445) 0.014	0.397 (0.465) 0.049	0.405 (0.473) 0.034	0.560 (0.499) 0.226
Paternal education(P value)		0.275	0.098	0.129	0.023
No education		reference	reference	reference	reference
Primary		1.013 (0.220) 0.954	1.009 (0.221) 0.967	1.018 (0.222) 0.936	1.015 (0.225) 0.946
Secondary		1.363 (0.236) 0.190	1.492 (0.240) 0.096	1.437(0.245) 0.134	1.595 (0.247) 0.055
Higher		1.607 (0.423) 0.263	2.040 (0.447) 0.107	2.077 (0.444) 0.099	2.758 (0.469) 0.028
Paternal occupation			0.226	0.21	0.4
clerical/sales			reference	reference	reference
professional/managerials			0.539 (0.428) 0.149	0.560 (0.465) 0.184	0.578 (0.468) 0.214
agricultural self employed			1.159(0.396) 0.670	1.217 (0.408)0.583	1.025 (0.413) 0.947
agricultural employee			0.667 (0.491) 0.354	1.217 (0.408)0.430	0.578 (0.505) 0.227
unskilled labour			0.979 (0.379) 0.951	1.217 (0.408)0.950	0.981 (0.392) 0.958
skilled labour			1.102 (0.367) 0.766	1.217 (0.408)0.631	0.963 (0.385) 0.914
Maternal age at child birth(P value)			0.427	0.49	0.638
Under 19			reference	reference	reference
20-29			0.827(0.160)0.235	0.834(0.161)0.261	0.858(0.162)0.346

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
30 and above			0.752(0.305)0.350	0.786(0.307)0.433	0.876(0.310)0.668
Preceding birth interval (P value)			0.267	0.185	0.174
No preceding birth			reference	reference	reference
Less than 2 years			1.193(0.274)0.520	1.209(0.277)0.493	1.141(0.278)0.634
Above 2 years			1.314(0.168)0.104	1.365(0.170)0.067	1.366(0.170)0.067
Child sex(P value)				0.055	0.047
male				reference	reference
female				0.756(0.146)0.055	0.748(0.147)0.047
Child age (P value)				0.703	0.722
under 1				reference	reference
1 to 2				1.147(0.365)0.708	1.096(0.366)0.803
2 to 3				1.199(0.498)0.715	1.411(0.500)0.791
3 to 4				1.510(0.609)0.499	1.425(0.614)0.556
4 to 5				0.706(0.856)0.685	0.672(0.860)0.644
Household wealth status(P value)					0.007
poorest					reference
poorer					0.853(0.191)0.404
middle					0.606(0.234)0.033
richer					0.452(0.272)0.003
richest					0.281(0.389)0.001
Residence (P value)					0.859
urban					reference
rural					0.960(0.232)0.859
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	2.236	5.294	3.576	13.336
Hosmer Lemeshow Test Significance	1.000	0.897	0.726	0.893	0.101
Nagelkerke Pseudo R square	0.004	0.007	0.031	0.053	0.063

Table 8: Stepwise logistic regression of maternal education on receiving the appropriate treatment for diarrhoea among children under five years of age controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 427 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.196	0.422	0.484	0.567	0.471
No education	reference	reference	reference	reference	reference
Primary	1.506 (0.274) 0.135	1.435 (0.298) 0.226	1.306 (0.314) 0.398	1.369 (0.329) 0.340	1.432 (0.346) 0.285
Secondary	1.894 (0.296) 0.031	1.566 (0.340) 0.188	1.484 (0.363) 0.215	1.480 (0.393) 0.295	1.829 (0.402) 0.133
Higher	1.419 (0.526) 0.505	0.897 (0.593) 0.855	0.776 (0.626) 0.684	0.861 (0.671) 0.817	1.268 (0.734) 0.743
Paternal education(P value)		0.245	0.3	0.155	0.163
No education		reference	reference	reference	reference
Primary		0.966 (0.308) 0.910	1.068 (0.330) 0.839	1.095 (0.336) 0.787	1.040 (0.356) 0.907
Secondary		1.248 (0.346) 0.522	1.344 (0.379) 0.430	1.653 (0.390) 0.197	1.722 (0.415) 0.171
Higher		4.260 (0.811) 0.074	4.470 (0.844) 0.073	5.118 (0.851) 0.052	4.376 (0.881) 0.090
Paternal occupation			0.08	0.043	0.042
clerical/sales			reference	reference	reference
professional/managerial			1.550 (0.656) 0.485	1.827(0.688) 0.353	1.814 (0.692) 0.365
agricultural self employed			1.251 (0.509) 0.642	1.271 (0.542) 0.630	1.326 (0.548) 0.752
agricultural employee			0.471 (0.649) 0.184	0.385 (0.693) 0.104	0.389 (0.711) 0.144
unskilled labour			1.022 (0.491) 0.963	1.045 (0.524) 0.929	0.970 (0.533) 0.951
skilled labour			1.609 (0.483) 0.295	1.531 (0.511) 0.366	1.570 (0.513)0.347
Maternal age at child birth(P value)			0.752	0.496	0.542
Under 19			reference	reference	reference
20-29			1.177(0.236)0.490	1.335 (0.322) 0.244	1.285 (0.251) 0.319
30 and above			1.303(0.501)0.597	1.359 (0.401) 0.551	1.517 (0.528) 0.430
Preceding birth interval (P value)			0.093	0.084	0.134
No preceding birth			reference	reference	reference
Less than 2 years			1.286(0.452)0.577	1.607 (0.485) 0.328	1.614(0.490) 0.328
Above 2 years			0.658(0.238)0.079	0.689 (0.754) 0.267	0.726(0.250) 0.200
Child sex(P value)				0.002	0.001
male				reference	reference
female				0.498(0.224)0.002	0.485(0.228)0.001
Child age (P value)				0.003	0.004
under 1				reference	reference
1 to 2				1.729(0.305)0.072	1.749(0.309)0.071
2 to 3				2.822(0.343)0.003	2.954(0.348)0.002
3 to 4				2.874(0.376)0.005	2.773(0.380)0.007
4 to 5				4.136(0.448)0.002	3.959(0.453)0.002
Household wealth status(P value)					0.334
poorest					reference
poorer					0.929 (0.313) 0.798
middle					0.538 (0.357) 0.073
richer					0.788 (0.399) 0.560
richest					0.458 (0.463) 0.144
Residence (P value)					0.136
urban					reference
rural					0.575 (0.371) 0.136

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	4.191	6.345	9.403	4.882
Hosmer Lemeshow Test Significance	1.000	0.651	0.609	0.309	0.77
Nagelkerke Pseudo R square	0.015	0.031	0.073	0.177	0.196

Table 9: Stepwise logistic regression of maternal education on receiving the appropriate treatment for pneumonia among children under five years of age controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size - 208

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.000	0.000	0.000	0.000	0.004
No education	reference	reference	reference	reference	reference
Primary	1.266 (0.153) 0.123	1.293 (0.164) 0.117	1.308 (0.176) 0.128	1.318 (0.178) 0.121	1.333 (0.182) 0.115
Secondary	2.036 (0.169) 0.000	1.902 (0.192) 0.001	1.813 (0.207) 0.003	1.655 (0.210) 0.016	1.313(0.226) 0.229
Higher	39.010 (0.766) 0.000	38.663 (0.828) 0.000	50.489 (0.891) 0.000	38.231 (0.893) 0.000	24.805 (0.929) 0.001
Paternal education(P value)		0.033	0.005	0.007	0.006
No education		reference	reference	reference	reference
Primary		0.706 (0.170) 0.401	0.707 (0.181) 0.055	0.686 (0.183) 0.039	0.596 (0.190) 0.006
Secondary		1.022 (0.183) 0.906	0.991 (0.196) 0.964	1.014 (0.199) 0.943	0.760 (0.211) 0.196
Higher		0.821 (0.430) 0.647	0.248 (0.558) 0.012	0.329 (0.561) 0.047	0.214 (0.594) 0.009
Paternal occupation			0	0	0.000
clerical/sales			reference	reference	reference
professional/managerial			7.108 (0.534) 0.000	8.020 (1.363) 0.000	7.193 (0.577) 0.001
agricultural self employed			0.309 (0.309) 0.000	0.369 (0.843) 0.002	0.381 (0.338) 0.004
agricultural employee			0.834 (0.384) 0.636	1.051 (1.035) 0.900	0.979 (0.411) 0.960
unskilled labour			0.766 (0.305) 0.381	1.015 (0.822) 0.963	0.936 (0.329) 0.840
skilled labour			0.892 (0.297) 0.700	1.049 (0.784) 0.876	1.106 (0.318) 0.752
Maternal age at child birth(P value)			0.045	0.888	0.219
Under 19			reference	reference	reference
20-29			0.931(0.135)0.596	0.961(0.139) 0.772	1.054 (0.145) 0.718
30 and above			0.497(0.283)0.013	0.580(0.292) 0.062	0.633 (0.302) 0.130
Preceding birth interval (P value)			0.002	0.013	0.011
No preceding birth			reference	reference	reference
Less than 2 years			0.581(0.242)0.025	0.641(0.248)0.073	0.649(0.255)0.90
Above 2 years			0.608(0.146)0.001	0.651(0.150)0.004	0.630(0.155)0.003

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Child sex(P value)				0.736	0.654
male				reference	reference
female				1.044(0.128)0.736	0.941(0.136)0.654
Child age (P value)				0.006	0.001
under 1				reference	reference
1 to 2				0.959(0.190)0.828	0.950(0.202)0.799
2 to 3				1.050(0.198)0.806	0.981(0.208)0.927
3 to 4				0.624(0.204)0.021	0.610(0.217)0.022
4 to 5				0.557(0.237)0.013	0.419(0.254)0.001
Household wealth status(P value)					0.000
poorest					reference
poorer					3.614 (0.178) 0.000
middle					1.144 (0.229) 0.556
richer					2.901 (0.245) 0.000
richest					1.746 (0.434) 0.199
Residence (P value)					0.01
urban					reference
rural					0.553(0.231)0.10
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	21.342	8.358	44.143	44.111
Hosmer Lemeshow Test Significance	1.000	0.001	0.399	0.000	0.000
Nagelkerke Pseudo R square	0.078	0.087	0.230	0.259	0.326

Table 10: Stepwise logistic regression of maternal education on receiving full vaccination among children aged 12-23 months controlling for potential confounders: Adjusted odds ratio (standard error) p value

Sample size – 852 children

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Maternal education (p value)	0.000	0.021	0.04	0.108	0.397
No education	reference	reference	reference	reference	reference
Primary	1.659 (0.209) 0.015	1.427 (0.221) 0.107	1.328 (0.227) 0.218	1.256 (0.232) 0.325	1.200 (0.273) 0.441
Secondary	1.857 (0.221) 0.005	1.387 (0.240) 0.173	1.362 (0.250) 0.241	1.322 (0.255) 0.273	0.952 (0.271) 0.857
Higher	5.607 (0.347) 0.000	3.287 (0.326) 0.002	2.769 (0.402) 0.008	2.685 (0.403) 0.014	1.508 (0.429) 0.338
Paternal education(P value)		0.003	0.004	0.002	0.047
No education		reference	reference	reference	reference
Primary		1.159 (0.207) 0.476	1.060 (0.211) 0.486	1.092 (0.217) 0.684	1.154 (0.221) 0.516
Secondary		1.941 (0.218) 0.002	1.905(0.223) 0.007	1.985 (0.223) 0.003	1.729 (0.235) 0.013

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education, father's occupation and maternal reproductive characteristics)	Batch 4 (parents' education, maternal reproductive characteristics and year of birth)	Batch 5 (parents' education, maternal, child, household and community characteristics)
Higher		2.278 (0.389) 0.034	2.035 (0.407) 0.081	2.199 (0.410) 0.055	1.486 (0.433) 0.360
Paternal occupation			0.54	0.5	0.579
clerical/sales			reference	reference	reference
professional/managerial			1.081 (0.381) 0.832	1.137 (0.390) 0.728	1.104(0.381) 0.795
agricultural self employed			1.171 (0.374) 0.643	1.208 (0.383) 0.579	1.675 (0.361) 0.153
agricultural employee			0.806 (0.449) 0.597	0.808 (0.459) 0.600	1.162 (0.428) 0.727
unskilled labour			1.404 (0.350) 0.302	1.440 (0.355) 0.267	1.556 (0.342) 0.198
skilled labour			1.002 (0.340) 0.995	1.024 (0.347) 0.940	1.376 (0.333) 0.338
Maternal age at child birth(P value)			0.006	0.004	0.025
Under 19			reference	reference	reference
20-29			0.996(0.170)0.983	0.989 (0.171) 0.986	1.014 (0.176) 0.937
30 and above			2.484(0.310)0.003	2.542(0.311) 0.003	2.226 (0.316) 0.011
Preceding birth interval (P value)			0.000	0.000	0.000
No preceding birth			reference	reference	reference
Less than 2 years			0.632(0.302)0.126	0.622(0.303)0.117	0.623(0.310)0.126
Above 2 years			1.761(0.165)0.001	1.766(0.165)0.001	1.780(0.110)0.001
Child sex(P value)				0.012	0.021
male				reference	reference
female				0.689(0.147)0.012	0.706(0.151)0.021
Household wealth status(P value)					0.000
poorest					reference
poorer					0.857 (0.210) 0.462
middle					2.272 (0.243) 0.001
richer					2.198 (0.252) 0.002
richest					3.934 (0.337) 0.000
Residence (P value)					0.845
urban					reference
rural					0.957 (0.226) 0.845
Model Statistics					
Hosmer Lemeshow Test Chi Square	0.000	0.615	18.908	14.619	6.417
Hosmer Lemeshow Test Significance	1.000	0.987	0.015	0.067	0.601
Nagelkerke Pseudo R square	0.045	0.067	0.083	0.151	0.202

Table 11: Testing effect modification: statistical significance (p –value) of interaction terms entered to the fifth batches of the regression models of respective child health outcomes

Interaction terms	Child Health Outcomes								
	Neonatal mortality	Infant mortality	Under five mortality	Stunting	Diarrhoea	Pneumonia	Treatment diarrhoea	Treatment pneumonia	Full Immunisation
Maternal education * paternal education	0.667	0.450	0.759	0.060	0.965	0.828	0.852	0.110	0.408
Maternal education * father's occupation	0.828	0.543	0.295	0.251	**0.015**	0.126	0.650	0.961	0.134
Maternal education* preceding birth interval	**0.027**	**0.000**	**0.000**	0.260	0.405	0.773	0.506	0.470	0.122
Maternal education * mother's age at child birth	0.335	0.296	**0.000**	0.213	0.0427	0.235	0.215	0.798	0.731
Maternal education * child's sex	0.328	0.420	0.358	0.395	0.947	0.393	0.122	0.984	0.200
Maternal education * household wealth level	**0.007**	**0.001**	**0.000**	**0.000**	0.195	0.754	0.999	0.599	0.404
Maternal education * residence	0.082	0.047	0.4	0.899	**0.000**	0.313	0.309	0.445	0.509
Maternal education * child age	n/a			**0.000**	0.483	0.638	0.333	n/a	

Table 12: Pathway analysis of the relationship between maternal education and childhood mortalities

Pathway/Independent variables	Pathway variable		dependent variable								
			Neonatal mortality			Infant mortality			Under five mortality		
	Regression Coefficient	P value	Regression Coefficients	P value	Sobel Test	Regression Coefficients	P value	Sobel Test	Regression Coefficients	P value	Sobel Test
Pathway: Maternal literacy					0.475			0.649			0.635
Step 1: Maternal education			-0.267	0.000		-0.396	0.000		-0.463	0.000	
Step 2: Maternal Education	3.265	0.000									
Step 3: Maternal literacy			-0.302	0.000		-0.371	0.000		-0.469	0.000	
Step 4: Multiple regression											
Maternal education			-0.240	0.000		-0.408	0.000		-0.451	0.000	
Maternal literacy			-0.064	0.469		-0.033	0.646		-0.028	0.631	
Pathway: Maternal health knowledge					0.022			0.014			0.000
Step 1: Maternal education			-0.267	0.000		-0.396	0.000		-0.463	0.000	
Step 2: Maternal education	0.943	0.000									
Step 3: Maternal health knowledge			-0.280	0.000		-0.305	0.000		-0.380	0.000	
Step 4: Multiple regression											
Maternal education			-0.233	0.000		-0.368	0.000		-0.426	0.000	
Maternal knowledge			-0.164	0.022		-0.129	0.015		-0.177	0.000	
Pathway: Maternal autonomy					0.546			0.319			0.018
Step 1: Maternal education			-0.267	0.000		-0.396	0.000		-0.463	0.000	
Step 2: Maternal education	-0.566	0.000									
Step 3: Maternal autonomy			-0.033	0.985		0.033	0.168		0.322	0.000	
Step 4: Multiple regression											
Maternal education			-0.270	0.000		-0.394	0.000		-0.456	0.000	
Maternal autonomy			-0.083	0.545		0.094	0.318		0.195	0.018	
Pathway: Maternal income (Household wealth status)					0.001			0.000			0.000
Step 1: Maternal education			-0.267	0.000		-0.396	0.000		-0.463	0.000	
Step 2: Maternal education	1.187	0.000									
Step 3: Maternal income			-0.407	0.000		-0.655	0.000		-0.717	0.000	
Step 4: Multiple regression											
Maternal education			-0.213	0.000		-0.308	0.000		-0.373	0.000	
Maternal income			-0.272	0.002		-0.470	0.000		-0.495	0.000	

Table 13: Pathway analysis of the relationship between maternal education and stunting among children under five

Pathways and Steps	Pathway Variable		dependent variable: Stunting		
	Regression Coefficients	Significance of regression coefficient	Regression Coefficients	Significance of regression coefficients	Sobel Test
Pathway: Maternal literacy					0.754
Step 1: Maternal education			-0.363	0.000	
Step 2: Maternal Education	3.678	0.000			
Step 3: Maternal literacy			-0.392	0.000	
Step 4: Multiple regression					
Maternal education			-0.374	0.000	
Maternal literacy			0.031	0.754	
Pathway: Maternal health knowledge					0.000
Step 1: Maternal education			-0.363	0.000	
Step 2: Maternal education	1.067	0.000			
Step 3: Maternal health knowledge			-0.481	0.000	
Step 4: Multiple regression					
Maternal education			-0.297	0.000	
Maternal knowledge			-0.298	0.000	
Pathway: Antenatal care					0.001
Step 1: Maternal education			-0.363	0.000	
Step 2: Maternal education	0.999	0.000			
Step 3: Maternal health behaviour			-0.462	0.000	
Step 4: Multiple regression					
Maternal education			-0.290	0.000	
Maternal behaviour			-0.292	0.001	
Pathway: Maternal autonomy					0.061
Step 1: Maternal education			-0.363	0.000	
Step 2: Maternal education	0.927	0.000			
Step 3: Maternal autonomy			-0.473	0.001	
Step 4: Multiple regression					
Maternal education			-0.350	0.000	
Maternal autonomy			-0.288	0.053	
Pathway: Maternal income (household wealth)					0.000
Step 1: Maternal education			-0.363	0.000	
Step 2: Maternal education	1.315	0.000			
Step 3: Maternal income			-0.786	0.000	
Step 4: Multiple regression					
Maternal education			-0.230	0.000	
Maternal income			-0.611	0.000	

Table 14: Pathway analysis on the relationship between maternal education and receiving full vaccination among children aged 12-23 months

Analytical steps	dependent variable									
	Pathway Variable		Immunisation			Pathway Variable		Pneumonia treatment		
	Regression Coefficients	Significance of regression coefficients	Regression Coefficients	Significance of regression coefficients	Sobel Test	Regression Coefficients	Significance of regression coefficients	Regression Coefficients	Significance of regression coefficients	Sobel Test
Pathway: Maternal literacy					0.617					0.071
Step 1: Maternal education			0.404	0.000				0.529	0.005	
Step 2: Maternal Education	3.452	0.000				4.673	0.000			
Step 3: Maternal literacy			0.514	0.001				0.986	0.001	
Step 4: Multiple regression										
Maternal education			0.370	0.001				0.246	0.339	
Maternal literacy			0.099	0.616				0.730	0.071	
Pathway: Health knowledge					0.000					0.291
Step 1: Maternal education			0.404	0.000				0.529	0.005	
Step 2: Maternal education	1.106	0.000				1.109	0.000			
Step 3: Maternal health knowledge			1.046	0.000				0.58	0.039	
Step 4: Multiple regression										
Maternal education			0.212	0.024				0.452	0.024	
Maternal knowledge			0.917	0.000				0.327	0.28	
Pathway: Antenatal Care					0.000					0.027
Step 1: Maternal education			0.404	0.000				0.529	0.005	
Step 2: Maternal education	0.941	0.000				0.725	0.001			
Step 3: Maternal health behaviour			1.137	0.000				0.835	0.006	
Step 4: Multiple regression										
Maternal education			0.177	0.061				0.391	0.063	
Maternal behaviour			1.043	0.000				0.315	0.027	
Pathway: Maternal autonomy					0.247					
Step 1: Maternal education			0.404	0.000				0.529	0.005	
Step 2: Maternal education	0.607	0.005				0.083	0.822			
Step 3: Maternal autonomy			0.545	0.103				0.225	0.699	
Step 4: Multiple regression										
Maternal education			0.394	0.000				n/a	n/a	
Maternal autonomy			0.404	0.232				n/a	n/a	
Pathway: Maternal income					0.000					0.011
Step 1: Maternal education			0.404	0.000				0.529	0.005	
Step 2: Maternal education	1.338	0.000				1.599	0.000			
Step 3: Maternal income			1.032	0.000				1.301	0.000	
Step 4: Multiple regression										
Maternal education			0.191	0.048				0.320	0.119	
Maternal income			0.891	0.000				1.051	0.011	

ANNEX 4: Approval letter from the DHS programme

DHS Download Account Application

archive@dhsprogram.com

Tue 3/28/2017 4:55 PM
To: Soe, Khaing <soek@exchange.lancs.ac.uk>;
1 attachments (47 KB)
DataNotes.doc;

**Please see attached. **

You have been authorised to download "Survey" data from the Demographic and Health Surveys (DHS) Program. This authorisation is for unrestricted countries requested on your application.

The requested data should only be used for the purpose of the registered research or study. To use the data for another purpose, a new research project must be "created" in your account. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. The data must not be passed on to other researchers (other than those in your download account), without the written consent of DHS. Users are required to submit a copy of any reports/publications resulting from using the DHS data files to: archive@dhsprogram.com.

The files you will download are in zipped format and must be unzipped before analysis. To begin downloading, please login at: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm . If you are approved for a large number of countries/datasets, we recommend that you use the Bulk Downloading System. For instructions on bulk downloading, please go to: http://userforum.dhsprogram.com/index.php?t=msg&th=5246 .

Following are some guidelines:

After unzipping, please print the file with the .DOC/DOCX extension (found in the Individual and Male Recode Zips). This file contains useful information on country specific variables and differences in the Standard Recode definition. You will also need the DHS Recode Manual: http://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-manuals.cfm . This manual contains a general description of the recode data file, including the rationale for recoding; a description of coding standards and recode variables, and a listing of the standard dictionary, with basic information relating to each variable.

It is essential that you consult the questionnaire for the country, when using the data files. Questionnaires are in the appendices of each survey's final report: http://dhsprogram.com/publications/publications-by-type.cfm . We also recommend that you make use of the Data Tools and Manuals at: http://www.dhsprogram.com/accesssurveys/technical_assistance.cfm .

For problems with your user account, please email archive@dhsprogram.com. For data related questions, please register to participate in the DHS Program User Forum at: http://userforum.dhsprogram.com . You may also benefit from watching the DHS series of

YouTube videos on Matching DHS Final Report Tables
at: https://www.youtube.com/playlist?list=PLagqLv-gqpTMU3avlnBDodTWCazURy4CT .

The Demographic and Health Surveys (DHS) Program
ICF INTERNATIONAL
530 Gaither Road
Suite 500
Rockville, MD 20850
USA
LOGIN INFORMATION :
Login Email : k.soe@lancaster.ac.uk
Password: (use password selected when you registered)

ANNEX 5: Some relevant survey questions of Myanmar 2015- 2016 DHS survey

The full report of the 2015-2016 Myanmar DHS Survey and the questionnaires can be accessed via the link below. https://dhsprogram.com/publications/publication-fr324-dhs-final-reports.cfm. In this Annex, only the survey questions which are relevant to the variables used in the present thesis are extracted and presented.

I. Relevant questions from the Household Questionnaire

							IF AGE 15 OR OLDER				
LINE NO.	USUAL RESIDENTS AND VISITORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX	RESIDENCE		AGE	MARITAL STATUS	ELIGIBILITY			
1	2	3	4	5	6	7	8	9	10	11	11A
	Please give me the names of the persons who usually live in your household and guests of the household who stayed here last night, starting with the head of the household. AFTER LISTING THE NAMES AND RECORDING THE RELATIONSHIP AND SEX FOR EACH PERSON, ASK QUESTIONS 2A-2C TO BE SURE THAT THE LISTING IS COMPLETE. THEN ASK APPROPRIATE QUESTIONS IN COLUMNS 5-20 FOR EACH PERSON.	What is the relationship of (NAME) to the head of the household? SEE CODES BELOW.	Is (NAME) male or female?	Does (NAME) usually live here?	Did (NAME) stay here last night?	How old is (NAME)? IF 95 OR MORE, RECORD '95'.	What is (NAME)'s current marital status? 1 = MARRIED OR LIVING TOGETHER 2 = DIVORCED/ SEPARATED 3 = WIDOWED 4 = NEVER-MARRIED AND NEVER LIVED TOGETHER	CIRCLE LINE NUMBER OF ALL WOMEN AGE 15-49	CIRCLE LINE NUMBER OF ALL MEN AGE 15-49	CIRCLE LINE NUMBER OF ALL CHILDREN AGE 0-5	CIRCLE LINE NUMBER OF ALL CHILDREN AGE 2-14
01		☐☐	M F 1 2	YN 12	Y N 1 2	IN YEARS ☐☐	☐	01	01	01	01

02			1 2	12	1 2			02	02	02	02
03			1 2	12	1 2			03	03	03	03

CODES FOR Q. 3: RELATIONSHIP TO HEAD OF HOUSEHOLD

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

Education level

	IF AGE 0-17 YEARS				**IF AGE 2-14 YEARS**	**IF AGE 5 YEARS OR OLDER**		**IF AGE 5-24 YEARS**		**IF AGE 0-4 YEARS**
LINE NO.	SURVIVORSHIP AND RESIDENCE OF BIOLOGICAL PARENTS				PRIMARY CARETAKER	EVER ATTENDED SCHOOL		CURRENT/RECENT SCHOOL ATTENDANCE		BIRTH REGIS-TRATION
	12	**13**	**14**	**15**	**15A**	**16**	**17**	**18**	**19**	**20**
	Is (NAME)'s natural mother alive?	Does (NAME)'s natural mother usually live in this household or was she a guest last night? IF YES: What is her name? RECORD	Is (NAME)'s natural father alive?	Does (NAME)'s natural father usually live in this household or was he a guest last night? IF YES: What is his name? RECORD	Who is the primary caretaker of (NAME)? RECORD PRIMARY CARETAKER'S	Has (NAME) ever attended school?	What is the highest grade (NAME) completed at school? SEE CODES BELOW.	Did (NAME) attend school at any time during the (2015/2016) school year?	During this/that school year, what grade [is/was] (NAME) attending? SEE CODES BELOW.	Does (NAME) have a birth certificate? IF NO, PROBE: Has (NAME)'s birth ever been registered with the civil authority? 1 = HAS CERTIFICATE 2 = REGISTERED 3 = NEITHER

		MOTHER'S LINE NUMBER. IF NO, RECORD '00'.		FATHER'S LINE NUMBER. IF NO, RECORD '00'.	LINE NUMBER IF NOT IN HOUSEHOLD RECORD '00'					8 = DON'T KNOW
	Y N DK		N N DK			Y N	GRADE	Y N	GRADE	
01	1 2 8		12 8			1 2		1 2		
	GO TO 14		GO TO 15A			NEXT LINE		NEXT LINE		
02	1 2 8		12 8			1 2		1 2		
	GO TO 14		GO TO 15A			NEXT LINE		NEXT LINE		
03	1 2 8		12 8			1 2		1 2		
	GO TO 14		GO TO 15A			NEXT LINE		NEXT LINE		

CODES FOR Qs. 17 AND 19: EDUCATION

GRADE

00 = LESS THAN GRADE 1 COMPLETED

01-11 = GRADE 1 - GRADE 11

12 = BACHELOR'S AND ABOVE

13 = VOCATIONAL EDUCATION

102	What is the main source of drinking water for members of your household?	PIPED WATER	
		PIPED INTO DWELLING	. 11
		PIPED TO YARD/PLOT	. 12 105

PUBLIC TAP/STANDPIPE	. 13		
TUBE WELL OR BOREHOLE	. 21		
DUG WELL			
PROTECTED WELL	. 31		
UNPROTECTED WELL	. 32		
WATER FROM SPRING			
PROTECTED SPRING	. 41		
UNPROTECTED SPRING	. 42		
RAINWATER	. 51	105	
TANKER TRUCK	. 61		
CART WITH SMALL TANK/DRUM	. 71		
SURFACE WATER (RIVER/DAM/			
LAKE/POND/STREAM/CANAL/			
IRRIGATION CHANNEL)	. 81		
BOTTLED WATER	. 91		
OTHER	96		
(SPECIFY)			

Household drinking water and toilet

107	What kind of toilet facility do members of your household usually use?	FLUSH OR POUR FLUSH TOILET		
		FLUSH TO PIPED SEWER SYSTEM	11....	
		FLUSH TO SEPTIC TANK	12.....	
		FLUSH TO PIT LATRINE	13.....	
		FLUSH TO SOMEWHERE ELSE. .	14....	
		FLUSH, DON'T KNOW WHERE. .	15....	
		PIT LATRINE		
		VENTILATED IMPROVED PIT LATRINE	21....	
		PIT LATRINE WITH SLAB	22.....	
		PIT LATRINE WITHOUT SLAB/ OPEN PIT	23....	
		COMPOSTING TOILET	.31....	
		BUCKET TOILET	41....	
		HANGING TOILET/HANGING LATRINE	51....	→
		NO FACILITY/BUSH/FIELD	61.....	110
		OTHER	96	
		(SPECIFY)		→
108	Do you share this toilet facility with other households?	YES	1....	
		NO	2....	110

Questions to calculate Household Wealth Index

110 Does your household have:

		YES	NO
Electricity?	ELECTRICITY	1	2

A radio?	RADIO	1	2
A television?	TELEVISION	1	2
A mobile telephone?	MOBILE TELEPHONE	1	2
A landline telephones?	LANDLINE PHONE	1	2
A refrigerator?	REFRIGERATOR	1	2
A table?	TABLE.	1	2
A chair?	CHAIR.	1	2
A sofa?	SOFA.	1	2
A bed?	BED.	1	2
A cupboard?	CUPBOARD.	1	2
An electric fan?	ELECTRIC FAN.	1	2
Air conditioner?	AIR CONDITIONER	1	2
A sewing machine?	SEWING MACHINE	1	2
A computer?	COMPUTER.	1	2

Questions on indoor cooking with biomass fuel

111	What type of fuel does your household mainly use for cooking?	ELECTRICITY	. 01	
		LPG	. 02	
		NATURAL GAS	. 03	
		BIOGAS	. 04	
		KEROSENE	. 05	
		COAL, LIGNITE	. 06	
		CHARCOAL	. 07	
		WOOD	. 08	
		STRAW/SHRUBS/GRASS	. 09	
		AGRICULTURAL CROP	. 10	
		ANIMAL DUNG	. 11	
		NO FOOD COOKED IN HOUSEHOLD	. 95	114
		OTHER	96	
112. Is the cooking usually done in the house, in a separate building, or outdoors?		IN THE HOUSE	. 1	
		IN A SEPARATE BUILDING	. 2	
		OUTDOORS	. 3	
				114
		OTHER	6	

114	MAIN MATERIAL OF THE FLOOR. RECORD OBSERVATION.	NATURAL FLOOR EARTH/SAND . . . . 11 DUNG . . . . . 12 RUDIMENTARY FLOOR WOOD PLANKS . . . . . 21 PALM/BAMBOO. . . . . 22 FINISHED FLOOR PARQUET OR POLISHED WOOD . . . . . 31 VINYL OR ASPHALT STRIPS . . . . . 32 CERAMIC TILES . . . . . 33 CEMENT . . . . . 34 CARPET . . . . . 35 OTHER 96 (SPECIFY)	→
115	MAIN MATERIAL OF THE ROOF. RECORD OBSERVATION.	NATURAL ROOFING NO ROOF . . . . . 11 THATCH/PALM LEAF . . . . . 12 SOD . . . . . 13 RUDIMENTARY ROOFING RUSTIC MAT . . . . . 21 PALM/BAMBOO . . . . . 22 WOOD PLANKS . . . . . 23 CARDBOARD . . . . . 24 FINISHED ROOFING METAL . . . . . 31 WOOD . . . . . 32 CALAMINE/CEMENT FIBER . . . . . 33 CERAMIC TILES . . . . . 34 CEMENT . . . . . 35 ROOFING SHINGLES . . . . . 36 OTHER 96 (SPECIFY)	

118 Does any member of this household own?

		YES	NO
A watch?	WATCH	1	2
A bicycle?	BICYCLE	1	2
A motorcycle or motor scooter?	MOTORCYCLE/SCOOTER . . .	1	2
An animal-drawn cart?	ANIMAL-DRAWN CART	1	2
A car or truck?	CAR/TRUCK	1	2
A took took/halurgy?	TUK TUK/HTAWLARGYI	1	2

A boat with a motor?	BOAT WITH MOTOR	1	2
A boat without a motor?	BOAT WITHOUT MOTOR	1	2

122 How many of the following animals does this household own?

IF NONE, ENTER '00'.

IF 95 OR MORE, ENTER '95'. IF UNKNOWN, ENTER '98'.

Cattle?	CATTLE	
Milk cows or bulls?	COWS/BULLS	
Horses, donkeys, or mules?	HORSES/DONKEYS/MULES	
Goats?	GOATS	
Sheep?	SHEEP	
Pigs?	PIGS.	
Chickens?	CHICKENS	
Ducks?	DUCKS.	

WEIGHT, HEIGHT MEASUREMENT FOR CHILDREN AGE 0-5

201 CHECK COLUMN 11 IN HOUSEHOLD SCHEDULE. RECORD THE LINE NUMBER AND NAME FOR ALL ELIGIBLE CHILDREN 0-5 YEARS IN QUESTION 202. IF MORE THAN SIX CHILDREN, USE ADDITIONAL QUESTIONNAIRE(S)
.

		CHILD 1	CHILD 2	CHILD 3
202	LINE NUMBER FROM COLUMN 11	LINE NUMBER	LINE NUMBER	LINE NUMBER . . . . .
	NAME FROM COLUMN 2	NAME	NAME	NAME
203	IF MOTHER INTERVIEWED, COPY MONTH AND YEAR OF BIRTH FROM BIRTH HISTORY AND ASK DAY; IF MOTHER NOT INTERVIEWED, ASK: What is (NAME)'s birth date?	DAY . . . . MONTH . . . . . YEAR	DAY . . . . MONTH . . . . . YEAR	DAY . . . . MONTH . . . . . YEAR
204	CHECK 203: CHILD BORN IN JANUARY 2010 OR LATER?	YES . . . . 1..... NO . . . . 2..... (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)	1..... YES . . . . 2..... NO . . . . (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)	1..... YES . . . . 2..... NO . . . . (GO TO 203 FOR NEXT CHILD OR, IF NO MORE CHILDREN, GO TO 214)

205	WEIGHT IN KILOGRAMS	KG.	.		KG.	.		KG.	.		
		NOT PRESENT	 9994		NOT PRESENT	 9994		NOT PRESENT	 9994		
		REFUSED. .	... 9995...		REFUSED. .	.. .9995...		REFUSED	. .. . 9995...		
		OTHER	9996....		OTHER	9996...		OTHER	9996....		
206	HEIGHT IN CENTIMETERS	CM.	.		CM.	.		CM.	.		
		NOT PRESENT	 9994		NOT PRESENT	 9994		NOT PRESENT	 9994		
		REFUSED. .	... 9995...		REFUSED. .	.. .9995...		REFUSED	. .. . 9995...		
		OTHER	9996....		OTHER	9996...		OTHER	9996....		
207	MEASURED LYING DOWN OR	LYING DOWN	. .	.1....	LYING DOWN	. .	1.....	LYING DOWN	. .	1.....	
	STANDING UP?	STANDING UP	. .	.2....	STANDING UP	. .	2.....	STANDING UP	. .	2.....	
		NOT MEASURED		3.....	NOT MEASURED		3.....	NOT MEASURED		3.....	

II. Questions related to mother's schooling and literacy

104	Have you ever attended school?	YES	1	
		NO	2	108

106 What is the highest grade you completed?

GRADE . . . .

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES		SKIP
108	Now I would like you to read this sentence to me.	CANNOT READ AT ALL	1	
		ABLE TO READ ONLY PARTS OF		
	SHOW CARD TO RESPONDENT.	SENTENCE	2	
		ABLE TO READ WHOLE SENTENCE	3	
	IF RESPONDENT CANNOT READ WHOLE SENTENCE, PROBE:	NO CARD WITH REQUIRED		
	Can you read any part of the sentence to me?	LANGUAGE	4	
		(SPECIFY LANGUAGE)		
		BLIND/VISUALLY IMPAIRED	5	

Questions related to child mortalities (birth history of the mothers)

201	Now I would like to ask about all the births you have had during your	YES	1.	
	life. Have you ever given birth?	NO	2.	206
202	Do you have any sons or daughters to whom you have given birth	YES	1.	
			2	
			0	
	who are now living with you?	NO	2.4	

203 How many sons live with you? SONS AT HOME

. . . . . .

And how many daughters live with you? DAUGHTERS AT HOME . . .. . | | |

IF NONE, RECORD '00'.

204 Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?

YES . . . . . 1.

NO 2. 206

SONS ELSEWHERE

205 How many sons are alive but do not live with you? . . . . . | | |

And how many daughters are alive but do not live with you? DAUGHTERS ELSEWHERE | | |

IF NONE, RECORD '00'.

206 Have you ever given birth to a boy or girl who was born alive but later died?

YES . . . . . 1....

IF NO, PROBE: Any baby who cried or showed signs of life but did not survive?

NO . . . . . 2.... 208

207 How many boys have died? BOYS DEAD . . . . . | | |

And how many girls have died? GIRLS DEAD . . . . . | | |

IF NONE, RECORD '00'.

211 Now I would like to record the names of all your births, whether still alive or not, starting with the first one you had.

RECORD NAMES OF ALL THE BIRTHS IN 212. RECORD TWINS AND TRIPLETS ON SEPARATE ROWS.

(IF THERE ARE MORE THAN 12 BIRTHS, USE AN ADDITIONAL QUESTIONNAIRE, STARTING WITH THE SECOND ROW).

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

04	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES. 1 NO . . . 2 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS. 3		YES . . .. 1 ADD BIRTH NO . . .. 2 NEXT BIRTH
05	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES. 1 NO . . . 2 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS. 3		YES . . .. 1 ADD BIRTH NO . . .. 2 NEXT BIRTH
06	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES. 1 NO . . . 2 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS. 3		YES . . .. 1 ADD BIRTH NO . . .. 2 NEXT BIRTH
07	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES. 1 NO . . . 2 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS. 3		YES . . .. 1 ADD BIRTH NO . . .. 2 NEXT BIRTH

222	Have you had any live births since the birth of (NAME OF LAST BIRTH)? IF YES, RECORD BIRTH(S) IN TABLE.	YES . . . . . 1..... NO . . .. 2.....
223	COMPARE 208 WITH NUMBER OF BIRTHS IN HISTORY ABOVE AND MARK: NUMBERS ARE SAME NUMBERS ARE DIFFERENT (PROBE AND RECONCILE)	
224	CHECK 215: ENTER THE NUMBER OF BIRTHS IN 2010 OR LATER.	NUMBER OF BIRTHS . . . . . . NONE . .0 226

Questions related to antenatal care during last pregnancy

Now I would like to ask some questions about your children born in the last five years. (We will talk about each separately.)

408	Did you see anyone for antenatal care for this pregnancy?	YES . . . . . 1 NO . . . . . 2 (SKIP TO 415)	
409	Whom did you see? Anyone else? PROBE TO IDENTIFY EACH TYPE OF PERSON AND RECORD ALL MENTIONED.	HEALTH PERSONNEL DOCTOR . . . . . A NURSE/MIDWIFE/ LHV . . . . . B AUXILIARY MIDWIFE . . . . C ANOTHER PERSON TRADITIONAL BIRTH ATTENDANT. D COMMUNITY/ VILLAGE HEALTH WORKER . . . E OTHER X (SPECIFY)	

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____	NEXT-TO-LAST BIRTH NAME _____	SECOND-FROM-LAST BIRTH NAME _____
410	Where did you receive antenatal care for this pregnancy? Anywhere else? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. _____ (NAME OF PLACE(S))	HOME YOUR HOME . . . A OTHER HOME . . . B PUBLIC SECTOR GOVT. HOSPITAL C GOVT. HEALTH CENTER (RHC. D GOVT. HEALTH POST SUB-CENTER . . .. . E MOBILE CLINIC. F UHC/MCH CENTER G ANOTHER PUBLIC SECTOR H _____ (SPECIFY) NGO MARIE STOPES. I MYANMAR RED CROSS J PSI/M (SUN) . . . K MMA . . . L ANOTHER NGO SECTOR M _____ (SPECIFY) PRIVATE MED. SECTOR PVT. HOSPITAL/ CLINIC . . . . N OTHER PRIVATE MED. SECTOR O _____ (SPECIFY) OTHER X _____ (SPECIFY)		
411	How many months pregnant were you when you first received antenatal care for this pregnancy?	MONTHS . . . [ ][ ] 9 DON'T KNOW 8		

412	How many times did you receive antenatal care during this pregnancy?	NUMBER OF TIMES	
		DON'T KNOW	9 8

Questions related to Child Immunization

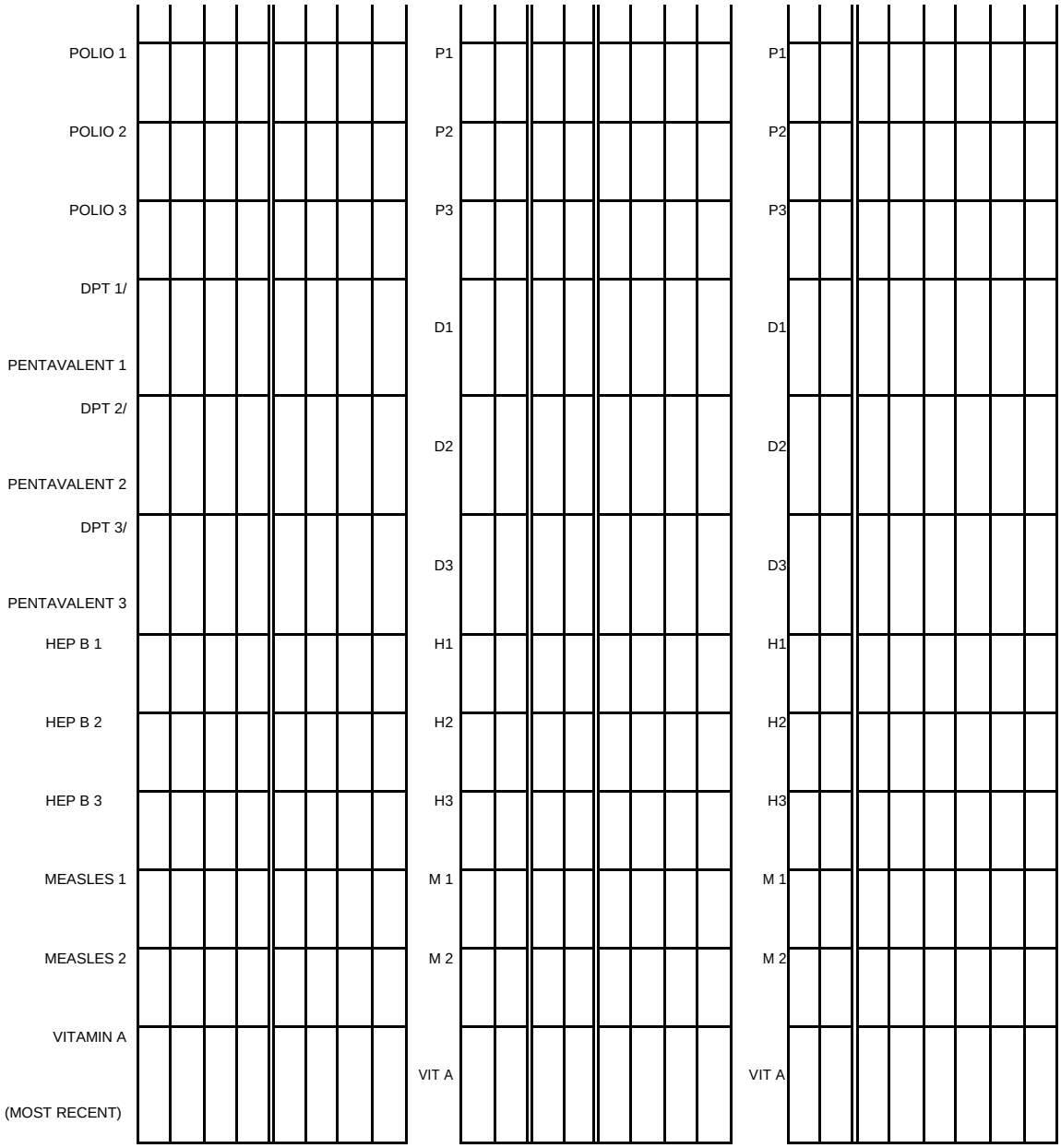
501 ENTER IN THE TABLE THE BIRTH HISTORY NUMBER, NAME, AND SURVIVAL STATUS OF EACH BIRTH IN 2010 OR LATER. ASK THE QUESTIONS ABOUT ALL OF THESE BIRTHS. BEGIN WITH THE LAST BIRTH.
(IF THERE ARE MORE THAN 3 BIRTHS, USE LAST 2 COLUMNS OF ADDITIONAL QUESTIONNAIRES).

502		LAST BIRTH		NEXT-TO-LAST BIRTH		SECOND-FROM-LAST BIRTH	
	BIRTH HISTORY NUMBER FROM 212 IN BIRTH HISTORY	BIRTH HISTORY NUMBER		BIRTH HISTORY NUMBER		BIRTH HISTORY NUMBER	
503	FROM 212 AND 216	NAME		NAME		NAME	
		LIVING	DEAD (GO TO 503 IN NEXT COLUMN OR, IF NO MORE BIRTHS, GO TO 553)	LIVING	DEAD (GO TO 503 IN NEXT COLUMN OR, IF NO MORE BIRTHS, GO TO 553)	LIVING	DEAD (GO TO 503 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE, OR IF NO MORE BIRTHS, GO TO 553)
504	Do you have a card? where (NAME)'s vaccinations are written down? IF YES: May I see it please?	YES, SEEN . . . . . (SKIP TO 506)	1	YES, SEEN . . . . . (SKIP TO 506)	1	YES, SEEN . . . . . (SKIP TO 506)	1
		YES, NOT SEEN . . . . . (SKIP TO 509)	2	YES, NOT SEEN . . . . . (SKIP TO 509)	2	YES, NOT SEEN . . . . . (SKIP TO 509)	2
		NO CARD	3	NO CARD	3	NO CARD	3
505	Did you ever have a vaccination card for (NAME)?	YES . . . . . (SKIP TO 509)	1	YES . . . . . (SKIP TO 509)	1	YES . . . . . (SKIP TO 509)	1
		NO	2	NO	2	NO	2

506 (1) COPY DATES FROM THE CARD.

(2) WRITE '44' IN 'DAY' COLUMN IF CARD SHOWS THAT A DOSE WAS GIVEN, BUT NO DATE IS RECORDED.

	LAST BIRTH		NEXT-TO-LAST BIRTH		SECOND-FROM-LAST BIRTH	
	DAY MONTH	YEAR	DAY MONTH	YEAR	DAY MONTH	YEAR
BCG						
HEP B0 (GIVEN AT BIRTH)			H0		H0	



507	CHECK 506:	BCG TO MEASLES 2 OTHER ALL RECORDED (GO TO 511)	BCG TO MEASLES 2 OTHER ALL RECORDED (GO TO 511)	BCG TO MEASLES 2 OTHER ALL RECORDED (GO TO 511)

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME ________________	NEXT-TO-LAST BIRTH NAME ________________	SECOND-FROM-LAST BIRTH NAME ________________
508	Has (NAME) had any vaccinations that are not recorded on this card, including vaccinations given in a national immunization day campaign? RECORD 'YES' ONLY IF THE RESPONDENT MENTIONS AT LEAST ONE OF THE VACCINATIONS IN 506 THAT ARE NOT RECORDED AS HAVING BEEN GIVEN.	YES . . . . 1 (PROBE FOR VACCINATIONS AND WRITE '66' IN THE CORRESPONDING DAY COLUMN IN 506) (SKIP TO 511) NO . . . . 2 (SKIP TO 511) DON'T KNOW 8	YES . . . . 1 (PROBE FOR VACCINATIONS AND WRITE '66' IN THE CORRESPONDING DAY COLUMN IN 506) (SKIP TO 511) NO . . . . 2 (SKIP TO 511) DON'T KNOW 8	YES . . . . 1 (PROBE FOR VACCINATIONS AND WRITE '66' IN THE CORRESPONDING DAY COLUMN IN 506) (SKIP TO 511) NO . . . . 2 (SKIP TO 511) DON'T KNOW 8
509	Did (NAME) ever have any vaccinations to prevent him/her from getting diseases, including vaccinations received in a national immunization day campaign?	YES . . . . 1 NO . . . . 2 (SKIP TO 511) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 511) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 511) DON'T KNOW 8
510	Please tell me if (NAME) had any of the following vaccinations:			
510A	A BCG vaccination against tuberculosis, that is, an injection in the arm or shoulder that usually causes a scar?	YES . . . . 1 NO . . . . 2 DON'T KNOW 8	YES . . . . 1 NO . . . . 2 DON'T KNOW 8	YES . . . . 1 NO . . . . 2 DON'T KNOW 8
510B	Within 24 hours after birth, did (NAME) receive a Hepatitis B vaccination, that is an injection in the thigh to prevent Hepatitis B?	YES . . . . 1 NO . . . . 2 DON'T KNOW 8	YES . . . . 1 NO . . . . 2 DON'T KNOW 8	YES . . . . 1 NO . . . . 2 DON'T KNOW 8
510C	Polio vaccine, that is, drops in the mouth?	YES . . . . 1 NO . . . . 2 (SKIP TO 510E) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 510E) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 510E) DON'T KNOW 8
510D	How many times was the polio vaccine given?	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES . . . . .
510E	A DPT/PENTAVALENT vaccination, that is, an injection given in the thigh, sometimes at the same time as polio drops?	YES . . . . 1 NO . . . . 2 (SKIP TO 510G) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 510G) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 510G) DON'T KNOW 8
510F	How many times was the DPT/PENTAVALENT vaccination	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES . . . . .

510G	A HEP B vaccination, that is, an injection given in the thigh, to prevent him/her from getting hepatitis?	YES . . . . NO . . . . (SKIP TO 510I) DON'T KNOW	1YES . . . . 2NO . . . . (SKIP TO 510I) 8DON'T KNOW	1YES . . . . 2NO . . . . (SKIP TO 510I) 8DON'T KNOW	1 2 8
510H	How many times was the HEP B vaccination given?	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES	
510I	A measles injection or an MMR/MR injection- that is, a shot in the arm at the age of 9 months or older - to prevent him/her from getting measles?	YES . . . . NO . . . . (SKIP TO 511) DON'T KNOW	1YES . . . . 2NO . . . . (SKIP TO 511) 8DON'T KNOW	1YES . . . . 2NO . . . . (SKIP TO 511) 8DON'T KNOW	1 2 8
510J	How many times did (NAME) receive the measles vaccine?	NUMBER OF TIMES	NUMBER OF TIMES	NUMBER OF TIMES	

Questions related to child diarrhea and pneumonia

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____		NEXT-TO-LAST BIRTH NAME _____		SECOND-FROM-LAST BIRTH NAME _____	
514	Has (NAME) had diarrhea in the last	YES	1	YES	1	YES	1
	2 weeks?	NO	2	NO	2	NO	2
		(SKIP TO 525)		(SKIP TO 525)		(SKIP TO 525)	
		DON'T KNOW . . .	8	DON'T KNOW . . .	8	DON'T KNOW . . .	8
515	Was there any blood in the stools?	YES	1	YES	1	YES	1
		NO	2	NO	2	NO	2
		DON'T KNOW . . .	8	DON'T KNOW . . .	8	DON'T KNOW . . .	8
111	Now I would like to know how much (NAME) was given to drink during the diarrhea (including breastmilk).						
	Was he/she given less than usual to						
	drink, about the same amount, or	MUCH LESS . . .	1	MUCH LESS . . .	1	MUCH LESS . . .	1
	more than usual to drink?	SOMEWHAT LESS	2	SOMEWHAT LESS	2	SOMEWHAT LESS	2
		ABOUT THE SAME	3	ABOUT THE SAME	3	ABOUT THE SAME	3
	IF LESS, PROBE: Was he/she	MORE	4	MORE	4	MORE	4
	given much less than usual to drink	NOTHING TO DRINK	5	NOTHING TO DRINK	5	NOTHING TO DRINK	5
	or somewhat less?	DON'T KNOW . . .	8	DON'T KNOW . . .	8	DON'T KNOW . . .	8
119	When (NAME) had diarrhea, was						
	he/she given less than usual to eat,	MUCH LESS . . .	1	MUCH LESS . . .	1	MUCH LESS . . .	1
	about the same amount, more than	SOMEWHAT LESS	2	SOMEWHAT LESS	2	SOMEWHAT LESS	2
	usual, or nothing to eat?	ABOUT THE SAME	3	ABOUT THE SAME	3	ABOUT THE SAME	3
		MORE	4	MORE	4	MORE	4
	IF LESS, PROBE: Was he/she	STOPPED FOOD	5	STOPPED FOOD	5	STOPPED FOOD	5
	given much less than usual to eat or	NEVER GAVE FOOD	6	NEVER GAVE FOOD	6	NEVER GAVE FOOD	6
	somewhat less?	DON'T KNOW . . .	8	DON'T KNOW . . .	8	DON'T KNOW . . .	8
518	Did you seek advice or treatment for	YES	1	YES	1	YES	1
	the diarrhea from any source?	NO	2	NO	2	NO	2
		(SKIP TO 522)		(SKIP TO 522)		(SKIP TO 522)	

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME ________________	NEXT-TO-LAST BIRTH NAME ________________	SECOND-FROM-LAST BIRTH NAME _________________
519	Where did you seek advice or treatment? Anywhere else? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. ______________________ (NAME OF PLACE(S))	PUBLIC SECTOR GOVT HOSPITAL A GOVT HEALTH CENTER (RHC) B GOVT HEALTH POST (SUB-CENTER . . .. . C VILLAGE HEALTH WORKER . . .. D MOBILE CLINIC. E UHC/MCH CENTER F TRADITIONAL MED. CLINIC. G ANOTHER PUBLIC SECTOR H ______________ (SPECIFY) NON-GOVERNMENT MARIE STOPES. I MYANMAR RED CROSS . . . J PSI/M (SUN) . . . K MMA . . .. L ANOTHER PUBLIC SECTOR M ______________ (SPECIFY) PRIVATE MEDICAL SECTOR PVT. HOSPITAL/ CLINIC . . . . N PHARMACY . . . O PVT DOCTOR . . . P MOBILE CLINIC. Q TRADITIONAL MED.CLINIC . . . R OTHER PRIVATE MED. SECTOR S ______________ (SPECIFY) ANOTHER SOURCE	PUBLIC SECTOR GOVT HOSPITAL A GOVT HEALTH CENTER (RHC) B GOVT HEALTH POST (SUB-CENTER . . .. . C VILLAGE HEALTH WORKER . . .. D MOBILE CLINIC. E UHC/MCH CENTER F TRADITIONAL MED. CLINIC. G ANOTHER PUBLIC SECTOR H ______________ (SPECIFY) NON-GOVERNMENT MARIE STOPES. I MYANMAR RED CROSS . . . J PSI/M (SUN) . . . K MMA . . .. L ANOTHER PUBLIC SECTOR M ______________ (SPECIFY) PRIVATE MEDICAL SECTOR PVT. HOSPITAL/ CLINIC . . . . N PHARMACY . . . O PVT DOCTOR . . . P MOBILE CLINIC. Q TRADITIONAL MED.CLINIC . . . R OTHER PRIVATE MED. SECTOR S ______________ (SPECIFY) ANOTHER SOURCE	PUBLIC SECTOR GOVT HOSPITAL A GOVT HEALTH CENTER (RHC) B GOVT HEALTH POST (SUB-CENTER . . .. . C VILLAGE HEALTH WORKER . . .. D MOBILE CLINIC. E UHC/MCH CENTER F TRADITIONAL MED. CLINIC. G ANOTHER PUBLIC SECTOR H ______________ (SPECIFY) NON-GOVERNMENT MARIE STOPES. I MYANMAR RED CROSS . . . J PSI/M (SUN) . . . K MMA . . .. L ANOTHER PUBLIC SECTOR M ______________ (SPECIFY) PRIVATE MEDICAL SECTOR PVT. HOSPITAL/ CLINIC . . . . N PHARMACY . . . O PVT DOCTOR . . . P MOBILE CLINIC. Q TRADITIONAL MED.CLINIC . . . R OTHER PRIVATE MED. SECTOR S ______________ (SPECIFY) ANOTHER SOURCE

		SHOP . . . . . T TRADITIONAL PRACTITIONER U MARKET . . .. . V OTHER X (SPECIFY)	SHOP . . . . . T TRADITIONAL PRACTITIONER U MARKET . . .. . V OTHER X (SPECIFY)	SHOP . . . . . T TRADITIONAL PRACTITIONER U MARKET . . .. . V OTHER X (SPECIFY)
520	CHECK 519:	TWO OR MORE CODES CIRCLED ONLY ONE CODE CIRCLED (SKIP TO 522)	TWO OR MORE CODES CIRCLED ONLY ONE CODE CIRCLED (SKIP TO 522)	TWO OR MORE CODES CIRCLED ONLY ONE CODE CIRCLED (SKIP TO 522)
521	Where did you first seek advice or treatment? USE LETTER CODE FROM 519.	FIRST PLACE . . .	FIRST PLACE . . .	FIRST PLACE . . .

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME ________________	NEXT-TO-LAST BIRTH NAME ________________	SECOND-FROM-LAST BIRTH NAME ________________
120	Was he/she given any of the following to drink at any time since he/she started having the diarrhea: a) A fluid made from a special packet called ORS (ORASEL, MFP)? c) A government-recommended homemade fluid?	YES NO DK FLUID FROM ORS PKT 1 2 8 HOMEMADE FLUID . . . 1 2 8	YES NO DK FLUID FROM ORS PKT 1 2 8 HOMEMADE FLUID . . . 1 2 8	YES NO DK FLUID FROM ORS PKT 1 2 8 HOMEMADE FLUID . . . 1 2 8
523	Was anything (else) given to treat the diarrhea?	YES . . . . 1 NO . . . . 2 (SKIP TO 525) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 525) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 525) DON'T KNOW 8
524	What (else) was given to treat the diarrhea? Anything else? RECORD ALL TREATMENTS GIVEN.	PILL OR SYRUP ANTIBIOTIC. . . . . A ANTIMOTILITY B ZINC . . . . C OTHER (NOT ANTI-BIOTIC, ANTI-MOTILITY, OR ZINC) . . . . D UNKNOWN PILL OR SYRUP . . . E INJECTION ANTIBIOTIC. . . . . F NON-ANTIBIOTIC G UNKNOWN INJECTION . . . H (IV) INTRAVENOUS I HOME REMEDY/ HERBAL MED-ICINE . . . . J OTHER X ________ (SPECIFY)	PILL OR SYRUP ANTIBIOTIC. . . . . A ANTIMOTILITY B ZINC . . . . C OTHER (NOT ANTI-BIOTIC, ANTI-MOTILITY, OR ZINC) . . . . D UNKNOWN PILL OR SYRUP . . . E INJECTION ANTIBIOTIC. . . . . F NON-ANTIBIOTIC G UNKNOWN INJECTION . . . H (IV) INTRAVENOUS I HOME REMEDY/ HERBAL MED-ICINE . . . . J OTHER X ________ (SPECIFY)	PILL OR SYRUP ANTIBIOTIC. . . . . A ANTIMOTILITY B ZINC . . . . C OTHER (NOT ANTI-BIOTIC, ANTI-MOTILITY, OR ZINC) . . . . D UNKNOWN PILL OR SYRUP . . . E INJECTION ANTIBIOTIC. . . . . F NON-ANTIBIOTIC G UNKNOWN INJECTION . . . H (IV) INTRAVENOUS I HOME REMEDY/ HERBAL MED-ICINE . . . . J OTHER X ________ (SPECIFY)
525	Has (NAME) been ill with a fever at any time in the last 2 weeks?	YES . . . . 1 NO . . . . 2 (SKIP TO 527) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 527) DON'T KNOW 8	YES . . . . 1 NO . . . . 2 (SKIP TO 527) DON'T KNOW 8
526	At any time during the illness, did (NAME) have blood taken from his/her finger or heel for testing?	YES . . . . 1 NO . . . . 2 DON'T KNOW 8	YES . . . . 1 NO . . . . 2 DON'T KNOW 8	YES . . . . 1 NO . . . . 2 DON'T KNOW 8

527	Has (NAME) had an illness with a cough at any time in the last 2 weeks?	YES . . . . 1 NO . . . . 2 (SKIP TO 530) DON'T KNOW 8				YES . . . . 1 NO . . . . 2 (SKIP TO 530) DON'T KNOW 8				YES . . . . 1 NO . . . . 2 (SKIP TO 530) DON'T KNOW 8			
528	When (NAME) had an illness with a cough, did he/she breathe faster than usual with short, rapid breaths or have difficulty breathing?	YES . . . . 1 NO . . . . 2 (SKIP TO 531) DON'T KNOW 8				YES . . . . 1 NO . . . . 2 (SKIP TO 531) DON'T KNOW 8				YES . . . . 1 NO . . . . 2 (SKIP TO 531) DON'T KNOW 8			

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME ________________	NEXT-TO-LAST BIRTH NAME ________________	SECOND-FROM-LAST BIRTH NAME ________________
529	Was the fast or difficult breathing due to a problem (tightness) in the chest or to a blocked or runny nose?	CHEST ONLY . . . 1 NOSE ONLY . . .. . 2 BOTH . . . . 3 OTHER 6 (SPECIFY) DON'T KNOW . . .. . 8 (SKIP TO 531)	CHEST ONLY . . . 1 NOSE ONLY . . .. . 2 BOTH . . . . 3 OTHER 6 (SPECIFY) DON'T KNOW . . .. . 8 (SKIP TO 531)	CHEST ONLY . . . 1 NOSE ONLY . . .. . 2 BOTH . . . . 3 OTHER 6 (SPECIFY) DON'T KNOW . . .. . 8 (SKIP TO 531)
530	CHECK 525: HAD FEVER?	YES [ ] NO OR DK [ ] (GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 553)	YES [ ] NO OR DK [ ] (GO BACK TO 503 IN NEXT COLUMN; OR, IF NO MORE BIRTHS, GO TO 553)	YES [ ] NO OR DK [ ] (GO TO 503 IN NEXT-TO-LAST COLUMN OF NEW QUESTIONNAIRE; OR, IF NO MORE BIRTHS, GO TO 553)
531	Now I would like to know how much (NAME) was given to drink (including breastmilk) during the illness with a (fever/cough). Was he/she given less than usual to drink, about the same amount, or more than usual to drink? IF LESS, PROBE: Was he/she given much less than usual to drink or somewhat less?	MUCH LESS . . .. . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8	MUCH LESS . . .. . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8	MUCH LESS . . .. . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . 4 NOTHING TO DRINK 5 DON'T KNOW 8
123	When (NAME) had a (fever/cough), was he/she given less than usual to eat, about the same amount, more than usual, or nothing to eat? IF LESS, PROBE: Was he/she given much less than usual to eat or somewhat less?	MUCH LESS . . .. . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8	MUCH LESS . . .. . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8	MUCH LESS . . .. . 1 SOMEWHAT LESS 2 ABOUT THE SAME 3 MORE . . . . 4 STOPPED FOOD 5 NEVER GAVE FOOD 6 DON'T KNOW 8
533	Did you seek advice or treatment for the illness from any source?	YES . . . . 1 NO . . . . 2 (SKIP TO 537)	YES . . . . 1 NO . . . . 2 (SKIP TO 537)	YES . . . . 1 NO . . . . 2 (SKIP TO 537)

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME ________________	NEXT-TO-LAST BIRTH NAME ________________	SECOND-FROM-LAST BIRTH NAME ________________
534	Where did you seek advice or treatment? Anywhere else? PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR, WRITE THE NAME OF THE PLACE. ________________ (NAME OF PLACE(S))	PUBLIC SECTOR GOVT HOSPITAL A GOVT HEALTH CENTER (RHC) B GOVT HEALTH POST (SUB-CENTER . . .. . C VILLAGE HEALTH WORKER . . .. D MOBILE CLINIC. E UHC/MCH CENTER F TRADITIONAL MED. CLINIC. G ANOTHER PUBLIC SECTOR H ________________ (SPECIFY) NON-GOVERNMENT MARIE STOPES. I MYANMAR RED CROSS . . . J PSI/M (SUN) . . . K MMA . . . . L ANOTHER PUBLIC SECTOR M ________________ (SPECIFY) PRIVATE MEDICAL SECTOR PVT HOSPITAL/ CLINIC . . . . N PHARMACY . . . O PVT DOCTOR . . . P MOBILE CLINIC. Q TRADITIONAL MED.CLINIC . . . R OTHER PRIVATE MED. SECTOR S ________________ (SPECIFY) ANOTHER SOURCE SHOP . . . . T TRADITIONAL PRACTITIONER U	PUBLIC SECTOR GOVT HOSPITAL A GOVT HEALTH CENTER (RHC) B GOVT HEALTH POST (SUB-CENTER . . .. . C VILLAGE HEALTH WORKER . . .. D MOBILE CLINIC. E UHC/MCH CENTER F TRADITIONAL MED. CLINIC. G ANOTHER PUBLIC SECTOR H ________________ (SPECIFY) NON-GOVERNMENT MARIE STOPES. I MYANMAR RED CROSS . . . J PSI/M (SUN) . . . K MMA . . . . L ANOTHER PUBLIC SECTOR M ________________ (SPECIFY) PRIVATE MEDICAL SECTOR PVT HOSPITAL/ CLINIC . . . . N PHARMACY . . . O PVT DOCTOR . . . P MOBILE CLINIC. Q TRADITIONAL MED.CLINIC . . . R OTHER PRIVATE MED. SECTOR S ________________ (SPECIFY) ANOTHER SOURCE SHOP . . . . T TRADITIONAL PRACTITIONER U	PUBLIC SECTOR GOVT HOSPITAL A GOVT HEALTH CENTER (RHC) B GOVT HEALTH POST (SUB-CENTER . . .. . C VILLAGE HEALTH WORKER . . .. D MOBILE CLINIC. E UHC/MCH CENTER F TRADITIONAL MED. CLINIC. G ANOTHER PUBLIC SECTOR H ________________ (SPECIFY) NON-GOVERNMENT MARIE STOPES. I MYANMAR RED CROSS . . . J PSI/M (SUN) . . . K MMA . . . . L ANOTHER PUBLIC SECTOR M ________________ (SPECIFY) PRIVATE MEDICAL SECTOR PVT HOSPITAL/ CLINIC . . . . N PHARMACY . . . O PVT DOCTOR . . . P MOBILE CLINIC. Q TRADITIONAL MED.CLINIC . . . R OTHER PRIVATE MED. SECTOR S ________________ (SPECIFY) ANOTHER SOURCE SHOP . . . . T TRADITIONAL PRACTITIONER U

		MARKET . . .. . V OTHER X (SPECIFY)	MARKET . . .. . V OTHER X (SPECIFY)	MARKET . . .. . V OTHER X (SPECIFY)
535	CHECK 534:	TWO OR MORE CODES CIRCLED ONLY ONE CODE CIRCLED (SKIP TO 537)	TWO OR MORE CODES CIRCLED ONLY ONE CODE CIRCLED (SKIP TO 537)	TWO OR MORE CODES CIRCLED ONLY ONE CODE CIRCLED (SKIP TO 537)
536	Where did you first seek advice or treatment? USE LETTER CODE FROM 534.	FIRST PLACE . . .	FIRST PLACE . . .	FIRST PLACE . . .

Questions related to mother's health related knowledge (danger signs in need of immediate medical attention)

579

CHILD NOT ABLE TO DRINK OR

Sometimes children have severe illness and should be taken immediately to a health facility. What types of symptoms would cause you to take your child to a health facility right away?

NO BREASTFEEDING……	A
CHILD BECOME SICKER……	B
CHILD DEVELOPS A FEVER	C
CHILD HAS FAST BREATHING	D
CHILD HAS DIFFICULT BREATHING .	E
CHILD HAS BLOOD IN STOOL	F
CHILD IS DRINKING POORLY	G
CHILD DEVELOPS RASHES	H
CHILD HAS DIARRHOEA	I
ANOTHER	x
(SPECIFY)	

Any other symptoms?

Questions related to husband (education and occupation)

601	Are you currently married?	YES, CURRENTLY MARRIED	1	604
		NO, NOT IN UNION	2	
602	Have you ever been married?	YES, FORMERLY MARRIED	1	
		NO	2	612
603	What is your marital status now: are you widowed, divorced, or separated?	WIDOWED	1	
		DIVORCED	2	609

103 How old was your husband on his last birthday?

AGE IN COMPLETED YEARS

803	Did your (last) husband ever attend school?	YES	 1	
		NO	 2	806

107 What was the highest grade he completed?

GRADE . . . .

IF COMPLETED LESS THAN GRADE ONE, RECORD '00'.

DON'T KNOW . . . . . 98.....

CURRENTLY MARRIED FORMERLY MARRIED

What is your husband's occupation? That is, what kind of work does he mainly does?

What was your (last) husband's occupation? That is, what kind of work did he mainly do?

Questions related to mother's education and occupation

807 Aside from your own housework, have you done any work in the last seven days? YES . . . . . 1..... 811

NO . . . . . 2.....

207 As you know, some women take up jobs for which they are paid in cash or kind. Others sell things, have a small business or work on the family farm or in the family business. In the last seven days, have you done any of these things or any other work?

YES 1 811

NO 2

209 Although you did not work in the last seven days, do you have any job or business from which you were absent for leave, illness, vacation, maternity leave, or any other such reason?

YES 1 811

NO 2

810 Have you done any work in the last 12 months?

YES 1

NO 2 815

212. What is your occupation, that is, what kind of work do you mainly do?

812 Do you do this work for a member of your family, for someone else, or are you self-employed?

FOR FAMILY MEMBER 1

FOR SOMEONE ELSE 2

SELF-EMPLOYED . . . .

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
813	Do you usually work throughout the year, or do you work seasonally? or only occasionally?	THROUGHOUT THE YEAR . . . . . 1 SEASONALLY/PART OF THE YEAR 2 ONCE IN A WHILE 3	
814	Are you paid in cash or kind for this work or are you not paid at all?	CASH ONLY . . . . . 1 CASH AND KIND . . . . . 2 IN KIND ONLY . . . . . 3 NOT PAID 4	
815	CHECK 601: CURRENTLY MARRIED / NOT IN UNION		823
816	CHECK 814: CODE 1 OR 2 CIRCLED / OTHER		819
		OTHER 6 (SPECIFY)	
	Questions related to maternal autonomy		
820	Who usually makes decisions about health care for yourself: you, your husband, you and your husband jointly, or someone else?	RESPONDENT . . . . . 1 HUSBAND. . . . . 2 RESPONDENT AND HUSBAND JOINTLY 3 SOMEONE ELSE . . . . . 4 OTHER 6	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP

ANNEX 6: FHMREC ethics approval

Applicant: Khaing Soe
Supervisor: Paula Holland, Ceu Mateus
Department: Health Research
FHMREC Reference: FHMREC16067

21 March 2017

Dear Khaing

Re: What is the association between maternal education and major childhood illnesses, utilization of child health services and child mortality in Myanmar?

Thank you for submitting your research ethics application for the above project for review by the **Faculty of Health and Medicine Research Ethics Committee (FHMREC)**. The application was recommended for approval by FHMREC, and on behalf of the Chair of the Committee, I can confirm that approval has been granted for this research project.

As principal investigator your responsibilities include:

- ensuring that (where applicable) all the necessary legal and regulatory requirements in order to conduct the research are met, and the necessary licenses and approvals have been obtained;
- reporting any ethics-related issues that occur during the course of the research or arising from the research to the Research Ethics Officer at the email address below (e.g. unforeseen ethical issues, complaints about the conduct of the research, adverse reactions such as extreme distress);
- submitting details of proposed substantive amendments to the protocol to the Research Ethics Officer for approval.

Please contact me if you have any queries or require further information.

Tel:- 01542 592838
Email:- fhmresearchsupport@lancaster.ac.uk

Yours sincerely,

Dr Diane Hopkins
Research Integrity and Governance Officer, Secretary to FHMREC.