DETERMINANTS OF NEONATAL MORTALITIES IN PAKISTAN

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58th International Course in Health Development

September 13, 2021 – September 2, 2022

KIT (ROYAL TROPICAL INSTITUTE)

Vrije Universiteit Amsterdam

DETERMINANTS OF NEONATAL MORTALITIES IN PAKISTAN

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health

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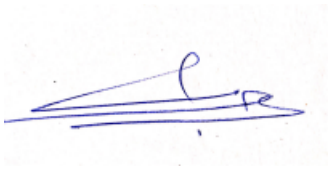

58th Master of Public Health/International Course in Health Development (MPH/ICHD)
13 September 2021 - 02 September 2022

KIT (Royal Tropical Institute)/Vrije Universiteit Amsterdam
Amsterdam, The Netherlands
September 2022

Organized by:

KIT (Royal Tropical Institute)
Amsterdam, The Netherlands

In co-operation with:

Vrije Universiteit Amsterdam (VU)
Amsterdam, The Netherlands

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Abbreviations

ANC	**Antenatal care ANC**
BHUs	**Basic health units**
BMI	**Body Mass Index**
CHWs	**Community Health workers**
CS	**Cesarean section**
DHQ	**District Head Quarters**
DHS	**Demographic health system**
EmONC	**Emergency Obstetric and Newborn Care**
HWs	**Health Workers**
HHs	**Households**
IUGR	**Intrauterine Growth Restriction**
LHWs	**Lady Health Workers**
LBW	**Low Birth Weight**
MOPH	**Ministry of Public Health**
MCH	**Maternal Child Health**
MCNH	**Maternal neonate Child Health**
PDHS	**Pakistan Demographic health system**
NT	**Neonatal tetanus**
NM	**Neonatal Mortality**
RHCs	**Rural health centers**
SBAs	**Skilled birth Attendants**
SGA	**Small for gestational age**
SDG	**Sustainable development Goals**
THQ	**Tehsil Head Quarters**
THHs	**Tertiary Healthcare Hospitals**
TBA	**Traditional birth attendant**

Glossary

Neonate:" A newborn infant, or neonate, is a child under 28 days of age(1) ".

Neonatal mortality rate (**NMR**): is the number of live birth babies who die during the first 28 days of their life per 1000 live births. Neonatal mortality is a very important public health indicator that reflect the quality of the health services. NMR is used to assess maternal and neonatal care/health (2).

GII gender inequality index: is an index that measures the inequality between women and men in society. The values range from 0 to 1; the highest number means a higher gender gap(3).

Maternal undernutrition : is indicated through low body mass index (less than 18.5), short stature (height less than 145 cm), and anaemia (HB less than 11 mg/dl)(4).

Skilled birth attendant SBA: is defined as a skilled health provider (who can be the midwives, doctors, or nurses) who is trained/educated to gain all the essential skills needed to manage pregnancy, childbirth, and postnatal care. SBAs have the required skills to identify, manage, and refer any danger signs (during the delivery) of pregnant women or the baby(5).

Birth asphyxia: "Defined, as the failure to establish breathing at birth, is one of the primary causes of early neonatal mortality"(6).

Acknowledgment

First of all, Alhamdulillah, thank God for everything.

I dedicate this work to the one who believes in me and supports and loves me unconditionally, my Mother, whose prayers are the reason behind every good thing in my life.

My sincere appreciation and ultimate love to my friends Yassmin , Maha and Muna, who, their continuous support, enabled me to overcome thesis challenges.

My deepest Thanks to my academic advisor for her technical and moral support. Thanks also to my thesis advisors, whose technical comments guided me to complete my work .

Last but not least, my special thanks to The Netherlands' government and people (Nuffic Scholarship) and Royal tropical institute for opening the opportunity for me to join this course and upgrade my knowledge and qualification in Public health.

Abstract

Introduction

Globally, neonatal mortality is high with approximately 2.4 million neonate deaths occurring annually,, which accounts for 47% of the total under five child deaths. Pakistan has one of the highest NMR in the world, with 47 deaths per 1000 live births, accounting for 7% of total global neonatal deaths. These deaths in Pakistan are driven by socio-determinants but there is limited information about these factors.

Objectives

Identify and analyze the determinants of neonatal mortality as well as best practices to reduce the burden of neonatal mortality in in Pakistan .

Study method

A literature review using published articles and reports was conducted and the identified factors were analysed using the adapted Mosley and Chen framework.

Findings

The study findings show that poor maternal education, poverty, and harmful cultural practices are common in Pakistan, and associated with adverse neonatal outcomes. Underutilization of maternal and child health services due to accessibility challenges and poor quality of services is a significant cause of poor neonatal survival rates. Also, young maternal age that results from the prevalence of early marriage in Pakistan, short birth interval, low maternal nutrition status, and low women empowerment are common causes of neonatal mortality in Pakistan.

Recommendation

The study recommended multisectoral interventions to improve mothers' living conditions and health. Interventions such as women empowerment and girls' education, and prohibition of early marriages will indirectly result to improved neonatal health, Government and relevant stakeholders should also work to improve the quality of service and access to the healthcare services.

Keywords: Neonatal mortality, Maternal and newborn health, intervention, socio-determinants, Pakistan

Word count: 13169

Chapter 1: Country Background

1.1 Geography*:*

Pakistan is one of the South Asian countries. It is located in the northwest part of the South Asian subcontinent. Pakistan shares its borders with four countries; China borders Pakistan from the northeast, India to the east, and Afghanistan and Iran from the west. In the south, Pakistan has a coastline of 1046 kilometers with the Arabian Sea and the Gulf of Oman. Pakistan ranks number 33 globally as the largest country by area, whereas it covers about 796,095 km². It has variant terrains, mountainous areas in the north, flat plains in the east, and the west Baluchistan plateau. The country has four main provinces Baluchistan, Punjab, Sindh, and Khyber Pakhtunkhwa. Islamabad, the capital of the country is located in the northeastern region of the country (7)(8).

Figure 1: Map of Pakistan.

Source Blank world Map (9)

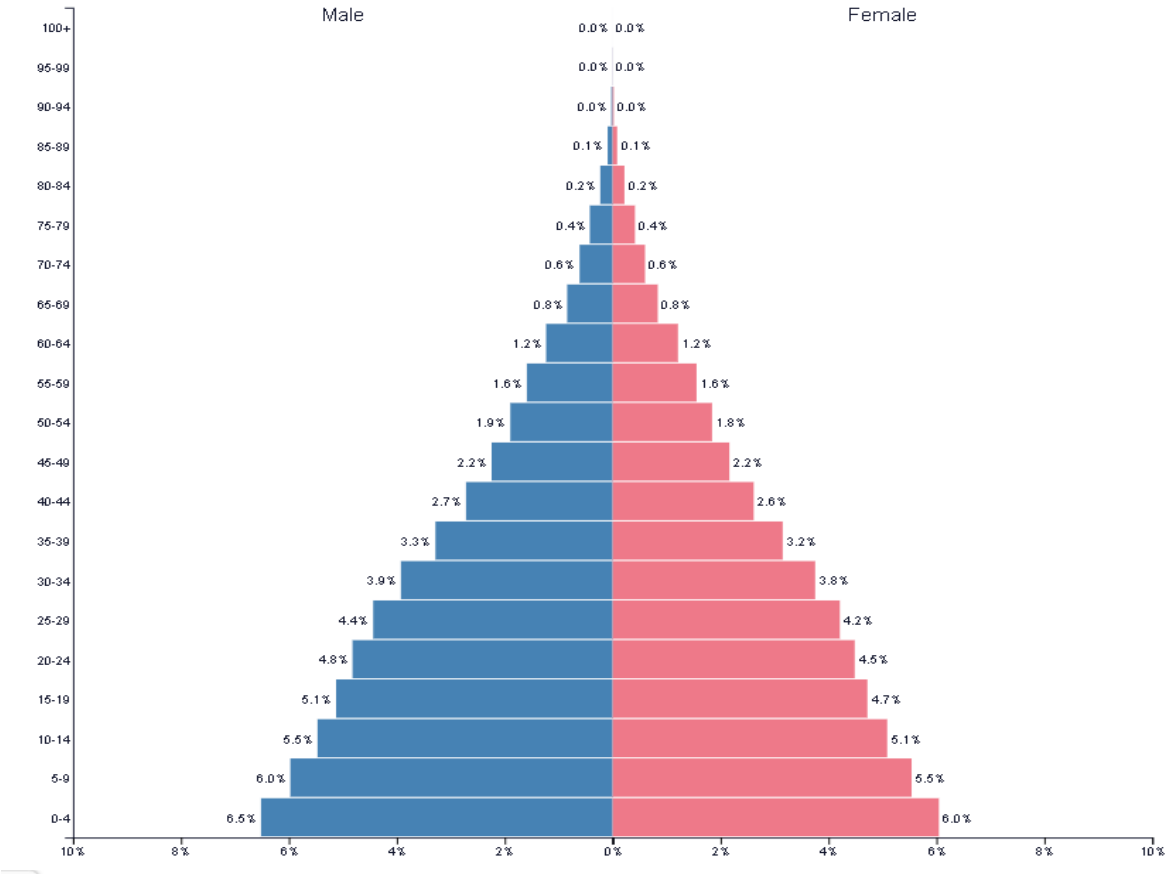
1.2 Demography:

Based on UN data, the total population of Pakistan in 2020 was 220,892,340, equivalent to 2.83 % of the entire world population. Pakistan ranks number five in the world as the most populated country (10). In 2020, the population growth rate of Pakistan was 2%, and the fertility rate was 3.4 live birth; an increase in the size of the population in the coming years to become the fourth biggest population globally by 2050 was predicted (11)(12)(13).

The dominant age group in Pakistan is the youth and based on the 2020 statistics, more than 35% of Pakistan's population was less than age fifteen years (14). The majority of the Pakistani population (about 65%) lives in rural areas while the rest (35%) live in the country's

urban side. In 2020, life expectancy of the males in Pakistan was estimated at 66.8 years, while for females was 68.9 years, and 67.8 years on the average for both sex. (10).

Figure 2: Pakistan Population Pyramid 2021.



source population pyramid of the world (15)

1.3 Cultural Aspects:

Pakistan is a multicultural country (16). Pakistan has multi-ethnic culture, whereas each ethnicity has its custom, beliefs, tradition, and language. The main ethics are Punjabi, considered as the biggest ethnic group with 44.7% of the total population, followed by Pathan 15.4%, Sindhi 14.1%, Saraiki 8.4%, Muhajirs 7.6%, and Balochi with 3.6% (17). People in Pakistan have about seven different languages based on their ethnic group, however, Urdu is the country's formal and most spoken language. English is the second formal language in Pakistan. Islam is the main religion in the country, and almost all the population in Pakistan are Muslim except for 3% of other religions like Sikh, Urdu, Christian, and Hindu (18). Pakistan is a conservative and male-dominated society and gender inequalities issues are prevalent in Pakistan. Based on UNDP's Human development report 2020, Pakistan ranks 135rd among 188 countries with 0.538 Gender inequality index GII (3).

1.4 Education and Literacy situation

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Pakistan has one of the lowest literacy rate in the world 46%. The United Nations Educational, Scientific and Cultural Organization (UNESCO) ranks Pakistan 160th among all countries in the world with the lowest literacy rate (19). Illiteracy rate is higher among women than men in Pakistan, whereas only 25% of the men are uneducated, half of the women (50%) are uneducated (12).

1.5 Political Environment

Pakistan is a semi-secular, Islamic federal parliamentary republic. Since the creation of Pakistan in 1947, the country has suffered from long-term political instability. The multicultural diversity in Pakistan contributed to the longstanding regional tension, with the government inability to form a constitution addressing the country's diversity (20)(21). The different factors contributing to the country's political instability include continuous fight among the provinces, the complicated conflict with India, and the oscillation of who will secure the authority between the military who ruled Pakistan and the elected democratic government (22)(21). Pakistan also has a long history of war against terrorism, and since the Taliban secured authority of Afghanistan, there has been increased th terrorist attacks in the country with recurrent assassinations of politicians which aggravated the country's instability (22). The past and ongoing political problems resulted in instability in the country affecting socio-economic development (23).

1.6 Economic Situation.

Pakistan is classified as a lower-middle-income country according to the World Bank classification with gross national income GNI per capita of 1,188.9 USD in 2020 (24)(25).

The World Bank, using the Poverty rate of lower middle income has estimated the Poverty rate of Pakistan for the year 2021-22 as 39.3 percent (26)(27). In Pakistan poor people mainly are living in rural areas where there is high proportion of unskilled, informal and less paid people (27).

Pakistan unemployment rate increased from 5.6% in 2017 to 6.9% in 2018. While the unemployment rate in the urban area was 7.9%, rural area rate was 6.4% (28). Unemployment rate in Pakistan is higher among women than men (80% versus 20 %) (12).

Pakistan's economy depends mainly on agriculture, manufacturing, and remittance. The Gross domestic Product GDP growth rate in Pakistan has been growing annually since 2005 by an average of five percent. In 2020, GDP growth rate increased by 1.5 and by 4 percent in 2021. Despite the growth in GDP growth rate, it does not meet the need of the people including the rapid growth of the population (29)(30)(25).

1.7 Health system

The healthcare delivery system in Pakistan comprises two main components; public and private health sectors. Health in Pakistan is under the responsibility of the provincial and federal governments, whereas they both work jointly to administer the public health system. The public health sector are classified to three levels (primary, secondary and tertiary) and compose of 14,016 total health facilities (HFs) (13,051 basic and 965 secondary and tertiary hospitals) (31)(32).

In Pakistan, primary healthcare is the first level care where the interaction between the patient and health providers occurs. The service at the primary healthcare is provided across 13,051 HFs which are Basic health units (BHUs) and Rural Health Centers (RHCs). The BHUs cover a catchment population of 25,000 people while RHCs serve a catchment population of 100000 people. Both BHUs and RHCs provide preventive, curative (service package) and referral services. In Pakistan, preventive and promotive health services are also provided by community health workers CHWs such as the 93,000 lady health workers LHWs and 6,000 community midwives, who work in collaboration and under the regulation of primary health care(31)(32).

The secondary healthcare level is the intermediate level where technical, comprehensive therapeutic and diagnostic services are provided. It composes of Tehsil Head Quarters (THQ) and District Head Quarters (DHQ). The THQ is the first referral place to receive cases from BHUs, RHCs, and LHWs. Each THQ covers 500000 to 1 million people in a sub-district level and has 40-60 beds. DHQ serves people at the district level covering around 1-3 million people. DHQ receives all referrals from all BHUs, RHUs, and THQs. Tertiary healthcare is the third level of health care in Pakistan. It comprises around 22 tertiary healthcare hospitals (THHs), most of which are teaching hospitals where more specialized services are provided. The THHs are located in the big cities and provide referral care to patients from primary and secondary health providers (33).

Only 30% of the population utilizes Public health care. There are about 73,000 private health facilities in Pakistan and despite the poverty rate, 71% of the people utilize the private sector, which cost more than the public sector (34).

The health system in Pakistan is consistently under-funded. The healthcare system in Pakistan suffers from many challenges due shortage in the availability of financial support. In 2018, the total expenditure per capita for health was 43$. Total current health expenditure in Pakistan represents 3.4% of the GDP (35). Health finance in Pakistan are: 37% governmental expenditure, 55% out pocket, and external resources represent 7% of the total expenditure (36). In 2016 the governmental health expenditures was only 0.8% of GDP, which is much lower than the value recommended By WHO (5%) (37). Existing social health insurance in Pakistan only covers five percent of the population (38) and the Demographic Health Survey (DHS) of Pakistan showed that women are less covered by any kind of health insurance than men in ratio of 1 to 4(12).

Chapter 2: Problem statement, Justification and Methodology

2.1 Problem statement:

Globally, the rate of neonatal mortality is still unacceptably high. In 2019, 2.4 million neonatal deaths occurred indicating 47% of the total under-five children mortalities the same year (1). Although the global neonatal mortality rate dropped by 52% from 1990 to 2019 in neonatal death rate, this is much slower than the mortality rate for under-five child (under one and 1-4 years mortalities) (1). Consequently, the proportion of neonatal deaths out of the rates of child death increased from 40% in 1990 to 47% in 2019 (40). A WHO report also showed that the highest neonatal mortality burden occurs in sub-Saharan Africa, Central and Southern Asia. In 2020, it was estimated that a child born in sub-Saharan Africa and South Asia is ten times and nine times respectively more at risk of death in the neonatal period than a child born in developed countries (1). In South Asia countries including Pakistan, 62% of child death occurs within the first 28 days of life (40).

A WHO report showed that Pakistan has one of the highest number of neonatal deaths in the world after India and Nigeria with 244,000 neonatal deaths in 2019 (41). The World Bank statistics in 2020 revealed that Pakistan recorded 40 deaths per 1000 live birth, translating to about 7 % of total global neonatal mortalities and the highest rate compared to her neighboring countries including India, Sri Lanka, Bangladesh and Nepal (42). Although there are interventions aimed at reducing neonatal mortality in Pakistan, the annual reduction rate is slow at a rate of 0.5%, and at this pace, it is impossible to achieve sustainable development goal SDG 3, which is to decrease NMR to 17 death per 1000 live birth by 2030 (43). Pakistan lacks a function vital statistics system, so the estimated number of neonatal deaths in the country is at best estimation while a lot of neonatal deaths are more likely to be under-reported (44).

The consequences of neonatal death on the parents especially mothers, the health system and the entire society are far-reaching. Reports indicated that at least one-quarter of women experience complicated and protracted grief after neonatal and other forms of perinatal loss and this presents with psychological, social, spiritual and biological implications (45). This grief is characterized by posttraumatic disorder, depression, social phobia and anxiety (46) and this traumatic emotional period is often aggravated and elongated by the health workers who do not provide the needed care partly because they are untrained and exhausted by the care for parents with neonatal loss (47)(48).

In addition, women with a neonatal loss are often not considered as mothers in the society and this give rise to sense of stigma, social withdrawal and isolation from the society. Similarly, mourning rituals or funeral activities are considered unnecessary for a neonatal loss and this further contribute to the grief of the bereaved parents (48).

Despite the increasing international and local efforts to improve neonatal conditions in Pakistan, neonatal mortality is still high. This indicates the strong roles of factors driving these deaths and possibly their interactions and regrettably, these factors and their linkages are not well understood (49).

2.2 Justification

Child health, and in particular, morbidity and mortality rates are part of critical indicators which reveals the performance of a nation's health system as well as the socio-economic development of such country (50). Children within the first 28 days of birth has the highest death risks and given, the large contribution of neonatal mortality to the general child mortality rate, and the slow rate of reduction in neonatal mortality compared to other children age groups in Pakistan, it is important to identify and understand the influencing factors driving neonatal mortality in the country.

Pregnant women who do not receive standard care continually from medical professionals were 16 times more likely to experience baby loss as most neonate deaths were as a result of diseases and conditions associated with lack of quality healthcare services at birth or immediately after birth (1). This report indirectly reveals the implications of socioeconomic factors, access to healthcare, quality of care and other determinants.

Since, health outcomes are largely influenced by a range of social determinants, identifying the determinants of neonatal mortality in Pakistan is critical to inform health interventions. Therefore, exploring and understanding the roles of social determinants of neonatal deaths in Pakistan is essential in order to inform corresponding policy formulation, health planning and resource allocation as well as other targeted pragmatic interventions, hence the rational for this study.

Although, there are pockets of studies across Pakistan reporting factors affecting neonatal mortality, these studies were conducted in different settings. For example, some were conducted in rural areas and others in the urban settlements, some in the hospital settings, while others were conducted in the community. However, it is paramount to review these studies in order to provide a comprehensive overview of the social determinants of neonatal mortality in Pakistan. In addition, there is paucity in knowledge regarding the interaction of the reported determinants and the need for this study which also aimed to explore the interaction of the determinants of neonatal mortality.

2.3 General Objective

The main goal of this study is to identify and analyze the determinants of neonatal mortality in Pakisatn and the possible effective interventions in order to develop practical recommendations to Ministry of public health MOPH, policymakers and relevant stakeholders.

2.4 Specific Objective

- To identify and analyze the socioeconomic determinants of neonatal mortalities in Pakistan.
- To identify and analyze the maternal and Health system Factors of neonatal mortalities in Pakistan.
- To identify and analyze neonatal, delivery and the postnatal care determinants of neonatal mortalities in Pakistan
- To identify evidence-based initiatives that were applied in other LMICs and showed good results in declining neonatal mortality.
- To develop recommendations to MOPH, policymakers, and relevant stakeholders in Pakistan to improve neonatal survival in Pakistan.

2.5 Methodology

2.5.1 Literature search strategy

This study employed a literature review design to identify and analyze the social determinants of neonatal mortality in Pakistan. The literature search for peer-reviewed resources was conducted across the Vrije University (VU) online library, Google, and Google Scholar and databases including PUBMED and MEDLINE. Grey literature including technical and programmatic reports, working papers, bulletins and research briefs were also reviewed. Websites of local and international agencies and NGOs working actively on policy or programme interventions on neonatal health such as World Health Organization, UNICEF, Save the Children, Ministry of National Health Services Regulation and Coordination, Society for the Protection of the Rights of the Children (SPARC), International Foundation for Mother and Child, Healthy Newborn Network and were also consulted. Articles published in English language between 2000 and 2022 were selected. The reference list of articles publications reviewed was also checked to gather additional relevant materials for this study (Snowballing technique). Although the study search mainly focused on articles related to the thesis topic within Pakistan, other closely related relevant resources from other countries in South Asia such as Afghanistan, India, Bangladesh and Nepal were also included in the study.

The key words used in the literature search include “neonate*”, “child*”, “perinatal”, “newborn “, “baby”, “care”, “neonatal infection”, “gestational age”, “pre-term”, “pre-mature”, “low birth weight”, “infection”, “defect”, ante natal”, “skilled birth”, “postnatal care”, “intrapartum”, “maternal”, “pregnancy”, “healthcare”, “health system”, “health workers”, “midwives” “mortality” “death”, “determinant”, “factor”, “driver”, “predictors”, “correlates”, “socioeconomic”, “socio-demographics”, “age”, “sex”, “gender”, “culture”, “religion”, “education”, “poverty”, “program*”, “intervention”, “initiative”, “Pakistan”, “developing countries”, “low-and-middle-income countries”, “middle east”, “South Asia”, “Asia”. These keywords were used separately or combined using logic connectors (AND/OR). (Further key wards are in the table below).

Objectives	Literature source	Type of source	Keywords
Objective 1 (To identify and analyze the socioeconomic determinants of neonatal mortalities in Pakistan)	Peer-reviewed Literature Grey literature	VU Library PUBMED, MEDLINE Google Scholar, Google, Report, Websites	neonate*, child*, Mortality * perinatal, new born , baby, care, neonatal infection, gestational age, pre-term, pre-mature, low birth weight, infection, ante natal, skilled birth, postnatal care, intrapartum, maternal, healthcare, health system, maternal death, determinant, factor, driver, predictors, correlates, socioeconomic, socio-demographics, age, sex, gender, culture, religion, education, poverty, Pakistan
Objective 2 (To identify and analyze the maternal and Health system determinants of neonatal mortalities in Pakistan)	Peer-reviewed Literature Grey literature	VU Library PUBMED, MEDLINE Google Scholar, Google, Report, Websites	neonate*, child*,Mortality* , perinatal, newborn , baby, care, Pregnancy, maternal, death, occupation, nutrition, BMI, empowerment ,autonomy, marital status ,Early marriage , ANC, Health system , skilled health providers, health workers, distance, Attitude, access. Awareness , determinant, factor, driver, predictors, Pakistan
Objective 3 (To identify and analyze neonatal, delivery and postnatal care determinants of neonatal mortalities in Pakistan).	Peer-reviewed Literature Grey literature	VU Library PUBMED, MEDLINE Google Scholar, Google, Report, Websites	neonate*, child*,Mortality* perinatal, newborn , baby, care, neonatal infection, gestational age, pre-term, pre-mature, low birth weight, sex , birth order , skilled birth attendant , postnatal care, hygiene ,breast feeding , intrapartum complication, Caesarean section, midwives, maternal death, Pakistan

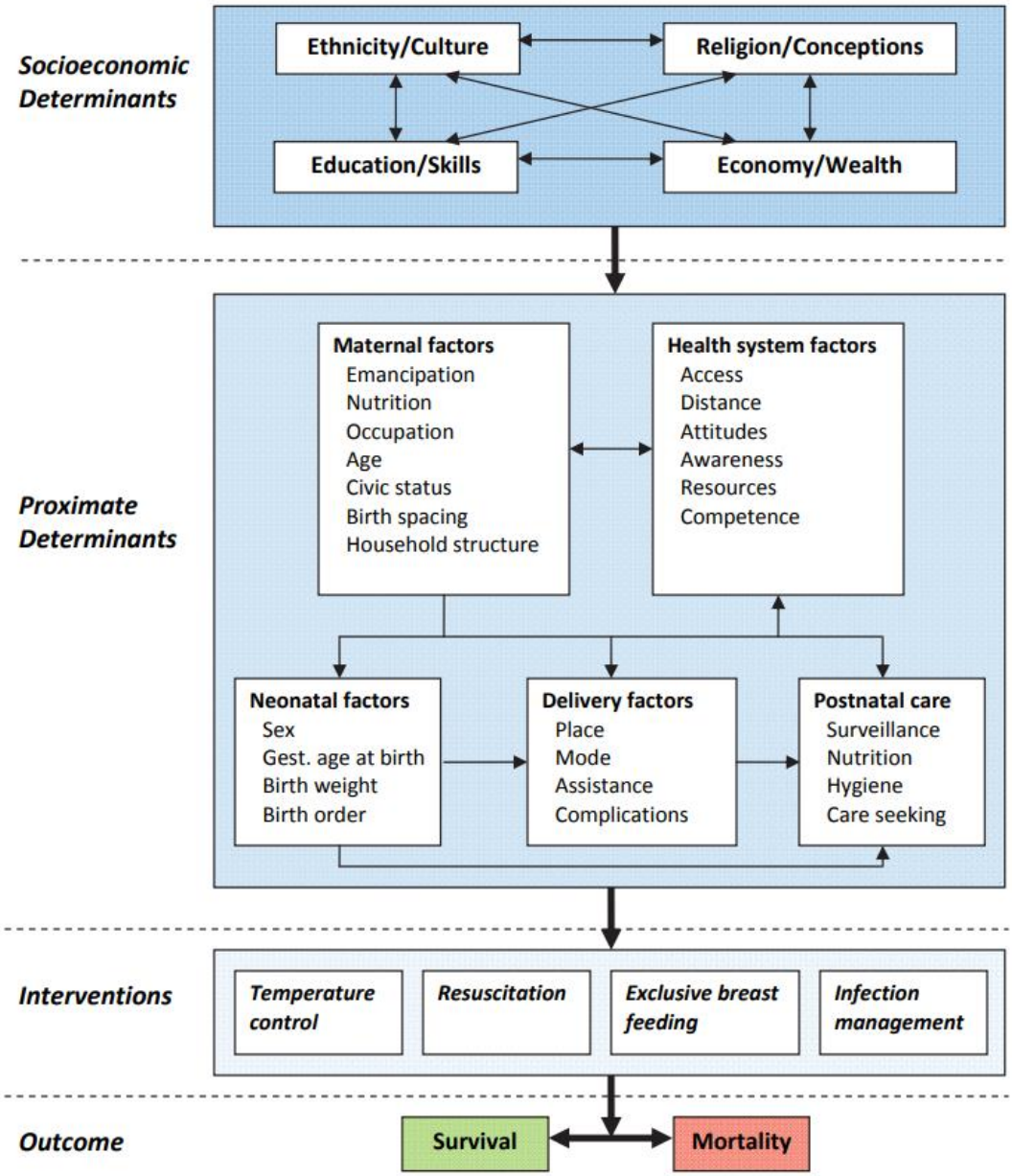
Objective 4)To identify evidence-based initiatives that were applied in other LMICs and showed good results in declining neonatal mortality.	Peer-reviewed Literature Grey literature	VU Library PUBMED, MEDLINE Google Scholar, Google, Report, Websites	neonate*, child*, Mortality * perinatal, newborn , baby, program*, intervention, initiative, best practices , evidence based practices Pakistan, developing countries, low-and-middle-income countries, middle east, South Asia, Asia ,India, Bangladesh, Nepal

Table 1: Search Table

2.5.2 Analytical Framework:

For this study, an adapted version of Mosley and Chen's framework was employed to analyze the social determinants of neonatal mortality in Pakistan. Mosely and Chens proposed the original framework in 1984 to explore the determinants of child survival in developing countries (51).However, this model has been adapted by other researchers to understand the determinants of maternal and neonatal mortality. The framework adapted by Mats Malqvist to analyze the determinants of neonatal mortality in Vietnam (52) was utilized in this study.

Figure 3: Conceptual framework for factors influencing neonatal mortality, adapted from Mosley and Chen by Malqvist.



Conceptual framework for factors influencing neonatal mortality, adapted from Mosley and Chen by Malqvist (52).

The adapted Mosley and Chen by Malqvist theoretical framework's major proposition is that neonatal outcomes (survival or mortality) are influenced by direct and indirect groups of factors which can be influenced by available interventions. The framework is a three-layer model that organizes factors associated with neonatal mortality into two broad determinant groupings (layers): proximate or socioeconomic and interventions as the third layer. The proximate level includes maternal and health system factors and these factors directly affect neonatal factors, delivery factors and postnatal care, all of which are interrelated. The second group (socio-economic determinants) include ethnicity/culture, religion/conceptions, education/skills and economy /wealth.

Although there are different conceptual frameworks, just a few of them focused mainly on determinants of neonatal mortality. For instance, the social determinant of health framework developed by Dahlgren and whitehead (53) focused on general factors related to health outcomes and not primarily related to neonatal mortality and therefore not suitable for this study. Similarly, the framework by Souza et al (54) which was used to analyzed the determinants of neonatal mortality in Brazil was considered in this study but post-natal factors which are important in neonatal deaths were missed in the framework.

In addition, a closely suitable framework for this study was the UNICEF-developed model (55). This model combined factors contributing to both maternal and neonatal mortality and although these factors are largely related, this study is focused on neonatal mortality. Furthermore, the UNICEF model focus more on access to healthcare with lesser information on the maternal and neonatal factors and this was a gap in the application of the model to this study. Therefore, the adapted Mosely and Chens was preferred because of its comprehensiveness in describing the factors and providing possible linkages among them.

It should be noted that the third layer of the adopted framework for the study relates to interventions. However, it was observed that the interventions in the framework are primarily medical interventions such (resuscitation, temperature control and infection control), while the study aims to find public health interventions. For that reason, the third layer in the framework (interventions) will be replaced by community-based interventions that were applied in Pakistan and other LMICs with similar setting to Pakistan and that have shown to be effective in reducing neonatal mortality.

Chapter 3: Findings

Under this chapter, the finding regarding the determinants in the framework will be described and analyzed.

3.1 Proximate Determinants:

The proximate determinants are grouped into five main factors that are interlinked to each other. The first two proximate Factors are maternal and health system factors; both are located above the other three factors (neonatal, delivery, and postnatal care factors), due to their significant impact on the other groups. For example, maternal nutrition is related to neonatal outcomes. Health systems such as the availability and the quality of service affect the utilization of delivery and postnatal care services(56)(12).

3.1.1 Maternal Factors:

Maternal health is related to neonatal health. Maternal, age, nutrition status, and occupation are all important demographic data associated with neonatal health outcomes.

3.1.1.1 Emancipation:

The degree of woman emancipation or autonomy plays an essential role in her ability to seek and utilize health care services. Women's emancipation or autonomy refers to the ability of women to make decisions, control their own lives and the lives of those who depend on them (their babies), access information, control finance, and move freely without constraints or restricted her physical movements(57). When the newborn's primary caregiver, usually the mother is empowered and has a good level of autonomy, the survival outcome of the newborn is improved (58).

An analytic study in Pakistan showed a positive relationship between women's ability to make a decision and the utilization of the main components of reproductive health services (ANC, institutional delivery, skilled birth Attendants SBAs, and Postnatal care). Women with high level of participation in decision making for utilization of reproductive health services showed better service utilization compared to their counterparts with low participation in decision making; 91% received ANC, 79% gave birth with SBA assistance and 71% received postnatal checkups during the first 48hr after birth(59).

Another study which analyzed the Demographic and Health Survey data showed the relationship between women's empowerment in Pakistan and infant mortality. The study indicated a positive association between women empowerment and infant survival outcome and the probability of infant mortality decreased by 0.4% as women's empowerment index increased by one unit. The more empowered a Pakistani woman is in making decisions on her reproductive life, the less number of children, longer birth interval, and gives birth to normal-weight babies; all which are related to decreased neonatal mortality (60).

Gender inequality is a prominent issue in Pakistan; women are less empowered to participate in decision-making, particularly in rural areas(60). A qualitative study revealed indicated that the husband, mother-in-law, or sometimes father-in-law or husband brother have the responsibility to decide when and where the pregnant women seek health care(61).Women emancipation is linked with the use of maternal health service which in turn affects neonatal outcomes (this is explained under the health system factors).

3.1.1.2 Maternal Nutrition:

The nutrition status of the mothers before and during the pregnancy is a powerful predictor of maternal and neonatal health outcomes (56). Maternal nutrition is essential for fetal growth, whereas a fetus depends mainly on the nutritional supply from his mother. Maternal undernutrition decreases the flow of nutrition to the fetus and impairs fetal development. Several studies have indicated the link between Maternal undernutrition and adverse birth outcomes: intrauterine growth restriction IUGR, low birth weight LBW, small of gestational age SGA, and preterm labor, which all put a newborn at high risk of death (62)(63).

A 2012-2013 Pakistani study showed that the neonatal mortality rate among newborns from underweight mothers with low Body Mass Index (BMI), a nutritional indicator was 74.7 deaths per 1000 live births which was higher than the rates for neonates of normal (45.8 death per 1000 live births) and overweight mothers (23.2 death per 1000 live births) respectively. The odds of death (1.68) during the first week were the highest among newborns from mothers with low BMI (64).

A multi-country study conducted to compare maternal and neonatal health outcomes among 6 LMICS (India, Pakistan, Democratic Republic of Congo, Guatemala, Kenya, Zambia) showed that the BMI of pregnant women in Pakistan and India (mean BMI=20) was lower than from other countries. The study also showed that the highest percentage of maternal anemia (HB less than 11) was 81% in Pakistan and India. Similarly, the percentage of severe anemia (HB less than 7) was 6.2% in Pakistan, the highest among all the countries (65).

3.1.1.3 Occupation:

Women's occupation is one the factors that relates to newborn health. Women's employment helps them be financially independent, thus enhancing their level of empowerment in society and increasing their ability to make decisions and control resources. Women who work outside the home expose themselves to the community and promote easy access to information related to child health, like the availability of health services and the importance of health care utilization.

In Pakistan, according to the Demographic health system DHS 2017-18, employment contributes to the decision making power of the women especially to utilize health service. More unemployed women (22%) require permission from their husbands in order to seek health services compared to employed women (17%) (12).

Although working especially in Agriculture (as it applies to most women in rural communities) help women earn some money and become independent, the physical labour for pregnant women causes physical pressure on their body and may leads to preterm birth and LBW thus increasing the risk of neonatal mortality (66). A study in Pakistan revealed that women, especially those who work in agriculture in rural areas leave their newborns for long hours without care or supervision during mothers' work. This results in less care and less breastfeeding frequency, which increases risk of neonatal morbidity and mortality (66).

3.1.1.4 Maternal age:

Evidence showed that pregnancy at a young age (less than 18 years old) or more than 35 years is associated with adverse maternal and neonatal outcomes(67). The UNICEF report 2013 showed that neonatal mortality NMR among newborns for younger mothers (less than 20

years) was 79 per 1000 live birth, while that for adult mothers (20-29 years) was 52 per 1000 live births. This indicated that NMR among young mothers is 1.5 times higher than older mothers (68).

Similarly, Pakistan DHS report in 2018 revealed that 34% of newborns with low birth weight but alive were from mothers aged less than twenty years compared to 21% of LBW babies from mothers aged more than 20 years old (12).

Another past analytical study in Pakistan using the DHS in 2006-2007 showed that NMR among neonates from mothers aged more than 30 years was 49.2 death per 1000 live births, compared to the lower NMR among newborns from mothers aged 20-29 years, which was 42.5 deaths per 1000 live birth(69). Studies showed that late age pregnancy is associated with a range of adverse outcomes on maternal and neonate health including high blood pressure, eclampsia, high blood sugar, obstructed labor, intrauterine growth retardation, and maternal and neonatal mortality (70).

A study exploring utilization of ANC services among pregnant women in Pakistan showed that fewer pregnant women (26.4%) aged 35-49 utilized ANC compared to those aged 20-34 years (40%) (71). However, in Pakistan, women, especially in rural areas, continue childbearing until 40 years and more, due to religious and cultural factors(70).

3.1.1.4.1 Early Marriage

Pakistan has one of the highest adolescent fertility rates globally, with 44 per 1,000 live births (72). The DHS report indicated that one in every 12 married women aged (20-24 years) has already started childbirth by the age of 18years (12) and 40% of married women aged 20-24 years indicated that they got married before the age of 18 years and this results in early pregnancy (12).

The negative consequences related to adolescent pregnancy are attributed to biological and socioeconomic factors. Biologically, the body of the adolescent is in the puberty phase, the phase when the body is still immature and growing. Females before the age of 20 years have poor physical growth and an incompletely developed reproductive system whereas pregnancy demands an extra growth of the fetus, resulting in a decrease in the resistance of the body of the pregnant teenager to diseases. Studies showed that adolescents have less and late utilization of healthcare (ANC, Perinatal, and postnatal) and has late initiation and low rate of breastfeeding compared to other age categories (73)(67)(74). This may be related to lower education attainment, lesser health awareness and lower autonomous decision-making power.

Although the legal age for female first marriage is 18 years in Pakistan, about 2 out of 10 girls are married out before the age of 18 years (75) and this practice is rooted in poverty, low education, and cultural beliefs (76).

3.1.1.5 Birth interval or birth spacing:

The WHO has defined birth spacing or birth interval as the duration between two consecutive births(77). Studies showed that birth intervals shorter than 36 months or longer than 60 months are associated with adverse maternal and child health outcomes (12). Recently UNSAID identified that the birth space of 3-5 years has better health outcomes and less risk.(78). Short birth interval has a lot of adverse maternal outcomes since the mother's body

is yet not fully recovered from the previous pregnancy. Short birth space is associated with maternal complications such as anemia, rupture uterus, placenta previa, and rupture placenta. These threaten the mother's life and increase the risk of neonatal mortality. Maternal complications due to short birth intervals increase the risk of neonatal death due to the baby being small for gestational age, low birth weight LBW, or congenital anomalies (79).

Pakistan DHS report showed that the highest neonatal mortality rate is among neonates born after a short interval of the preceding birth. Whereas 65 NMR occurred among those who were born in a short birth interval less than two years, and 28 NMR occurred among those more than four years (12). Similarly, a cross-sectional study in Pakistan revealed that neonates born after a short interval (less than 18 months) are six times more at risk of death during the neonatal period than those born within the average birth interval (+36 months)(80).

In Pakistan, the median birth space is 28.2 months. About 36% of birth in Pakistan occurs in an interval less than 24 months from the preceding birth, and just 9% occur in more than 60 months and shorter birth interval is more common among mothers of the younger age group, while longer intervals occur among older women (12).

3.1.2 Health System Factors

This section examined the association between health system factors and neonatal health outcomes. Skilled healthcare is essential for better neonatal outcomes; therefore, the provision and utilization of health care services are necessary determinant of maternal and neonatal health.

3.1.2.1 Access/distance:

Physical and financial accessibility is essential for health services utilization. Financial constraints are one of Pakistan's most common barriers to maternal and neonatal services utilization. In Pakistan, 7 in every 10 women face at least one problem related to access to health services and 75% of women in rural Pakistan and 53% in urban areas have at least one barrier accessing health services respectively (12). Other qualitative studies, especially in a rural part of Pakistan, where two-thirds of the Pakistani population is reside, showed that pregnant women could not afford the cost of transportation and healthcare cost. The healthcare expenses and transportation costs prevent them from seeking healthcare(81)(82)(83). Public health service in Pakistan is not free, and the cost of treatment and investigation are relatively high. Although some NGOs have contracted out 48% of Basic health centers to provide free services, people in Pakistan prefer the private sector to the public sector because most public HFs are not adequately equipped (84).

According to the Pakistan DHS 2018, 36.5% of women in rural areas and 20% in urban areas do not seek health services due to insufficient money to cover treatment and transportation costs (12).

Similarly, distance of health facilities plays an important role in health-seeking behavior. The long distance from the health facility is considered the main barrier to accessing health services and causes delays in decision-making to seek healthcare(85). Most Pakistani population reside in rural areas (86) and the nearest health facility in a rural area is located from 1-4 Km. The 2018 DHS Report showed that 55% of households in rural areas live at place distance of more than 10KM to the nearest hospital and 39% of households HHs in rural

areas are living at a distance of 1-4 km from the nearest BHCs. Regarding RHCs, the report also showed that most HHs (47%) are at a distance more than 10km from the nearest RHCs. The percentage of women who could not seek healthcare due to the long distances they have to cover to the HF is 26% in urban areas, while the rate increased to 52% in rural areas (12).

Similarly, the maternal and neonatal advanced and emergency care services are provided only by secondary and tertiary healthcare mostly located in urban regions, so people in rural need to travel long distances to receive healthcare. A qualitative study conducted in three districts of Sindh showed that people living more than 5 km of HF incur higher expenditures than those within the range of 5km. In the same study, 55% of public health users and 71% of private health facilities users could not seek care because they could not cover the travel costs, and others had to take loans to cover the travel cost. Another study reported that in rural areas, even if the money is available to cover the travel cost, people suffer from unavailability of transportation to access healthcare, especially at night (87).

3.1.2.2 Quality of care:

Attitude of healthcare providers

The attitude of healthcare providers toward healthcare seekers plays an essential role in healthcare utilization. The positive attitude of health workers, such as being respectful, helpful, caring, and sympathetic, encourages the patient to seek health care (88). In Pakistan, a qualitative study showed that the poor attitude of the health workers HWs stopped people especially women from seeking care from public health facilities due to the rude attitude of health workers and because the HWs treat the clients based on their socioeconomic and cultural background. The study also showed that public health workers ignore illiterate, low economic, and low ethnic, non-Muslim clients. Therefore, because of the fear of discrimination by HWs, people prefer not to use the health facilities (85).

Availability of Human resources for health

The availability of skilled human resources, life-saving and emergency medication, essential equipment, and blood are important determinants for obtaining good quality services and also affect the seeking health behaviors. Pakistan is classified as one of the 57 countries suffering from a shortage of human resource for health. Reports showed that the approximate average nurse-patient ratio is 1:5, which is much lower than the recommended ratio by WHO 5:1. The Pakistan government also stated the lack of 60,000 nurses to fill the neede gap in the public health sector (89). In Pakistan, there is an unequal distribution of health workers between the urban and rural regions, where rural areas suffered from more lack in HWs than urban area (90). A study in Sindh showed that most health facilities have a shortage of health workers, especially female (85). The shortage of HWs leads to decreased work quality, increased patient waiting time and staff workload. Another study in hospitals of Khyber Pakhtunkhwa province indicated that due to inadequate health workers, patients stopped utilizing the public health sector as a result of long waiting times as patients had to wait at least 72 minutes to receive medical consultation (91). In some rural areas, women cannot seek ANC or institutional delivery of postnatal care because of unavailability of female health workers and fears of being examined by male health workers (92).

A cross-section study conducted in 25 districts in Balochistan province which targeted 177 HFs, of which 88.7% are public facilities showed that only 36% of HFs provide birth and

neonatal care, only 3 HFs have a neonatal intensive care unit, with the health workers' patient ratio of 1:5 (93).

3.1.2.3 Antenatal care :

Antenatal care (ANC), sometimes referred to as pregnancy or maternity care is a kind of preventive care or medical checkup provided by health professionals for women during pregnancy. ANC aims to screen for the diseases that may threaten the mother and her unborn baby during pregnancy. Antenatal care is essential for safe pregnancy and delivery to decrease maternal and neonatal mortality risk (94)(95). Past studies showed that in LMICs, where access to emergency obstetric and neonatal care is limited, ANC is a protective factor against newborn mortality (96). The WHO recommended at least four antenatal care visits as essential to follow up with a woman with uncomplicated pregnancy(95).

In Pakistan, ANC is provided in primary health care as part of maternal and child health care services. In 2018, 86% of pregnant women in Pakistan received ANC from skilled health providers. The utilization of ANC service in Pakistan is related to women's socioeconomic characteristics. The highest percentage of ANC utilization was among the women from the highest wealth quintile and women with the highest education, while the lowest rate of ANC visits was among the poor and non-educated women, as shown in the table below(12). A study that used DHS from 69 LMICs including, between 1990 and 2013 has shown that one ANC can decrease neonatal mortality risk by 1.04% (97). ANC enhances the birth at a health facility. In Pakistan, the rate of women who gave birth by skilled providers was three times higher than women who never had ANC (89% and 30%, respectively). The utilization of ANC care in Pakistan increased from 26.3% in 1990 to 86% in 2018. (12).

Table 2: Maternal Education and Wealth and ANC

Women Education and Wealth level	**Percentage of receiving ANC visits by SBA**
Education	
Non Educated	76
higher Education	99
Wealth	
Lowest wealth quintile	67
Highest wealth quintile	98

Source Pakistan DHS 2017-18. (12)

In Pakistan, studies relating ANC with neonatal mortality are very limited. A cohort study conducted between 2003-2005 in urban Pakistan showed the association between neonatal mortality NM and ANC; the survival rate of an infant is higher among infants from mothers who received one or more ANC visits than babies from mothers who never had ANC (73 versus 42 respectively)(98). A similar study carried out in Bangladesh, a country similar in its context to Pakistan showed that women who received at least one ANC from a skilled health provider have 18% lower odds of neonatal mortality than their counterparts who had no ANC (99).

3.1.2.3.1 Tetanus vaccination

Tetanus vaccination is considered one of the preventive measures that prevent maternal and neonate tetanus. It is an essential component of ANC which safeguard neonates against tetanus infections as a result of especially when contaminated cutting tools are used during delivery. Neonatal Tetanus NT is considered as one of the leading causes of NMR in developing countries (100). However, maternal vaccination is one of the most effective measures that decreases NT and a study showed that Maternal vaccination could 84% protect the newborn from neonatal tetanus (101).

In Pakistan, almost 69% of women received the recommended tetanus toxoid TT shot. As shown in the table below, the percentage of women who received tetanus toxoid was higher among educated women (91%) than non-educated women (52%), and in women with high economic status (90%) than women from the poorest households (44%). Also, the percentage of women receiving TT was higher in urban areas, 80%, than in rural areas, 63%(12).

Table 3: Tetanus vaccination and maternal education, Wealth level and Region

Women Education and Wealth level and region	**Percentage of women who received the recommend doses of TT.**
Education	
Non Educated	52
higher Education	91
Wealth	
Lowest wealth quintile	44
Highest wealth quintile	90
Region	
Rural	63
Urban	80

Source Pakistan DHS (12)

3.1.3 Neonatal Factors

The neonatal factors mentioned in the framework, such as sex, gestational age, birth weight, and birth order, are going to be analyzed in this chapter to show their association with the risk of neonatal mortality in Pakistan.

3.1.3.1 Sex:

The sex of the neonate has been shown to be a risk factor for neonatal morbidity and mortality. Studies showed that male newborns are at a greater risk of death during the neonatal period than their female counterparts (102). Biologically, male neonates are more susceptible to infections than females due to immune deficiency and delay in lung maturity. The development of male neonatal lung is usually delayed by a week in gestational age, resulting in a higher risk of respiratory distress syndromes and chest infection among male neonates. Male neonates are also at increased risk of congenital anomalies and preterm birth. These put male neonates at higher risk of mortality and morbidity, especially in early neonatal life (103)(104)(105).

A study analyzing the association between neonatal sex and the risk of neonate mortality using DHS data in Pakistan between 2002-2006 showed that the mortality rate among male neonates is greater than NMR among female neonates, with 51.5 and 38.5 deaths per 1000 live births, respectively. Another secondary analytic study investigating the relationship between neonatal sex and the risk of neonatal mortality was conducted between 2010-2018 from three sites (two sites in India and one in Pakistan). The study results showed a significant difference between the NMR of male neonates (33.2 deaths per 1,000 live births) compared to the NMR among their female counterparts which was 27 deaths per 1,000 live births (106).

A 2018 study in Pakistan indicated that male newborns are at higher risk of dying during the first 28 days of their lives than their female counterparts. While the mortality rate among female neonates was 33 deaths per 1000 live births, NMR among the male neonates was 52 deaths per 1000 live births (12). A more recent data by the UNICEF revealed that NMR of Pakistani male neonates is 70 deaths per 1,000 live births compared to 60 deaths per 1,000 live births among the female neonates (75).

3.1.3.2 Gestational age at birth

Gestational age refers to the duration of the pregnancy that is the duration from the first day of the last menstrual cycle to the day of birth (or any day in between). Gestational age is measured in weeks and the normal average gestational age is 38-42 weeks (107). A baby born alive before 37 weeks of pregnancy are completed is defined as Preterm birth and this has been classified into extremely preterm where gestational age is less than 28 weeks, very preterm (28-32 weeks) and moderate or late Preterm (32-37weeks). A preterm baby is at high risk of death due to the vulnerability to different risks that lead to death including hypothermia, sepsis, bleeding and apnoea (108). Pakistan has one of the highest numbers of preterm births.

In 2018, Pakistan ranks fourth in the number of preterm births globally (748,100 preterm births) (109) and a 2020 publication of a study conducted in various hospitals in four provinces of the country reported that the prevalence of preterm birth was 21.6%(110).

Over the years, preterm birth has been the leading cause of neonatal mortalities in Pakistan. A prospective population-based study between 2003-2005 in Pakistan reported that the highest percentage of neonatal deaths, 34%, was attributed to the complications of preterm birth (98).

3.1.3.3 Birth weight

Birth weight is the weight of the newborn just after the birth and the average normal birth weight is 2.5 kg-4kg. Low birth weight (LBW) is when the neonate's weight at birth,

regardless of the gestational age, is less than 2.5kg (5.5 pounds)(111). While different reasons cause low birth weight in babies, the main two are preterm and intrauterine growth retardation IUGR(112). In Pakistan, about 22% of the reported total newborns were babies with LBW between 2013-2018 (12).

Neonates with LBW are at higher risk of death and between 40-80% of global neonatal deaths are due to LBW (113). In Pakistan, different studies have shown that the risk of neonatal death is the highest when the newborn has low birth weight especially as a result of preterm (114).

A cohort study conducted in a tertiary healthcare facility in Karachi, Pakistan compared the mortality rate among normal-weight and low-weight babies. A total of 500 newborn babies were included in the study and followed up for the entire neonatal period. The study results showed that the highest NMR was among babies with the lowest birth weight. The study reported that 2.4% of the mortalities were among neonates with normal birth weight, 16.4% among low birth weight neonates, and the majority of the neonatal mortality (96%) was among the very low birth weight categories (115).

3.1.3.4 Birth Order

Although there is a long history of controversial results about the association between birth order and child health outcomes, evidence from most studies showed relationship between birth order, child mortality and survival rate. While some studies indicated that the risk of death during the neonatal period increases as the birth order increases, which mean that the later the birth order, the higher risk of dying. Other studies showed the U shape relationship between birth order and child death, which means the first and last-born babies are at a higher risk of neonatal death. However, studies suggested that the association between birth order and neonatal mortality is affected by other factors including sex of the baby, maternal education level, economic status, culture, ethnicity and healthcare utilization(116)(117).

One of the hypotheses explaining the role of birth order in determining the survival and mortality rate of neonates stated that increasing family size (increasing the number of births) leads to an increased economic burden on the family and consequently a decreased desire to have a baby. This, in turn results in adverse behaviors toward the baby with late birth order such as less attention and care, less health service utilization, and poor hygienic practices. In addition, most cases of late birth order babies are from older mothers and older maternal age is related with adverse impact on neonatal health(70).

In Pakistan, the 2018 reported that neonatal mortality rate is higher among the first (50 deaths per 1,000 live birth) and higher-birth order babies (more than 4) (48 deaths per 1,000 live birth), compared to other birth order neonates (12). Other older studies also showed a U-shaped relationship between neonatal mortality and birth order in Pakistan with higher NMR at first and last births (114).

3.1.4 Delivery Factors:

In this chapter, delivery factors like place, assistance and mode of delivery as well as childbirth complications will described and analyzed.

3.1.4.1 Place of delivery and skilled birth attendant

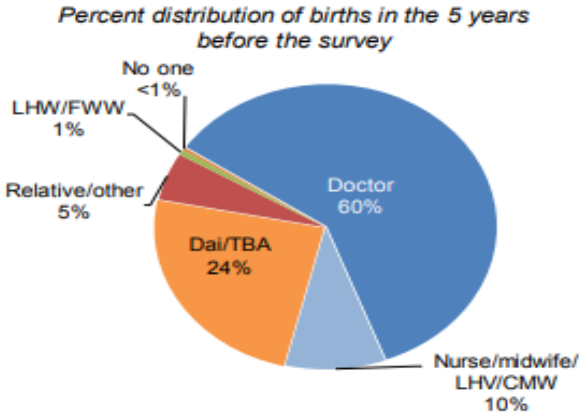
The place of child delivery is important in determining the quality of care the newborn and the mother receive during childbirth. The WHO estimated that newborns delivered at HF have 30-50% less risk of neonatal mortality than those born at home (118). The place of delivery is associated with neonatal health outcomes through interactions with other factors such as availability of SBAs, availability of postnatal services and safe and hygienic conditions.

Studies showed that most home deliveries in LMICs including Pakistan occur in unhygienic and unsafe environments and usually in the absence of emergency medications. Similarly, home delivery is associated with high maternal and neonatal death due to an increased risk of birth infection, asphyxia and trauma. In addition, home deliveries are usually characterised with the absence of SBA supervision and obstetric emergence care thus increasing the risk of neonatal death (119). Newborns born at home are 6 times more at risk of having umbilical infection than those born in hospitals(120) In Pakistan A bout 40% of deliveries are taken place at home and most of them without supervision of SBA (121).

SBA is defined as a skilled health provider (who can be the midwives, doctors, or nurses) who is trained/educated to gain all the essential skills needed to manage pregnancy, childbirth, and postnatal care. SBAs have the required skills to identify, manage, and refer any danger signs (during the delivery) of pregnant women or the baby and ensure the clean delivery (5). The presence of SBA during childbirth reduce the risk of Intrapartum complications and birth infection; which both are attributable to 40 % of global neonatal deaths (122)(123).

Based on DHS 2017-2018 of Pakistan, 69% of delivery took place with the assistance of skilled health providers (66% out of them were in HFs), while 24% of the women gave birth at home with the aid of a traditional birth attendant TBA or Dai (in local language)(FIGURE 4)(12).

Figure 4: Type of birth assistance providers in Pakistan, Source DHS 2017-2018 (12).



However, giving birth at home is influenced by other socioeconomic factors such as rurality, wealth index, education, and the level of woman empowerment. These factors are reviewed in sections below.

3.1.4.2 Mode of delivery:

While vaginal delivery is associated with some difficulties that threaten mother and neonatal health and different modes of delivery are used to assist the childbirth process, instrumental

delivery such as vacuum extraction and forceps delivery are also associated with increased risk of neonatal birth asphyxia and trauma that may leads to neonatal mortality or morbidity (124).

Another mode of delivery is the Cesarean section (CS) and based on WHO recommendations, CS should only be used in cases when normal vaginal delivery threatens the mother or baby's health (125). Although CS reduces the risk of childbirth complications such as birth asphyxia, meconium aspiration, and birth trauma, the cesarean section is associated with the risk of newborn respiratory distress due to anesthesia or delayed absorption of fetal lung fluid and this increases the risk of neonatal mortality and morbidity (126).

In Pakistan, a study showed that neonatal mortality is associated with childbirth through CS. The study reported that neonatal mortality rate among newborns of CS was 74.4, higher than the NMR among newborns born without CS which was 43.5 (114).

3.1.4.3 Child birth complication

The time of labor/childbirth is the most critical time and the riskiest time in the human life cycle. There are different causes of childbirth complications and these include premature rupture of membranes, haemorrhage, obstructed labour or malpresentation(127). When intrapartum complications are not properly identified and timely managed, it negatively impacts maternal and neonatal health resulting into severe breathing distress (birth asphyxia) and other life-threatening conditions (128).

3.1.5 Postnatal care:

Under this section postnatal care in Pakistan, hygiene and nutrition will be analyzed.

3.1.5.1 Nutrition (Early initiation of breast-feeding)

The WHO recommended that breastfeeding should be initiated within the first hour of delivery and exclusive breastfeeding for the first six months of newborn life should be promoted. Early breastfeeding initiation decreases the risk of neonatal hypoglycemia, enhances mother-baby-bound, prompts mother-to-baby skin contact, and decreases the risk of neonatal hypothermia. It also promote newborn immunity; the milk produced in the first days (colostrum) is full and rich in nutrition and immunity (129).

According to the 2018 DHS, 20% of newborns in Pakistan are put on breastfeeding within the first hour after birth, 48.4% babies are placed on exclusive breastfeeding during the first six months of life and about 54% of the mothers received consultation about the importance of early and exclusive breastfeeding (12). A study showed that 30% of mothers gave their newborn substances like water and salt, cow milk, or holy water from Mecca, the Muslim holy city (130).

Early breastfeeding initiation for newborns is related to the socioeconomic character of the women. The DHS showed that early breastfeeding initiation is higher among mothers living in urban areas, with high education levels and from the highest wealth quintile. It was also reported that early breastfeeding is less common among mothers aged less than 20 years (39%) compared to those older than 20 years (53%)(12).

3.1.5.2 Hygiene practices

The hygienic setting in the process of delivery contributes to the risk of infections which could lead to complications and death (12). For example, neonatal tetanus caused by a bacterium infection usually transmitted during delivery with unhygienic practices and materials (131). Thus, in order to reduce the health risks of fatal infections to infants and their mothers, a clean, hygienic and sterilized delivery practices with skilled health practitioners is a critical element (12). Unhygienic conditions and practices are considered as major causes of neonatal infections.

In Pakistan, neonatal sepsis is an important cause of mortality and morbidity(132). A Pakistan cross-sectional study carried out in 2011 stated that 60% of the participants, mothers and health workers, reported that unhygienic kits for delivery were used although the study could have been biased by social desirability which may increase have increased the responses indicating that they used hygienic kits (133).

3.1.5.3 Postnatal care seeking

The first month after childbirth (postnatal period), particularly the first hours extended to the second and third days of life, is a critical period of maternal and newborn life . In 2013, an estimated 1 million newborn deaths occurred globally in the first hour of life(134). The care and practices provided by the households or health providers for newborns during the postnatal period are essential determinants of neonatal health outcomes.

The WHO recommended that every mother and newborn carry out at least four postnatal visits. The first one should start as early as possible, within 24 hours after birth. The second one is on the second–third days (48 -72 hours), the third is on the seventh day after delivery, and the last one is on the sixth week .(134)

In Pakistan, about 65% of total newborns receive postnatal care within the first two days of delivery (41% of them received the care in the first hour of birth) (12).

Postnatal care checks are also related to other factors that determine service utilization in Pakistan such as place of delivery and educational level, wealth quintile and residence Table 4). For instance, the proportion of newborns who received PNC was the highest among newborns from mothers with higher education levels, high wealth quintile and from urban areas (12). Similarly, a study that analyzed the effectiveness of postnatal home visits PNHVs in different LMICs showed that in Pakistan, out of 36% of home deliveries, only 3% of the newborns received postnatal care from skilled health providers within the first two days (135).

Table 4: Postnatal care in Pakistan

Women Education and Wealth level and residency	Percentage of newborns who received PNC visits by SBA
Education	
Non Educated	50
higher Education	86
Wealth	
Lowest wealth quintile	46
Highest wealth quintile	88
Region	
rural	54
urban	76

Source DHS 2018 (12)

3.2 Socio-economic determinants:

This chapter will describe and analyze four socioeconomic factors (ethnicity /culture, Religion/conceptions, Education/skills, Economy/wealth). The socioeconomic factors are the underlying causes of the proximate determinates.

3.2.1 Ethnicity /culture:

Studies showed that cultural factors prevent women from seeking healthcare (136). In Pakistan, women cannot seek healthcare for themselves or their newborns due to cultural belief, social norms and practices (61). This is interrelated with gender inequality issues, such as movement restrictions for women which prevent women from seeking healthcare without the permission of their husbands or mothers-in-law, even in cases of emergencies(137).

Due to cultural beliefs, Pakistanis have stronger trust in the informal health sector than the formal health care. This informal health care comprises of traditional healers (in the local language called Hakeem), traditional birth attendants TBA(locally called Dai), and spiritual and faith healers. Report shows that these informal health practitioners account for 70% of all medical consultations (138)(82).

Additionally, early marriage is a common cultural practice in Pakistan. As discussed above, this practice, in addition to poor access to family planning services contributes to early pregnancy especially among young non-educated poor women. Early pregnancy is a risk factor for LBW, preterm and hence neonatal mortality(139).

Similarly, consanguineous marriage is one of the common cultural practices in Pakistan. During the last three decades, Pakistan recorded 63% rate of consanguinity marriage mostly prevalent among young women who are non-educated from the lowest wealth quintile and

from rural areas (140) Past studies showed that consanguinity is a risk factor for children congenital anomalies which in turn causes 9% of the total neonatal mortality in Pakistan (141). A study in Pakistan showed that children born from consanguineous marriage are 2.3 times more likely to have congenital heart diseases than babies born from non-consanguineous marriages (142).

In developing countries, the high neonatal mortality and morbidity rate has been attributed to the prevalence of poor cultural practices during the postnatal period, such as the traditional application of unhygienic substances on the cord, late breastfeeding initiation, and suboptimal thermal care.(130)

In Pakistan, especially in rural areas and among illiterate mothers, there is a high prevalence of some cultural practices for newborns during postnatal care. Studies showed that women in rural areas in Pakistan, has shown that most of the mothers used traditional applicants on the cord clump, such as: Matti (crashed apricot seed), turmeric powder, mustard seed oil , Dettol , coconut oil (130)(143).

In addition, some common cultural practices in Pakistan increase the risk of neonatal Hypothermia(130). Physiologically, All newborns of different gestation ages are at a high risk of heat loss after birth (Hypothermia). Still, some traditional practices common in developing countries increase the risk of neonatal Hypothermia, such as early bath of the newborn. The WHO recommended that the newborn's bath be at least after the first six hours of birth(144). In Pakistan, a study found that 78% of newborns' baths occurred within the first hour of life(130). Hypothermia increases the risk of NM; a study in Pakistan showed a higher NMR among newborns who had Hypothermia (33%)than those with normal temperature (6%)(145).

3.2.2 Religion/conceptions

Religion plays a role in the outcomes of maternal health and neonatal health (146). The practice of child marriage (under age of 18) is strongly supported and widely practiced in Pakistan due to religious acceptance. This consequently leads to underage pregnancy and increase the risk of maternal and neonatal mortality as there are increased chances of birth complications (12)(147). In a study conducted in urban slum of Lahore, Pakistan, early marriage was justified by parents on the basis of Islam approval to get their daughters married as soon as they start their menstrual cycle (147).

Similarly, the use of family planning was also influenced by religion. Pakistanis especially in rural areas believed that fertility control is against Islam and should not be adopted and hence the low rate of family planning utilization (148)(61). Consequently, the birth interval between pregnancies is short and this increases the risk of neonatal complications which leads to increased neonatal mortality rate (12).

3.2.3 Education/skills

The level of education of the mother is another socio-economic factor contributing to newborn mortality. Different studies in Pakistan have shown a positive association between maternal level of education and neonatal survival outcomes. A 2013 report in Pakistan showed that the rate of NMR among newborns from mothers with higher education was 27, while NMR among babies of non-educated mothers was 65 (68).

The recent 2018 DHS report also showed that NMR among newborns of mothers who have no education was 48 death per 1000 live birth, while NMR among those born to mothers with secondary and higher education levels was 30 and 31, respectively (12).

Studies showed that maternal level of education is related to healthcare-seeking behaviors which consequently impact neonatal outcomes. A study in Pakistan reported that women with high level of education showed better and more utilization of healthcare services for their health and newborn than those with lower education (149). The rates of ANC utilization, institutional delivery and best postnatal newborn practices were higher among educated mothers than their uneducated counterparts. Moreover, educated mothers showed to have acquired more health information as well as indicated easier adoption to healthy behaviors and have better hygiene practices than their uneducated counterparts (58)(150).

Similarly, maternal education level affects maternal socio-economic status as women with higher education have better job opportunities that enable them to be financially independent and this further enhances their autonomy and ability to make informed decision for their health and their neonates (151).

In addition, education reduces the probability of early marriage and pregnancy because girls who are in school were often married out early unlike girls who drop out of school and are married out at more early ages (152).

3.2.4 Economy/Wealth

In Pakistan, there is a disparity in NMRs among newborns from different wealth quintile levels. Data analysis from the 2018 DHS report showed that NMR among women from the lowest wealth quintile was 51 death per 1000 live birth compared to 43 death per 1000 live births among women in the highest wealth quintile. The survey reports showed that neonatal mortality risk reduced with as wealth quintile increase. Although there is reduce in the gap difference between NMR between the richest and poorest quintile, as shown in PDHS 2018, health inequality between the most impoverished and richest households still exists in Pakistan (12).

In Pakistan, almost 22% of the population lives below the poverty line, which translates into about 46.5 million people (153). The economic status of a household shapes the living condition, food security status, access to information, access and utilization of health services and health outcomes.

A study in Pakistan showed that the risk of maternal undernutrition is high among women from the poorest wealth quintile than women from the higher wealth quintile and maternal undernutrition is a risk factor that results for SGA and LBW newborns (154). Past studies also showed that the delay in seeking health services due to financial challenges is more prevalent among the poorest families with lack of money to cover the cost of transportation and health services(84)(83).

The 2018 DHS indicated that poor utilization of ANC, HF-based delivery, and postnatal care is common among women from the lowest quintile and poverty was the main barrier to utilization of health care services (12). Similarly, low socio-economic status due to poverty leads to early marriage where families in the poor wealth quintile marry off their daughters at

early ages in order to relieve their responsibility and expenses and decrease the economic burden(69). As earlier discussed, early marriage leads to early pregnancy, which contributes to higher risk for NM (69). A study in Pakistan showed that poor families are unable to afford schooling expenses and therefore stopped their girls from schooling, thus increasing the risk of neonatal mortality through uneducated mothers as earlier discussed (155). Another study in Pakistan showed association between poverty and poor hygienic practices; where impoverished families live in crowded areas and have with poorer access to clean water which in turn is associated with an increased risk of neonatal infection (152).

Chapter 4: Initiative to decrease the burden of neonatal mortality:

The Pakistan government has committed SDG target (3.2.2) which is to reduce the NMR less than 12 per 1000 live births by the end of 2030 and therefore has been formulating policies and implementing programs to address and improve neonatal health(156).

The Saving Newborn Lives (SNL-1) was one of the earlier programs adopted by the government of Pakistan in 2000s. In 2014, Pakistan was among the first countries to create a national plan after the initiation of Every Newborn Action Plan (ENAP). The Ministry of National Health Services Regulation of Pakistan also developed a national guideline of the Kangaroo Mother Care program for preterm birth in 2019 with collaboration of partners(156).

Maternal Neonatal Child Health program (MNCH) is another program that increases the essential health care for the newborn for example, improve the antenatal care, used skilled attendant at birth and access to life saving emergency obstetric care. The program aim is to improve hospitals and health facilities to be able to deliver a comprehensive, basic and essential EmONC services, train community midwives and enhance knowledge and skills of the health care workers (156).

4.1 National and international best evidence-based interventions:

4.1.1 Lady Health Worker Program (community-based intervention) in Pakistan:

The government of Pakistan launched a program at the community level called Lady Health Worker Program (LHW) in 1994. About 50% of the population in the rural areas were covered with a national policy plan suggested to cover 100 % of the rural population by the year of 2025. LHW is a woman from local communities with a minimum of 8 years of formal education, who were undergo 15 months of training (3 classroom, 12 field-based) to serve and deliver care in community level. The focus of LHW program is on family planning, and prevention and promotion of maternal and neonatal health at rural areas of Pakistan. For example, provide counseling on the routine immunization and provide them, detect the early danger sings and referral of childhood sickness, and provide counseling regarding breastfeeding, infant feeding, and hygiene. Every LHW were responsible to deliver a health service for around 200 households (1000 -1500 person). In a recent descriptive cross-sectional study published in 2020 aimed to study the quantity and quality of LHW program, it was found that the LHW program is reassembling the backbone of child health care in rural areas. However, the quality of delivering these care services was poor. It was suggested that instead of policy discussion regarding to scale up or downsize the program, prioritizing the quality and supervision of services are more important to improve child health(157).

4.1.2 Community-based newborn-care intervention package in Bangladesh:

This 30-month intervention was implemented in Sylhet district of Bangladesh. Sylhet had the highest neonatal mortality rate among Bangladesh's six divisions and the intervention package was developed to promote birth and newborn-care preparedness, including essential newborn care, birth planning, pregnancy care, and increase awareness of emergency care for

maternal and newborn diseases. The intervention package was designed with two service-delivery strategies: home-care and community-care.

In home-care arm, one female community health worker (CHW) was recruited for every four villages, The CHW received 6 weeks supervised training in a tertiary-care hospital, provision of essential newborn care and skills development for behaviour-change communication. The CHW thereafter identified pregnant women through routine surveillance during visits to each household once every 2 months, made two antenatal home visits to promote birth and newborn-care preparedness, made post natal home visits to assess newborns, and refer or treat sick neonates. In both intervention arms, community mobilisers were responsible to hold meetings for promote birth and newborn-care preparedness and orientation for traditional birth attendants.

The result of this intervention revealed that within 6 months, the neonatal mortality was decreased in the home-care intervention by 34% (158).

4.1.3 Home based Neonatal care (HBNC) in India:

This home-based newborn care (HBNC) intervention was implemented in five districts in India after which a community-based cluster randomised trial was conducted to evaluate the effectiveness of the intervention in reducing the neonatal mortality rate. The package of HBNC included the following interventions: training of health workers, health education, awareness of community leaders, care at birth, management of hypothermia, care of LBW neonates, postnatal home visits, identification of high risk and sick neonates, and community mobilization.

The intervention was based on the on the guideline that considered home-based newborn care (HBNC) as an essential component of community-based interventions for neonatal health, in which care delivered at homes are health workers (HW) in the antenatal, intrapartum and postnatal intervals.

At the end of the intervention, the risk of neonatal mortality was 25% lower in the areas of interventions compared to control areas. The evaluation report concluded that HBNC when delivered by a committed HWs is effective in lowering neonatal mortality rate (159). A similar intervention in rural India, providing preventive package of interventions consisting of birth preparedness, clean delivery, danger sign recognition, thermal care and breastfeeding promotion to pregnant and mothers of newborns led to a significant behavioral change and reduction in NM up to 54% in the intervention area (160).

4.1.4The Integrated Nutrition and Health Programme (INHP) in India:

The INHP was a program implemented through the infrastructure of the government's Ministry of Women and the Ministry of Health and Family Welfare in India. This program mobilized HWs and community based workers who made home visits to enhance home care and care-seeking, encourage use of family planning methods, skilled attendant delivery, provide immunization, and distribute supplementary food to poor families.

The program report revealed that the INHP program increased coverage of SBAs from 16% to 22%. The program also reportedly increased coverage of antenatal and postnatal visits, and

improved neonatal-care practices. Moreover, the PN home visit within the first 28 days enhanced decreasing the neonatal mortality rate by 34% from the baseline data prior the intervention (161).

4.1.5 Safe Delivery Incentive Programme (SDIP) and Community-based Neonatal Care Package (CBNCP) in Nepal:

Nepal's Government Introduced SPID, an innovative financial scheme, in 2005 as a component of its strategy to improve the use of maternity services. The SDIP provided incentive to health workers and cash to women who deliver in a health facility (162). This incentive-based intervention was reported to effectively enhance behavior modification as more women delivered in the health facility. The evaluation report showed that 24% of women who participated in the project were more likely to deliver in HFs and 13% more likely to have a SBAs compared to those who did not participate in the project (163).

Chapter 5: Discussion

Pakistan has one of the highest NMR in the world, where 7% of the total global neonatal deaths occurred. Using the adapted Mosely and Chen framework, this study results revealed different factors which directly and indirectly influence NM in Pakistan.

This study revealed that birth interval affects neonatal mortality. Therefore, with about 36% of births in Pakistan occurring in a short interval of less than two years, there are implications for neonatal mortality (12). Interestingly, these short birth intervals are more prevalently among younger women who may not have mature body physiological development especially the adolescents. In situations where the mother's body is yet to fully regain immunity, nutritional, and psychological stability from the previous birth, there is high chance of inability of the body to adequately provide appropriate support for the next pregnancy. Similarly, psychologically imbalanced mothers may not be able to carry out all ANC visits, take adequate hygienic precautions and other health behaviour and these consequently affect her health and the neonate negatively.

Similarly, the short birth interval also suggests low uptake of family planning services in Pakistan. As indicated by the recent DHS, three out of every four Pakistani women within the reproductive age bracket do not use modern contraceptives (12). As reported by earlier studies, the use of family planning services is largely influenced by religious perceptions such as believing that family planning is a sin and against Islam (the religion of the majority in Pakistan)(164) . Furthermore, poor family planning utilization may not be unrelated with the poor awareness about this essential public health intervention(165). Hence, family planning interventions in Pakistan may indirectly contribute to improved neonatal outcomes by increasing birth intervals.

This study also revealed that the neonatal health and mortality largely depend on the health and living conditions of the mother and this implies that the state of health during pregnancy and birth as well as the socio-economic condition of the mother and the household impact on neonatal outcomes.

With the large inequality gap in Pakistan which is fueled by religious and cultural beliefs, norms and practices, women are less educated, less empowered and unable to make personal decisions about their health and that of their newborn and this negatively contributes to neonatal mortality. This corroborates other studies around the world where gender inequalities contribute adversely to neonatal outcomes (166).

Consistent with other previous studies, maternal socio-economic determinants such as level of educational attainment, religion, socioeconomic status/wealth and age were also found to affect neonatal deaths in Pakistan (167)(168). As corroborated by past studies, maternal education is an important neonatal determinant as educated mothers are better health aware and this influence their attitude and practice towards disease prevention and health-seeking behavior. Higher educated mothers are able to find better employment opportunities with better remuneration and thus able to afford essential commodities needed for neonatal care. When women are gainfully employed as a result of better education, they are financially independent and this enhances their autonomy and ability to make decisions over their health

and that of their neonates. They are more likely to have better healthcare utilization rates and discard cultural and traditional practices that are harmful to them and their neonates(169) . study conducted in south Asia countries (Indonesia and Myanmar) showed that women's empowerment helped increase the utilization of MNH services (170).

Socioeconomic status also predicted neonatal mortality in Pakistan. Neonates born from mothers from the lowest wealth quintile are at a higher risk of death than those from the highest wealth quintile. A similar study in Nigeria also showed that higher rate of NMR in the country was among the lowest wealth quintile and in rural areas (171). This may be linked to other factors such as poor nutrition status among pregnant women, poor health education, poor utilization of MCH services which are hinged on affordability and financial capabilities.

Considering the high poverty rate of 39.3 % (26) which was aggravated by a protracted period of crises and political instability in Pakistan, improving neonatal health outcomes may be challenging as interventions targeted at neonatal health must also seek to address babies' deaths that are attributed to poverty and wealth inequalities. Although, Pakistan has social health insurance which could alleviate the financial burden related to seeking maternal and child healthcare, this insurance scheme only covers 5% of the population(38).

Furthermore, cultural beliefs and practices in Pakistan indirectly act as a determinant for neonatal mortality as it influences how the society perceive and respond to health problems. For example, early marriage in Pakistan, a common cultural practice increases girls' early pregnancy rate as well as complications thus, leading to an increased risk of NM. Similarly, other cultural practices affect hygienic practices in neonatal care. Common cultural practices such as application of unhygienic traditional substances on the babies' umbilical cord expose them to infections and therefore increase the chance of death. Some babies are also fed with some liquid substance linked to spiritual beliefs instead of starting early and exclusive breastfeeding. Similar studies in Bangladesh also showed how cultural practices affected the newborn's survival. The study revealed that the placenta is linked to spiritual beliefs and therefore given so much attention during childbirth while the baby is left unattended (172).

Limitation of the study:

The available studies on the determinants of neonatal mortality in Pakistan are limited with most available literature using data from Pakistan DHS of different years. Most literature like the data in DHS regarding neonatal mortality did not include data on the father's level of education, occupation or paternal related determinants. Therefore, most of the socioeconomic determinants analysis focused more on the mother. In addition, only literature published in English language was identified and included in this review and those published in Urdu, Pakistan's official language was excluded and therefore some important determinants in those articles may have been missed. It is noteworthy that the framework utilized was useful in analysing the factors as it identified most factors. However, literature that shows the association between neonatal mortality and some factors in the frameworks were not found, such as civic status, household structure, and surveillance. Similarly, other essential factors found in the literature but not included in the framework, such as early marriage, ANC and tetanus vaccination were included in the review.

CHAPTER 6: Conclusion and Recommendation

6.1 Conclusion:

This study investigated the socio-determinants of neonatal mortality in Pakistan, highlighting the various interacting factors. Although a gradual reduction in the neonatal mortality rate in Pakistan since 1990, more efforts are still required to significantly improve neonatal health in the country.

In a multi-culture country such as Pakistan, it is imperative to consider underlying drivers of neonatal deaths. As identified in this study, these factors range from the child's birth conditions such as LBW and preterm to maternal individual factors such age, level of education, occupation and socioeconomic status. Other identified factors were the community factors such as religion and culture. Health system factors were also identified. It is noteworthy that factors such as maternal education interrelated with other direct and indirect factors.

Considering the aforementioned factors, interventions addressing neonatal mortality in Pakistan will therefore need to employ ecological strategies which can address these drivers at the different levels.

6.2 Recommendations:

Based on the research findings, the following recommendations are made to the relevant stakeholders in Pakistan:

Policy Recommendations

1. **Strengthening social health insurance scheme:** Considering the poverty level in the country and its influence on neonatal mortality through health service utilization, policy interventions by the government to increase the number of health insurance especially for women is required.
2. **Prohibition of early girl marriage:** Since early marriage contributes to NMR, laws and regulations prohibiting the practice need to be put in place by the government.
3. **Improving coverage and access maternal and neonatal healthcare services:** Government and other stakeholders need to ensure creation of health facilities that can provide basic maternal and neonatal care especially in the rural communities to increase healthcare service utilization.

Programmatic Recommendations

1. **Women empowerment interventions:** Programs aimed at empowering women economically and financially such as engagement in income generating activities, training and skill acquisition should be designed to facilitate financial freedom for women.
2. **Health facility delivery initiatives:** Interventions targeted improving safe delivery through increase in the number of health facility delivery should be designed as this will enhance the management of complications from conditions such as LBW and preterm births.
3. **Enhance the retention of health workers in rural areas:** Since health care services in rural areas suffering from shortage in HWs its essential to improve the availability of the human resources.
4. **Community post natal care Programmes:** Since a high number of mothers do not return to the health facility for the recommended post natal visit, an appropriate

home visit intervention, implemented in the community will ensure adequate post natal care and prevent neonatal loss.

5. **Capacity building interventions for health worker:** It is imperative to design interventions which continuously improve the competencies of health workers especially obstetric personnel in areas such as birth complication management, respectful maternity care and interpersonal skills.

6. **Post natal care health awareness and education:** Health awareness and education interventions on postnatal care should be designed for mothers and the community members. Topics including safe hygienic practices for neonatal care, importance of breastfeeding, consequences of harmful cultural practices such as cultural umbilical practices should be covered to improve the knowledge and skills of mothers in neonatal care.

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