Explaining Maternal Mortality: An In-depth Analysis of Pakistan Maternal Mortality Survey 2019

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Foreword

Pakistan's maternal mortality ratio (MMR) has come down to 186 per 100,000 live births in 2019 — compared to 276 in 2006-07. However, this progress has been slow and uneven and indicates that the target of MMR of less than 70 by year 2030 is unlikely to be achieved unless efforts and investments to save women's lives are intensified.

This report provides an in-depth analysis of the Pakistan Maternal Mortality Survey 2019 (PMMS 2019) and helps to explain the antecedents and predisposing causes of maternal deaths in Pakistan. The report highlights the inequities that continue to persist in terms of the burden of maternal mortality by region, place of residence and educational status.

The team of the National Committee for Maternal and Neonatal Health (NCMNH) has assiduously gone through all the verbal autopsies of maternal deaths and identified the tragic narratives of women who lost their lives in the process of bringing a new life. The analysis provides a wealth of knowledge regarding the determinants of maternal deaths at the societal, programmatic, and individual levels. It documents the weaknesses of our health system that translates into poor quality of care offered at both the public and private sector facilities. It shows that many maternal deaths were occurring because mothers in life-threatening health conditions were being shifted from one ill-equipped facility to another, resulting in many deaths occurring on the way or upon arrival at the last referred hospital.

One of the major factors in maternal deaths, apart from skilled deliveries, is the high number of pregnancies and deliveries women undergo and the associated health risks. The report clearly shows that not practicing family planning was a major risk factor contributing to maternal deaths especially among younger and older women. If we do not address millions of unwanted pregnancies that occur in Pakistan each year, we will continue to see women dying or suffering from lifelong ill health brought on by complications resulting from repeated pregnancies with short intervals in between. It is not possible to reduce maternal mortality without bringing down fertility rates.

Pakistan continues to have the highest fertility rates in Asia, with women having almost one child on average more than their desires. We cannot expect to reduce the risk of maternal deaths without expanding access to family planning and reducing unwanted pregnancies.

The report also stresses the need for strengthening maternal health services at the community level. The community-based Lady Health Workers (LHWs) can play a crucial role in preventing unwanted pregnancies at the same time they can better prepare women to undergo an uneventful pregnancy outcome through proper antenatal care and continuum of care from pre-pregnancy to postpartum period. They can link women to functional referral facilities where women can be transported in the shorter possible time and receive appropriate and timely care. With the rapid expansion of technology, we must also look at the wider application of m-health to provide preventive and therapeutic care especially in rural communities.

There have been few nationally representative studies to obtain maternal mortality estimates for Pakistan. We need to invest in strengthening our capacity to gather data on maternal deaths more frequently and with greater regularity. And to use the evidence for policy and programmatic decision-making and action. The report provides several policy and programmatic recommendations and calls for high priority to be accorded to ending preventable maternal deaths.

We must act on changing the very foundation of how we regard the rights of women and children. Every maternal death is a tragedy and a human rights violation with wide ranging and incalculable loss to family, community, and society.

Professor Dr. Sadiqua Jafarey, FRCOG
President National Committee for Maternal and Neonatal Health

Contents

List of Tables

List of Figures

Part 1

Part 2

Part 1

Explaining Maternal Mortality: An In-depth Analysis of Pakistan Maternal Mortality Survey 2019

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Abbreviations

AJ&K	Azad Jammu & Kashmir
ANC	Antenatal Care
BP	Blood pressure
CI	Confidence Interval
CCI	Council of Common Interests
CPR	Contraceptive Prevalence Rate
DHS	Demographic and Health Survey
GB	Gilgit Baltistan
ICPD	International Conference on Population and Development
KP	Khyber Pakhtunkhwa
MMS	Maternal Mortality Survey
MMR	Maternal Mortality Ratio
mCPR	Contraceptive Prevalence Rate of Modern Methods
MNCH	Maternal, Neonatal and Child Health
NIPS	National Institute of Population Studies
OR	Odds Ratio
PDHS	Pakistan Demographic and Health Survey
PMMS	Pakistan Maternal Mortality Survey 2019
SDG	Sustainable Development Goal
UNFPA	United Nations Population Fund
UNICEF	United Nations Children Fund
WHO	World Health Organization

Executive Summary

An in-depth analysis of the nationally representative 2019 Pakistan Maternal Mortality Survey (PMMS 2019) was carried out with the primary objective to identify the predictors of maternal mortality for evidence informed policy and programming. International comparisons and time trends were also analyzed using the Pakistan Demographic and Health survey 2006-2007.

Over a period of 13 years, maternal deaths per 100,000 live births (defined as maternal mortality ratio – MMR) declined in Pakistan from 276 in PDHS 2006-07 to 186 in PMMS 2019. During the same period, MMR declined from 227 to 157 per 100,000 live births in Punjab; 314 to 224 in Sindh; 275 to 165 in Khyber Pakhtunkhwa (KP), and, most substantially, from 785 to 298 in Balochistan. Yet, Balochistan continues to display the highest MMR in 2019, almost twice that of Punjab. MMR also declined in both urban and rural areas during the same period from 175 to 158 and 319 to 199, respectively. Despite this decline, inequity in the burden of maternal mortality persists by region and place of residence and among subgroups of population.

Between 2006-07 and 2019, the proportion of women with six or higher order births declined from 21.8% to 15%. An increase was noted in the proportion of women having four or more antenatal care (ANC) visits during the last pregnancy, from 28% in 2006-07 to 52% in 2019. The proportion who saw an obstetrician/gynecologist or a doctor for ANC almost doubled from 33% in 2006-07 to 60% in 2019. The literacy rate and educational attainment also improved, especially in rural areas. In rural areas, the proportion of women with no education reduced from 76% to 62% and the proportion with secondary or higher education increased from 6.3% to 14%. On the other hand, little progress was noted in rural areas for access to the nearest functioning basic health unit or rural health centre. However, mobile phone coverage in rural areas increased from 46% in 2006-07 to 93% in 2019.

The in-depth analysis of PMMS 2019 was undertaken using the nested case-control design by matching the maternal deaths (147) that occurred during three years prior to PMMS 2019, defined as "cases", with women (724) who delivered during the same period, defined as "controls". These women were alive at the time of the survey and residing in the same cluster (region and urban-rural place of residence) as cases. The ratio between cases and controls was 1:5. The deceased women (cases) were matched with those who gave birth and were alive (controls) in terms of the distribution by region and urban-rural place of residence. Similar proportion of cases and controls had visited for ANC; and saw an obstetrician/gynecologist or a doctor for ANC. Cases were, however, distinctly different from controls on important attributes like age group, level of education, number of pregnancies, type of delivery, tetanus toxoid vaccination during last pregnancy, ever used a contraceptive method, that predisposed them for maternal health risks. Surprisingly, more of the cases had their last delivery by a skilled birth attendant (83% vs 63.1%) and delivered at the government hospital (43.1% vs 33.4%) while home delivery was relatively more common among controls (32.5%) compared to cases (25.3%). The level of complications was experienced by a similar proportion in the two groups, but importantly greater numbers of symptoms were experienced by the maternal death cases than by women in the control group.

A multivariate analysis was undertaken to control for the confounding effects of age, education, ever given birth, ever had a cesarean section, had injection in the last pregnancy to prevent tetanus,

whether received delivery assistance from a skilled attendant, and ever used a contraceptive method while looking at the conditional odds of each one for maternal death to look at factors that had compounding or attenuating effects. The odds ratios after controlling for factors included in the model, were higher for women giving birth at younger age (15-19) or at older ages (30-39 and 40-49). Age group 20-29 had the least risk. Women with education had lower odds than those with no education with 0.35 odds of maternal death for women with secondary education and 0.51 for those with middle or less education compared to 1.0 for women with no education. Having ever had a cesarean section doubles the odds of maternal death while having had the tetanus injection in the last pregnancy drastically reduces the odds for maternal death close to zero as compared to women who were not vaccinated. Also, having had ever used a contraceptive method reduces the odds to 0.21 compared to 1.0 for never users. Delivery by skilled birth attendant was associated with higher odds of maternal death. The qualitative analysis of verbal autopsies in Part 2 provides greater insights into this unexpected finding.

Despite the progress made in reducing maternal mortality, the PMMS 2019 indicates that approximately 1 in 143 women in Pakistan will die during her lifetime due to complications during pregnancy, childbirth/abortion, or the postpartum period. The study indicates a number of policy and programmatic implications. First, childbearing at too early (below age 20) and at later ages (over 30) to be both discouraged and given priority attention and quality care. Second, contraceptive use should be promoted for maternal and child survival through birth spacing and prevention of unintended and high-risk pregnancies. Third, tetanus toxoid injection during pregnancy should be universal because of its protective effect. Fourth, a functional and efficient referral system need to be in place. Fifth, quality of care to be improved and health system to be strengthened. Interventions that make optimal use of the high coverage of mobile phone with home visits by Lady Health Workers and Community Midwives are needed to provide continuum of care for maternal, neonatal and child health. Concerted efforts and investments are needed to meet the public health and human rights imperative of saving maternal lives. This will also enable Pakistan to meet the Sustainable Development Goal 3 target 3.1 to reduce MMR to less than 70 per 100,000 live births by 2030 as well as to realize the priorities set in Pakistan 2025: One Nation – One Vision.

This report comprises two parts. Part 1 is based on quantitative analysis of the dataset of 147 maternal deaths due to direct or indirect causes matched to 724 women from the same region and place of residence as cases who had a live birth in three years prior to PMMS 2019. Part 2 covers in-depth analysis of 259 verbal autopsies of deceased women who died because of direct or indirect causes, or coincidental causes or had a late maternal death. Note that the work reported in Part 2 also included additional maternal deaths attributable to medical or surgical misadventures that were not previously identified in the PMMS 2019 Report.

INTRODUCTION

Maternal deaths are a tragic loss of life that are mostly preventable. A maternal death also adversely affects the survival and wellbeing of children and family cohesion. The disastrous consequences for the community, society and economy are incalculable. Maternal mortality is a key indicator of the coverage and quality of country's health system and status of women in the society, including the social and cultural norms that they have to conform to and the care they receive (or lack) in general and during pregnancy and while giving birth, in particular. Maternal mortality is often a result of violations of key human rights principles including accountability, equality, non-discrimination, and meaningful participation[1]. The target 3.1 of the Sustainable Development Goal (SDG) 3 is to reduce global maternal mortality ratio (MMR) to less than 70 maternal deaths per 100,000 live births by 2030.

World Health Organization (WHO) defines maternal death as the death of a woman while pregnant, during childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 2019)[2]. Direct maternal deaths are due to obstetric complications of the pregnant state (pregnancy, labour, and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.

Indirect maternal deaths are those resulting from a previously existing disease, or a disease that developed during pregnancy that was not due to direct obstetric causes, even when it was aggravated by the physiologic effects of pregnancy.

Various methods and estimates are used by researchers to estimate maternal mortality ratio (MMR), defined as the number of maternal deaths per 100,000 livebirths. While modelling provides point estimates for MMR, survey data such as those collected in Demographic and Health Surveys (DHS) and Maternal Mortality Surveys (MMS) provide estimates that are for a period of three years before the survey. Recently, WHO has compiled a series of latest indicators on sexual and reproductive health and rights from reputable international sources and produced an infographic snapshot by each country (https://www.who.int/publications/i/item/WHO-SRH-21.21). MMR in 2017 (Figure 1) was lower in Pakistan (140) compared to Bangladesh (173) and Nepal (186) and close to that in India (145), but much higher than that in Iran (16) or Sri Lanka (36). Compared to Bangladesh (60%), Nepal (66%) and India (61%), Pakistan has achieved the least progress (51%) in reducing MMR from 2000 to 2017. However, the PMMS 2019 documented the MMR to be 186 for the period covering three years prior to the survey, which is higher than the value estimated in 2017 for the country. Keeping view of the 2017 vs 2019 MMR estimation variance, it is important to note that 2019 PMMS figure is derived directly from a nationally representative survey whereas 2017 estimate is based on the application of modeling,

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[1]Navanethem Pillay, (Former) High Commissioner for Human Rights. September 2nd, 2010. https://newsarchive.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=10301&LangID=e.

[2]World Health Organization. 2019. Trends in maternal mortality 2000 to 2017: Estimates by WHO, UNICEF, UNFPA, The World Bank, United Nations Population Division. Geneva: World Health Organization.

Figure 1: Trend in Model-based Maternal Mortality Ratio (MMR), Selected Countries, 2000-2017
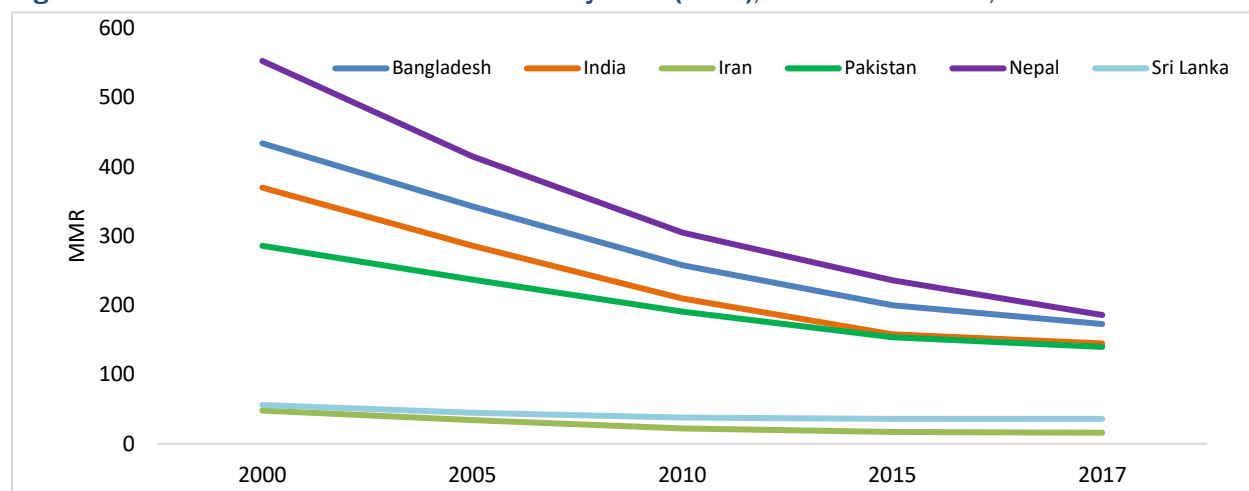
Source: WHO, 2019

The data presented in Table 1 indicate that among the six countries, Pakistan has the highest level of total fertility and neonatal mortality and the lowest prevalence of modern contraceptives. Perhaps a more disconcerting finding is that Pakistan ranked 153 out of 156 countries in 2021 on Global Gender Gap Index compared to Bangladesh that ranked 65th (World Economic Forum, 2021)[3]. Pakistan also performed poorly on "Economic Participation and Opportunity" and "Educational Attainment" ranking 152nd and 144th, respectively.

Table 1: Country comparison of selected Reproductive and Maternal, Neonatal, and Child Health (MNCH) indicators

Indicator	Bangladesh	India	Iran	Nepal	Pakistan	Sri Lanka
Total Fertility Rate per woman	2.1	2.2	2.2	1.9	3.6	2.2
Modern Contraceptive Prevalence Rate (%)	59.1	47.8	57.0	44.2	23.4	53.6
Adolescent birth rate per 1,000 women 15-19	83	13.2	40.6	65.1	38.8	20.9
Percent marrying <18 among 20-24	58.6	27.3	NA	39.5	18.3	9.8
Percent of births by a skilled provider	59.0	81.4	99.0	77.2	71.0	99.5
Percent attending antenatal clinic at least once	75.2	79.3	NA	83.6	86.2	98.8
Country rank on Global Gender Index	65th	140th	150th	106th	153rd	116th
Neonatal mortality rate per 1,000 live births	19.1	21.7	8.6	19.8	41.2	4.3
Maternal Mortality Ratio per 100,000 live births	173	145	16	186	140	36

Notes: NA=Not available.

Source: https://www.who.int/publications/i/item/WHO-SRH-21.21 (accessed on 15 December 2021).

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[3] World Economic Forum. 2021. Global Gender Gap Report 2021. Geneva: World Economic Forum.

Background

Maternal deaths constitute a high percentage of deaths among women of reproductive age in developing countries, even though they are completely preventable in most cases. Although South Asia reduced its MMR by nearly 60% between 2000 and 2017, the region still contributes one-fifth of all maternal deaths globally.[4] Pakistan has also witnessed an overall decrease in the MMR, from 276 maternal deaths per 100,000 live births as reported in the 2006-07 Pakistan Demographic and Health Survey (PDHS), to 186 maternal deaths per 100,000 live births as reported in the 2019 Pakistan Maternal Mortality Survey (PMMS).[5] Divergent estimates were derived across the 1995 – 2019 for MMR (Table *2*). These different studies used different estimation approaches and may reflect varying results for similar time frames (e.g., NIPS and Midhet F. estimates of 1991).

Table 2: Estimates of MMR for Pakistan

Reference Period	Study/Source	Estimation Method	Geographic Coverage	MMR Estimate
1990–1991	National RH and FP Survey 2001 (National Institute of Population Studies 2002)	Indirect sisterhood method	Pakistan	533[6]
1988–1993	Maternal and Infant Mortality Survey (Midhet et al. 1998)	Verbal autopsies	Selected rural districts of KP and Balochistan	392[7]
2000–2001	Maternal and Infant Mortality Survey (MIMS) (Midhet 2001)	Statistical modeling using district characteristics as independent variables	Pakistan	279[8]
2000	Estimates developed by WHO, UNICEF, and UNFPA (Abou Zahr and Wardlaw 2004)	Statistical modeling using country characteristics as independent variables	Pakistan	500[9]
2005	Estimates developed by WHO, UNICEF, UNFPA, and World Bank (WHO 2005)	Statistical modeling using country characteristics as independent variables	Pakistan	320[10]
2006-2007	Pakistan Demographic and Health Survey	Direct sibling method through household survey	Pakistan	276[11]
2014	Feasibility of Using Community Informant Networks to Estimate Maternal Mortality Pilot Study in Chakwal	MADE-IN/MADE-FOR	District Chakwal	309[12] (95% CI 266-358)
2014	Global Burden of Diseases	Statistical Modeling	Pakistan	401[13] (233-560)
2015	Using the Community Informant Networks (MADE-IN MADE-FOR) Methodology to Estimate Maternal Mortality in Punjab	MADE-IN/MADE-FOR	Punjab	302[14] (258-346)
2016	Using the Community Informant Networks (MADE-IN MADE-FOR) Methodology to Estimate Maternal Mortality in KP	MADE-IN/MADE-FOR	Khyber Pakhtunkhwa	271[15] (260-290)

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[4] "Maternal Mortality." World Health Organization. Accessed November 2020. https://www.who.int/news-room/fact-sheets/detail/ maternal mortality.

[5] The MMS calculated the MMR using survey data encompassing the three years preceding the survey.

[6] National RH and FP Survey 2001 (National Institute of Population Studies 2002)

[7] Maternal and Infant Mortality Survey (Midhet et al. 1998)

[8] Maternal and Infant Mortality Survey (MIMS) (Midhet 2001)

[9] Estimates developed by WHO, UNICEF, and UNFPA (Abou Zahr and Wardlaw 2004)

[10] Estimates developed by WHO, UNICEF, UNFPA, and World Bank (WHO 2005)

[11] Pakistan Demographic and Health Survey 2006-07

[12] Feasibility of Using Community Informant Networks to Estimate Maternal Mortality Pilot Study in Chakwal

[13] Global Burden of Diseases

[14] Using the Community Informant Networks (MADE-IN MADE-FOR) Methodology to Estimate Maternal Mortality in Punjab

[15] Using the Community Informant Networks (MADE-IN MADE-FOR) Methodology to Estimate Maternal Mortality in KP

These figures represent a one-third decline[16] in the number of maternal deaths between 2007 and 2019. However, given that the SDG target for reducing maternal mortality is to lower the MMR to less than 70 maternal deaths per 100,000 live births by 2030, Pakistan still needs to make substantive progress on this indicator. Information on the maternal mortality ratio was collected for the first time in the PDHS 2006-07. In 2019, Pakistan achieved an important milestone by completing its first independent study on maternal mortality and morbidity, i.e., the Pakistan Maternal Mortality Survey (PMMS), which was implemented by the National Institute of Population Studies (NIPS) under the aegis of the Ministry of National Health Services Regulations and Coordination.

The PMMS 2019 provides a snapshot of maternal health, illness, and mortality across Pakistan through a large-scale household survey that is representative of the country as well as its constituent provinces and regions. A comparison of MMR between 2006-07 and 2019 at the national and regional levels provides an excellent opportunity to evaluate Pakistan's progress on this important indicator. At the same time, the information provided by the PMMS 2019 offers useful insights into the maternal, neonatal and child health (MNCH) landscape in Pakistan, as well as the ways in which Pakistan can best prepare its health systems to serve the needs of its mothers and children. Table 2 shows a general trend in the decline of maternal mortality with the latest estimate of 186 (95% confidence interval: 138-234) during the three years before 2019 PMMS. This table also draws our attention to wide range of discrepancies in the findings because of different methodological approaches used most strikingly the MMR estimates drawn by the National Institute of Population Studies and Midhet, F for the same year of 1991. Therefore, methodology is a key to conclude the sound results from the research studies.

The decrease of maternal and infant mortality was recognized as a policy priority in Pakistan Vision 2025 (Government of Pakistan 2014)[17]. To actualize this priority, it is critical to introduce mechanisms by which periodically updated statistics can be produced which make it possible to: 1) Monitor and evaluate existing maternal, neonatal, and child health (MNCH) programs; 2) Introduce greater accountability of MNCH programs and relevant actors, and 3) Plan new or improve ongoing MNCH initiatives. From a programmatic perspective, it is crucial to have the data necessary to develop a thorough understanding of the underlying causes of, and risk factors contributing to maternal mortality in Pakistan so that viable MNCH initiatives can be planned and implemented accordingly. Moreover, in-depth information on MNCH is necessary to facilitate advocacy efforts that can effectively increase public awareness about maternal health issues, enhance policy focus on key MNCH interventions, and maintain concerted efforts to achieving SDG 3 by 2030.

The primary objective of this research is to provide evidence on factors associated with maternal mortality in Pakistan by conducting an in-depth analysis of PMMS 2019 data. We provide a snapshot of maternal mortality by province/region and urban-rural place of residence, followed by the multivariate analysis of data to examine the relative role of biological and social factors explaining the persistence of high maternal mortality in Pakistan. In addition, we examine the changes in maternal mortality between 2007 and 2019. In Part 2, the Report assesses the relative contribution of three-delays (delay in deciding to seek the appropriate medical help for an obstetric emergency; delay in reaching an appropriate obstetric facility; and delay in receiving adequate care once a facility is

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[16] This evidence of a decline does not take account of statistical uncertainty in the estimates from the two surveys.

reached) in this study. We conclude with the policy and program implications and recommendations based on the findings.

Aims and domains of analysis

PMMS provides nationally representative information on maternal health and mortality. A total of 1,177 verbal autopsies were conducted from across Pakistan (940 in KP, Punjab, Sindh, and Balochistan; 149 in AJ&K and 88 in GB) to collect information on women ages 15-49 who died in the three years preceding the survey. In addition to providing a snapshot of maternal health, illness, and mortality across Pakistan, PMMS also provides important insights on factors associated with maternal health and mortality.

The analysis was predicated on the following points of study:

1. Examining the change in maternal mortality between 2007 and 2019.

2. Examining the change in the relevance of demographic characteristics and key risk factors contributing to maternal mortality across these years, including:
   a. Variation across provinces.
   b. Variation between urban and rural areas.
3. The role of other individual and context-specific risk factors associated with maternal mortality in Pakistan.

ANALYSIS METHODS

While the PMMS 2019 recorded data on births and deaths from all the respondents surveyed, with a sample encompassing 109,000 households across Punjab, Sindh, Balochistan and KP, 11,000 from Gilgit Baltistan (GB), and 16,500 from Azad Jammu and Kashmir (AJ&K), detailed birth histories recording the risk factors to maternal and child health were only obtained from 10% of the households sampled. This amounts to approximately 10,900 ever-married female respondents. This data limitation makes a direct estimation of the relative risk of maternal mortality at the household and community level impossible.

To overcome this difficulty, we applied a nested case-control study design to identify the important risk factors associated with maternal mortality in Pakistan. The nested case control design extends the flexibility of focusing specifically on those who experienced mortality (cases), and a set of matched controls per case providing the statistical strength to conduct analysis through which variability due to known and unknown risk factors related to various characteristics can be controlled in an appropriate manner. The data were obtained from the PMMS 2019 that was a multi-stage cluster survey conducted across four provinces of Pakistan as well as GB and AJ&K. We performed a nested case control study in which all maternal deaths (147) identified in the 2019 PMMS were regarded as cases, while the controls were randomly selected after being matched on cluster from the (6,907) women who reported a live birth during the last three years before the survey.

There was a 1:5 ratio between cases and controls. All deaths of women of reproductive age that occurred during last three years preceding the survey and were classified as maternal deaths due to direct or indirect causes were included as cases in the study (N = 147). On the other hand, all women who reported a live birth during the same time period and were matched on the same clusters as cases were classified as controls. These controls (N = 724) were identified, for whom the required information about risk factors was also available. These sample sizes were computed at the 95% confidence level, at a power of 90%, an assumed 20% rate of exposure among controls, a case-to-control ratio of 1:5, and (2) minimum risk to be estimated. The risk factors that were included in the analysis are provided in the framework shown in Figure 2.

Figure 2: Groups of potential predictors and the outcome of maternal death

Socio economic determinants

Region of Residence

Place of Residence

Education level of women

Women level risk factors

Age of women

Parity/ Ever given birth

Live children she had

Ever had a caesarean section

Place of delivery

Assistance at delivery

Type of delivery

Ever use of a family planning method

Health seeking behavior/ comorbidities

Seek antenatal care

Antenatal care provider

Month of pregnancy at first ANC visit

TT injection during pregnancy

Composite complications

Composite symptoms

Maternal Deaths

Across the initial stages of the analyses, three sets of iterations were run on the independent variables to understand the patterns of predictors. The process also facilitated the re-defining of categories and modifying the scale of various categorical and continuous variables. Given the relatively small number of cases in the survey, the number of categories were merged for variables to allow meaningful comparison.

Analysis was done using Stata version 14 and SPSS version 23. Maternal death was taken as outcome/dependent variable which was dichotomized into whether the death occurred or not (i.e., cases were maternal deaths, and controls were women who were alive and had a live birth). Frequencies and percentages were reported for qualitative variables (like age groups and education level of women, assistance at delivery, province/region and place of residence etc.) and medians with standard deviation for quantitative variables (for example, composite complications and composite symptoms). Cross tabulations for categorical variables were run with outcome in order to identify any sparse data.

To determine the risk factors associated with maternal deaths, these factors were run separately in univariate analysis. Crude odds ratios (OR) and matched odds ratios (Matched OR) with 95% Confidence interval (CI) were computed by simple logistic regression and conditional logistic regression respectively. Variables with a p-value less than 0.25 at the univariate level were included in the multivariable analysis and multicollinearity among the independent variables was checked.

Multivariable analysis was done using same regression techniques in order to determine risk factors associated with maternal deaths computing adjusted odds ratio (Adjusted OR) with 95% CIs. Variables having p-value less than 0.05 were kept in the final multivariable model and the Hosmer Lemshaw goodness of fit test was run to check how good is the fit of model using simple logistic regression technique.

RESULTS

Comparisons of PMMS 2019 and PDHS 2006-07

A comparison of descriptive given in the reports of PDHS 2006-07 and PMMS 2019 applicable for maternal deaths and livebirths was carried out. Three types of indicators/risk factors, namely, women level risk factors, socioeconomic and demographic risk factors for both urban and rural areas and community level risk factors in rural areas were compared to see distribution of risk factors across these two surveys and whether those indicators have improved over time.

The multi-stage analyses included the phases of descriptive analysis, and inferential analyses through univariate and multivariate regression modelling.

Descriptive Analysis

Since the datasets of cases and eligible controls were matched on the cluster level (Figure 3), the proportional representation of cases versus controls was similar for the variables of region/province of residence and place of residence (i.e., urban vs rural).

Figure 3: Scheme of cases and controls identification and matching
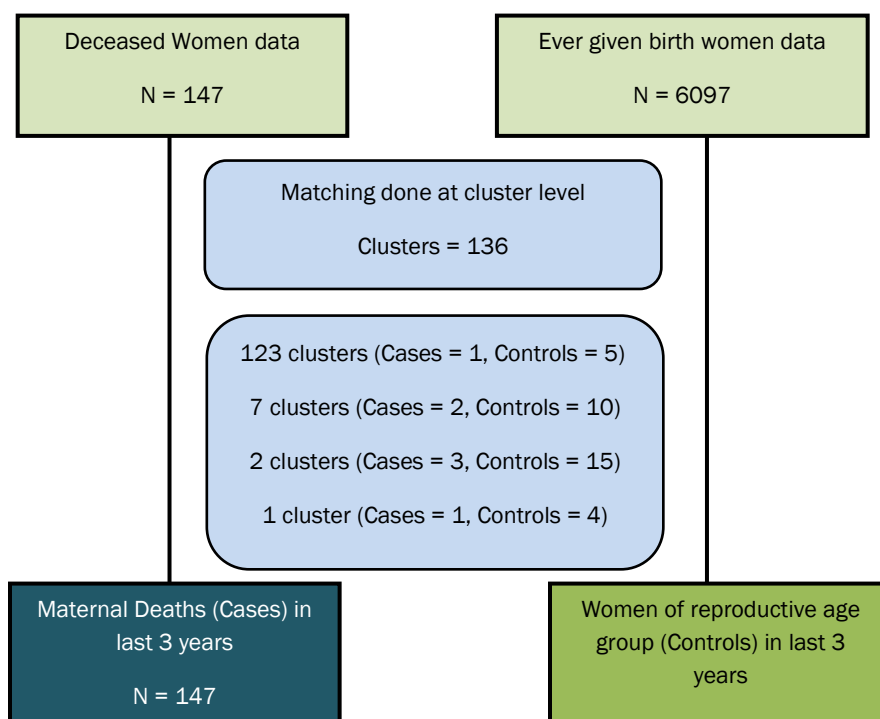
Demographics

With reference to the age distribution of cases, the highest proportional representation of maternal deaths was observed for the age group of 30-39 years (44.5%), and nearly one third of the mortality recorded in the 20-29 years age group (34.7%), with nearly one tenth of cases represented in the adolescent age group (Table 3). Among controls, more than half of the women who had a live birth during three years before PMMS were from the age group of 20-29 years (54.1%) and nearly one-third were from the age group of 30-39 years (33.0%). More than two thirds of the maternal deaths were of women with no formal education (69.4%), and nearly one sixth had eight years or less of formal education. In the control group, more than half of the women had no formal education (57.9%) and nearly a quarter (23.3%) of these women had eight years or less of formal education.

Obstetric History

The descriptive results related to obstetric history reflected that more than one tenth of the cases were primigravida (12.9%) while such women were minimally represented among the controls (3.6%). The majority across both cases and controls were not primigravida in the most recent pregnancy. Analyses of the number of pregnancies reflected that among the cases half of the women had had three or fewer pregnancies, and nearly one fifth (19.5%) of them having seven or more pregnancies. Comparatively, among the controls a lesser proportion of women as compared to cases had a higher reproductive health burden (11.6% having had seven or more pregnancies). History of caesarian section procedure in the past revealed that less than half the proportion of controls (14.4%) as compared to cases (27.9%) had undergone a surgical procedure in this regard.

Antenatal Care use

Utilization of antenatal care (ANC) reflected similar patterns of service use across the cases and controls with the vast majority in both groups having sought ANC (85.0% in cases and 87.9% in controls) during the last pregnancy. Comparable distribution across both the study groups was observed for the type of provider for ANC, with nearly three quarters of the cases and controls seeking care from an obstetrician or a doctor (cases: 73.5%, controls: 77.6%). With regards to the timing of first ANC visit bifurcated across the three trimesters, it was derived that more than half of the cases and controls sought such care during the first trimester (cases: 50.4%; controls: 56.3%). However, a differential was observed for receiving of tetanus toxoid (TT) vaccine during the last pregnancy with a comparatively higher proportion of controls (nearly all – 99.9%) as compared to the cases (86.4%).

Natal care

Birthing experience and use of natal care was analyzed for selected variables of place of delivery, type of birth attendant/assistance at delivery and the mode of delivery. It was found that similar and nearly equal proportions among the controls had their delivery conducted at home (32.5%), government health facility (33.4%), or private health facility (34.1%). Among cases, home-based births were one quarter (25.3%) while about one-third (31.6%) having delivered at a private health facility and 43.1% at government health facility. Comparison for the type of assistance at the time of delivery, a higher proportion of cases had a skilled birth attendant (83%) as compared to the controls (63.1%). Among the cases, nearly two thirds had experienced a normal vaginal delivery (61.1%) as compared to a higher proportion of controls (73.6%). In this milieu about one quarters of the controls (23.3%) and one third of the cases (31.6%) had their last delivery by a caesarian section.

Table 3: Number and Percent Distribution of Cases and Controls, by Background Variables PMMS 2019

Name of Variables	Cases No.	Cases %	Controls No.	Controls %	Cases Mean (SD)	Controls
Descriptive Analysis						
Region of residence						
Punjab	32	21.77	150	20.72		
Sindh	42	28.57	210	29.01		
KP	27	18.37	134	18.51		
Balochistan	26	17.69	130	17.96		
GB/ AJ&K	20	13.61	100	13.81		
Total	**147**	**100**	**724**	**100**		
Place of residence						
Urban	49	33.33	242	33.43		
Rural	98	66.67	482	66.57		
Total	**147**	**100**	**724**	**100**		
Age groups (years)						
15-19	16	10.88	43	5.94		
20-29	51	34.69	392	54.14		
30-39	66	44.9	239	33.01		
40-49	14	9.52	50	6.91		
Total	**147**	**100**	**724**	**100**		
Highest class completed						
No education	102	69.39	419	57.87		
Middle or less	26	17.69	169	23.34		
Secondary and higher	19	12.93	136	18.78		
Total	**147**	**100**	**724**	**100**		
Ever given birth						
Yes	128	87.07	698	96.41		
No	19	12.93	26	3.59		
Total	**147**	**100**	**724**	**100**		
Number of children alive						
3 and less	64	50.00	446	61.6		
Between 4-6	39	30.47	194	26.8		
7 and above	25	19.53	84	11.6		
Total	**128**	**100**	**724**	**100**		
Ever had a caesarean section operation						
Yes	41	27.89	104	14.36		
No	106	72.11	620	85.64		
Total	**147**	**100**	**724**	**100**		
Did see anyone for antenatal care						
Yes	125	85.03	636	87.85		
No	22	14.97	88	12.15		
Total	**147**	**100**	**724**	**100**		
Who did she see for antenatal care						
Did not see anyone	22	14.97	88	12.15		
Obstetrician/Specialist	59	40.14	330	45.58		
Doctor	49	33.33	232	32.04		

Descriptive Analysis						
	Cases		Controls		Cases	Controls
Name of Variables	No.	%	No.	%	Mean (SD)	
Nurse/Midwife/LHV	13	8.84	64	8.84		
Nonskilled Birth Attendants	4	2.72	10	1.38		
Total	**147**	**100**	**724**	**100**		
Trimester of pregnancy at first health provider visit						
1st trimester	63	50.4	358	56.29		
2nd trimester	37	29.6	200	31.45		
3rd trimester	25	20.0	78	12.26		
Total	**125**	**100**	**636**	**100**		
During last pregnancy had an injection to prevent tetanus						
Yes	127	86.39	723	99.86		
No	20	13.61	1	0.14		
Total	**147**	**100**	**724**	**100**		
Place of delivery						
Home	24	25.26	215	32.48		
Govt. hospital/other public	41	43.16	221	33.38		
Pvt. hospital/clinic	30	31.58	226	34.14		
Total	**95**	**100**	**662**	**100**		
Assistance at delivery						
Skilled Birth Attendants	122	82.99	457	63.12		
Others	25	17.01	267	36.88		
Total	**147**	**100**	**724**	**100**		
How was the delivery						
Normal	58	61.05	328	73.54		
assisted vaginal	7	7.37	14	3.14		
caesarean section	30	31.58	104	23.32		
Total	**95**	**100**	**446**	**100**		
Ever used a Contraceptive method						
Yes	17	11.56	263	36.33		
No	130	88.44	461	63.67		
Total	**147**	**100**	**724**	**100**		
*Composite complications					0.62 (0.77)	0.63 (0.77)
**Composite Symptoms					2.35 (1.86)	1.85(1.62)

Complications include High BP, Diabetes, Anemia & Jaundice during last pregnancy

**Symptoms include Fever, Fits, Vaginal bleeding, Jaundice, Abdominal pain, Breathing difficulty, Paleness/Anemia, Swelling feet or ankles & Swelling face during last pregnancy/illness

Ever use of Contraceptives

Analysis of ever-use of contraceptives among the two study groups reflected that such practice was three times more common among the controls (36.3%) as compared to the cases (11.6%). This finding reflects a markedly less common adoption of contraceptives among the cases. The finding corroborated indirectly with the observed result of number of pregnancies in the past among the study subjects aligns to some extent with the finding that nearly double the proportion of cases (19.5%) had

7 or more pregnancies as compared to the controls (11.6%). This reflects a higher reproductive health burden among those who experienced mortality, and possibly a higher risk of adverse pregnancy outcome(s).

Symptoms and complications during last pregnancy

Composite variables on a continuous scale were developed for the complications and symptoms experienced during the last pregnancy. The complications included High BP, Diabetes, Anemia and Jaundice, while symptoms included fever, fits, vaginal bleeding, jaundice (yellowish sclera), abdominal pain, breathing difficulty, paleness/anemia, swelling feet or ankles and swelling of face. Medians with standard deviations were derived for the respective variables. The median score for complications was similar among the cases and controls (cases: 0.62 std dev 0.77; controls: 0.63 std dev 0.77); however, a markedly higher median score for symptoms was observed among the cases (2.35 with std dev 1.86) as compared to the controls (1.85 with std dev 1.62). These results reflect that the cases had a more difficult pregnancy and more commonly experienced adverse symptoms during their last pregnancy as compared to controls.

Women-level risk factors

Among the women level risk factors, age at the time of last birth, birth order of the most recent pregnancy, history of pregnancy loss, type of birth attendant at the time of the most recent delivery/birth and the use of ANC during the most recent pregnancy were included (Table 4).

Distribution of age at time of last birth among the respondents across the two surveys were nearly similar with the majority falling in the age group of 20-34 years in PDHS 2006-07 (76.6%) and PMMS 2019 (77.6%) respectively. Nearly one tenth of the respondents belonged to less than 20 years age group in both surveys and a little higher proportion reported in the 35-49 years age group. Mothers having 2 to 3 children had the highest proportion across both surveys with higher percentage reported in PMMS 2019 (38.8%) as compared to PDHS 2006-07 (34.2%) and approximately one fourth of the mothers had 4 to 5 children according to PDHS 2006-07 (23.1%) and PMMS 2019 (24.9%). Additionally, more than one-fifth mothers reported only one child in both surveys. However, mothers having six or more children were notably fewer in PMMS 2019 (15.0%) as compared to PDHS 2006-07(21.8%).

Miscarriages were reported by less than one tenth of the women in PDHS 2006-07 (8.1%) and more than one-tenth of the women in PMMS 2019 (11.9%). Still births proportion was nearly similar in both PDHS 2006-07 (2.8%) and PMMS 2019 (2.6%), while induced abortions accounted for the lowest proportion according to PDHS 2006-07 (1.5%) with slightly higher proportion reported in PMMS 2019 (1.9%). Approximately three fourths of the deliveries took place with the assistance of skilled birth attendants (doctors, obstetrician, and nurse/midwives) according to PMMS 2019 (74%) as compared to only two fifth in PDHS 2006-07 (39%). The major bulk of deliveries were by traditional birth attendants/Dai reported in PDHS 2006-07 (51.5%) when compared with PMMS 2019 (21.0%) while some of them were conducted in the presence of relative or a friend as reported in both PDHS 2006-07 (7.4%) and PMMS 2019 (5.0%).

Table 4 : Comparison of women level risk factors across PDHS 2006-07 and PMMS 2019

Women-Level Risk Factors		PDHS 2006 - 2007 (%)	PMMS 2019 (%)
Age at birth			
<20		10.6	9.4
20 − 34		76.6	77.6
35 − 49		12.9	13.0
	Total	100	100
Birth Order			
1		20.9	21.3
2 − 3		34.2	38.8
4 − 5		23.1	24.9
6+		21.8	15.0
	Total	100	100
History of pregnancy loss			
Miscarriage		8.1	11.9
Induced abortion		1.5	1.9
Still birth		2.8	2.6
	Total	100 (including live births)	100 (including live births)
Skilled birth attendance at last delivery			
Obstetrician/ Specialist		-	37.0
Doctor		33.0	23.0
Nurse/midwife/Lady Health visitor		5.8	14.0
Dai/TBA		51.5	21.0
LHW		0.5	-
Hakim		0.1	-
Relative/friend		7.4	5.0
No one		0.7	<1.0
	Total	100	100
Antenatal care in current pregnancy			
None		34.7	7.5
1		13.2	9.0
2 − 3		22.2	30.8
4+		28.4	52.4
DK / Missing		1.4	0.1
	Total	100	100

More than half of the women visited a health facility, four or more times for antenatal care (ANC) during the most recent pregnancy according to PMMS 2019 (52.4%) as compared to more than one fourth reported in PDHS 2006-07 (28.4%). The higher proportion of women had never visited any of the health care facility for ANC as per PDHS 2006-07 (34.7%) as compared to PMMS 2019 (7.5%). More than one tenth of them had one ANC visit reported in PDHS 2006-07 (13.2%) as compared to PMMS 2019 (9.0%) while more than 30 percent had 2-3 visits in PMMS 2019 as compared to more than 20 percent in PDHS 2006-07.

These comparisons help us derive that although there may be no major shift across the surveys for the reproductive health burden (i.e. the number of pregnancies experienced) and adverse outcomes of pregnancy(ies); however, improvements are observed for use of antenatal care (i.e., more than 4 ANC visits) and skilled birth attendance; with the latter indicators manifesting as near doubling of both the former and the latter use of services across the time span of 2006-07 to 2019.

Demographic and socio-economic factors

The socioeconomic and demographic characteristics of the survey respondents indicated (Table 5) that about one third of the rural women belong to the lowest wealth quintile with more than quarter of the respondents belonging to lowest wealth quintile reported in PDHS 2006-07 (28.7%) and PMMS 2019 (29.5%) respectively in rural areas, as compared to urban population where more than two fifth of the respondents belong to the highest wealth quintile reported in PDHS 2006-07 (45.9%) and PMMS 2019 (41.3%).

More than three fourth of the respondents had no formal education in rural areas according to PDHS 2006-07 (76.0%) as compared to more than three fifth in PMMS 2019 (62.0%) while more than two fifth in the urban population reported no formal education in PDHS 2006-07 (43.1%) as compared to more than one third in PMMS 2019 (34.0%). According to PDHS 2006-07, more than one tenth of the survey respondents had five years or less of formal education in rural areas (13.5%), as compared to slightly higher proportions in urban areas (15.5%), whereas PMMS 2019 reported higher proportion of such respondents in rural areas (18.0%) as compared to urban areas (17.0%). The number of respondents having eleven years and higher formal education was higher in PMMS 2019, as compared to PDHS 2006-07 in both rural (7.0% and 2.2% respectively) and urban areas (22.0% and 15.0% respectively). More than half of the respondents belong to Punjab province in both the PDHS 2006-07 (57.9%) and PMMS 2019 (53.2%), followed by the provinces of Sindh, Khyber Pakhtunkhwa and Balochistan, which represent the lowest number of respondents. Nearly one third of the respondents belong to urban areas in both the PDHS 2006-07 (33.4%) and PMMS 2019 (37.0%).

Table 5 : Comparison of demographic & socioeconomic factors in PDHS 2006-07 and PMMS 2019

Demographic and Socioeconomic Characteristics	PDHS 2006 - 2007 (%)		PMMS 2019 (%)	
Socioeconomic status of the household	Rural	Urban	Rural	Urban
Lowest	28.7	2.9	29.5	3.3
Second	27.0	6.2	27.0	7.7
Middle	22.2	15.8	20.8	18.6
Fourth	15.3	29.2	14.8	29.2
Highest	6.7	45.9	8.0	41.3
Educational attainment	Rural	Urban	Rural	Urban
No education	76.0	43.1	62.0	34.0
Primary (1-5)	13.5	15.5	18.0	17.0
Middle (6-8)	4.3	10.3	6.0	10.0
Secondary (9-10)	4.1	16.1	7.0	17.0
Higher (11+)	2.2	15.0	7.0	22.0
Province				
Punjab	57.9		53.2	
Sindh	24.0		22.7	
NWFP/KP	13.5		19.2	
Baluchistan	4.6		4.9	
Residence (major urban, other urban, rural)				
Total Urban	33.4		37.0	
Major Urban	18.9		-	
Other Urban	14.5		-	
Rural	66.6		63.0	

Community level factors in rural areas

The descriptive results (Table 6) related to community level risk factors in rural areas reflected that most of the functioning basic health units lie within the territory of one-to-four-kilometer radius from the residences of the respondents in both surveys, with more than a quarter reported in PDHS 2006-07 (27.3%), as compared to nearly one third in PMMS 2019 (31.7%). More than one fifth of these were situated within the community and within five to nine kilometers radius according to PDHS 2006-07 (20.8% and 22.5% respectively), whereas less than one fifth of those were located within the community (16.5%) and more than a quarter in five to nine kilometers radius (26.5%) according to PMMS 2019. Nearly half of the Rural Health Centers and Secondary/tertiary hospitals are far away from where the respondents reside, at a distance of 10 or more kilometer radius according to both the PDHS 2006-07 (45.8% and 54.1% respectively) and PMMS 2019 (53.8% and 54.3% respectively), whereas very few of them were situated within the community, as reflected in both PDHS 2006-07 (6.0% and 8.6% respectively) and PMMS 2019 (6.3% and 7.4% respectively). Nearly two thirds of the respondents reported availability of motorized public transport within the community in both PDHS 2006-07 (63.2%) and PMMS 2019 (64.6%) whereas less than one sixth of them had access to transport in one to four kilometers territory and approximately one tenth of them had public transport available within ten or more kilometer radius from the respondents' homes, according to both surveys. Mobile phone coverage was nearly half according to PDHS 2006-07 (45.7%) as compared to a much higher proportion reported in PMMS 2019 (93.4%).

Table 6: Comparison of community level factors in PDHS 2006-07 and PMMS 2019

Community-Level Risk Factors in Rural Areas	PDHS 2006 – 2007 (%)	PMMS 2019 (%)
Distance to the nearest Functioning Basic Health Unit		
In community	20.8	16.5
1 – 4 km	27.3	31.7
5 – 9 km	22.5	26.5
10+ km	19.5	24.1
DK / missing	10.0	1.2
Distance to the nearest Rural health Centre (RHC)		
In community	6.0	6.3
1 – 4 km	15.0	14.2
5 – 9 km	24.2	19.3
10+ km	45.8	53.8
DK / missing	9.0	6.3
Distance to the nearest Secondary/tertiary Hospital		
In community	8.6	7.4
1 – 4 km	14.0	14.3
5 – 9 km	17.9	20.3
10+ km	54.1	54.3
DK / missing	5.3	3.6
Availability of motorized public transport		
In community	63.2	64.6
1 – 4 km	14.5	14.9
5 – 9 km	6.3	8.9
10+ km	11.4	10.4
DK / missing	4.5	1.2
Mobile phone coverage	45.7	93.4

Univariate analysis

Univariate regression analysis was conducted to ascertain the strength and direction of association between various predictors and the outcome status of cases vs controls (i.e. maternal death vs live birth during the last 3 years). The univariate regression was done based on the approach of unconditional using simple logistic regression technique, and then based on conditional logistic regression technique which is an extension of simple logistic regression that is used to analyze the matched data. Crude and adjusted odds ratios along with 95% Confidence Intervals (CIs) were derived (Table 7).

Table 7: Univariate analyses of cases vs controls (PMMS 2019)

| Name of Variables | Univariate Analysis | | | | | |
| | Unconditional logistic regression | | | Conditional logistic regression | | |
	Crude ORs	95% CIs	*p* value	Matched ORs	95 % CIs	*p* value
Region of residence						
Punjab	1	-	-	NA	-	-
Sindh	0.93	(0.57 - 1.55)	**0.802**	NA	-	-
KP	0.94	(0.54 - 1.66)	**0.842**	NA	-	-
Balochistan	0.93	(0.53 - 1.65)	**0.824**	NA	-	-
GB/ AJ&K	0.93	(0.51 - 1.73)	**0.837**	NA	-	-
Place of residence						
Urban	1	-	-	NA	-	-
Rural	1.004	(0.69 - 1.46)	**0.983**	NA	-	-
Age groups (years)						
15-19	1	-	-	1	-	-
20-29	0.35	(0.18 - 0.67)	**0.001**	0.36	(0.19 - 0.68)	**0.002**
30-39	0.74	(0.4 - 1.4)	**0.358**	0.76	(0.4 - 1.46)	**0.417**
40-49	0.75	(0.33 - 1.72)	**0.499**	0.8	(0.34 - 1.86)	**0.597**
Highest class completed						
No education	1	-	-	1	-	-
Middle or less	0.63	(0.40 – 1.01)	**0.054**	0.51	(0.31 - 0.85)	**0.010**
Secondary and higher	0.57	(0.34 – 0.97)	**0.039**	0.40	(0.21 – 0.75)	**0.004**
Ever given birth						
Yes	0.25	(0.13 - 0.47)	**0.00**	0.24	(0.13 - 0.46)	**0.00**
No	1	-	-	1	-	-
Number of children alive						
3 and less	0.48	(0.29 - 0.81)	**0.006**	0.43	(0.25 - 0.75)	**0.003**
Between 4-6	0.68	(0.4 - 1.19)	**0.172**	0.63	(0.35 - 1.13)	**0.119**
7 and above	1	-	-	1	-	-
Ever had a caesarean section operation						
Yes	2.31	(1.52 - 3.5)	**0.000**	2.48	(1.58 - 3.87)	**0.000**
No	1	-	-	1	-	-

| Name of Variables | Univariate Analysis | | | Conditional logistic regression | | |
| | Unconditional logistic regression | | | | | |
	Crude ORs	95% CIs	*p* value	Matched ORs	95 % CIs	*p* value
Did see anyone for antenatal care						
Yes	0.79	(0.47 - 1.30)	**0.35**	0.75	(0.44 - 1.3)	**0.31**
No	1	-	-	1	-	-
Who did she see for antenatal care						
Did not see anyone	1.40	(0.81 – 2.40)	**0.226**	1.56	(0.85 – 2.83)	**0.150**
Obstetrician / Specialist	1	-	-	1	-	-
Doctor	1.18	(0.78 – 1.79)	**0.431**	1.33	(0.81 – 2.19)	**0.262**
Nurse/Midwife	1.14	(0.59 – 2.19)	**0.704**	1.24	(0.62 – 2.48)	**0.544**
Nonskilled Birth Attendants	2.24	(0.68 – 7.37)	**0.186**	2.60	(0.74 – 9.16)	**0.138**
Trimester of pregnancy at first health provider visit						
1st trimester	1	-	-	1	-	-
2nd trimester	1.05	(0.67 – 1.63)	**0.824**	1.01	(0.64 – 1.60)	**0.964**
3rd trimester	1.82	(1.08 – 3.08)	**0.025**	1.82	(1.03 – 3.2)	**0.039**
During last pregnancy had an injection to prevent tetanus						
Yes	0.009	(0.001 – 0.66)	**0.000**	0.009	(0.001 – 0.072)	**0.000**
No	1	-	-	1	-	-
Place of delivery						
Home	1	-	-	1	-	-
Govt. hospital/other public	1.66	(0.97 – 2.85)	**0.064**	2.02	(1.09 – 3.72)	**0.025**
Pvt. Hospital/clinic	1.19	(0.67 – 2.09)	**0.55**	1.34	(0.71 – 2.53)	**0.364**
Assistance at delivery						
Skilled Birth Attendants	2.85	(1.81 – 4.50)	**0.000**	3.26	(2.00 – 5.32)	**0.000**
Others	1	-	-	1	-	-
How was the delivery						
Normal	1	-	-	1	-	-
assisted vaginal delivery	2.83	(1.09 - 7.31)	**0.032**	2.8	(0.97 - 8.04)	**0.056**
caesarean section	1.63	(0.99 - 2.67)	**0.052**	1.78	(1.02 - 3.13)	**0.044**
Total						
Ever Used a Contraceptive method						
Yes	0.23	(0.14 - 0.39)	**0.000**	0.21	(0.12 - 0.36)	**0.000**
No	1	-	-	1	-	-
*Composite complications	0.98	(0.77 - 1.23)	**0.831**	0.95	(0.73 - 1.23)	**0.702**
**Composite Symptoms	1.18	(1.07 - 1.31)	**0.001**	1.21	(1.09 - 1.35)	**0.001**

*Complications include High BP, Diabetes, Anemia & Jaundice during last pregnancy

**Symptoms include Fever, Fits, Vaginal bleeding, Jaundice, Abdominal pain, breathing difficulty, Paleness/Anemia, swelling feet or ankles & Swelling face during last pregnancy/illness

Keeping view of the matching variable of cluster, the conditional logistic regression-based estimates were not generated for the variables of region/province of residence and place of residence (i.e. urban vs rural).

Demographics

The demographic variables for which univariate unconditional logistic regression analysis was conducted included region of residence, place of residence, age group and education of the woman, while conditional logistic estimates were generated for the latter two variables. It was observed that when we retain the youngest age category of 15-19 as reference, the other age categories of 20-29 years, 30-39 years and 40-49 years had a relatively lesser risk of maternal mortality. This implies that woman who conceive in their teen years are at a relatively higher risk of maternal mortality as compared to women aged 20 or older. However, keeping view of the univariate level of analysis, this derivation like other univariate results was indicative and the age variable was considered for the multivariate analysis. Across the education status of women, those who had no education were at relatively higher risk of maternal mortality.

Obstetric History

The obstetric history variables included for univariate regression relate to ever given birth, number of pregnancies, and experience of a caesarian section procedure in the past.

It was observed that women who were primigravida (i.e., women conceiving for the first time) in the most recent pregnancy were more predisposed to dying. Furthermore, women with a higher reproductive health burden (4-6 pregnancies and 7 or more pregnancies) had higher risk as compared to those who had 2-3 pregnancies; while those who had experienced a caesarian section procedure in the past had a nearly two and half times higher odds ratio of mortality (Conditional OR: 2.48) as compared to those who had not experienced a caesarian section operation in the past. From the data available, the direction of causation is, however, difficult to determine as complications in pregnancy or stalled labor may have resulted in caesarian section that resulted in a maternal death, or a caesarian section caused complications due to poor quality of care or misadventure.

Antenatal Care use (ANC)

Among the available variables across both cases and controls datasets were segments related to seeking ANC during the most recent pregnancy, the type of ANC provider, the trimester of pregnancy when 1st ANC visit was done and having received the tetanus toxoid (TT) injection during the most recent pregnancy.

The univariate regression analysis indicated that those who had not sought ANC during the most recent pregnancy were at a higher risk of dying. For the variable of type of care provider, when retaining the Obstetrician/Gynecologist as the reference category, all other types of care providers reflected a higher predisposition towards mortality with the greatest risk of nearly 2.5 times observed for those who sought ANC from non-skilled care providers (Dai/TBA and dispenser) (OR: 2.60). Timing of first ANC visit was categorized across the trimesters of pregnancy. Keeping the 1st trimester as the reference category, it was observed that those women who had their first ANC visit late in the pregnancy (i.e. in 3rd trimester) had the highest comparative risk (OR: 1.82) as compared to those who visited in the 1st

trimester or the 2nd trimester. Those who received protection against tetanus during the most recent pregnancy had a strong protective effect as compared to those who did not (OR: 0.009).

Natal care

Regression analysis for the uniformly available variables across the cases and controls for natal care was conducted on the place of delivery, type of assistance at the time of delivery, and the mode of delivery. Keeping view of the limited number of cases and maintaining as high number of categories of each variable as permissible (i.e. avoiding sparsity of data), the respective variables were finalized to have dichotomous or three categories. The univariate regression reflected that those who had delivered at a government health facility or private health facility had a higher risk of adverse outcome of maternal death compared to those who delivered at home. In this milieu, having skilled attendance at the time of delivery carried a higher risk of mortality compared to one that included an unskilled or unknown attendant. This is in contrast to the type of provider for ANC visit as noted above. Furthermore, those who had a normal vaginal delivery were at lesser risk of adverse outcome as compared to those who had an assisted delivery or caesarian section.

Ever use of Contraceptives

As documented through the descriptive analysis, the univariate regression analysis also reflected a protective effect of past contraceptive use on maternal death. The protective effect at this stage of analysis was marked across both unconditional (OR: 0.23) and conditional logistic regression (OR: 0.21).

Symptoms and complications during last pregnancy

Univariate regression analysis for the composite variables of symptoms and complications provided useful insights about the relationship of experiencing complications/co-morbidities or severe symptoms during the last pregnancy. It was observed that those who had experienced symptoms related to Fever, Fits, Vaginal bleeding, Jaundice, abdominal pain, breathing difficulty, paleness/anemia, swelling feet or ankles and/or swelling of face during the last pregnancy/illness had a greater predisposition to maternal mortality. The composite variables were included in the conditional multivariate regression, for deriving a parsimonious model, that explained the variability for the occurrence of maternal mortality, in a statistically robust manner for the available set of variables, as assessed through the Hosmer and Lemeshow goodness of fit testing of the multivariate model.

Multivariate Analysis

A parsimonious multivariate logistic regression model (Table 8) was developed with adjusted ORs generated on the basis of results from un-conditional regression. The parsimonious model was tested for Goodness of Fit, to ascertain if a statistically robust model had been generated. Based on the Hosemer and Lemeshow Goodness of Fit test results (p-value < 0.938), the model was finalized. The same set of variables were then used to execute the conditional multivariate logistic regression to generate Matched Adjusted Odds Ratios. Variables shown in Table 8 were retained for the final model.

Table 8: The Multivariate Conditional Logistic and Unconditional Logistic regression model for predictors of Maternal Mortality (PMMS 2019)

Name of Variables	Conditional logistic regression (N=871)			Unconditional logistic regression (N=871)			Goodness of fit
	Matched Adjusted ORs	95% CIs	*p* value	Adjusted ORs	95 % CIs	*p* value	
Age groups (years)							
15-19	1	-	-	1	-	-	
20-29	0.50	(0.23 – 1.07)	0.075	0.47	(0.21 - 0.93)	0.031	
30-39	1.34	(0.61 – 2.95)	0.467	1.24	(0.59 – 2.61)	0.564	
40-49	1.21	(0.42 – 3.45)	0.726	1.06	(0.40 – 2.83)	0.912	
Highest class completed							
No education	1	-	-	1	-	-	
Middle or less	0.51	(0.27 – 0.98)	0.042	0.57	(0.33 - 0.99)	0.046	
Secondary and higher	0.35	(0.17 – 0.74)	0.006	0.49	(0.27 – 0.90)	0.021	N= 871
Ever given birth							Hosmer and lemeshow Goodness of fit – test statistics (chi²) = 62.39
Yes	0.19	(0.09 – 0.39)	0.000	0.21	(0.10 – 0.45)	0.000	
No	1	-	-	1	-	-	
Ever had a caesarean section operation							
Yes	2.05	(1.18 - 3.55)	0.011	2.22	(1.35 - 3.66)	0.002	
No	1	-	-	1	-	-	p value = 0.9380 (model is good fit)
During last pregnancy had an injection to prevent tetanus							
Yes	0.007	(0.001 – 0.06)	0.000	0.005	(0.001 – 0.046)	0.000	
No	1	-	-	1	-	-	
Assistance at delivery							
Skilled Birth Attendants	4.07	(2.19 – 7.57)	0.000	4.13	(2.32 – 7.35)	0.000	
Others	1	-	-	1	-	-	
Ever Used a Contraceptive method							
Yes	0.21	(0.11 - 0.39)	0.000	0.22	(0.12 - 0.39)	0.000	
No	1	-	-	1	-	-	

Matching variables in relation to urban – rural status and province of residence were retained in the model as matching variables

Women who belonged to the age groups of 30-39 years, and 40-49 years were at a relatively higher risk of mortality as compared to the youngest age group of adolescent women of 15-19 years (Matched Adjusted OR 1.34 and 1.21 respectively); with the age group of 30-39 years having the highest predisposition towards mortality across all age groups. However, women in age 20-29 had relatively the least risk (Matched Adjusted OR 0.5). The education status of women reflected that as compared to those who had no formal education, women with middle or less education, and secondary or higher education were at a lower risk of mortality (Matched Adjusted ORs 0.51 and 0.35, respectively).

Women who had ever given birth were at a lower risk than those who had never given birth or who were primigravida (Matched Adjusted OR 0.21); thus, reflecting that the primigravida women were nearly 5 times at higher risk of maternal mortality as compared to those who had given birth before.

In this milieu, women who had had a Caesarian section procedure in the past were at a relatively higher risk (Matched Adjusted OR 2.05) in relation to those who had never had a Caesarian section procedure in the past. Having received protection against tetanus during the last pregnancy had a marked protective effect against adverse maternal outcome (Matched Adjusted OR 0.007).

Results for the type of birth attendant at the last pregnancy showed an unusual pattern, in the sense that women who had a skilled birth attendant were at a markedly higher risk (Matched Adjusted OR 4.07) of adverse maternal outcome as compared to those who were attended by others. Part 2 provides the evidence for this counterintuitive finding. Women with serious pregnancy complications were often turned away by other providers sought care eventually from the skilled birth attendant too late to save their lives. This selectivity of women with high risk of maternal death accessing delivery care from skilled attendant partially explains the unexpected positive association between maternal mortality and skilled birth attendant. Part 2 further examines the potential factors contributing to higher maternal mortality among those who had the delivery by skilled birth attendant.

Ever-users of contraception were found to be at a lower risk of adverse maternal outcome (Matched Adjusted OR 0.21) as compared to never-users even when confounding effects of other factors are controlled.

Contextual determinants of maternal morbidity and mortality in 2006-07 and 2019

## Maternal Survival by Region and Place of Residence

Provinces and regions with diverse socio-economic, ethnic, and linguistic features constitute the federation of Pakistan. With the passage of the Eighteenth Amendment to Pakistan's constitution in 2010, the devolution of power to provinces/regions also included, among others, responsibilities for health and welfare of its people. It is, therefore, useful to provide estimates of MMRs by province/region and place of residence, to document the progress made thus far and identify the gaps in reaching the SDG goals, the 2019 decisions of the Council of Common Interests (CCIs) and Vision 2025 goals and targets. PMMS 2019 and Pakistan Demographic Health Survey (PDHS) 2006-07 used a similar methodology of verbal autopsy (VA) to identify maternal deaths. Altogether, 1,177 verbal autopsies were conducted in 2019 PMMS and 1,062 in PDHS 2006-07 from across Pakistan to collect information regarding women aged 15-49 who died within three years preceding the survey.

PMMS estimated the MMR for the three-year period preceding the survey as 186 (95% CI: 138-234) nationally (excluding Azad Jammu and Kashmir and Gilgit Baltistan), down from 276 per 100,000 livebirths during the three years prior to PDHS 2006-07 (Figure 4)[17]. Among the provinces, Balochistan had the highest MMR of 298 (CI: 130-466) whereas Punjab the lowest at 157 (CI: 79-235) in 2019 (Figure 5).

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[17] National Institute of Population Studies (NIPS) [Pakistan], and Macro International Inc. 2008. Pakistan Demographic and Health Survey 2006-07. Islamabad, Pakistan: National Institute of Population Studies and Macro International Inc.

National Institute of Population Studies (NIPS) [Pakistan] and ICF. 2020. Pakistan Maternal Mortality Survey 2019. Islamabad, Pakistan and Rockville, Maryland, USA: NIPS and ICF.

Figure 4: Maternal Mortality Ratio per 100,000 livebirths, by Survey period and Province
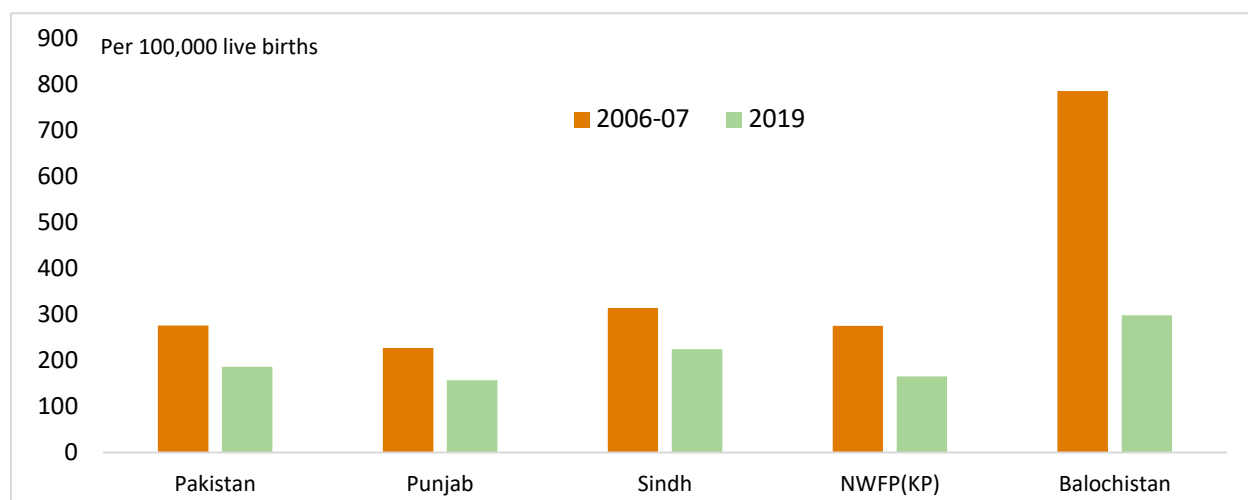
Source: Pakistan Demographic and Health Survey 2006-07 and Pakistan Maternal Mortality Survey 2019.

Figure 5: Maternal mortality ratio (MMR) with 95% Confidence Intervals, by Region, 2019
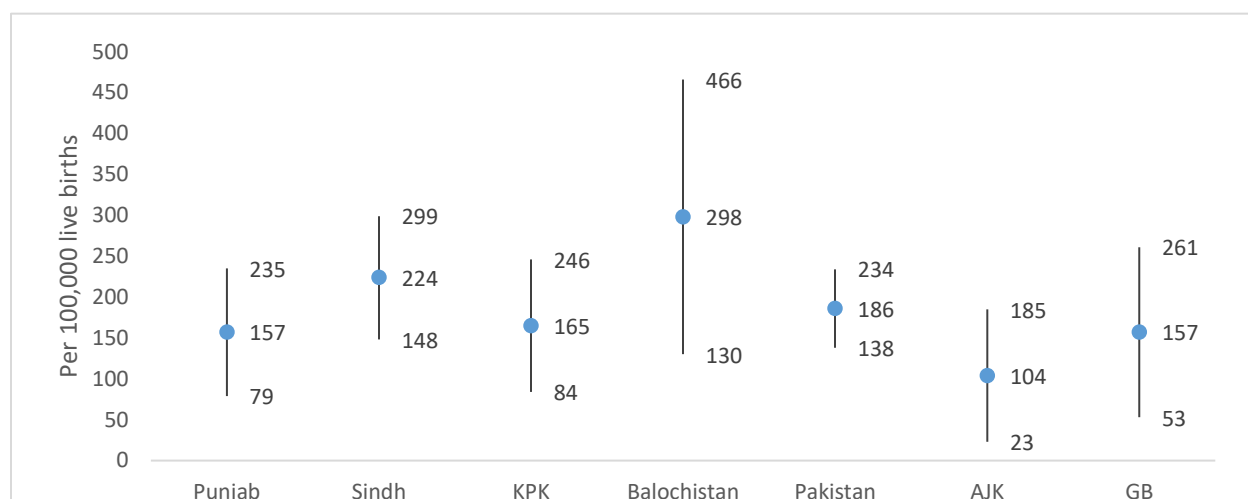
Source: Pakistan Maternal Mortality Survey, 2019.
Total figures for Pakistan exclude Azad Jammu and Kashmir and Gilgit Baltistan.
KP=Khyber Pakhtunkhwa; AJK=Azad Jammu and Kashmir; GB=Gilgit Baltistan
MMRs refer to a period of three years before the survey

As Figure 4 shows, MMRs declined in all four provinces in 2019 as compared to 2006-07, with Balochistan showing the most substantial drop from 785 in 2006-07 to 298 leading to a reduction of 487 deaths per 100,000 livebirths. However, the estimates for Balochistan are prone to fluctuation due to its relatively small sample size. There were 90 fewer deaths per 100,000 live births in 2019 nationally and in Sindh compared to 2006-07. The decrease in maternal deaths was notably the least in Punjab (70) while Khyber Pakhtunkhwa witnessed a decrease of 110 maternal deaths per 100,000 livebirths. Note that the 95% confidence intervals for all regions indicate that the MMR differences between regions were not statistically significant in 2019 PMMS. Also, the evidence of decline from

2006-07 to 2019 does not take into account the statistical uncertainty in the estimates from the two surveys.

Ahmed et al. (2012) estimates that 40-42% of maternal deaths in Pakistan can be averted by family planning[18]. Contraceptive use of any method in 2017-18 in Balochistan was the lowest (20%) amongst all provinces and about half of the rate in Punjab (38%) (National Institute of Population Studies (NIPS) and Macro International, 2019)[19]. Fewer than 3 of 20 married women of reproductive age of 15-49 were using a modern method in Baluchistan at the time of PDHS 2017-18.

MMR declined from 175 in 2006-07 to 158 per 100,000 livebirths in 2019 in urban as compared from 319 to 199 in rural areas during the same period (Figure 6). These MMRs imply that there were 17 fewer deaths per 100,000 livebirths in urban and 120 in rural areas in 2019 compared to 2006-07.

Figure 6: Maternal Mortality Ratio per 100,000 livebirths, by Survey period and Place of Residence
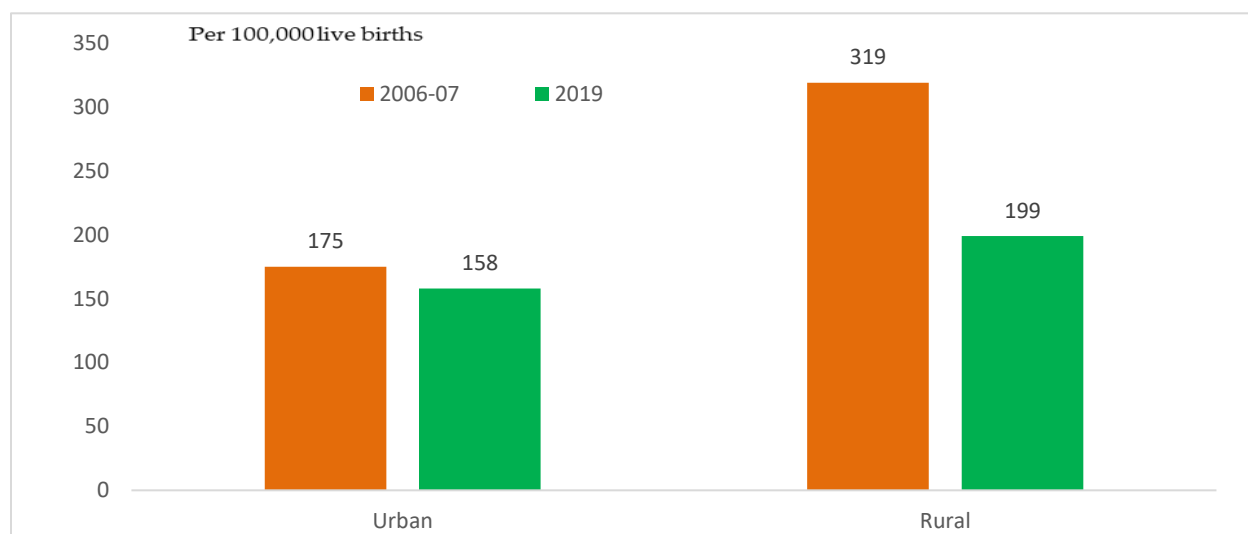
Source: Pakistan Demographic and Health Survey 2006-07 and Pakistan Maternal Mortality Survey 2019

Obstetric hemorrhage was the leading cause of maternal deaths (41%) in 2019, followed by hypertensive disorders in pregnancy, childbirth, and the puerperium (29%). Spontaneous or induced abortions accounted for 10% while pregnancy-related infections for another 6% of maternal deaths. Four percent of maternal deaths were due to non-obstetric (indirect) complications. The proportion of maternal deaths due to pregnancy-related infections declined from 14% in 2006-07 to 6% in 2019. However, the proportion of maternal deaths because of hypertensive disorders increased from 10% in 2006-07 to 29% in 2019 and deaths due to obstetric hemorrhage from 33% in 2006-07 to 41% in 2019.

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[18] Ahmed S., Li Qingfeg, Liu L., and Tsui A. O. 2012. Maternal deaths averted by contraceptive use: an analysis of 172 countries. Lancet, 380:111-25. http://dx.doi.org/10.1016/S0140-6736(12)60478-4.
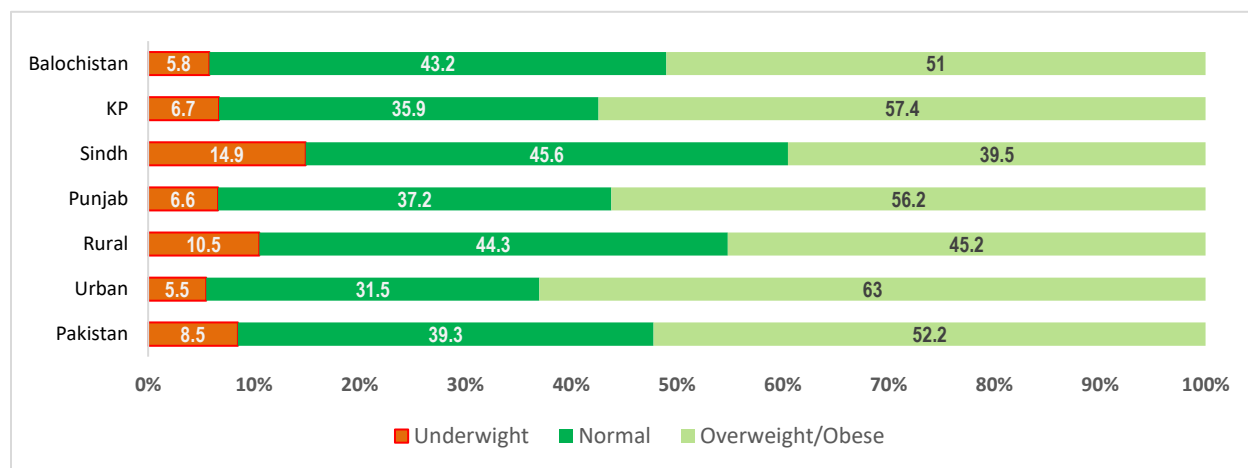
[19] National Institute of Population Studies (NIPS) [Pakistan] and ICF. 2019. Pakistan Demographic and Health Survey 2017-18. Islamabad, Pakistan, Rockville, Maryland, USA: NIPS and ICF.

Nutritional status of women and maternal morbidity as risk factors

Both anemia and abnormal weight are risk factors for pregnancy. Severe anemia increases the risk of blood loss during labor, preterm delivery, low birth weight, and perinatal mortality and, thus, endangering the life and wellbeing of both the mother and the newborn. Being undernourished or overweight and, especially, obese are detrimental to safe pregnancy and childbirth. Being obese during pregnancy increases the risk of preeclampsia, gestational diabetes, miscarriage, stillbirth and recurrent miscarriage. No information was collected on the nutritional status of women in PMMS. However, PDHS 2017-18 and National Nutritional Survey (NNS) 2018 (UNICEF, 2019)[20] collected these data.

PDHS 2017-18 measured the nutritional status of women by using anthropometric indices of height and body mass and calculated body mass index (BMI) by dividing the weight in kilograms (kg) by height in meters squared (kg/m²) (Figure 7). The survey collected height and weight of 4,690 ever-married women aged 15-49 who were not pregnant or had given birth in the 2 months preceding the survey. Overall, 9% of women were underweight (BMI less than 18.5), 39% had normal BMI between 18.5 and 24.9, 30% were overweight (BMI between 25.0 and 29.9) and 22% were obese (BMI greater than or equal to 30.0). The proportion of women underweight declined from 14% in 2012-13 to 9% in 2017-18, but the proportion overweight and obese increased from 40% to 52% during the same period (National Institute of Population Studies (NIPS) and ICF, 2019).

Figure 7: Percentage of Ever-Married Women 15-49, by Nutritional Status, Province and Place of Residence, Pakistan, 2018-19.


Source: National Institute of Population Studies (NIPS) and ICF, 2019.

By province (Figure 8), Sindh had the highest number of underweight women (14.9%) and Baluchistan the least (5.8%). More women in KP (57.4%) and Punjab (56.2%) were overweight or obese than in Baluchistan (51%) and Sindh (39.5%). Urban-rural differences show that twice as many women in rural areas (10.5%) were underweight than their counterpart in urban areas (5.5%). However, more women in urban areas were overweight or obese (63%) than in rural areas (45.2%). While malnourishment is higher among women in rural areas, overweight and obesity are higher among women in urban areas.

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[20] UNICEF. 2019. National Nutritional Survey 2018: Key Findings Report. Islamabad: UNICEF.

Figure 8: Neonatal, infant and child (<5) mortality per 1,000 livebirths in the last five years, 1990-91 to 2017-18
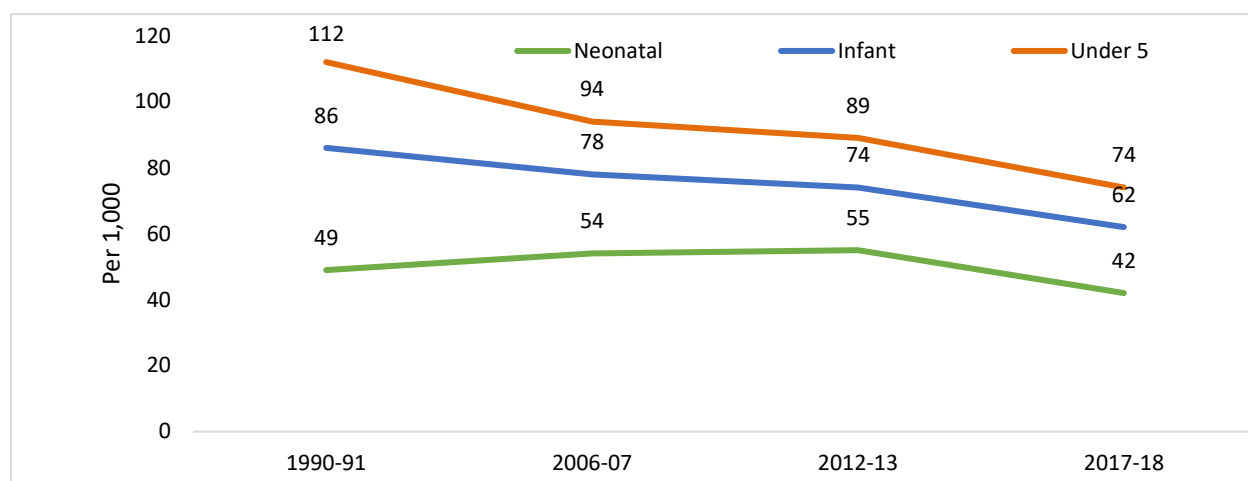
NNS 2018 measured the micronutrient deficiencies in women of reproductive age (15-49 years). In 2018, 1.0% had severe anemia (<7gm/dL) and 41.7% had moderate anemia (7-11.99gm/dL) while the remaining 57.3% were normal (UNICEF, 2019). The proportions of women with severe and moderate anemia declined from 1.6% and 48.9% in 2011, respectively. The proportion of anemic women was slightly higher in rural (44.3%) than in urban areas (40.2%).

Appropriate interventions for adequate nutrition and for treating anemia are critically needed for safe pregnancy and delivery.

Neonatal Mortality and its correlation with maternal morbidity and mortality

Poor health and nutrition, along with the lack of quality care, expose women to high risk of pregnancy complications and death, but also to their newborns, if they are born alive. Perinatal asphyxia – a major cause of neonatal deaths in Pakistan – can occur due to such maternal events as hemorrhage, amniotic fluid embolism; hemodynamic collapse or the poor quality of care leading to acute abruption of placenta, uterine rupture, or intrapartum infection. As Table 1 in the Introduction section shows, neonatal mortality (i.e., the probability of dying in the first month of life per 1,000 livebirths) in Pakistan is the highest among the six countries (Bangladesh, India, Iran, Nepal, Pakistan, and Sri Lanka).

From 1990-91 to 2017-18, neonatal mortality witnessed the least decline compared to infant and under five mortality (Figure 8). The levels of neonatal mortality were higher for males than for females and lower for urban than for rural areas, across all periods (Table 9). The regional mortality rates fluctuated over the last 27 years. In 2017-18, Punjab had the highest levels of neonatal (51) mortality compared to any other province[21]. During the same period, the neonatal mortality was the lowest (34) in Balochistan. A large proportion of infant deaths in Pakistan occur during the neonatal period. The contribution of neonatal deaths to infant mortality ranged from 52% in Balochistan, 63% in Sindh and

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[21] National Institute of Population Studies (NIPS) [Pakistan], and Macro International Inc. 2008. Pakistan Demographic and Health Survey 2006-07. Islamabad, Pakistan: National Institute of Population Studies and Macro International Inc.

68% in Punjab to 79% in KP. Overall, 68% of infant mortality in Pakistan in 2017-18 resulted from neonatal deaths (National Institute of Population Studies (NIPS) and ICF, 2019).

Table 9: Neonatal and infant mortality rate per 1,000 live births with 95% Confidence Interval (CI), by background characteristics, 1990-91 to 2017-2018

Characteristics	1990-91		2006-07		2012-13		2017-18	
	Neonatal (95% CI)	IMR (95% CI)	Neonatal (95% CI)	IMR (95% CI)	Neonatal (CI)	IMR (CI)	Neonatal (CI)	IMR (CI)
Sex								
Male	57 (44 - 69)	95 (81 - 113)	60 (51 - 69)	83 (72 - 94)	57 (48 - 66)	75 (65 - 85)	52 (44 - 60)	71 (61 - 82)
Female	41 (32 - 49)	76 (33 - 46)	47 (39 - 55)	72 (62 - 81)	53 (44 - 62)	72 (62 - 83)	33 (25 - 41)	53 (43 - 64)
Place of residence								
Urban	39 (30 - 48)	69 (57 - 82)	50 (39 - 61)	66 (53 - 79)	39 (31 - 48)	54 (45 - 63)	37 (29 - 46)	50 (41 - 60)
Rural	53 (42 - 64)	94 (78-109)	55 (49 - 61)	83 (73 - 92)	61 (53 - 70)	81 (72 - 91)	45 (36 - 54)	68 (57 - 79)
Region*								
Punjab	58 (48 - 69)	104 (90 - 119)	58 (51 - 66)	81 (72 - 90)	63 (56 - 71)	88 (80 - 96)	51 (42 - 59)	73 (62 - 83)
Sindh	44 (36 - 53)	81 (68 - 93)	53 (45 - 61)	81 (71 - 92)	54 (46 - 62)	74 (65 - 83)	38 (31- 44)	60 (47 - 74)
NWFP/KP	48 (37 - 59)	80 (59 - 100)	41 (33 - 49)	63 (52 - 73)	41 (30 - 52)	58 (46 - 70)	42 (32 - 52)	53 (41 - 65)
Balochistan	46 (16 - 76)	72 (32 - 113)	30 (41 - 57)	49 (34 - 64)	63 (50 - 76)	97 (77 - 117)	34 (20-47)	66 (41 - 91)
Total	**49 (41 - 57)**	**86 (74 - 98)**	**54 (47 - 60)**	**78 (70 - 85)**	**55 (48 - 62)**	**74 (66 - 81)**	**42 (36 - 49)**	**62 (54- 71)**

NA=Information not available. CI=95% Confidence Interval. IMR=Infant mortality rate.

*Based on births in the preceding 10 years; Neonatal mortality refers to the probability of dying within the first month of birth and infant mortality within the first year of birth per 1,000 live births, based on births during the five years before the survey.

Source: Various Pakistan Demographic and Health Surveys from 1990-1991 to 2017-18, National Institute of Population Studies (NIPS) and Macro International, 2008; 2020.

A prospective study [The Alliance for Maternal and Newborn Health Improvement (AMANHI) Mortality Study Group, 2018][22] that included two sites in Pakistan, among 11 research sites in South Asia and sub-Saharan Africa, found a neonatal mortality rate of 46.9 (95% confidence interval (CI) 44.4-49.4)

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[22] The Alliance for Maternal and Newborn Health Improvement (AMANHI) mortality study group. 2018. Population-based rates, timing, and causes of maternal deaths, stillbirths, and neonatal deaths in south Asia and sub-Saharan Africa: a multi-country prospective cohort Lancet Glob Health, 6: e1297–308.

per 1,000 live births in Matiari and 50.1 (CI: 46.9-53.4) in Karachi. These rates were higher than those for sites in India (Haryana: 40 and Uttar Pradesh 41.7 per 1,000 live births). The two leading causes of neonatal deaths were: (1) perinatal asphyxia (43% in Matiari and 40% in Karachi) and, (2) severe neonatal infection, including neonatal pneumonia, sepsis, or meningitis (32% in Matiari and 29% in Karachi).

Data Limitations

Data for both cases (deceased women in 3 years before the survey) and controls (women with a live birth in 3 years before the survey) were extensive, including information on a sizeable number of maternal and child health related indicators. However, the datasets lacked in completeness of reporting and in consistency of variables uniformly across cases and controls which was the main reason of excluding some of those indicators in our analysis which we had initially thought of (primarily Intermediate level determinants). One such example is the lack of information on three delays for controls. Part 2 examines the role of three delays in maternal deaths (cases). Also, the analysis of short birth spacing as the risk factor could not be undertaken due to few cases.

Estimating maternal mortality and its risk factors require an exceptionally large sample size that is often not feasible due to cost and required logistics. To keep the sample size within manageable limits, a three-year recall of births and deaths was used in PDHS 2006-07 and PMMS 2019. This approach has problems in that the recall of deaths may have declined during the second and third years as compared to the last year before the survey, presumably due to recall errors, misreporting of dates, and/or dissolution or change in the composition of households. It is, therefore, possible that recall errors for the second or third year before the survey led to underreporting of maternal deaths. Also, information on the causes and circumstances of deaths ascertained through the verbal autopsy may be less reliable for deaths that occurred in the second or third years of recall.

Another challenge encountered in the analysis was the missing information or a "Don't Know" response among categories of some variables that were around 10 percent at maximum in one, or a couple of variables among all those that have been analyzed. A conservative approach was used to overcome this problem by merging those missing numbers into the most plausible categories because the sparsity of data for cases would have otherwise limited our capacity to conduct meaningful analyses.

Another potential limitation is the intentional or unintentional misreporting. Given the cultural sensitivity, induced abortions are notoriously underreported or misreported, especially in the restrictive legal contexts such as Pakistan. It is, therefore, possible that some of the induced abortions were either not reported or reported as miscarriages.

Notwithstanding these constraints, the PMMS 2019 and PDHS 2006-07 offer rich and valid data and provide highly relevant information for evidence-based policymaking. In addition, with the application of a matched nested case control study design, one can reasonably assume similar quality and coverage of information across all the indicators at cluster level and, thus, adding statistical rigor to the study results.

Policy Implications

Maternal mortality declined in Pakistan nationally, in all regions and in urban-rural place of residence. Compared to 2006-07, progress was also noted in 2019 for an increase in literacy rate and higher educational attainment, especially in rural areas. The coverage of mobile phones in rural areas also doubled from 46% in 2006-07 to 93% in 2019. Higher order (6 or more) births declined from 22% to 15%; 4 or more ANC visits nearly doubled from 28% to 52% as well as the visit to obstetrician/gynecologist and doctor for ANC from 33% to 60%.

This progress has been, however, slow and uneven. Women in rural areas, with no education and those living in Balochistan continue to suffer excessive risk of maternal death than their counterparts in urban areas, living in other regions of Pakistan or educated, especially those attaining higher levels of education. In addition, little progress has been made in rural infrastructure in terms of improved access to the nearest functioning basic health unit, rural health centre (RHC), secondary/tertiary hospital or the availability of motorized public transport. The finding that women with the last delivery by a skilled birth attendant had higher odds of maternal death is counterintuitive, though consistent in both PDHS 2006-07 and PMMS 2019. Part 2 of this Report explains this finding using the framework of "three delays", together with the pattern of medical or surgical misadventures.

Despite a positive trend of improved maternal survival, the 2019 estimates of MMR show that Pakistan has a long way to go to meet the SDG 3 global target 3.1 and the commitment Pakistan made at the 2019 Nairobi Summit (ICPD25) for MMR of less than 70 maternal deaths per 100,000 live births by 2030. Therefore, concerted efforts are needed to avert preventable maternal deaths as a priority human rights and public health imperative.

This in-depth analysis of determinants of maternal mortality suggests a number of implications for programs and policies. First, regions and groups with higher maternal mortality burden must be prioritized for policies and programs. These include Balochistan, rural areas, women with no education, women who never used a contraceptive method, women who do not get injection in pregnancy against tetanus, and women who do not or seek ANC later in pregnancy. Second, programs should focus on the symptomology during pregnancy that is the rarely touched area in the context of maternal mortality. Third, Lady Health Workers (LHWs) and other skilled providers should be trained in counselling and provision of services for ANC care, injection against tetanus, and nutrition needs as well as family planning. Taking advantage of the high mobile phone coverage together with high percentage of pregnant women attending ANC, mHealth approaches complemented by home visit by LHWs and Community Midwives (CMWs) can improve the provision of information and access to timely and quality care. Fourth, the coverage and quality of care across the continuum from pre-pregnancy to post-partum period need to be expanded for improved maternal, neonatal and child health outcomes. Fifth, as shown in this and other studies, contraceptive use is amongst the most effective intervention to decrease pregnancy and maternal risks with spinoff effects, through increased birth spacing, on reducing neonatal and infant mortality. Therefore, contraceptive information should be integrated with ANC and postpartum counselling and services as well as part of LHWs priorities for home visits. For sustainable impact, additional resources need to be devoted to education of women and for MNCH programs. The required investment may be large, but the cost of inaction or poor investment can be enormous. The lack of progress from PMMS 2019 implies a lifetime risk resulting in 1 in 143 women in Pakistan to die during her lifetime due to complications during pregnancy, childbirth/abortion, or the postpartum period.

Annex 1

ASSESMENT PROCESS

In order to achieve the study objectives, the process was bifurcated across two broader phases, namely the inception phase and the consultations-analysis-report preparation phase (Table 10 and Figure 11).

Table 10 : Phases and outputs of the assignment

	Inception Phase		
Output 1	1. Inception meetings with the Population Council team and NIPS team, and acquisition of related documents 2. Parameters of analysis discussed and agreed		
Output 2	1. Plan of Analysis developed 2. Plan of Analysis endorsed by the Technical Advisory Group 3. Overall PMMS dataset made available by NIPS		
	Consultations, analysis and report preparation phase		
Output 3	1. Dataset preparation by Population Council team 2. Finalization of variables according to the uniform availability across cases database and controls database through a 3-stage process 3. Iterative processes for deriving descriptive based refinement of data needs/cleaning and merging for analysis 4. Cluster matched dataset (1:5 case to controls) finalized and merged 5. Descriptive analyses completed and shared		
Output 4	Univariate and multivariate regression analyses completed		
Output 5	Draft and final reports		

Inception Phase

The inception phase of the assignment was divided across the following key set of activities:

1. Team meetings and review of related documents.
2. Parameters of exercise discussed and agreed.
3. Plan of Analysis developed.
4. Plan of Analysis endorsed by the Technical Advisory Group.

Inception meetings and parameters of exercise discussed and agreed

Initial consultative and exploratory meetings to have common understanding and mutual agreement of the assignment's analysis parameters were conducted during the early part of the inception phase of the assignment. The meetings were to understand the priorities for the assignment, as well as to have insights of key domains of potential predictors for maternal mortality, and to group these predictors across the broader proposed segments of distant, intermediate and proximate determinants. This initial framework was informed by a focused review of literature on maternal mortality in Pakistan and elsewhere.

More specifically, we considered the conceptual framework proposed by McCarthy and Maine published in 1992[23] for analyzing the determinants of maternal mortality and morbidity. They termed Socio-economic and Cultural Factors as *Distant Determinants*; and group health status, reproductive status, access to health services, health care behavior/use of health services under *Intermediate Determinants*; while pregnancy, complications and death/disability as *Outcomes*. Intermediate Determinants were postulated to directly impact the Outcomes while Distant Determinants impacted indirectly through Intermediate Determinants. McCarthy and Maine also indicated Unknown and Unpredicted Factors that can directly impact on complications. They further elaborated a list of indicators (variables) under each component of determinants.

More recently, Filippi et al (2018)[24] outlined a detailed framework of maternal mortality and its determinants. Their Maternal Mortality Measurement (MMM) framework covers Laws and Policies, Health System and Quality of Care, Pre-existing Socioeconomic Status and Health Status (medical conditions). This framework emphasized the broad implications and consequences of maternal morbidity and mortality and underlined the type of measurements that take into account what matters to women, service providers, and policy makers. Additional insights from Cleland et al [25], Hanif et al[26], Midhet, Durrani and Jaffery[27], and others contributed to the development of the framework. We suggest that Distant Determinants impact on the Outcome of maternal death through Intermediate and Proximate Determinants while Proximate Determinants directly affect the outcome.

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[23] McCarthy, James and Deborah Maine. 1992. A framework for analyzing the determinants of maternal mortality. *Studies in Family Planning;* 23(1): 23-33.

[24] Filippi, Veronique, Doris Chou, Maria Barreix, Lale Say on behalf of the WHO Maternal Morbidity Working Group (MMWG), 2018. A new conceptual framework for maternal morbidity. *Int J Gynecol Obstet*; 141 (Suppl. 1): 4–9.

[25] Cleland, John, Agustin Conde-Agudelo, Herbert Peterson, John Ross, Amy Tsui. 2012. Contraception and health. *The Lancet*; 380 (9837): 149-156.

[26] Hanif, Muhammed, Siddra Khalid, Akhtar Rasul, and Khalid Mahmood. Maternal Mortality in Rural Areas of Pakistan: Challenges and Prospects. Chapter in *IntechOpen.*

[27] Midhet, Farid, Durrani Sabina, and Sadiqua Jaffery. Maternal Mortality. "Women and Children's Health An In-depth Analysis of 2006-07 Pakistan Demographic and Health Survey Data".

Figure 11: Initially proposed groups of predictors for MMR in-depth analyses

Initial Framework considerations for analyzing maternal death
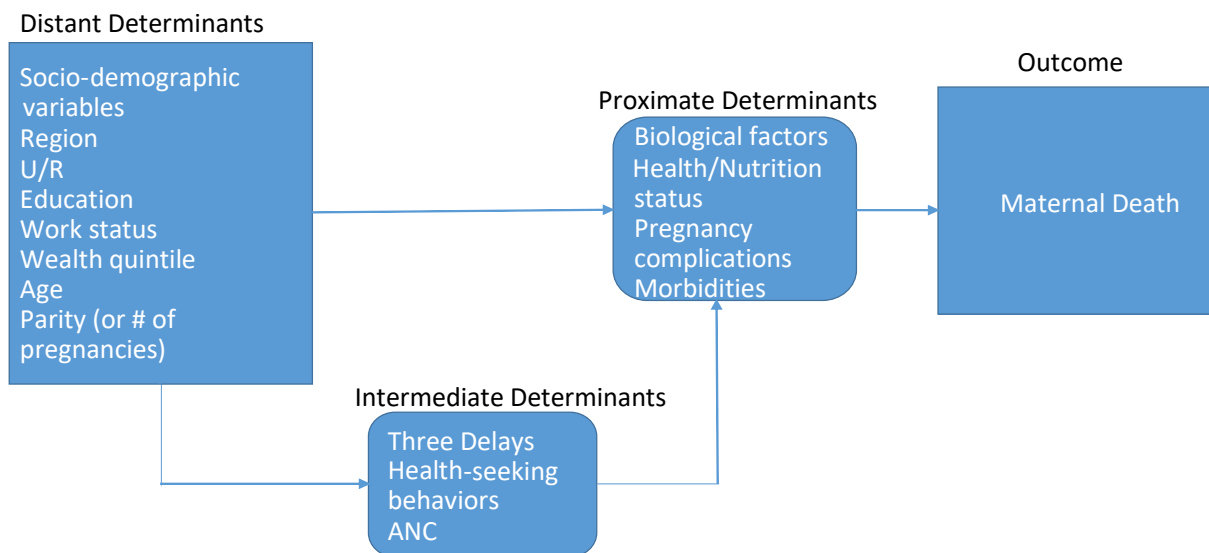
It is pertinent to mention, however, that in the later stages of the assignment, due to non-availability and non-uniformity of the information on three delays across the respective cases and controls datasets, the intermediate determinants were not analyzed, but covered for deceased women in Part 2 of this Report.
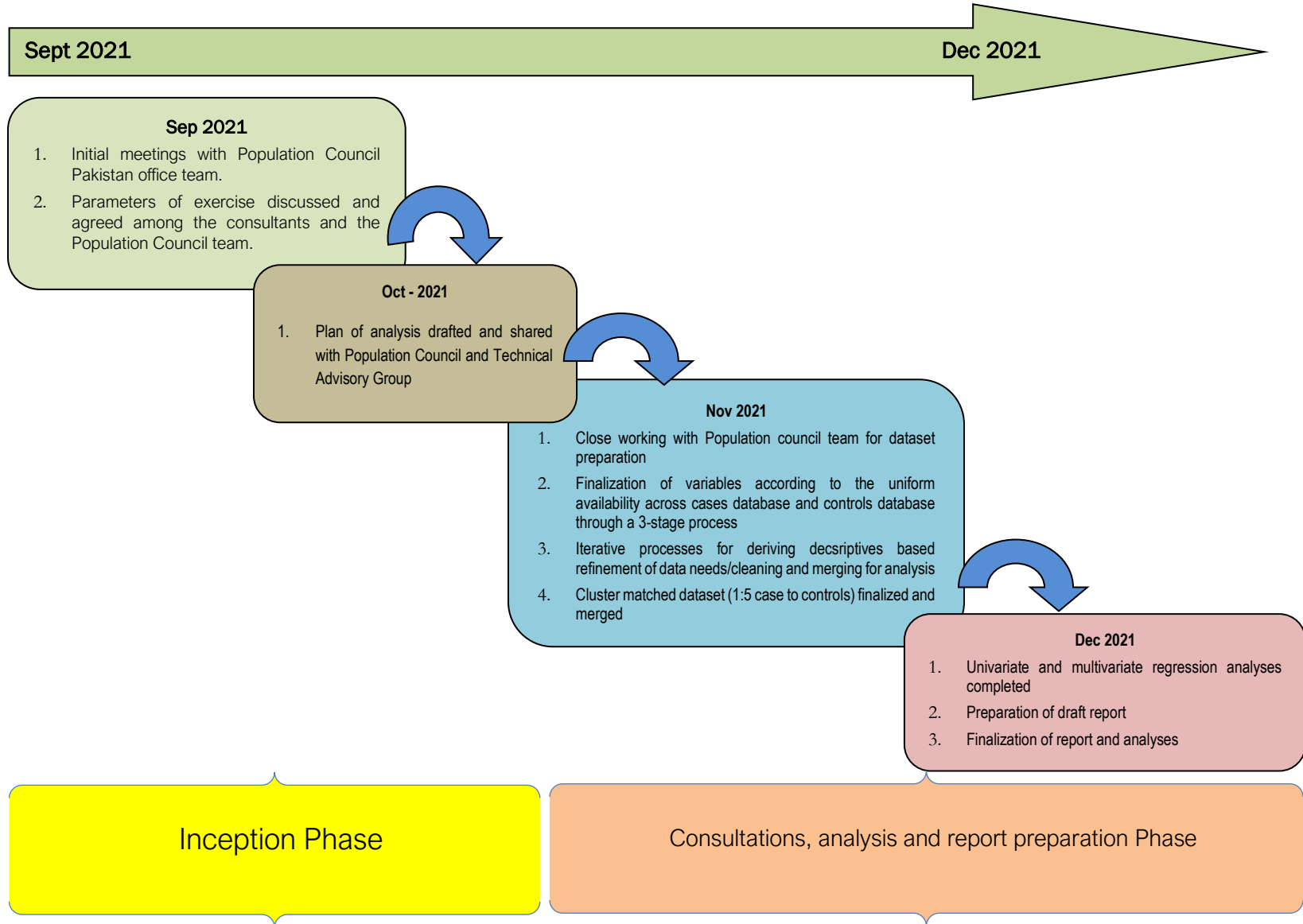
In this regard, another proposed segmented approach for domains of predictors was structured (Table 11).

Table 11: Initial proposed domains of analysis for predictors of Maternal Mortality

Women-Level Risk Factors	Demographic and Socioeconomic Characteristics	Community-Level Risk Factors in Rural Areas
Age at birth, parity	Socioeconomic status of the household	Distance to the nearest primary health facility
History of pregnancy loss	Education level of the woman and her husband	Secondary/tertiary hospital
Skilled birth attendance at last delivery	Residence (major urban, other urban, rural)	Availability of motorized public transport
Antenatal care in current pregnancy	Province/region	Mobile phone coverage
Place of last delivery		Presence of a Lady Health Worker (LHW) in the village

However, the combined merged dataset for cases and controls did not include information on community level risk factors uniformly, and hence the said domain of predictors had to be dropped from the scope of analysis of matched dataset.

Phase-wise layout of the assignment and work plan

Sept 2021 → Dec 2021

Sep 2021
1. Initial meetings with Population Council Pakistan office team.
2. Parameters of exercise discussed and agreed among the consultants and the Population Council team.

Oct - 2021
1. Plan of analysis drafted and shared with Population Council and Technical Advisory Group

Nov 2021
1. Close working with Population council team for dataset preparation
2. Finalization of variables according to the uniform availability across cases database and controls database through a 3-stage process
3. Iterative processes for deriving decsriptives based refinement of data needs/cleaning and merging for analysis
4. Cluster matched dataset (1:5 case to controls) finalized and merged

Dec 2021
1. Univariate and multivariate regression analyses completed
2. Preparation of draft report
3. Finalization of report and analyses

Inception Phase

Consultations, analysis and report preparation Phase

Consultations, analysis, and report preparation phase

This phase was structured across the following process steps:

1. Meetings and data/documents acquisition from the National Institute of Population Studies for the merged case-controls PMMS data, in relation to maternal deaths line data that was cluster-matched with controls with a ratio of 5 controls per case.

2. Iterative analyses based on descriptive through derivation of:

    1. Frequencies and proportions,

    2. Means with 95% confidence intervals, and

    3. Composite variables for symptoms and complications.

3. Execution of univariate and multivariate regression modelling along with

    1. Comparative derivations of un-conditional and conditional logistic regression based unadjusted and adjusted Odds Ratios

    2. Testing for Goodness of Fit of multivariate model(s) through Hosmer and Lemeshow Goodness of fit test run on the unconditional logistic regression models

4. Finalization of descriptives, univariate and multivariate regression results

5. Draft and final report preparation

Annex 2

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Part 2

In-Depth Analysis of Maternal Deaths
Unpacking and Disaggregating Causes of Maternal Deaths & Levels of Delay

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Acknowledgments:

Abbreviations

AJK	Azad Jammu and Kashmir
AMTSL	Active Management of Third Stage of Labor
ANC	Antenatal care
APH	Antepartum Hemorrhage
BHU	Basic Health Unit
BP	Blood Pressure
BVH	Bahawalpur Victoria Hospital
CEmONC	Comprehensive Emergency Obstetric and Newborn Care
DIC	Disseminated Intravascular Coagulation
DVT	Deep Vein Thrombosis
EmONC	Emergency Obstetric and Newborn Care
FP	Family Planning
GB	Gilgit Baltistan
HCPs	Healthcare Providers
HELLP	Hemolysis, Elevated Liver enzymes, Low Platelets
HFs	Health Facilities
HTN	Hypertension
HTSP	Healthy Timings and Spacing of Pregnancy
ICD	International Classification of Diseases
ICT	Islamabad Capital Territory
JPMC	Jinnah Postgraduate Medical Centre
KP	Khyber Pakhtunkhwa
LHV	Lady Health Visitor
LHW	Lady Health Worker
MLPs	Midlevel Providers
MH	Military Hospital
MMR	Maternal Mortality Ratio

MW	Midwife
NCMNH	National Committee for Maternal and Neonatal Health
NCOC	National Command and Operation Center
PDHS	Pakistan Demographic and Health Survey
PIH	Pregnancy Induced Hypertension
PHF	Primary Health Facility
PMMS	Pakistan Maternal Mortality Survey (2019)
PNC	Postnatal Care
PPH	Postpartum Hemorrhage
RAF	Reviewers Assessment Form
RHC	Rural Health Center
SOGP	Society of Obstetricians and Gynecologists of Pakistan
SOPs	Standard Operating Procedures
VAQ	Verbal Autopsy Questionnaire
WHO	World Health Organization

Executive Summary

In 2019, the first exclusive survey on Maternal Mortality (PMMS 2019) was conducted in Pakistan to obtain an estimate of Maternal Mortality Ratio (MMR) for the country as well as to gather information on the direct and indirect causes of maternal deaths, using verbal autopsy instruments. All deaths among ever-married women aged 15-49 years, in the three years prior to the survey, were investigated in detail using a verbal autopsy questionnaire (VAQ).

A total of 1,177 VAQs were reviewed by a panel of expert obstetricians and gynecologists and physicians at the National Committee for Maternal and Neonatal Health (NCMNH). The MMR of 186 per 100,000 live births was reported from the data of the Pakistan Maternal Mortality Survey (PMMS), for the four provinces of Pakistan (Punjab, Sindh, KP and Balochistan). Though the survey was also conducted in other areas of Pakistan including Azad Jammu & Kashmir (AJK) and Gilgit Baltistan (GB), the national total for indicators excluded AJK and GB.

NCMNH in collaboration with the Population Council and with support from World Health Organization (WHO) conducted an in-depth analysis of the verbal autopsies, identified as maternal deaths during the review process, to unpack the underlying causes of maternal deaths while examining the societal and medical factors that had a bearing on these deaths. From 1,177 adult female deaths of women of reproductive ages, living in different provinces and areas of Pakistan, 259 maternal deaths were identified. In the qualitative analysis we were able to identify additional maternal deaths attributable to medical or surgical misadventures.

The objective of revisiting the VAQs was to unpack and disaggregate the maternal deaths—direct, indirect, coincidental, and late maternal deaths—by:

1. Medical causes

2. Impact of socio-cultural factors

3. Contribution of surgical and medical misadventures

4. Levels and causes of three delays

The review yielded important information about medical and social determinants of maternal deaths in Pakistan.

Of the total maternal deaths, 62 percent (n=160) were direct maternal deaths and 14 percent (n= 37) were indirect maternal deaths. Coincidental, that is incidental or accidental causes for maternal deaths, were responsible for 7 percent of deaths (n= 18). Late maternal deaths constituted 16 percent of maternal deaths (n=42). The major cause of direct maternal deaths was obstetric hemorrhage (n=65; 41%). Of the deaths due to obstetric hemorrhage, 50 (89%) were due to postpartum hemorrhage (PPH) and 15 (11%) were due to antepartum hemorrhage (APH). This was followed by hypertensive disorders (27%), puerperal sepsis (8%), and pregnancies with abortive outcomes (7%). Of the indirect maternal deaths, cardio-vascular disorders were the major cause of deaths. The review also helped to unpack the causes of coincidental, late and probable maternal deaths.

The review has highlighted the poor quality of health services in Pakistan as surgical or medical misadventures contributed significantly to 36 percent of maternal deaths. While reviewing the verbal autopsies, it was felt that neglect or poor management of women in health facilities contributed to these deaths in a major way. These deaths may have been prevented if skilled care was given in a timely manner, once the woman reached the appropriate health facility (HF) in a reasonable state of health. To say the least, substandard care was given to women at different levels of healthcare, from primary to tertiary teaching hospitals.

The verbal autopsies were also revisited for an in-depth analysis to understand the delays at various levels leading to maternal deaths. It is with great sadness we report that women in Pakistan are caught between the devil and the deep blue sea. They die at home or on their way to various health facilities due to societal norms, cultural limitations, and gender discrimination. If they succeed in reaching an HF, they face poor quality services and die due to the apathy of unmotivated and poorly skilled healthcare providers (HCPs), lack of equipment, medicines and so on, basically totally unsupported by the health system.

Various recommendations have been suggested in this report, including various advocacy campaigns to sensitize the government, the HCPs, and the public at large. Empathetic, skilled, and humane HCPs need to emerge from their training institutions and join the health system, instead of successive generations vying to go abroad and never coming back to serve their country.

A. INTRODUCTION

The NCMNH conducted this in-depth analysis to disaggregate causes of maternal deaths and levels of delay from the data obtained from the PMMS 2019.

In 2006–07, the maternal mortality data were collected for the first time as a part of Pakistan Demographic and Health Survey (PDHS). Previously, all estimates of Maternal Mortality Ratio (MMR) were based on mathematical models or indirect estimation. The NCMNH reviewed the VAQs and all female deaths including maternal deaths were analyzed, categorized, and the cause of death was assigned and coded using the World Health Organization's Tenth Revision of International Statistical Classification of Diseases and Related Health Problems (ICD-10).

The NCMNH then conducted an in-depth analysis of the data obtained from PDHS 2006–07 on the deaths of women of reproductive age. The psycho-socio-cultural factors contributing to adult female deaths were unpacked and late maternal deaths were also identified.

In 2019, the first exclusive survey on Maternal Mortality was conducted in Pakistan to obtain an estimate of the MMR for the country as well as to gather information on the direct and indirect causes of maternal deaths, using verbal autopsy instruments. All deaths among ever-married women aged 15-49 years, in the three years prior to the survey (i.e. since January 2016), were investigated in detail using a VAQ. The questionnaire included details about the woman's characteristics and symptoms, and the circumstances prior to her death. A total of 1,177 VAQs were reviewed by a panel of expert obstetricians and gynecologists and physicians at NCMNH. During the review process, the medical causes of deaths were analyzed, assigned categories of death (maternal and non-maternal), and then coded according to ICD–10. Though the PMMS has demonstrated a decrease in the MMR from the 276 maternal deaths per 100,000 live births reported in the 2006–07 PDHS, to 186, much more still needs to be done in order to achieve the Sustainable Development Goal (SDG) target of reducing MMR to 70 per 100,000 live births.

This analysis is being carried out to unpack the underlying causes of maternal deaths, while examining the societal and medical factors that had a bearing on these deaths.

Objectives

The objective of revisiting the VAQs was to unpack and disaggregate the maternal deaths—direct, indirect, coincidental and late maternal deaths—by:

1. Medical causes

2. Impact of socio-cultural factors

3. Contribution of surgical and medical misadventures

4. Levels and causes of three delays

The leading cause of maternal mortality in the current PMMS is obstetric hemorrhage which has increased from 33 percent in 2006–07 to 41 percent in 2019. The underlying cause of obstetric hemorrhage needs to be determined and unpacked in order to understand whether this was ante-

partum or post-partum hemorrhage and so on, so that preventive and therapeutic strategies may be suggested, and resources diverted accordingly. Deaths due to hypertensive disorders have increased from 10 to 29 percent; the reasons for this increase were investigated to determine if the hypertensive disorders preexisted or precipitated during the antenatal, natal or postnatal period. Similarly, pregnancy with abortive outcomes and pregnancy-related infections were unpacked to determine the exact medical condition and if its mismanagement had led to the woman's death.

Though there are positive trends for antenatal care, in the form of greater access to skilled birth attendance and delivery in a healthcare facility, a corresponding decrease in maternal mortality has not been observed. This indicates that the quality of care in the health facilities is not up to the mark and needs to be improved. In 2006–7, eight percent of maternal deaths were attributed to "iatrogenic" causes, meaning that a surgical or medical misadventure resulted in the death of these women. However, in the current PMMS 2019 report none of the maternal deaths have been classified as iatrogenic, although it was observed that for a number of maternal deaths surgical/medical misadventure contributed significantly.

The delays at various levels which ultimately led to death also need to be identified. It was found that a few women died at home and a vast majority died at a facility simply because they did not reach the appropriate facility or had spent a considerable period of time shuttling between facilities before reaching the appropriate facility. Moreover, the lack of skilled staff or equipment, or systems not being in place, contributed significantly to the number of maternal deaths.

B. METHODOLOGY

From 1,177 female deaths reported from all the provinces and regions of Pakistan, including Islamabad Capital Territory (ICT), Azad Jammu Kashmir (AJK) and Gilgit Baltistan (GB), 259 maternal deaths were identified. In addition, one more death was identified from KP which was not included in the PMMS-2019 for unknown reasons. This was a direct maternal death of a multigravida (i.e., a woman who has been pregnant at least a second time) due to postpartum hemorrhage at a tertiary level health facility. To avoid confusion, this case is not included in the in-depth analysis. The 259 maternal deaths identified were organized according to the provinces, districts, tehsils, and regions (ICT, AJK, and GB). All categories of maternal deaths whether direct, indirect, coincidental, or late were analyzed in depth.

Reviewers Assessment forms (RAFs) were organized according to their respective VAQs to document the category and cause of maternal death and an ICD-10 code was assigned in the reviewer's form.

A specific assessment tool was developed (Annex-1) to enter the data to further analyze the PMMS 2019. An in-depth analysis was conducted by minutely scanning the VAQs and RAFs to disaggregate, unpack and understand the underlying factors causing maternal deaths.

As the data were entered, those cases that required detailed insight, and where medical or surgical misadventures played a significant role in causing the death, were identified so as to discuss it in a meeting of experts. Similarly, those cases where delays were encountered, and compromised quality of care played a significant role were identified and some were selected and written as case studies to work as policy advocacy briefs. The data entry was done by two doctors with a public health background and experience in Obstetrics and Gynecology. Both were also reviewers and coders of the VAQs of the PMMS 2019 and were therefore familiar with the VAQs.

A group of six nosologists were identified, including the lead nosologist, all of whom are practicing and experienced obstetricians and gynecologists. Their task was to specifically review those cases where the lead nosologist thought that surgical or medical misadventure played a significant role in causing that maternal death. Of the nosologists, five had also reviewed the VAQs of the PMMS-2019.

C. RESULTS

In total, 259 VAQs and RAFs of maternal deaths were reviewed and analyzed. Out of 259 maternal deaths, the majority were from Sindh followed by Punjab. The distribution of VAQs by province/region is represented in Figure 1.1.

Figure 1.1: Maternal Deaths by Province and Region (n=259)

Profile of Deceased Women aged 15–49 years

Among 259 maternal deaths, the majority of women (114) were between the ages of 30 and 39 years (Table 1.1), followed by women between the ages of 20 and 29 years (98).

Most of the women (101) had been pregnant 2–4 times. Forty-nine of these women were primigravida, that is, pregnant with their first child.

Table 1.1 Profile of deceased women

Age and Number of Pregnancies of deceased women at the time of Death	Number of women
Age	
15 – 19 years	22
20 – 29 years	98
30 – 39 years	114
40 – 49 years	25
Total	259
Number of Pregnancies	
Primigravida	49
2 – 4 pregnancies	101
5 – 9 pregnancies	92
≥ 10 pregnancies	17
Total	259

Of the 259 maternal deaths, the majority were delivered normally and 16 percent were delivered by cesarean section. Higher cesarean section rates were seen in Punjab (25%) and KP (26%). This shows that they were managed by HCPs who were probably not skilled in their jobs. There were relatively low rates of cesarean sections in Balochistan (4%) and GB (5%); these women either died at home, or on the way, or at smaller health facilities where performing cesarean sections was not possible. (Table 1.2).

Table 1.2: Maternal Deaths by mode of delivery and province (n=259)

| Provinces & Areas	Died in Pregnancy	Pregnancy with Abortive Outcome	Spontaneous Vertex Delivery (SVD)	Cesarean Section	Total
Punjab	18 (30%)	3 (5%)	25 (41%)	15 (25%)	61
Sindh	18 (25%)	6 (8%)	37 (52%)	10 (14%)	71
Balochistan	12 (27%)	4 (9%)	27 (60%)	2 (4%)	45
KP	10 (23%)	1 (2%)	21 (49%)	11 (26%)	43
GB	2 (10%)	1 (5%)	16 (80%)	1 (5%)	20
AJK	3 (16%)	4 (21%)	9 (47%)	3 (16%)	19
Total	63 (24%)	19 (7%)	135 (52%)	42 (16%)	259

Category of Maternal Deaths:

Of the total maternal deaths, 62 percent were direct maternal deaths (Figure 1.2) and 14 percent were indirect maternal deaths. Coincidental, that is, incidental or accidental, causes for maternal deaths were responsible for 7 percent of deaths. Late maternal deaths constituted 16 percent of the total deaths. The category for 14 maternal deaths was changed after in-depth analysis. Descriptions are given in sections for that specific category of death.

Maternal Death: is the death of a woman while pregnant or within 42 days of termination of pregnancy irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental cause.

Pregnancy-related mortality includes all deaths during pregnancy or childbirth within 42 days after the birth or termination of pregnancy irrespective of the cause of death.

Figure 1.2: Category of Maternal Deaths (n=259)

Late =42 (16%)
Probable =2 (1%)
Co incidental =18 (7%)
Direct =160 (62%)
Indirect =37 (14%)
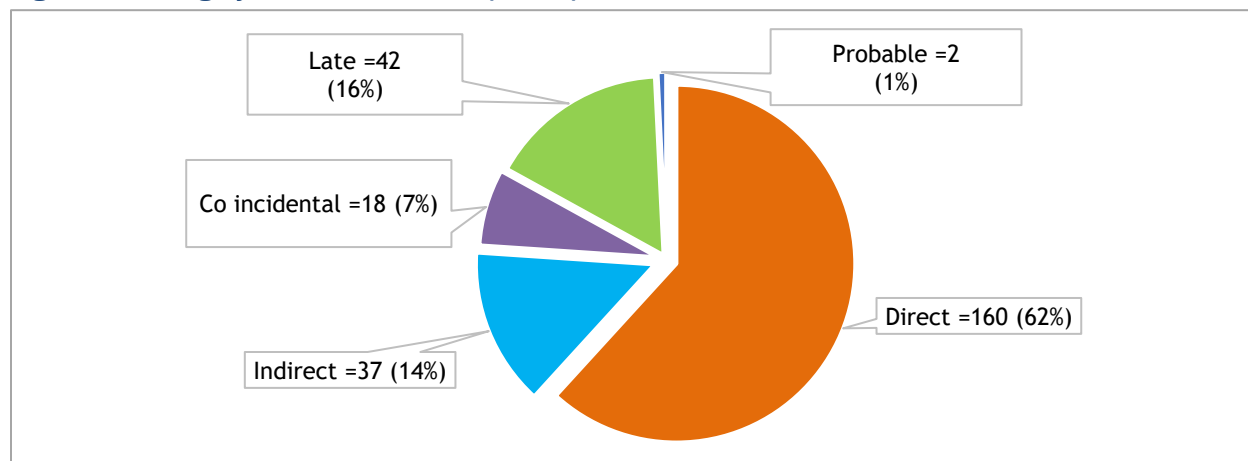
Direct maternal deaths reflect the quality and standard of obstetric care given. It is above 60 percent in all the provinces except AJK (53%) and reflects poor obstetric care given to those women. (Table 1.3)

Table 1.3: Category of Maternal Deaths by province (n=259)

Provinces & Areas	Direct Maternal Deaths	Indirect Maternal Deaths	Coincidental Maternal Deaths	Late Maternal Deaths	Probable Maternal Deaths	Total Maternal Deaths
Punjab	37 (61%)	6 (10%)	4 (7%)	14 (23%)	0	61
Sindh	45 (63%)	11 (15%)	4 (6%)	9 (13%)	2 (3%)	71
Balochistan	29 (64%)	8 (18%)	3(7%)	5 (11%)	0	45
KP	27 (63%)	7 (16%)	2 (5%)	7 (16%)	0	43
GB	12 (60%)	2 (10%)	3 (15%)	3 (15%)	0	20
AJK	10 (53%)	3 (16%)	2 (11%)	4 (21%)	0	19
Total	160 (62%)	37 (14%)	18 (7%)	42 (16%)	2 (0.7%)	259

47

Direct Obstetric Deaths:

Death resulting from obstetric complications of the pregnant state (pregnancy, labor and puerperium {within 42 days of termination of pregnancy}), from medical and surgical interventions to treat these complications, from omissions in treatment, from incorrect treatment or from a chain of events resulting from any of above.

Indirect Obstetric Deaths:

Deaths resulting from previous existing disease or disease that developed during pregnancy and that was not due to direct obstetric cause, but that was aggravated by physiological effects of pregnancy, childbirth or puerperium.

Probable Obstetric Deaths: When the reviewer does not have sufficient and/or definitive information to classify the death into either of the above two categories (direct obstetric death and indirect obstetric death) but is convinced that the death occurred due to diseases, complications, treatment failures or from a chain of events which were directly or indirectly related to or aggravated by pregnancy, childbirth, or puerperium. Hence the death is most likely to be obstetric but cannot be categorized into direct or indirect obstetric death categories.

Coincidental Obstetric Deaths: (Pregnancy-related death): When the reviewer does not have reason to believe that the death occurred due to any direct or indirect obstetric causes but is convinced that the death occurred while the woman was pregnant or within 42 days of termination of the pregnancy (puerperium), irrespective of the cause of death (obstetric and non-obstetric). Examples are deaths due to traffic accidents, violence, or a disease completely unrelated to pregnancy/childbirth/postpartum, while the woman was pregnant or in the postpartum period at the time of death.

Late Maternal Deaths: When the death occurred after 42 days but within one year of termination of pregnancy and the reviewer is convinced that the death occurred from complications or sequels of direct or indirect obstetric causes.

Direct Maternal Deaths

The major cause of direct maternal deaths was obstetric hemorrhage (n=65; 41%) (Figure 1.3). The second major cause of direct maternal deaths was hypertensive disorders (n=41; 26%); of these, 7 had chronic hypertension, 10 developed gestational hypertension, 9 had severe pre-eclampsia and 13 developed eclampsia. Among the women who developed eclampsia, 4 developed in the antepartum period, 2 during labor and 7 in the postpartum period. Two women died of stroke following severe pre-eclampsia.

Twelve women died due to abortive outcomes of pregnancy, of which 3 died of complications of unsafe abortion, 4 of septic abortion and 3 due to incomplete abortion; it is not clear if these abortions were spontaneous or induced. Other causes of deaths in this group included one case each of ectopic pregnancy and gestational trophoblastic disease.

Deaths due to infections of the genital tract (puerperal sepsis) contributed to 8 percent of maternal deaths. Deaths during labor and puerperium accounted for 12 (7%) maternal deaths. In this group 8 women died of prolonged and/or obstructed labor, 4 of them ended up with ruptured uterus/scar

dehiscence. Two women died undelivered during labor; the cause of death is not clear. One woman died after childbirth with tachycardia; the family described "pure joy" of the deceased on having given birth to be the cause of her death. One woman died in the operating theater with leaking of amniotic fluid and fever.

Other causes of maternal deaths included anemia, thalassemia, hyperemesis gravidarum, deep vein thrombosis (DVT), pulmonary thromboembolism, blood transfusion reaction, disseminated intravascular coagulation (DIC) – secondary to massive PPH and hepatitis. (Figure 1.3).

Figure 1.3: Causes of Direct Maternal Deaths (n=160)
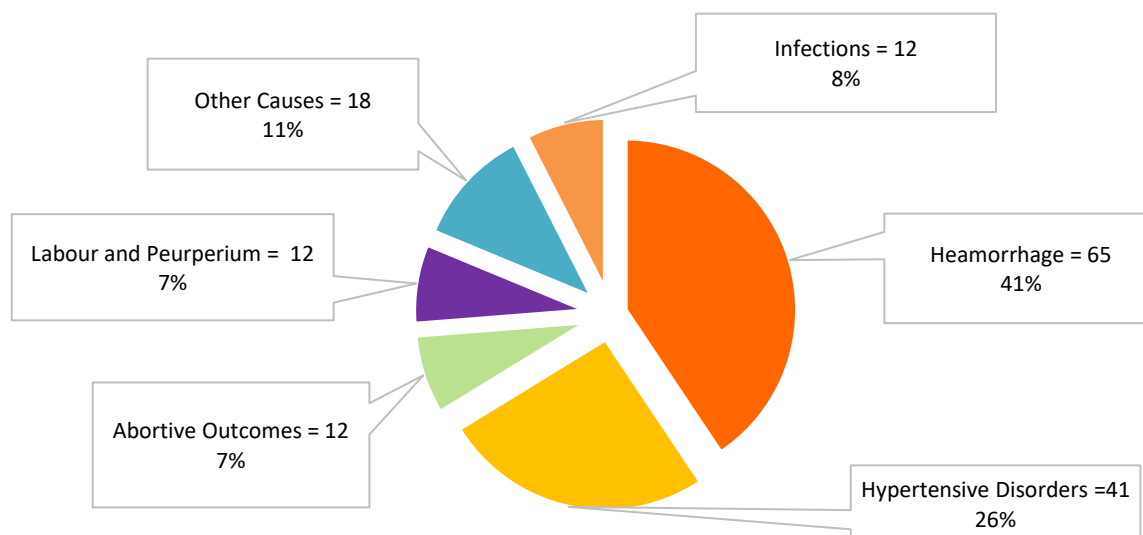
The category of three maternal deaths was changed from indirect to direct maternal death and added to this group. This included a case each of puerperal sepsis, anemia unspecified and viral hepatitis which on in-depth analysis was thought to be due to HELLP (Hemolysis, Elevated Liver enzymes, Low Platelets) syndrome rather than viral hepatitis. Highest number of deaths due to obstetric hemorrhage were reported in GB (58%) and KP (56%), followed by Balochistan (48%), Punjab (38%), Sindh (29%) and AJK (20%). (Table 1.4).

Table 1.4: Causes of Direct Maternal Deaths by province (n=160)

| Provinces & Areas | Obstetric Hemorrhage | | | Hypertensive Disorders | Infections | Labor & Puerperium | Pregnancy with abortive outcome | Other Causes | Total |
	APH	PPH	Total						
Punjab	3	11	14 (38%)	10 (27%)	2 (5%)	1 (3%)	4 (11%)	6 (16%)	37
Sindh	1	12	13 (29%)	10 (22%)	4 (9%)	8 (18%)	4 (9%)	6 (13%)	45
Balochistan	5	9	14(48%)	8 (28%)	3 (10%)	1 (3%)	2 (7%)	1 (3%)	29
KP	4	11	15 (56%)	7 (26%)	1 (4%)	2 (7%)	0	2 (7%)	27
GB	1	6	7 (58%)	1 (8%)	2 (17%)	0	1 (8%)	1 (8%)	12
AJK	1	1	2 (20%)	5 (50%)	0	0	1 (10%)	2 (20%)	10
Total	15	50	65 (41%)	41 (26%)	12 (7%)	12 (7%)	12 (7%)	18 (11%)	160

Of the deaths due to obstetric hemorrhage, 50 (89%) were due to postpartum hemorrhage (PPH) and 15 (11%) were due to antepartum hemorrhage (APH). (Figure 1.4)

Among 50 women who had postpartum hemorrhage (PPH), 48 (96%) had primary PPH and 2 (4%) had secondary PPH. Among 15 women who had APH, 10 died after abruptio placentae (when the placenta separates from the inner wall of the uterus before birth), 3 had placenta previa (when the placenta is located in the lower part of the uterus), and 2 died of a ruptured uterus.

Causes of primary PPH included uterine inertia, trauma, DIC etc. (Fig 1.5). In all the cases of PPH where trauma or any other cause of PPH was not described, it was assumed to be due to uterine inertia. Of the two women who died of secondary PPH, one probably died due to bleeding following retained placental pieces and the other died with continuous bleeding on the third day after a cesarean section.

**Figure 1.4: Maternal Deaths due to Obstetric Hemorrhage (n=65)**

Primary PPH is the loss of 500 ml or more of blood from the genital tract within 24 hours of childbirth.

Secondary PPH is defined as any significant uterine bleeding after 24 hours of childbirth and before 6 weeks postpartum.

Figure 1.5: Maternal Deaths due to Primary Postpartum Hemorrhage (n=48)

Indirect Maternal Deaths

Of the 37 indirect maternal deaths, cardiovascular disorders was the major cause of death. Of the 12 deaths due to cardiovascular disorders, 5 had myocardial infarction, 4 had some pre-existing heart disease, and 3 had hypertension unspecified. Some other causes of indirect maternal deaths included hematological disorders, diabetes mellitus, chronic renal failure, respiratory disorders, septicemia (following an intestinal perforation noticed at cesarean section). (Figure 1.6).

Figure 1.6: Causes of Indirect Maternal Deaths (n=37)
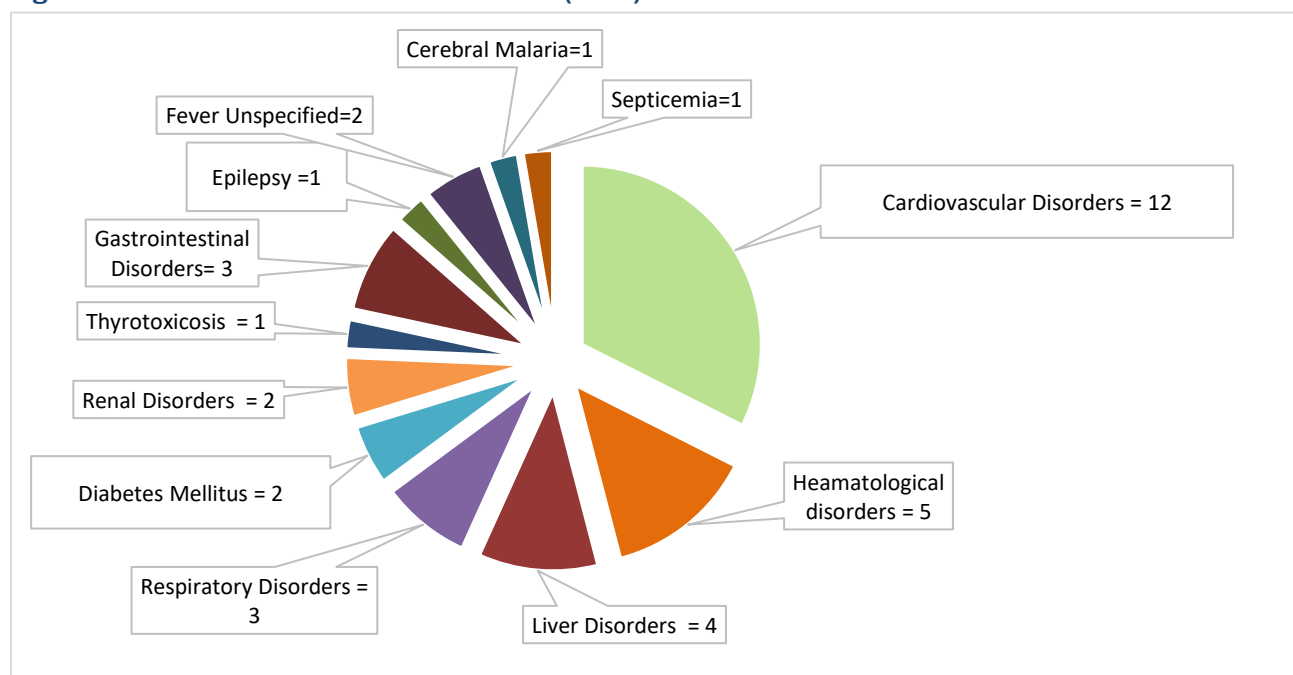
The category of three maternal deaths was changed from direct to indirect maternal deaths and added to this group. This included a case each of septicemia, hepatitis unspecified and gastroenteritis. Similarly, the category of three maternal deaths was changed from coincidental to indirect maternal deaths. This included a case each of malignant hypertension, myocardial infarction, and pneumonia. In total, 6 maternal deaths were added to indirect maternal deaths and 3 shifted to direct maternal deaths as described earlier. The distribution of causes of indirect maternal deaths by province is shown in Table 1.5. Six out of seven indirect maternal deaths in KP were attributed to cardiovascular disease.

Table 1.5: Causes of Indirect Maternal Deaths by province (n=37)

Causes of Late Maternal Deaths	Punjab	Sindh	KP	Balochistan	GB	AJK	Total
Cardiovascular	2	3	6	0	0	1	12
Hematological	1	2	0	1	1	0	5
Liver Disorders	1	1	0	2	0	0	4
Respiratory Disorders	1	1	0	0	0	1	3
Diabetes Mellitus	0	1	0	0	0	1	2
Gastrointestinal Causes	0	2	0	1	0	0	3
Renal Disorders	0	0	0	1	1	0	2
Thyrotoxicosis	0	0	1	0	0	0	1
Epilepsy	1	0	0	0	0	0	1
Fever Unspecified	0	0	0	2	0	0	2
Cerebral Malaria	0	0	0	1	0	0	1
Septicemia	0	1	0	0	0	0	1
Total	6	11	7	8	2	3	37

Coincidental Maternal Deaths

Of the 18 coincidental maternal deaths, natural disasters (flood or lightning) and road traffic accidents, malignancies, accidental burns, or suicides were the major causes of deaths and of equal magnitude (Table 1.6). Other causes included rabies, electrocution, suspicious death (homicide). The distribution of coincidental deaths by cause and province is shown in Table 1.7. While half of the coincidental maternal deaths in Punjab were due to road traffic accidents, suicides accounted for the same proportion in KP and AJK.

Table 1.6: Causes of Coincidental Maternal Deaths

Causes of Coincidental Maternal Deaths	Number of women
Road Traffic Accidents	3
Malignancies	3
Natural Disasters	3
Accidental Burns	3
Suicide	3
Suspicious Death (Homicide)	1
Electrocution	1
Rabies	1
Total	18

Table 1.7: Causes of Coincidental Maternal Deaths by province (n=18)

Causes of Coincidental Maternal Deaths	Punjab	Sindh	KP	Balochistan	GB	AJK	Total
Road Traffic Accidents	2	0	0	1	0	0	3
Malignancies	1	1	1	0	0	0	3
Natural Disasters	0	0	0	1	1	1	3
Accidental Burns	1	0	0	1	1	0	3
Suicide	0	0	1	0	1	1	3
Suspicious Death (Homicide)	0	1	0	0	0	0	1
Electrocution	0	1	0	0	0	0	1
Rabies	0	1	0	0	0	0	1
Total	4	4	2	3	3	2	18

Late Maternal Deaths:

Causes of late maternal deaths included malignancies followed by cardiovascular and liver disorders. Other causes included hemorrhage, tuberculosis, hypertension, chronic renal failure, anemia, among others (Table 1.8). One woman included in this group died from a firearm injury inflicted by her brother-in-law, 10 months after childbirth.

Table 1.8: Causes of Late Maternal Deaths

Causes of Late Maternal Deaths	Number of women
Malignancies	15
Cardiovascular	7
Liver Disorders	5
Tuberculosis	2
Undetermined/Unspecified cause of death	2
Gastrointestinal Causes	2
Burns	1
Diabetes Mellitus	1
Cerebral Hemorrhage	1
RPOCs	1
Epilepsy	1
Anemia	1
Chronic Renal Failure	1
Firearm Injury	1
Severe Hemorrhage and Renal Failure	1
Total	42

The category of one maternal death was changed from coincidental to late maternal death and added to this group. This was a case of anal region malignancy. The distribution of causes of late maternal deaths by region are shown in Table 1.9.

Table 1.9: Causes of Late Maternal Deaths by province (n=42)

Causes of Late Maternal Deaths	Punjab	Sindh	KP	Balochistan	GB	AJK	Total
Malignancies	3	3	4	2	1	2	15
Cardiovascular	4	0	1	2	0	0	7
Liver Disorders	1	2	0	1	1	0	5
Tuberculosis	0	0	1	0	1	0	2
Undetermined/Unspecified cause of death	1	1	0	0	0	0	2
Gastrointestinal Causes	2	0	0	0	0	0	2
Burns	1	0	0	0	0	0	1
Diabetes Mellitus	1	0	0	0	0	0	1
Cerebral Hemorrhage	1	0	0	0	0	0	1
RPOCs	0	0	0	0	0	1	1
Epilepsy	0	1	0	0	0	0	1
Anemia	0	1	0	0	0	0	1
Chronic Renal Failure	0	1	0	0	0	0	1
Firearm Injury	0	0	1	0	0	0	1
Severe Hemorrhage and Renal Failure	0	0	0	0	0	1	1
Total	14	9	7	5	3	4	42

Probable Maternal Deaths:

There were two maternal deaths for which a definite cause of death could not be identified; one died within two days of delivery and the other was a suspicious death (homicide/action based on superstitious beliefs) within one month of childbirth.

Misadventures contributing to Maternal Deaths:

Surgical or medical misadventures contributed significantly to 93 (36%) maternal deaths (Figure 1.7). Seven women died during pregnancies with abortive outcomes, 21 died undelivered, 36 passed away during or after spontaneous vaginal deliveries (SVD) and 29 women died during or after cesarean sections. Most of the misadventures were identified in 85 (91%) direct maternal deaths.

Figure 1.7: Surgical/Medical Misadventures contributing to Maternal Deaths (n=93)
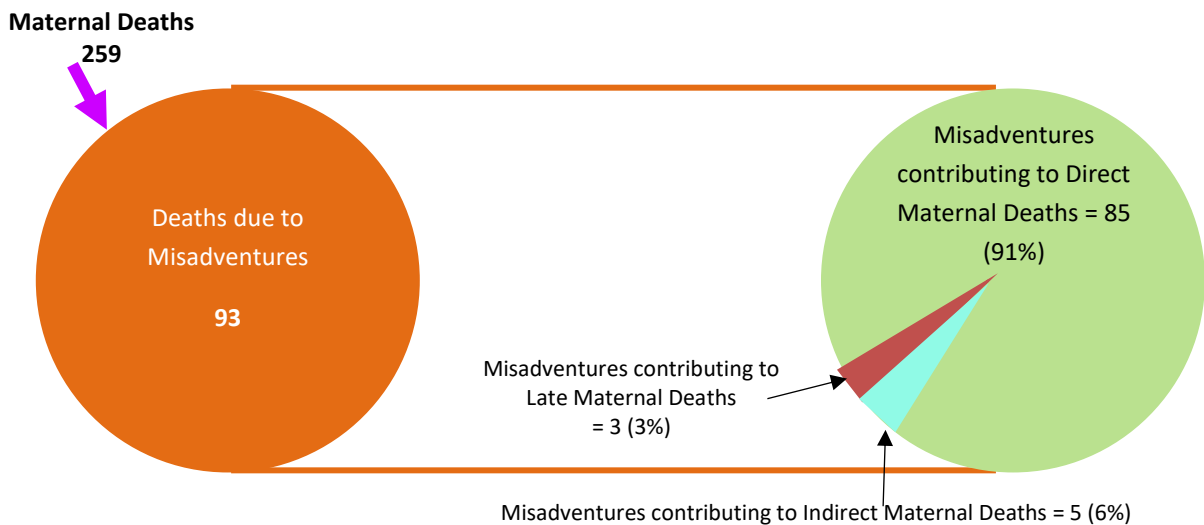
While reviewing the verbal autopsies of these cases, it was felt by reviewers that neglect or poor management of women in health facilities contributed to these deaths in a major way. These deaths may have been prevented if skilled care was given in a timely manner, once the women reached the appropriate HF in a reasonable state of health. To say the least, substandard care was given to the women at different levels of health facilities, from primary to tertiary teaching hospitals. The distribution of women by cause of death and misadventures is shown in Table 1.10.

Table 1.10 Cause of Maternal Deaths and Misadventures

Cause of Maternal Deaths and Misadventures	Number of women
Direct maternal deaths	
PPH	36
APH	9
Hypertensive Disorders	16
Pregnancy with abortive outcomes	7
Deaths during Labor and Puerperium	7
Anemia/Blood Transfusion Reactions	5
Infections	3
Others	2
Indirect maternal deaths	
Septicemia	1
Valvular Heart Disease	1
Epilepsy	1
Severe Anemia	1
Gastritis and Enterocolitis	1
Late maternal deaths	
Malignancies	2
Severe PPH leading to acute renal failure	1
Total	93

Misadventures contributed to more than 40 percent of maternal deaths in Sindh, AJK and KP. (Table 1.11). Fewer misadventures were noted for GB (10%) and Balochistan (29%).

Table 1.11: Misadventures contributing to maternal deaths by province (n=93)

Provinces & Areas	Maternal Deaths	Misadventures contributing to deaths (%)
Punjab	61	21 (34.4%)
Sindh	71	31 (44%)
Balochistan	45	13 (29%)
KP	44	18 (41%)
GB	20	2 (10%)
AJK	19	8 (42%)
Total	259	93 (36%)

Delays Contributing to Maternal Deaths

In some women, all three delays were identified, in others 1 or 2 delays were observed. The first delay contributed to 168 maternal deaths in an adverse manner. The second delay was noted for 98 deaths; women travelled between first, second or third and sometimes more referral health facilities losing precious time. The third delay was identified in 128 deaths. In 37 cases, all three delays were seen (Figure 1.8).

Delay 1:
Delay in deciding to seek professional care

Delay 2:
Delay in identifying and reaching an appropriate health facility

Delay 3:
Delay in receiving adequate and appropriate treatment at the facility

Figure 1.8: Distribution of maternal deaths by The Three Delays
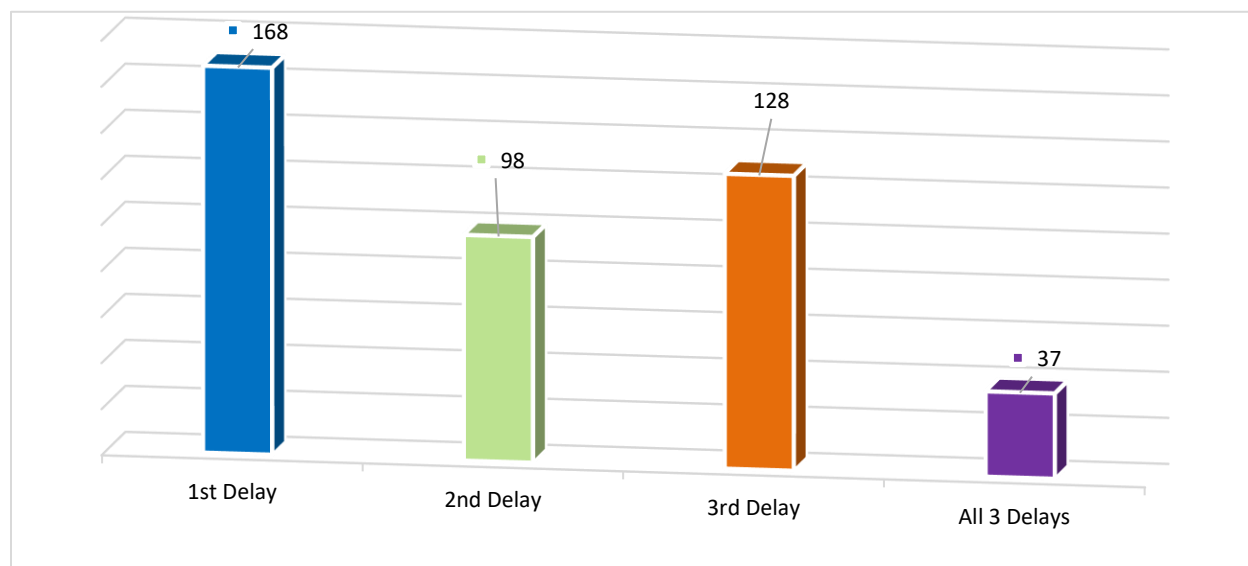
Of the 128 women who experienced the third delay, the majority received care at a tertiary care health facility. The women who died on their way back from a health facility or at home experienced the third delay at a primary or secondary health facility. (Table 1.12)

Table 1.12: Deaths due to delay in reaching and appropriate facility (n=128)

Level of health facility where women experienced third delay	Primary	Secondary	Tertiary	Total
Died at the health facility	23	30	47	100
Died on their way back from a health facility	7	7	1	15
Died at home after receiving treatment from a health facility	5	5	3	13
Total	35	42	51	128

Among the128 women who experienced the third delay, 42 received care from both the public and private facilities. Fifty-eight received care only from public sector facilities and 28 received care only from private sector facilities.

Case of Marvi* from Sindh Province

Uneducated young woman of 17 years, married to her cousin of 17 years, who was a fisherman by profession. As Marvi had no brother, her husband moved in with her parents and became the "ghar damad". He would be away for weeks to fish, and then return to be home for a week or two. Marvi lived in a far-off village where there was no health facility, school, or bazaar. There were dirt roads and no transport; mobile phone signals were also not available. A compounder in the village roamed the streets to provide services to the village residents.

When Marvi conceived, she was very happy but did not see any doctor for antenatal care due to poverty and issues of access to care. While pregnant, she had headaches, vomiting, body aches, weakness, blurring of vision, and swelling of the body. She also complained of stiff hands and feet; this should have raised red flags, but she remained oblivious as she did not know that these were 'danger signs.

One day when she started having labor pains, the compounder was called, who said her blood pressure was elevated. Soon she started to convulse along with frothing at the mouth and then fainted. A maulvi (religious leader leading prayers) was then called, who gave "misri" (sugar) with "dum" (reciting holy verses and blowing over the sugar). A greenish vaginal discharge (meconium- an evidence of fetal distress) was also noticed at this time. Her condition did not improve and then the dai (traditional midwife) was called, the unborn baby's head was visible, and the family decided to take her to a hospital on the dai's advice.

They went to a nearby hospital, where she was checked at the gate while still in the vehicle and was referred to a hospital in Sajawal. They reached Civil Hospital, Sujawal in half an hour, and there also she was examined in the vehicle and the family was told that as she was having fits she should be taken to the Civil Hospital, Thatta. No first aid was given at either of the health facilities.

At Thatta civil hospital, the doctor/nurse examined her and gave injections but, as her condition did not improve, they were told to go to Karachi. They started on their journey to Karachi and at Gagar Phatak the van driver arranged an ambulance for them, as it is easier to navigate the roads in Karachi in an ambulance. They lost precious time while arranging the ambulance. The journey in the ambulance took 3 hours to reach Jinnah Postgraduate Medical Centre (JPMC), Karachi. There she was immediately attended to, and the family was informed that the baby had died.

The relatives did not allow the doctors to deliver the baby and wanted the patient to get better first. Marvi remained unresponsive and passed away within two hours of reaching JPMC.

Marvi's body was carried in an ambulance back to the village. Somewhere on the way the driver refused to go any further and told the family to get out of the vehicle. After much coaxing and paying extra money, he agreed to take them to the village. Marvi was buried and her husband returned from fishing days after her last rites were solemnized.

A disenfranchised victim of child marriage, teenage pregnancy, failure to recognize danger signs, no antenatal care, she developed eclampsia, suffered a prolonged and obstructed labor, and died undelivered, shuttled between several health facilities!

* The name has been changed to ensure confidentiality.

Some examples of first delay

- No antenatal care was sought, as it was generally believed to be unnecessary.
- Despite chronic medical conditions before pregnancy (for example, tuberculosis, cardiovascular disease, chronic renal ailments, hepatitis B & C), no treatment was sought before getting pregnant.
- Suffered from chronic ailments during pregnancy, yet did not seek treatment
- In spite of living in remote areas with no easy access to good care, no birth plans were made.
- Delayed going to the hospital until the morning while complications developed, especially in remote areas.

- Decided to stay home and not seek care at an HF when complications set in. Some reasons given for not seeking treatment included, "roads are not paved, takes a long time to reach the hospital, don't know where to go, hospital is too far, transport is difficult to find, we are poor, will meet a male doctor in the hospital, not aware about severity of illness, bad security situation, it is not our custom" and so on.

- Sought alternative treatment and spiritual/ritual care for serious illnesses, for example, a "Syed" was called to do "dum" and "durood" (reciting verses from the Quran) to treat eclamptic fits.

- Chose to deliver at home with a traditional birth attendant, against the advice of an HCP, for example chose a *dai* and a compounder to deliver twins at home, mother of 11 children was given injections to expedite labor, attempted a normal delivery when the doctor had advised a cesarean section, or had a hydrocephalic fetus (fetus with enlarged head).

- Not aware of danger signs indicating onset of serious complications during pregnancy and hence delayed decision to seek care.

- Excessive bleeding after childbirth was considered normal. When the woman died the family said "sangini ka andaza nahi tha" (we did not understand the severity of the condition).

- Chose not to seek care as treatment was "too expensive".

- Aware of presence of a breast lump/cancer for years, was on treatment, yet took no precautions and got pregnant.

- Tried to terminate pregnancy with some medicine; when it did not work, ingested rat poison, and when she told her husband, he completed his meal before taking her to the hospital.

- Woman had cardiac disease since childhood for which she had surgery and then went on to have six children.

- Labor was induced at home by the woman herself using vaginal tablets, against the advice of two doctors to have a cesarean section.

Some examples of second delay

Ambulance services were non-existent, and people relied on their neighbors and hired taxis and cars to get to health facilities when emergency situations cropped up. Some of the drivers of these vehicles exploited dying women and one such driver demanded more money during the journey to take the dead body back to her hometown. No birth plans were made by women and their families and hence no arrangement was made for transport in advance and last-minute preparations led to serious delays. Shuttling between different health facilities in emergency situations also led to a delay in seeking care and valuable time was lost in trying to find an appropriate HF. Sixteen women died at home and did not seek care while 26 women who died at home returned from different health facilities (Figure1.9). Twenty-two women died on their way to different health facilities. Two women visited up to six different health facilities to get to an appropriate facility. People living in remote areas and mountainous terrains were even more disadvantaged when trying to find transport. They would often wait until morning before trying to arrange transportation.

Figure 1.9: Maternal Deaths (direct and indirect) by place of death (n=197)

Some examples of third delay and misadventures

The following delays at the level of health facilities and surgical/medical misadventures were noted:

- The decision to perform a cesarean section was delayed, resulting in stillbirth and maternal death.

- Postoperatively the decision to re-operate was delayed even though there were obvious signs of intra-abdominal bleeding. When repeat surgery was done, HCPs told ridiculous stories to pacify the relatives (water was removed from the abdomen, as she drank water too soon after the cesarean section). Similarly, in some cases even when the woman was at a tertiary level health facility with PPH, the delayed decision to perform a hysterectomy proved lethal.

- Twenty-nine women in apparently good health died in the operation theatre or within hours of surgery due to medical/surgical misadventure; these deaths could be due to anesthetic/surgical complications encountered during surgery.

- In at least 3 cases a cesarean section was performed by a general surgeon; it seems they lacked core obstetric skills and were unable to control the situation when complications developed.

- Sometimes cesarean sections were done on frivolous grounds, such as a woman who had four previous normal vaginal deliveries had a cesarean section, the indication being postdates. This led to severe bleeding, she had to be reopened and eventually died. An induction of labor or just waiting for natural labor to start could have been a safer option. In another case a woman, apparently in good health, uncomplicated pregnancy, two previous normal vaginal deliveries, went into labor and a cesarean section was performed for no apparent reason. The woman and her baby died during the cesarean section.

- In one case labor was induced in a woman at home, even after previous cesarean sections, by dais and midlevel providers like LHVs and MWs.

- In one case surgery was performed by a nurse who owned the clinic and many deaths had been previously reported from the same clinic.

- Care given at the HFs was mostly substandard, referral protocols were not followed and patients were referred in an unstable condition, mostly in private vehicles. In almost all cases the patient was not accompanied by health professionals, except in two instances where patients were accompanied by doctors in ambulances, one in Balochistan and the other in KP.

- First aid was not given, and patients were sent straight away to other hospitals without stabilizing them. Women were transferred from one HF to the next, denied care and without proper referral protocols. The family was not guided to go to a Comprehensive Emergency Obstetric and Newborn Care services (CEmONC) facility directly, but instead the family took the woman to several health facilities which were not equipped to deal with the complication, before finally reaching an appropriate HF with the woman in a moribund state or already dead.

- Danger/warning signs were not recognized by HCPs during antenatal visits, labor and postnatal period, for example women with classic symptoms of impending eclampsia like headache, vomiting, blurring of vision and seeing flashes of light were sent home instead of admitting them or referring to a specialist. These women subsequently developed eclamptic fits and died. Moreover, when the danger signs appeared the HCPs not only did not take appropriate action, but also did not communicate the possible consequences to women and their family.

- Medicines to augment labor were given by untrained/unskilled HCPs at low resource health settings, sometimes to women with previous cesarean sections, resulting in serious consequences, including ruptured uterus.

- Labor was augmented to expedite delivery in high-risk patients at health centers, where there were no facilities to perform a cesarean section if required.

- Labor in a primigravida with breech presentation was augmented resulting in stillbirth and maternal death.

- Severity of antepartum hemorrhage was not recognized, and interventions were delayed, resulting in stillbirth and death of the woman.

- Some women delivered at a hospital and died due to PPH and simple measures were not taken

to prevent or treat PPH, such as active management of third stage of labor (AMTSL), Misoprostol, Uterine massage, Bimanual Uterine compression (Internal and External), Aortic compression, use of Non-pneumatic Anti Shock Garment (NASG) and Balloon/Condom Tamponade.

- A woman was delivered by a Lady Health Visitor (LHV) in a basic health unit when the provisional diagnosis was placenta previa; she subsequently had massive PPH and died before she could be shifted to the next level of care.

- Internal/vaginal examination was done by midlevel providers with suspected placenta previa, provoking heavy vaginal bleeding.

- Obstetric hemorrhage was not managed appropriately leading to acute renal failure.

- In at least three cases mismatched blood transfusion was identified as a cause of death.

- Unethical practices abounded; in one case a blood transfusion was given at home by a compounder, the woman became breathless soon after and died at home within a few hours of the transfusion.

- Women were delivered in health facilities and discharged soon after, sometimes against the woman's wishes, only to die with PPH within a few hours of reaching home. The midlevel providers usually ran small maternity homes which worked during the daytime and were in a hurry to discharge patients before night set in.

- High risk patients were accepted for delivery in small health units which cannot cope with complications if and when they arise. For example, women with severe anemia were delivered at HFs with no facility for blood transfusion.

- A woman under treatment for cancer was not advised family planning (FP), as a result of which her cancer treatment could not be optimized; she got pregnant twice after cancer was diagnosed.

- FP services were not integrated with routine healthcare, sometimes contraceptives were denied even when requested by the woman.

- In most of the cases, poor anemic women with big families of both boys and girls were not advised FP when they visited the HCPs during pregnancy or otherwise.

- When young girls attended clinics as child brides with teenage pregnancy, it was business as usual and the family was not guided about the law on child marriage, its punishments and about Healthy Timing & Spacing of Pregnancy (HTSP).

- Unsafe abortion by quacks and untrained HCPs using medieval methods led to a few deaths.

- HCPs were not present at the health facility, especially during public holidays and the women died before being attended to by the doctor.

- There is shortage of staff too and sometimes reported as "there are 15 to 16 patients at a time for delivery but only one LHV and dai are present".

- There was no triage in busy public hospitals and high-risk patients waited in the queue at the emergency room, sometimes to die without being attended to.

- Callous, inhumane, and rude behavior of staff was reported by the relatives. *"Barwaqt tawajah"* and *"ilaj ki sahulat mai kami"* (doctors did not give prompt treatment) as narrated by relatives.

When a patient reported with fits, she was labeled as "*pagal*" (mad) by the doctor and sent home. One husband said *"Hukoomat kuch nahi kareygi, in doctoron ka license cancel kerdena chahye koi strict action lena chahye hukoomat ko"* (the government will not do anything, the license of these doctors should be cancelled, and the government should take strict action against them).

- Women did not get due attention when they complained, they were usually brushed off instead of getting appropriate treatment. For example, instead of treating the woman, the doctor at the facility advised the family to get help from a spiritual healer because she had some evil effects. In another case the woman developed postoperative complications and the doctor said *"natak ker rahi ho"* (she is being dramatic).

- In public hospitals, junior doctors on duty managed patients on their own without supervision and were hesitant to call and consult their seniors, especially during the late hours of the night. As described by a relative, "doctors were sleeping while the nurses were around".

- In spite of repeated visits to the antenatal clinic, there would usually be no diagnosis, no management plan and only symptomatic treatment was given.

- Relatives were asked to get medicines and disposable items (sutures, gloves and so on) and surgery was delayed until the required items were delivered. No stock of these items was available for emergency surgery.

- Sometimes in private hospitals treatment was not started until money was paid.

- Sometimes women attended with mild labor pains and were repeatedly sent back home with instructions to return when the pains increased; some returned with a ruptured uterus.

- Communication between the HCPs and family lacked clarity, for example when the woman died of eclamptic fits, the family thought she had died of a wrongly administered injection.

- In a case of ruptured ectopic pregnancy, the patient was shuttled between two tertiary hospitals, symptomatic treatment was given, and precious time was lost performing CT scans and arranging for renal dialysis, instead of operating to stop the intra-abdominal bleeding.

- In the postnatal period if a complication arose and the patient required hospital admission, there would be a conflict between the departments as to where the patient should be admitted, as no department was willing to take responsibility for a sick woman. For example, a woman with postnatal eclampsia after a cesarean section was referred to a tertiary hospital, where she was admitted in a medical ward instead of the obstetric unit, from where she was sent back for removal of sutures to another facility where she had the cesarean section. She returned to the medical ward after removal of sutures and died shortly after. The behavior of HCPs at the tertiary hospital was inhumane and callous; they could have removed the sutures themselves or could have called the obstetric department to do so. Moreover, the woman with eclampsia should have been admitted in the obstetric unit to begin with.

Chanda* from AJK

Chanda, 25 years old, educated up to class 11, was married a year ago to a 27-year-old man working at a 'tandoor' (clay oven). She lived in Leepa valley, about 105 km from Muzzafarabad in Azad Kashmir.

This was Chanda's first pregnancy; she was in good health and visited the doctor four times during pregnancy for antenatal checkups. She remained well and when labor pains started, she was taken to the Rural Health Center (RHC) in Leepa. A baby boy was delivered normally by a team of a doctor and a LHV at the RHC. After delivery the family was informed that a cut had to be made in the birth canal to facilitate delivery of the baby, and she should be shifted to have it sutured at the military hospital (MH), which was at a distance of about 30 minutes from RHC. She was immediately shifted to the MH where the family was informed that Chanda was bleeding profusely. HCPs at the RHC had packed her vagina with two bedsheets and cotton to control the bleeding; when these were removed at the MH, so much blood started pouring that it splashed on the walls. She was transfused 6 bottles of blood, but no efforts could stop the bleeding. Arrangements were then made to shift her in an ambulance to the Combined Military Hospital (CMH) Muzaffarabad, and a blood transfusion was in progress during the transfer.

As it was winter and there was heavy snowfall causing treacherous conditions, the ambulance had to stop at a place called Moji. Chanda was offloaded and the family members took turns to carry her, profusely bleeding, on a charpoy while holding up a blood bottle. The nightmare ended as they crossed the snow and reached Daokhand on the other side where they arranged another ambulance to carry Chanda to CMH. At CMH the doctors immediately checked her, applied sutures to control the bleeding and gave her more blood transfusions. She was given 40 bottles of blood in two days but in spite of the wound being repaired, she continued to bleed. The family was told that an abnormal passage (fistula) had formed between the vagina, urinary bladder, and rectum and due to heavy blood loss, she had become very anemic.

After two days in CMH, she was referred to Pakistan institute of Medical Sciences (PIMS), Islamabad. There the family was told that her kidneys had shrunk (not functioning) and that she required dialysis. She remained in hospital for 10 days, the bleeding had stopped, and she was undergoing dialysis twice a week. The family had to rent a house near PIMS and stayed there for the dialysis. Nine months after delivery she died at PIMS while being prepared for dialysis.

Chanda died due to mismanagement at the time of delivery at RHC Leepa.

A primigravida living in a remote area, genital tract tears during childbirth leading to PPH and genital tract fistulae, acute renal failure, requiring massive blood transfusions and renal dialysis. A sad chain of events!

* The name has been changed to ensure confidentiality.

Psycho-Socio-Cultural factors unpacked during in-depth analysis contributing to Maternal Deaths

Families of 65 deceased women admitted poverty as the root cause preventing them from seeking timely care. Disenfranchisement contributed to deaths in 85 cases. The causes included difficult terrain, inaccessibility to a health facility, unavailability of healthcare providers especially on public holidays, referral to a distant health facility because of non-availability of services like cesarean section, among other reasons.

One of the respondent said *"Yahan sahi doctor and sahi hospital nahi he, Is ilaquy m buht ziyada amwat buchon, hamal, zachgi k doran hoti he, Ghurbat bhi buht he, hamari Hukoomat se durkhawast he k yaha Hospital banaye aur qabil doctors tainaat karey to buht si Aurateen buch sakti hen"*, (we do not have good doctors or hospitals; in this area, there are a lot of deaths among children, during pregnancy and childbirth. We are very poor and request the government to make good hospitals and post skilled doctors, so that a lot of women can be saved).

Low self-esteem, helplessness and depression was described by relatives in 74 cases. The circumstances of most of these women, however, were such that it would cause depression in any human being.

Superstitions as a cause of illness was mentioned by respondents of 58 deceased women and this led to failure in recognizing the symptoms of fatal illness and, consequently, delay in seeking appropriate care.

The decision to seek spiritual and ritual treatment for fatal complications was taken by 60 women and their relatives. Some respondents expressed their beliefs as follows:

> *"Un per kisi ne taweez kiye they doctor ki report main kuch nahi ata tha magar wo beemar thi", (Someone had done black magic on her, her lab reports were normal but she remained unwell).*

> *"Marhooma buht Khoobsoorat thi Nazar lag gai" (she was very beautiful, got the evil eye).*

> *"Perfume laga ker Qabristan ko Cross kiya inko kuch nazar aya tha jiske bad inko dorey pertey they" (she went to the graveyard with perfume on and saw something, after which she started to fit).*

Rubina* from Balochistan Province

Rubina was a young woman of 19 years, married to a 22-year-old shopkeeper. She was in good health and happy.

Rubina was eight months pregnant when she died. It was her first pregnancy, and she used to go for regular antenatal checkups to a doctor. She was told her blood pressure (BP) was high, but the doctor did not prescribe medicines to control it. One day she fainted at home; her husband took her to a nearby doctor who informed him that Rubina's BP was high, gave her injections and some medicines and sent her back home reassuring her that she would be fine and not to worry. As soon as she reached home, Rubina fainted again. Her teeth were clenched, her tongue was severely bitten, and she started to bleed from her nose and mouth and her whole body became very stiff. Despite her serious condition, she was not taken to the hospital, because the doctor had reassured them, and a spiritual healer was consulted because they thought she was possessed by "jinns" (evil spirits). She died on her way home, after visiting the spiritual healer.

Her husband said she died of a stroke and was lamenting that she might be living today if he had taken her to a hospital instead of the "maulvi" (religious man).

Teenage pregnancy, a case of eclampsia, the doctor failed to recognize the condition, gave medicines, and sent her home, and in the end the family sought treatment from a faith healer! The family still does not understand the real cause of death, they are none the wiser and even in their family women will continue to suffer and die from hypertensive disorders of pregnancy.

* The name has been changed to ensure confidentiality

Physical domestic violence was suspected in 27 women and there were many more subjected to emotional/psychological and verbal abuse.

Gender discrimination was found in five cases. As narrated by the son of a deceased woman: *"Hamarey Khandan m rawaj hai k Auraton ko Hospital nahi lekar jatey"* (In our family, it is a custom

not to take women to hospital). *"Hamarey Ilaqy k Log Jahil hen or Aurat ki koi value nahi he, Meri Ami beemar hoti thin or unki beemari ko halka samjha gaya jab unki tabiyat ziyada kharab hui to unkey bhai unko ilaj k liye Gilgit Legae or wahin unki death hogai"* (People in our area are illiterate, do not value women. My mother was not well but her illness was not taken seriously and only when she was really bad, her brothers came and took her to a hospital in Gilgit).

D. Specific Recommendations: What could have been done to avert maternal deaths?

Surgical and medical misadventures contributed significantly to quite a few maternal deaths, even when judged by the substandard care that usually exists in Pakistan. Misadventures contributed to deaths directly or indirectly in most of the cases and were not reported as such but the medical cause was attributed as the primary cause of death in PMMS 2019. This failed to capture the complete picture and therefore appropriate remedial actions cannot be planned and implemented. Following are recommendations (shown in *italic* and **bold**) addressing specific situations and causes noted in the analysis of verbal autopsies.

- Cesarean sections were done on frivolous grounds at times by inexperienced HCPs leading to maternal deaths.
  Recommendation: *Ethics and evidence-based practice has to become a mandatory requirement and part of the medical training curriculum.*

- It was generally noticed that there was reluctance to reopen the abdomen when indicated, resulting in delayed decision by the HCPs. A decision to perform exploratory surgery is always difficult, it is quite traumatic for the HCP, requires courage and is like an admission of guilt, so the HCPs remain in a state of denial and keep on observing the patient hoping for the best, instead of immediately re-exploring the patient or referring early in a timely manner. Fear of repercussions by the family of the patient also delays appropriate action.
  Recommendation: *A system needs to be in place where doctors are not only trained but supported when confronted with such alarming situations and are not left at the mercy of angry relatives, who damage the hospital property and physically harm the HCPs. Security cover and Medical Defense Unions need to be in place.*

- Injections to augment labor in multigravid women, often with previous cesarean section, were given and led to a ruptured uterus. This was mostly done in low resource settings, where a quick resort to cesarean section, if required, was not possible. These reckless HCPs included mostly midlevel HCPs who could not deal with the consequences of their actions. A classic case of "what the mind does not know, the eyes cannot see" or *"Anjam se bekhabar aatish e Nimrod mein kud jana"* (jumping into the fire of Nimrod without thinking of the consequences).
  Recommendation: *Strict protocols and guidelines for induction of labor have to be made and implemented.*

- When family members/attendants complained about the unstable condition of the patient, HCPs usually did not pay heed to their complaints and hence appropriate actions were not taken in a timely manner.
  Recommendation: *In the absence of adequate nursing staff, when family members are actually*

nursing the patients at the health facilities, due attention needs to be given to their observations/complaints.

- PPH was mostly underestimated by the HCPs who informed the relatives that bleeding after childbirth is normal. Women bled under the sheet or blanket that they were covered with and slipped into irreversible shock without the excessive blood loss being noticed. Excessive vaginal bleeding after childbirth is also perceived as normal by relatives and a decision to seek medical help is usually very late.
Recommendation: *Information about what is an acceptable volume of blood loss after childbirth needs to be disseminated, both to the public at large and the HCPs.*

- Blood transfusions were given as an ultimate treatment for PPH, and the underlying cause was not addressed.
Recommendation: *It is very important to train HCPs to look at and treat the cause of PPH and not rely only on blood transfusion to treat PPH.*

- Anemia was very common among women and even a slight amount of bleeding, especially PPH, tipped the balance and pushed the women over the edge.
Recommendation: *Prevention and treatment of anemia should be the cornerstone of good antenatal care.*

- Finding voluntary blood donors was a challenge and arranging blood products for hemorrhaging patients was difficult.
Recommendation: *Awareness campaigns should be run about the importance and benefits of voluntary blood donation.*

- Mismatched blood transfusion was responsible for a few deaths.
Recommendation: *Setting up blood banks with standard protocols is vitally important as is only transfusing blood when required, and not on frivolous grounds.*

- HCPs would wait for blood while the patient was hemorrhaging, instead of taking her to the operating theater straight away, for example in ruptured ectopic pregnancy. This wait often led to the death of young women.
Recommendation: *Women with a diagnosis of ruptured ectopic pregnancy should be operated upon immediately to arrest bleeding without waiting for the blood to arrive. Think 'ectopic' in a young woman of reproductive age with abdominal pain.*

- A lot of women with complications of pregnancy sought treatment for their ailments from spiritual faith healers, who treated them with taweez (amulets), water to drink and so on. In KP a taweez soaked in water and then drunk is called "sakht" and is described in a few cases.
Recommendation: *It is of utmost importance that the government takes action to rid the society of such quacks and ensure availability of healthcare for all, close to their homes. Also, engage these leaders to encourage patients and their relatives to seek appropriate medical care promptly.*

- Sometimes doctors also encouraged treatment by spiritual healers and propagated myths, trying to justify or cover up the surgical or medical misadventure that happened under their care, such as" bucha *mar gaya aur jism m zehr phehl gaya"* (the baby died and the poison has spread all over the body).

Recommendation: *HCPs have to be trained and required to treat patients with evidence-based medical practices, hence providing quality care. Measures of accountability should be put in place to eliminate negligence and misadventures.*

- Myths and misconceptions existed about placenta previa; tablets and injections for its cure were prescribed and the women mistakenly believed that the medicines would correct the situation. There was poor understanding in the communities about the medical condition and its consequences and therefore the myths persisted even though there had been a death in the family from that medical condition. For example, in households where the woman died of eclampsia, the family believed that she died due to a wrongly administered injection. So, no lessons were learnt, and the women will keep on dying of eclampsia in that community.
  Recommendation: *If the family was counseled about the exact cause of death and made aware of the danger signs during pregnancy, they would be in a better position to recognize the danger signs and seek care from a qualified HCP the next time, instead of believing the death was due to a wrongly administered injection or due to her being possessed by a jinn (evil spirit). Mass awareness campaigns about danger signs during pregnancy, childbirth and postnatal period should be created. Posters in local languages should be pasted in health facilities, mosques, madrasas, schools, markets, beauty parlors, and so on.*

- Many myths and misconceptions prevail in the communities. A commonly held belief was that when a baby died in utero, it should be delivered by cesarean section and not delivered normally; family members accused HCPs of attempting to or delivering a dead baby vaginally and attributed the death to this. The family gave reasons for death as: "*Woh khushi se mar gai*" (she died of pure joy- as she had delivered a boy), "*dimagh ne kam kerna chor diya*" (her brain had stopped functioning), "*nazar lagne ki waja se mar gai*" (died of evil eye), "*pareshani se mar gai*" (died of worries), "*Allah ki marzi thi or din purey hogae they*" (Allah's will and her days were completed), "*maikey gai to mar gae*" (died as she had gone to her mother's house). In the latter case, they usually did not know much about the circumstances of her death and insinuated that as she was at her mother's house, she did not get good care and attention. It seems that these women had gone to their parents' home after some disagreement and the husband, and his family had not kept in touch. It is noted with great concern that when there was a maternal death in the family of an identifiable medical cause, the family was not any wiser, and the myths still prevailed.
  Recommendation: *If they were given a clear understanding of the condition, counseled about danger signs and the need to make a birth preparedness and complication readiness plan, at least the future generations of women could be saved.*

- Women had chronic medical conditions before pregnancy (for example, tuberculosis, cardiovascular disease, chronic renal ailments, hepatitis B & C) but no treatment was sought before getting pregnant.
  Recommendation: *The importance of pre-pregnancy screening, counseling and multidisciplinary care during pregnancy has to be emphasized.*

- Women under treatment for cancer were not advised FP, as a result cancer treatment could not be optimized, and women got pregnant after cancer was diagnosed.
  Recommendation: *Integrating FP services with all clinical interactions is a must.*

- Women indulged in procreation even when they had many sons and daughters; some had earlier terminated pregnancies too and used no contraceptive method subsequently. They died in the process of bringing a new life into the world, leaving their children at the mercy of a society which generally has no empathy and a husband who is most likely to remarry, as seen in a few cases when the interviewers went to these households.

  Recommendation: *Awareness needs to be created about the fact that complications during pregnancy and childbirth are the leading cause of death amongst young women in Pakistan. All pregnancies should be planned after carefully considered decision-making and not as a result of a casual sexual relationship, where the intention is to have sex and the result is a pregnancy.*

- When young girls attended clinics as child brides and with teenage pregnancy, it was business as usual and the family was not guided about the law on child marriage, its punishments and Healthy Timing and Spacing of Pregnancy (HTSP)

  Recommendation: *HCPs need to give awareness about laws regulating child marriage. Information should also be given about HTSP. Effects should also be made for enforcement of the laws and the special health care needs of young mothers.*

  > **Hafeeza* from Azad Jammu & Kashmir**
  >
  > Hafeeza, was 31 years of age when she died, married to a laborer of poor means aged 45 years. The couple had no education and lived in extreme poverty in a far-flung village, where there was no public transport nor any health facility. She was married off when she was only 19 years of age; during her 12 years of marriage, she was pregnant 10 times, delivered 7 children normally and had 3 miscarriages. Of the 7 children she delivered, only 3 were alive, one boy and two girls. It is noteworthy that she delivered four children in the last three years of her life.
  >
  > Hafeeza had no medical illness and had never used any family planning method. During her last pregnancy she visited a specialist four times, was told she was deficient of blood and prescribed iron and calcium tablets. At term when labor pains started, Hafeeza hired a private vehicle to go to a hospital, which was at a distance of about one hour. On the way, the fuel in the vehicle ran out and it took about one and a half hours to refuel it when a motorbike rider gave them some fuel to get to a gas station to fill the tank. All this took three hours. At the government hospital Hafeeza was immediately checked by a doctor and her blood pressure (BP) was found to be quite high. She delivered an alive baby girl, but her BP remained high and could not be controlled, she died twenty minutes after childbirth.
  >
  > The likely cause of Hafeeza's death was pregnancy induced hypertension.
  >
  > *During all her married life Hafeeza was either pregnant or lactating. She must have come in contact with many healthcare providers during this period, but family planning was never integrated with her care.*
  >
  > * The name has been changed to ensure confidentiality.

- It was noted that in certain geographical areas young girls described as very pretty, and with no previous ailments, died suddenly during early pregnancy in suspicious circumstances. Was there an attempt to terminate a pregnancy or were these honor killings? *"Buht khoobsorat thi or hamal ke doran aur khoobsoorat hogai thi is wajah se nazar lag gai"* (she was very beautiful and during pregnancy she became even more beautiful and that's why she got the evil eye). Some families were reluctant to talk about the dead women, especially when women died in suspicious circumstances and said *"Marney waley ka perda rakhna chaye keyun k humein bhi merna he"* (It is better to not talk about the dead as we have to die as well).

Recommendation: *HCPs should have good communication skills to understand the real underlying cause of death.*

- When it was felt that the woman was terminally ill and would die soon, the HCPs referred them in haste to other health facilities in an unstable moribund condition, standard referral protocols were not followed, and women either died on the road or soon after admission in the next hospital. It is quite common for women to shuttle between several hospitals where they were either denied care or given substandard care. Sometimes they were seen at the gate and not even given first aid, ultimately ending up in a secondary/tertiary health facility, already dead or in a condition in which there was no hope of survival. Sometimes, fearing repercussions in the eventuality of death, HCPs referred women to other hospitals, mostly public, to escape violence from the relatives, thereby denying women a dignified death in hospital.

  Recommendation: *Standard referral protocols should be adopted and firmly implemented, so that women and their families are properly guided towards going to a suitable facility, instead of shuttling between many small ill-equipped health units. Moreover, HCPs should understand that hospitals are not hotels and that inevitably some patients will die. If the family understands and sees that everything possible was done to save the woman, and if they are kept in the loop during treatment and counseled, they will readily accept death as the will of Allah and not resort to violence. Desperately ill women should be able to die with dignity in the hospital, instead of being put in a vehicle and sent to another health facility. Zero tolerance for indifference and neglect by HCP and/or the facility should be instituted and enforced.*

- A birth preparedness and complication readiness plan was missing in all the cases.

  Recommendation: *Clear instructions about what to do and where to go in the event that complications set in should be given by the HCPs at the health facilities. Information about birth preparedness and complication readiness should be widely disseminated amongst the community, and the HCPs should be made aware of the need to counsel their clients and to guide them to prepare birth plans. Mass media campaigns need to be planned around the topic.*

- Men are generally kept out of the conversation in matters of pregnancy and childbirth, both by the women elders of the family and the HCPs; hence they do not understand the urgency of the situation when complications set in.

  Recommendation: *Men should be made part of the discussions and decision-making during all clinical interaction and discussions.*

- In smaller cities and towns, cesarean sections were usually done by general surgeons who are not trained in core obstetric skills. They coped with uncomplicated cases but whenever any complication set in during surgery or a medical condition like eclampsia developed, women were not managed appropriately and died within hours of surgery. It is possible that these women died of surgical and/or anesthetic complications but the family was usually informed that the woman died of a cardiac event.

  Recommendation: *General surgeons working in small towns and villages and providing operative deliveries should be given refresher trainings in tertiary teaching hospitals.*

- Women with unplanned/unwanted pregnancies have no option but to seek help from quacks and unprincipled HCPs, who resorted to unsafe abortion, leading to horrible and agonizing deaths of these women.

Rehana, a 28-year-old uneducated, healthy young woman, was married to an uneducated laborer of 27 years of age. She conceived two years after marriage and twice had antenatal checkups during her last pregnancy by a doctor at a nearby clinic. One day at term, at around 5:00pm, she had labor pains and her husband called the village dai. She examined Rehana and said the labor pains were not strong and that there was still time to delivery and left. Early the next morning Rehana had strong labor pains and the dai was called again. This time she informed the family that there was some complication and the baby could not be delivered normally. She advised the family to shift her to a hospital. Rehana was then taken to a private hospital at Head Rajkan, where the doctor told the family that she needed an operation to deliver the baby. Blood was arranged and a live baby boy was delivered by cesarean section. The third day after surgery, on discharge she complained of pain in the lower abdomen, and she was given an injection. She then also complained of blurred vision and seeing flashes of light. The doctor reassured her and said there was nothing to worry about and advised her to drink "doodh patti chai" (tea infused in milk) and wash her face with cold water.

Soon after reaching home, she started to convulse. Her husband called the surgeon who said he was in Bahawalpur and instructed him to take Rehana back to his hospital where the staff would take good care of her. It took more than one hour to arrange transport. At the hospital a compounder checked her, gave her some injections and an intravenous drip, but her condition worsened, and she complained of loss of vision. She was then referred to Bahawalpur Victoria Hospital (BVH). At this the family got angry and shouted at the compounder that their patient was operated upon in this hospital, they had spent so much money, she was mismanaged and now being referred to Bahawalpur.

But the relatives had no other option and took Rehana to BVH, where she was admitted to a medical ward; there her fits were controlled on the fourth day. Fourteen days after surgery the family realized that her stitches had not been removed and requested the doctors at BVH to remove the sutures. She was told to get her stitches removed from the hospital where she was operated upon, so the family took her again to the hospital at Head Rajkan, the stitches were removed, and she returned to BVH. She then started having fever and her BP remained high. The family was told to arrange blood for transfusion, but while she was being transfused blood, she became unconscious and died.

The family is of the opinion that Rehana died due to hypertension and the injection given at the hospital in Head Rajkan. Rehana, however, died of complications of eclampsia. She had classic symptoms of impending eclampsia, which were missed by the HCPs. Even after Rehana's death, her family is unaware of the real cause of her death.

The HCPs failed the family in not informing them about the cause of death, discharging her after surgery when she complained of seeing flashes of light and blurring of vision, then guiding her back to the same hospital when she had fits, where there was no doctor, thereby delaying her care.

At BVH she was admitted to the medical ward instead of the OB/Gyn ward, as there is usually a tussle in a multidisciplinary health unit over where the patient should be admitted in the postpartum period. To top it all, an unstable patient was sent back to the private hospital for removal of sutures, instead of calling the OB/Gyn resident to remove them.

* The name has been changed to ensure confidentiality.

Recommendation: *It is imperative to create awareness in the community about the fact that there are medical methods available for termination of pregnancy, especially for women who live in remote areas and do not have access to qualified HCPs. Moreover, the HCPs have to be sensitized about their professional responsibilities which should not be compromised by their personal beliefs.*

- There is generally a lack of information about the use of misoprostol for prevention and treatment of PPH and to manage unwanted pregnancies.

Recommendation: *This information should be widely available for the community at large and the HCPs should be trained in its use.*

- Leucorrhea/vaginal discharge is listed as chronic illness in the VAQ and women sought treatment for it. Unethical HCPs generally not only treat it with medicines but also perform surgical procedures.
  Recommendation: *Awareness should be created among the public that leucorrhea is a normal physiological discharge and does not require treatment.*

Khadija* from Punjab Province

Khadija was 32 years of age when she died, and her husband was a farmer of 26 years of age. Both had no schooling. They had two daughters; the last one was born nine months earlier. Khadija had some thyroid disease from a young age and was taking treatment for it, but irregularly.

She was using some contraceptive method, but it failed, and she conceived. This was an unwanted pregnancy and she and her husband decided to terminate it. She went to a village dai, who confirmed that she was three months pregnant. After discussing the matter with her husband, she went back the next day to the dai, accompanied by a neighbor. The dai gave her some medicines to terminate the pregnancy. Khadija took the medicines and on the third day she experienced some abdominal pain upon which her husband took her to the dai again. He left Khadija at the dai's clinic at 10:00am and returned home. At around 1:00pm he received a call from the dai telling him that Khadija's condition was very serious. When he reached there, Khadija was lying dead on a charpoy. The dai told him that she had called a doctor, who confirmed that Khadija had died of thyroid disease.

The husband believed Khadija died of excessive vaginal bleeding as she continued to bleed even during her last ablution.

A case of unsafe abortion of an unwanted pregnancy by an unskilled provider! Information about available medical methods of termination of pregnancy could have saved her.

* The name has been changed to ensure confidentiality.

- HCPs who could perform a cesarean section did so on the slightest pretext, whereas HCPs without the skills to perform a cesarean section tried to deliver women normally at all costs, resulting in delayed referrals and serious consequences, including death.
  Recommendation: *The health system should be regulated to ensure that only trained and accredited HCPs perform their duties in an ethical manner.*

- HCPs generally do not know how to write a death certificate and list cardiopulmonary arrest as a cause of death in all cases. The general public says the cause of death is "*Allah ki marzi*" (God's will).
  Recommendation: *Writing a death certificate is a special skill and should be taught to all HCPs during under- and postgraduate trainings.*

- There were some deaths due to severe burns from exploding stoves while cooking.
  Recommendation: *The quality of gas cylinders needs to be standardized.*

- A death resulted from rabies.

Recommendation: *Managing stray dogs and availability of vaccination has to be ensured.*

- In some provinces, for example KP, AJK, GB and some areas of Balochistan, the terrain is extremely difficult, and transport is not readily available. Women were carried, tied to a charpoy, where it was impossible to run any vehicle on the dirt roads, and where the family had to wait until morning before attempting to go to a hospital.

  Recommendation: *In such situations, it is recommended to organize "waiting houses" near tertiary/secondary hospitals, where women with high-risk pregnancies in their last trimester/month can wait until they deliver. Similar models have been set up in Brazil.*

> **Safia* from Baluchistan Province**
>
> Safia was reportedly 47 years old when she died, and she was married to a 46-year-old farmer. Both had no schooling and had three children, two boys and one girl.
>
> Safia was often sick but had no access to good medical care as there was no healthcare facility or doctor in the area she lived. Medicines were also not available and whenever Safia was sick, someone would get her medicines from the city.
>
> While pregnant she felt very weak but could not seek any healthcare. At term when labor pains started, a village dai was called, and a healthy baby girl was delivered, but Safia started to bleed heavily. The dai reassured them that it is normal to bleed after childbirth, but by the evening on the next day bleeding increased and her condition started to deteriorate. It was nighttime, the dai was called and advised them to shift her to a hospital. The family was extremely poor, transport was not available and there was no hospital in the area. While transport was being arranged, Safia died at home.
>
> *A mother of three living in a remote area with a family of sons and a daughter, is disenfranchised and dies of PPH. Family planning, if nothing else, would have saved her. Setting up 'waiting houses' near a secondary/tertiary hospital, where women living in remote areas in their last trimester/month of pregnancy wait to deliver, could have saved her.*
>
> * The name has been changed to ensure confidentiality.

- Domestic violence was not described in most of the cases, and this might be true for physical violence, but most of the women were subjected to emotional and psychological violence. Poverty, incessant childbearing, household, and outdoor chores with very little help from their spouses, was how their life was described. In some areas especially KP, the husbands were usually abroad working, while the wives struggled alone.

  Recommendation: *Women's education, economic empowerment and information about their rights should be widely disseminated, including prevention of child marriage and teenage pregnancies.*

- On public holidays like Eid, doctors are usually not present in the hospitals.

  Recommendation: *Ensuring availability of staff at all levels of healthcare is a must.*

- A common question asked by the HCPs of relatives in challenging circumstances is "*Maa chaye k bacha?*" (Who do you want to be saved, mother or the baby), Putting the family in this melodramatic situation is very inhumane, creates drama and is far removed from the existing medical situation. This seems to be only a cover-up ploy. Lame excuses were given when surgery went wrong "*Jaldi pani piya tha wo nikala hai*" (she drank water too soon after the cesarean

section and that was taken out), as a reason for exploratory laparotomy. In another similar instance the relatives were informed that ''*Ander kachra reh gaya he*'' (Some waste material had to be removed). There were instances of misbehavior by HCPs, for example when a woman with fits was referred to a doctor, she called her a "*pagal*" (madwoman) and sent her away. More respondents said, *'' Doctor ne buht badtameezi k sath Faisalabad refer kiya''* (Doctor misbehaved and referred us to Faisalabad)*, "Doctor sahih batatey nahi they na test na report karatey they, hemoglobin 7 tha but blood nahi lagwaya tha bus halki goli detey they maine bola mera aur uska blood group B positive tha per blood nahi lagaya''* (Doctors would not talk to us, would not do any tests, her hemoglobin was 7 but they did not transfuse blood and only gave some tablets. Although my blood group was the same as hers).

Recommendation: *Speaking honestly to the relatives in a humane manner and giving explanations while treating the women is vitally important. Training the HCPs on "breaking bad news" is very important. HCPs need to be emotionally invested and have to go beyond the call of duty with a sense of urgency to save these young women.*

- In many cases women were discriminated against and faced domestic violence after giving birth to girls.
  Recommendation: *There needs to be a mass awareness campaign, including for the religious leaders, about the fact that the woman has no role in determining the gender of a newborn and that in fact it is the man who determines the gender of a baby.*

- In tertiary and secondary hospitals decisions about patient management were taken by on duty junior staff for serious moribund patients. Senior consultants were not available in person and the on-call staff was hesitant and too scared to call their seniors at night. This resulted in mismanagement.
  Recommendation: *Senior skilled staff should be always accessible for consultation either in person or on call.*

- There is a shortage of staff, equipment, and disposable materials such as gloves, sutures and so on, especially in public health facilities.
  Recommendation: *This needs to be addressed as a priority.*

- Sadly, there is a communication gap between the HCPs and their clients. The severity of the condition, danger signs and possible risks are not communicated to the clients. The HCPs also lack communication skills and do not have appropriate words in local languages to communicate.
  Recommendation: *A concerted effort needs to be made to develop communication skills of HCPs during undergraduate education and they should be made to demonstrate them during their training. Finding suitable words to communicate on reproductive health matters is also important; words which are easily understood and do not cause embarrassment or shame to the HCPs. The HCPs should be encouraged to communicate without getting embarrassed in a desensitized manner.*

- Political interference in some public hospitals also leads to their deprivation and discontent among staff, who are not paid salaries for months and made to work in the poor, unsanitary conditions prevailing in the hospitals. This leads to poorly motivated and discontented staff.

Recommendation: *Adequate funding for hospitals is essential.*

- Sometimes there were misadventures at multiple levels. Women in Pakistan are caught between the devil and the deep blue sea. They die in desperate situations at home or on the roads, cannot reach the health facility and when they do get to a hospital they die of medical and surgical misadventures.

  Recommendations:
  - *There needs to be a system where tertiary hospitals should bring the secondary and primary health centers in their catchment areas under their jurisdiction/supervision, so that trained residents under direct supervision of their supervisors are rotated in these health facilities to improve maternal and neonatal healthcare.*

  - *Training in Obstetric first aid, Basic and Comprehensive Emergency Obstetric & Newborn Care (EmONC) should be given at all levels. Health facilities should be equipped, staffed and geared towards timely and proper referral when required. There should be opportunities for refresher trainings, mentoring and handholding. HFs should be instructed to conduct emergency drills and well-performing units should be appreciated to motivate them to perform even better. HCPs should be encouraged to work in group practices, so as to support each other when complications arise and cover for each other during holidays.*

  - *As the majority of deaths were due to PPH, focused training on prevention and treatment of PPH should be given. Refresher trainings and emergency drills on a regular basis is essential. It is imperative to create awareness that misoprostol works in this context.*

  - *It is suggested that Healthcare Commissions of each province should be involved, and all those health facilities named in the VAQs should be visited to improve their service delivery and provide supportive supervision.*

To summarize/conclude, we recommend the following:

1. A central cell should be created in the Prime Minister's office/President's office (this was done in Malaysia) along the lines of the COVID-19 cases that were reported daily to the National Command and Operation Center (NCOC). Similarly, all maternal deaths across the country should be digitally reported on a daily basis using a standard format.
   *Maternal Death Registry has already been developed by Society of Obstetricians and Gynecologists of Pakistan (SOGP)

2. All reported maternal deaths should be enquired into confidentially on a monthly basis to identify gaps and suggest actions to prevent such deaths.

3. Mass awareness must be created at community and facility level about:

   a. The significance of pre-marital counseling.

   b. The importance of pre-pregnancy screening and counseling to ensure a healthy outcome for both the mother and baby.

   c. The importance of making a birth preparedness plan. The HCPs should be oriented and trained to help their clients in making a birth plan.

d. Danger signs during pregnancy and postpartum period and what to do when danger signs appear and dispelling myths and misconceptions.

e. Identification of high-risk pregnancies and the importance of quality antenatal care (ANC).

f. The need to engage men during counseling and decision-making.

g. Importance and benefits of voluntary blood donations.

h. The laws on early age marriage, child labor and abortion in Pakistan.

i. The fact that women have no role in determining the gender of a newborn baby.

j. The availability of medicines that can be self-administered to either terminate a pregnancy if required, or to prevent postpartum hemorrhage.

4. Integration of family planning services with all kinds of healthcare specifically during the maternity cycle. With effective family planning, pregnancies can be prevented and, thus, averting maternal deaths.

5. Standard Operating Procedures (SOPs) should be in place and prominently displayed at all facilities and should be monitored by hospital administration. Emergency drills (such as emergency obstetric and neonatal situations) should be regularly conducted to assess if SOPs are being followed. A supportive system needs to be built in to ensure the safety of HCPs when faced with angry relatives.

6. Quality of care at all levels of health facilities must be enhanced. Essential equipment and supplies for providing comprehensive emergency obstetric and newborn care must be ensured, such as a functional blood bank, trained staff, including cover by specialists.

7. Evidence-based training of healthcare providers on person-centered care and providing care in a humane manner. Training must include good communications skills.

8. Technical competence of junior staff must be enhanced through mentoring and supervision by senior consultants around-the-clock.

9. A proper functional referral system needs to be put in place with functional ambulances allowing transport of emergency cases directly to tertiary care facilities, thus saving precious time spent in shuttling between facilities not equipped to handle obstetric emergencies.

10. In remote areas, "waiting houses" near tertiary/secondary hospitals should be organised, where women with high-risk pregnancies in their last trimester/month can wait until they deliver.

11. Regulatory bodies such as Healthcare Commissions of each province should be engaged in eliminating the role of quacks including the faith healers from counselling and/or care that endanger women's survival.

Ah e Zan   آہ زن

(A sigh of womanhood)

English		Urdu
We know each day In this merciless world How many daughters While attaining motherhood Enter the vale of death O my eloquent versifiers O my vehement healers Feel the pain Listen to my voice A daughter may belong to Chhor Or be a Kashmiri From Khyber Pakhtunkhwa Or be a Karachiite For becoming a mother needs easy access to medical help All of them have a right All be rendered equal help May it be Kharan or Makran Gilgit-Baltistan Lahore or Kohistan Any village, any suburb Big city or far-flung Seeking medical help Daughters shouldn't wander Attaining motherhood Needs to be rewarded And never be a torture Even if she is to die Death should be an honor O my dear shamans O my articulate versifiers Up and do something for These lovely daughters When they grow up as mothers Should be blissfully happy Can play with their children And blossom like flowers May their dreams come true Shine and rise with families Foreheads adorned with moons Stars sparkle in their eyes	O my healers Time to leave this callousness Up and do something NOW Eliminate this sadness Just see each day How many daughters Are facing death Wandering here and there And dying helpless O my eloquent versifiers Feel my pain And be my voice	اے میرے چارہ گرو اے میرے سخن ورو کچھ تو ایسا کرو بیٹی جب بھی ماں بنے تو وہ شاد ماں رہے اپنے بچوں میں کھیلے پھولوں جیسی رہے خواب سارے پورے ہوں مسکراتی ہی رہے اس کے ماتھے پہ ہمیشہ چاند چمکتے رہیں اور آنکھوں میں ستارے جھلملاتے ہی رہیں اے میرے چارہ گرو اے میرے سخن ورو اب تو چھوڑو بے حسی اب اٹھو کچھ تو کرو دیکھو تو روز کتنی بیٹیاں ماں بنتے ہوئے روز مرتی ہیں یہاں
جانے کتنی بیٹیاں ماں بنتے ہوئے روز مرتی ہیں یہاں اے میرے سخن ورو اے میرے چارہ گرو درد محسوس کرو میری آواز سنو بیٹی ہو میری چھور کی یا کراچی شہر کی خیبر پختونخوا کی ہو یا میرے کشمیر کی ماں بننے کے لئے سب کو ملے یکساں مدد خاران یا مکران ہو گلگت بلتستان ہو لاہور یا کوہستان ہو کوئی گاؤں کو ئی نگر چھوٹے بڑے سارے شہر صحت کی تلاش میں بیٹی نہ ہو یوں دربدر ماں بننے کا عمل اعزاز ہو سزا نہ ہو کہ زندگی ہارے اگر تو موت بھی ہو معتبر		

* Written by Brig.(R) Mubushra Samina, one of the nosologists who was deeply and emotionally affected after attending many verbal autopsy meetings.