ORIGINAL ARTICLE

# Trends in Maternal Mortality in Tertiary Care Hospital, Peshawar Pakistan-A Follow up study

FOUZIA FAHIM[1], WALEED BIN FAHIM[2], FARZANA BURKI[3], MEHNAZ RAEES[4], GUL LAKHTA[5]
[1]FCPS Associate Professor of Gynae /Obs, Medical Teaching Institution/ Lady Reading Hospital, Peshawar
[2]MBBS, Medical Officer, Shifa International Hospital, Islamabad, Pakistan
[3]MBBS, FCPS, Assistant professor of Gynae /Obs, Peshawar medical college, Pakistan
[4]Assistant Professor, Medical Teaching Institute, Lady Reading Hospital, Peshawar, Pakistan
[5]MBBS Medical Officer, Rural Health Centre, Nowshera
Corresponding author: Mehnaz Raees, Email: 1916danishsarwar@gmail.com

## ABSTRACT

**Objective:** To describe the trends in maternal mortality in tertiary care hospitals in the last five years and compare the mortalities in the previous ten years.

**Methods:** All pregnant women from January 2016 to December 2020 were analyzed. The primary outcome of this research was maternal mortality ratios. Various causes of maternal mortality were also evaluated. The correlation between maternal characteristics and maternal mortality was inspected using logistic regression models. Pregnancy outcomes of mothers who died versus mothers who survived were also evaluated.

**Results:** One hundred seventy-three maternal deaths were noted in 49283 pregnant women in 2016-2020. The average maternal mortality ratio in 5 years period was 409 per 100,000 live births. It showed a decreasing curve over the five years, from 539/100,000 live births in 2016 to 295 in 2020. Five year clusters also demonstrated a falling trend, from 856/100,000 live births to 409. Hemorrhage (34.68%), hypertensive disorders of pregnancy (21.38%), suspected cases of thromboembolism (20.80%) were the leading causes of maternal mortality. Pregnancy outcomes in mothers who survived and who expired were evaluated. Almost 33% of maternal deaths had stillbirths as compared to 4.69% in alive mothers (RR 6.87); similarly, unknown outcomes (RR7.56) and ectopic pregnancies (RR 3.01) were more frequent in cases of maternal demise.

**Conclusion:** Trends in maternal mortality show a decreasing curve. Hemorrhage remains the leading cause. Attainment of SDGs requires interventions both at primary and tertiary health care.

**Keywords:** Maternal mortality and Maternal Mortality Ratio (MMR), trends, causes of maternal mortality.

## INTRODUCTION

Maternal mortality remains one of the major barometers to gauge the standard of any health care system. It is widely credited as a key criterion of health and socio-demographic well-being. Still, it also represents the overall constitution of a country. A particular society's social, economic, cultural, and political ideologies affect maternal well-being, both directly and indirectly [1,2]. Averting maternal mortality and morbidity and stipulating best outcomes for pregnancies remain the obstetricians' foremost objective. Comprehensive health plans and clinical care codes cover the well-being of pregnant women. These protocols are regularly revised based on maternal mortality data in any particular country. Nevertheless, maternal mortality remains a disparaging health issue in middle and low-earning countries [3,4]. Many factors have been attributed to higher mortality rates in developing nations. Lower literacy rates, noncompliance regarding antenatal checkups, higher fertility rates, less access to medical care, and high incidence of infectious diseases have been found as major hindrances to lower pregnancy-related morbidities and mortalities [5,6].

World Health Organization gives a measure of 358,000 pregnancy-related deaths globally. A major portion (99%) of the fatalities occur in low-income countries, especially in Southeast Asia and Sub-Saharan Africa [7,8]. Most of these deaths can be averted by substantiated responses. These responses are based on tackling the predictors of maternal mortalities. As for the poor countries, socio-demographic factors, appropriate transportation systems, emergency medical care, cultural taboos are major determinants. These can ultimately affect pregnancy outcomes and their related complications [9]. Much research has been done to assess the predictors of maternal mortality. However, the effect of comprehensive community-based indicators like gross domestic per capita income, education rates, contraceptive acceptability rates, and total fertility rates have not been fully considered [10,11]. Two essential evidence-based interventions are comprehensive emergency obstetric and neonatal care (EmONC) and accessibility to skill births attendants (SBA's). They significantly decrease maternal morbidity and mortality [12]. The United Nations' pivotal role in addressing the issue of maternal mortality globally September 2000 has been a watershed moment in the history of the UN. The Millennium Development Goals (MDG) were agreed upon by the countries and international bodies in this session. MDG-5 entreats the reduction of Maternal Mortality Ratio (MMR) by 75% between 1990 and 2015 [13,14,15]. Pakistan has demonstrated a decrease in its maternal mortality ratio since 1990. Still, the advancement in this area is far less than in other South Asian Countries.

The maternal mortality ratio has been 431 deaths per 100,000 live births in 1990, which fell by 58.7% to 178 deaths per 100,000 live births in 2015 [16,17,18]. Progress assessment for MDGs found Pakistan pursuing goal 5 but could not achieve the target in 2015. Lately, Pakistan has been the signatory of the UN's Sustainable Development Goals (SDGs), making an allegiance to reduce maternal mortality ratio to less than 70/100,000 live birth by the year 2030. Seeking these targets for the year 2015 and year 2030, the Government of Pakistan initiated a series of measures during the last decade in the form of increased skilled birth attendance, access to contraceptive services, and increasing the number of community health workers [18]. The policies implemented at the primary health care services level do have a trickling down effect on the specialized health facilities, such as Lady Reading Hospital, where this current study was conducted. This research aimed to assess any changing trends in the maternal mortality ratio in the last decade. LRH is a tertiary referral center that receives patients with high-risk factors. Thus the differences in maternal mortality ratios can be accounted for. Additionally, there have been major changes in this hospital's organizational setup, and its impact on maternal care was also studied. The causes of maternal mortality were also analyzed to see any shift from direct obstetrical causes to indirect ones, as observed in developed countries.

## METHODS

It was an institutional-based cohort study. The data was acquired from the HMIS record of the Medical teaching institute, Lady reading hospital Peshawar, Pakistan. HMIS records the administrative, demographic and clinical information of all the hospital admissions and discharges. This research was carried out under the ethical policies and regulations of the institute's ethical committee. It was approved by the medical teaching institute's Institutional Review Board (IRB), Lady Reading Hospital. All the

records were rendered anonymous, so informed consent from the patients was not required. STROBE (strengthening and reporting of observational studies in epidemiology) guidelines were taken into account while conducting this study.

All the pregnancies from January 2016 to December 2020 were included. Pregnancies culminating into miscarriages and ectopic pregnancies were also a part of the data. Women who were lost to follow-up before delivery and those with missing data at 42 days after delivery were excluded from the analysis. Maternal characteristics such as age, parity, and antenatal visits were included in the variables.

The primary outcome of this research was maternal death. It was defined in conformity with the World Health Organization, the "death of a woman while pregnant or within 42 days after the termination of pregnancy". Maternal Mortality Ratio encompasses all maternal deaths independent of the result. The divisor is the live births. The main expression of interest was the causes of maternal death. Any shift from direct to indirect causes was noted.

**Statistical analysis:** Data were examined by SPSS version 22. Descriptive analysis included numbers and percentages. The correlation between maternal characteristics and all-inclusive maternal mortality was inspected using logistic regression models. Risk ratios of mortality as a function of each maternal characteristic were estimated. Pregnancy outcomes of mothers who died versus the mothers who survived were also evaluated in these models.

## RESULTS

We included 49,283 women from 2016 to 2020 in this study. Women who were lost to follow-up during 42 days of delivery were excluded from the analysis. The outcomes of the included pregnancies showed 42,640 (86.52%) live births, 2362 (4.79%) stillbirths, 768 (1.55%) early neonatal deaths, 2652 (5.38%) miscarriages, 475 (0.96%) cases of ectopic pregnancies. In 75 (0.152%) patients, outcomes could not be ascertained due to various reasons. Data on 173 maternal deaths during these five years (2016–2020) were included in terms of their outcomes: 99 (57.22%) women gave birth to live babies, 57 (32.94%) women had a stillbirth, 1 (0.12%) of the babies born to dead mothers also died in the early neonatal period, 9 (5.20%) women had miscarriages, 5 (2.89%) maternal deaths were accompanied by ectopic pregnancies, 2 (1.15%) deaths had unknown delivery outcomes. Comparing the pregnancy outcomes in maternal deaths to the women who survived, almost 33% of maternal deaths had stillbirths compared to 4.69% in alive mothers. The relative risk of stillbirth is quite high (RR 6.87) in mothers who do not survive. Similarly, unknown outcomes (RR 7.56) and ectopic pregnancies (RR 3.01) were more frequent in cases of maternal demise. ( Table No.1)

Table 1: Overall Pregnancy outcomes

| | Died (n %) | Alive | Total (n %) | RR |
|---|---|---|---|---|
| Deliveries (n) | 173 | 49,110 | 49,283 | |
| Live Births | 99 (57.22) | 42,541 (86.62) | 42,640 (86.52) | 0.66 |
| Still Births | 57 (32.94) | 2305 (4.69) | 2362 (4.79) | 6.87 |
| Early Neonatal Death | 1 (0.57) | 767 (1.56) | 768 (1.55) | 0.36 |
| Miscarriages | 9 (5.20) | 2643 (5.38) | 2652 (5.38) | 0.966 |
| Ectopic pregnancies | 5 (2.89) | 470 (0.95) | 475 (0.96) | 3.01 |
| Unknown outcomes | 2 (1.15) | 73 (0.15) | 75 (0.152) | 7.56 |

Maternal features associated with maternal demise were evaluated (Table No.2). Mothers who were more than 35 years of age, great grand multiparas with parity of more than 7 and no antenatal care with trained health personnel were at an increased risk of death during pregnancy.

Haemorrhage (35%), hypertensive disorders of pregnancies (21%) and suspected cases of thromboembolism (21%) were the leading causes of maternal mortalities in our study population (Table No.3). The main causes of death remained the same in these five years of study. Maternal deaths attributed to indirect causes were in the range of 11–16%.

Table 2: Maternal Characteristics (2016- 2020)

| | Died (n %) | Alive | Total (n %) | RR |
|---|---|---|---|---|
| Deliveries (n) | 173 | 49,110 | 49,283 | |
| Maternal age | | | | |
| < 20 | 3 (1.7) | 1030 (2.09) | 1033 (2.09) | 0.81 |
| 20 – 35 | 145 (83.81) | 42,040 (85.60) | 42,185 (85.59) | 0.97 |
| > 35 | 25 (14.45) | 6040 (12.29) | 6065 (12.30) | 1.17 |
| Parity | | | | |
| 0 | 18 (10.40) | 7367 (15) | 7685 (14.98) | 0.69 |
| 1 – 3 | 80 (46.24) | 25,146 (51.20) | 25,226 (51.18) | 0.90 |
| 4 – 6 | 49 (28.32) | 12,706 (25.87) | 12,755 (25.86) | 1.09 |
| > 7 | 26 (15.02) | 3891 (7.9) | 3917 (7.94) | 1.89 |
| Antenatal Care | | | | |
| No Visit | 77 (44.50) | 3929 (8) | 4006 (8.1) | 5.5 |
| < 3 visits | 63 (36.41) | 19600 (40) | 19663 (39.9) | 0.91 |
| 3 and more visits | 33 (19.07) | 25,581 (52) | 25,614 (52) | 0.36 |

Table 3: Causes of Maternal Deaths

| | 2016 | 2017 | 2018 | 2019 | 2020 | Total (n %) |
|---|---|---|---|---|---|---|
| Maternal Death(n) | 40 | 44 | 37 | 27 | 25 | 173 |
| Causes (n %) | | | | | | |
| Hemorrhage | 15(37.5) | 12(27.27) | 18(48.64) | 5(18.51) | 10(40) | 60(34.68) |
| Hypertensive disorders of pregnancy | 5(12.5) | 12(27.27) | 6(16.21) | 10(37.03) | 4(16) | 37(21.38) |
| Thromboembolism | 10(25) | 11(25) | 4(10.81) | 6(22.22) | 5(20) | 36(20.80) |
| Sepsis | 4(10) | 4(9.09) | 3(8.10) | 3(11.11) | 3(12) | 17(9.82) |
| Indirect causes | 6(15) | 5(11.36) | 6(16.21) | 3(11.11) | 3(12) | 23(13.29) |

A total of 49,283 study population was included to assess the trends in maternal mortality ratio over five years. The total maternal mortality ratio was 409, ranging from 295 to 539. A year-wise decreasing trend was noted in the study period. (Table-4)

Table 4: Year Wise Trends in Maternal Mortality

| 2016 | 539/100,000 live births |
|---|---|
| 2017 | 503/100,000 live births |
| 2018 | 409/100,000 live births |
| 2019 | 300/100,000 live births |
| 2020 | 295/100,000 live births |

The maternal mortality ratio in the 5-year clusters of the same institute were 856 (2006–2010), 431 (2011–2015), and 409 (2016–2020). An improving trend in maternal mortality was observed.

Table 5: Maternal mortality ratio in 5-year clusters

| Years | Maternal Mortality Ratio (Mean) |
|---|---|
| 2016 – 2020 | 409 |
| 2011 – 2015 | 431 |
| 2006 – 2010 | 856 |

## DISCUSSION

The result of pregnancy in terms of maternal mortality was evaluated from this study data encompassing the year 2016 to the year 2020. Our figures show a maternal mortality ratio of 409/100,000 live births. Most of the databases comprising various cluster years show a very high maternal mortality ratio in Pakistan, but with decreasing trends. Data published in 2012 [19] showed a maternal mortality ratio of 1017/100,000 live births from 2000–to 2009. Similarly, a study in the same tertiary care hospital in 2013–2017 showed a maternal mortality ratio of 431/100,000 [20]. Many studies have been published where lower and middle-income

countries' maternal mortality ratio was analyzed. Mostly they have used figures from Maternal Newborn Health Registry (MNHR). A study published in reproductive health 2020 analyzed data from pregnant women enrolled in the NICHD global network for women's children's health research from 2010 to 2018 [21]. Zambia, Pakistan, Kenya, India, Guatemala, and the democratic republic of Congo were studied regarding their maternal outcomes and maternal mortalities. They showed great variations in maternal mortality ratio in these areas, with the lowest in Guatemala (97) and highest in Pakistan (327). A similar study by Aziz et al., using the same database of MNHR, showed a maternal mortality ratio of 319 per 100,000 live births in Pakistan from 2010–2018 [16]. This signifies that Pakistan has one of the dismal pregnancy outcomes worldwide. Although we have seen decreasing trends in the maternal mortality ratio in the last 15 years, these ratios are still very high compared to the regional countries [17].

Various factors have been identified which may explain the contrasting outcomes between the various low and medium-income countries. In our study, the relative risk of maternal mortality increased with increasing maternal age. This is in line with other studies. Similarly, increasing rates of maternal mortality were seen with increasing parity. Pasha et al. have identified that the average parity of women in Pakistan was twofold compared to India, Africa, and Latin America[17]. The ratio of grand multiparas women in Pakistan was again twofold. There is considerable data of many developing countries that show higher parity being associated with worse maternal and perinatal outcomes. Our data also showed that women having more than 7 children had a relative risk of 1.89 maternal deaths. Similarly, lack of antenatal care also contributed to increased maternal mortality and maternal. Most of the studies potentiate our observation [26,27].

The Pakistan demographic and health survey (PDHS) has shown an improvement in maternal health indicators. They signify a substantial decline in maternal mortality ratio from 276(2006-07) to 178(2017-18) [18]. While comparing the maternal mortality ratio in our hospital with the PDHS surveys, we encounter higher maternal mortality. This observation agrees with many literature reviews that stipulate that the highest number of maternal deaths occur in health centers, which cater to high-risk patients and are tertiary care referral centers [21, 28, 29]. Lady reading hospital is the largest tertiary care health facility in KPK, and hence we expect higher mortalities. The data for the last 15 years show similar trends. However, 2020 showed a significant decline in maternal mortality ratio to 295. This can be attributed to the upgrading and consolidation of intensive care facilities in our hospital in the last 2 years, with more ICU beds available for obstetric emergencies.

Hemorrhage, hypertensive disorder of pregnancies, and suspected cases of thromboembolism remain the leading causes of maternal mortality in all five years of data collection. These trends remain more or less the same in the whole world. However, in the developed world, especially the USA, the foremost cause of maternal mortality is indirect cardiovascular disease followed by hemorrhage, hypertensive disorders, and sepsis[30]. In the developing world, the indirect causes still contribute to the lowest maternal mortality.

There are certain limitations to our study. The complications during labor and puerperium were not considered while studying the maternal characteristics. The diagnosis of thromboembolism events was based on clinical findings, and autopsies were not performed.

## CONCLUSION

The trends in maternal mortality show a decreasing curve. Hemorrhage remains the leading cause. The attainment of UN's Sustainable Development Goals (SDGs) can be made possible through increased skilled births attendance, access to contraception, and training of community health workers. As for the tertiary health services, further improvement in emergency and critical care obstetrics can decrease the maternal mortality ratio.

## REFERENCES

1. Sajedinejad et al. Maternal Mortality: a cross-sectional study in global health. Globalisation and Health,;201511:4.
2. Wilmorth JR,Mizoguchi N, Oestergaard MZ, Say L, Mathew's CD. A new method for driving global estimates of maternal mortality. Stat Polit Policy. 2012;3: article 3.
3. Fadiloglu E et al. Maternal Mortality: 10 years experience of a tertiary centre in Turkey. Hindawi. Case reports in Medicine.2020; Article ID 3595024,4 pages. https://doi.org/10.1155/2020/3595024.
4. M. Bauserman, A. Lokangaka, V. Thorsten et al., "Risk factors for maternal death and trends in maternal mortality in low and middle-income countries: a prospective longitudinal cohort analysis," Reproductive Health.2015; 12: 2.
5. Diana S, Wahyuni CU, Prasetyo B. Maternal complications and risk factors for mortality. Journal of public health research 2020;9:1842.
6. Girum T, Wasie A. Correlates of maternal mortality in developing countries: an ecological study in 82 countries. Maternal health, Neonatology, And Perinatology 2017;3:9.
7. Muhammed et al. A ten year analysis of maternal deaths in a tertiary hospital using the three delays model.BMC Pregnancy and childbirth 2020;20:585.
8. Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR, et al. Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet (London, England). 2014;384(9947): 980–1004.
9. Agha S. A profile of women at the highest risk of maternal death in Pakistan. Health policy and planning 2015;30:830-836.
10. Gaskin IM. Maternal Death in the United States: A Problem Solved or a Problem Ignored? J Perinat Educ. 2008;17(2):9–13.
11. Campbell OM, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. Lancet. 2006;9543:1284–99.
12. World Health Organization and Aga Khan University. Essential Interventions, Commodities and Guidelines for Reproductive, Maternal, Newborn and Child Health: A global review of the key interventions related to Reproductive, Maternal, Newborn and Child Health (RMNCH). Geneva: PMNCH, World Health Organization; 2011.
13. Albemarle et al. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015,with scenario based projections to 2030: a systemic analysis by the UN Maternal Mortality Estimation Inter Agency Group. Lancet 2016;387:462-74.
14. Brown SZ et al. Understanding Global Trends in Maternal Mortality. International Perspectives on Sexual and Reproductive Health 2013;39(1):32-41.
15. Rivera FP, Finland SD. Severe maternal morbidity and mortality. JAMA network open 2020;3(1):e200045.
16. Aziz A et al. Why are the Pakistani maternal, fetal and newborn outcomes so poor compared to other low and middle-income countries? Reprod Health 2020;17(3):190.
17. Pasha O et al. Maternal and newborn outcomes in Pakistan compared to other low and middle-income countries in the Global Networks Maternal Newborn Health Registry: an active community based, pregnancy surveillance mechanism. Reproductive Health 2015 ;12(2):S15.
18. National Institute of Population studies (NIPS)[Pakistan] and ICF. 2020. Pakistan Maternal mortality survey 2019: Key indicators report. Islamabad, Pakistan, and Rockville, Maryland, USA: NIPS and ICF.
19. Fahim F, Nabeel N, Utman N. Trends in maternal mortality in tertiary care hospital in Peshawar-Pakistan. J Postgrad Med Inst 2012;26(4):422-7
20. Rafiq S, Sweden W, Ghaffar SF. Trends and causes of maternal mortality in a tertiary care hospital over 5 years. 2013-2017. Pak J Med Sci. 2019;35(4):1128-1131.
21. Bauserman M et al. Maternal Mortality in six low and lower middle-income countries from 2010 to 2018: risk factors and trends. Reproductive Health 2020;17(3):173.
22. Nisar YB, Dibley MJ: Determinants of neonatal mortality in Pakistan: secondary analysis of Pakistan Demographic and Health Survey 2006-07. BMC Public Health 2014, 14:663.
23. Mazhar SB, Batool A, Emanuel A, Khan AT, Bhutta S: Severe maternal outcomes and their predictors among Pakistani women in the WHO Multicountry Survey on Maternal and Newborn Health. Int J Gynaecol Obstet 2014, 129(1):30-33.
24. Mgaya AH, Massawe SN, Kidanto HL, Mgaya HN: Grand multiparity: is it still a risk in pregnancy? BMC Pregnancy Childbirth 2013, 13:241.
25. Kayode GA, Ansah E, Agyepong IA, Amoakoh-Coleman M, Grobbee DE, Klipstein-Grobusch K: Individual and community determinants of neonatal mortality in Ghana: a multilevel analysis. BMC Pregnancy Childbirth 2014; 14:165.
26. Meh C et al. Trends in maternal mortality in India over two decades in nationally representative surveys. Doi:10.1111/1471-0528.16888.
27. Gelato A, Chojenta C, Taddele T,Loxton D. Association between maternal mortality and cesarean section in Ethopia: a national cross-sectional study. BMC Pregnancy and childbirth 2020;20:588.
28. Ronsmans C, Graham WJ, steering g LMSS. Maternal mortality: who, when, where, and why. Lancet. 2006;368:1189–200.
29. Saucedo M et al. Delivery hospital characteristics and postpartum maternal mortality: A national case control study in France. Obstetric Anaesthesiology 2029;130(1):52-62.
30. Creanga AA et al. Pregnancy related mortality in United States, 2011 -2013. Obstetrics & Gynaecology 2017; 130(2):366-373.