

A Retrospective Study of Changing Trends in Maternal Mortality in Tertiary Care Hospital

Nisha Mandloi¹, Nandini Singh Bhati², Sunil Bajoliya³, Shailja Garg⁴

¹Associate Professor Department of Obstetrics and Gynaecology, Nandkumar Singh Chauhan GMC Khandwa

²Senior Resident Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal

³Assistant Professor Department of ENT, Nandkumar Singh Chauhan GMC Khandwa

⁴Senior Resident Department of Obstetrics and Gynaecology, Nandkumar Singh Chauhan GMC Khandwa

Received: 23-07-2022 / Revised: 28-08-2022 / Accepted: 20-09-2022

Corresponding author: Dr. Nandini Singh Bhati

Conflict of interest: Nil

Abstract

Objective: The study intends to review maternal deaths in our institute to study the epidemiology of maternal death and differentiate between treatable and untreatable causes, thus alleviating burden of unfortunate maternal death.

Methods: All maternal deaths due to pregnancy or causes related or aggravated by pregnancy or its management during pregnancy or within 42 days of delivery irrespective of duration and site of pregnancy were included. The maternal mortality forms which were filled by the treating doctor under guidance of senior faculty were scrutinized and cause of death was derived. All the parameters were analyzed using descriptive statistics (percentages and proportions) were calculated.

Results: Among 40 maternal deaths 18 (45.0 %). It was observed that 30 (75.0%) maternal deaths were reported in rural patients. There were 28 (70.0%) deaths among illiterate patients. 28 (70.0%) maternal deaths in patients belonging to below poverty line. Majority 19 (47.5%) were third gravida and more. It was noted that there were 25 (62.5%) deaths of referred patients .15 (37.5%) died in antepartum period and 25 (63.5%) died in postpartum period. 31 (77.5%) died in less than 24 hours and 9 (22.5%) patients died after 24 hours.

Conclusion: Most of the causes of death were treatable. The Anganwadi workers, Accredited social health activist (ASHA) and Auxillary nurse midwife (ANM) are the connecting link between patients living in remote areas and doctors, therefore conducting training programmes for them can bring a major change. We need a holistic approach involving volunteers from various fields to ensure basic health care facilities equally to every women.

Keywords: Basic Emergency Obstetrics Care (BEMOC) , Skilled Attendant at Birth (SAB), Accredited Social Health Activist (ASHA) and Auxillary Nurse Midwife (ANM), Maternal Mortality Ratio (MMR) ,World Health Organisation (WHO) Janani Shishu Suraksha Karyakram (JSSK) under National Health Mission (NRHM)

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Pregnancy is an overwhelming state in a women's life but if turned into obnoxious events may lead entire family into bewilderment. Maternal mortality is the most common cause of death among women in reproductive age group. The maternal mortality ratio (MMR) as per World Health Organisation (WHO) is defined as number of maternal deaths per lakh live birth in a definite period of time. India has declared a downfall from 122/100,000 live births in 2015-2017 to 113/100,000 live births in 2016-18. MMR has a wide variation in our country, for example in Assam MMR is 215 and in Kerala it is 43. This disparity can be explained on the grounds of socioeconomic background, rate of literacy, availability of medical assistance and access to comprehensive obstetric care [1-3].

MMR is a sensitive health index however, it is also a reflection of equality of women in society, her decision making power and standard of obstetric care received. Though India has declared decline in MMR by 6.2% from 2014-16 to 2015-17, it is still far away from achieving the target 3.1.1 of Sustainable Development Goal to reduce global MMR to less than 70 per 100,000 births by 2030. The central government had executed various national schemes like Janani Shishu Suraksha Karyakram (JSSK) under National Health Mission (NRHM) in 2013 to promote institutional deliveries by providing cash incentive and ensuring essential services like free delivery, drugs and diet for mother and child but still the outcomes are unsatisfactory with negligible improvement in MMR [4-7].

India has also introduced a national electronic database to monitor maternal death in 2013 yet with limited progress due to shortage of resources. Majority of data for maternal mortality is gathered either from hospital or community based reports

with its limitations. The study intends to review maternal deaths in our institute to study the epidemiology of maternal death and differentiate between treatable and untreatable causes, thus alleviating burden of unfortunate maternal death. [8-11]

Materials and Methods

This was a retrospective observational study conducted at department of obstetrics and gynecology in GMC, Khandwa from April 2018 to January 2021. All maternal deaths that occurred in GMC, Khandwa due to pregnancy or causes related or aggravated by pregnancy or its management during pregnancy or within 42 days of delivery irrespective of duration and site of pregnancy were included and the fortuitous causes of death were excluded. Total number of live births in defined period of time was recorded.

$$\text{MMR} = \frac{\text{Number of maternal deaths}}{\text{Number of live births}} \times 100,000$$

Detailed demographic data pertaining to age, education, socioeconomic status, residential area, referral status, antenatal care received or not, obstetric score, mode of delivery, time interval between admission and death, blood transfusion if given, any associated co-morbidities were recorded. The maternal mortality forms which were filled by the treating doctor under guidance of senior faculty were scrutinized and cause of death was derived. All the parameters were analyzed using descriptive statistics (percentages and proportions) were calculated.

Consent: Written consent was obtained from the relatives of patients after explaining them the nature and purpose of the study. They were assured that confidentiality would be strictly maintained. The option to withdraw from the study was always open.

Observation Chart

Table 1: MMR in relation to demographic data of patients(n=40)

		N	Percent
Age Groups	<=20	8	20.0%
	21-25	18	45.0%
	>25	14	35.0%
Residential Area	Rural	30	75.0%
	Urban	10	25.0%
Education	Illiterate	28	70.0%
	literate	12	30.0%
SES	Above Poverty	12	30.0%
	Below Poverty	28	70.0%
Booking Status	Booked	17	42.5%
	Un booked	23	57.5%

Table 2: Maternal mortality in relation to obstetric score (n=40)

		N	Percentage
Obstetric score	Primi	10	25%
	Second gravida	11	27.5%
	Third gravida and more	19	47.5%

Table 3: MMR in relation to referred vs. non referred patients. (n=40)

		N	Percentage
Referred	NO	15	37.5%
	YES	25	62.5%

Table 4: Maternal mortality in relation to mode of delivery. (n=40)

		N	Percentage
Mode of Delivery	Antenatal	15	37.5%
	Home Delivery	5	12.5%
	LSCS	6	15.0%
	NVD	14	35.0%

Table 5: Maternal mortality in relation to admission to death interval (n=40)

		N	Percentage
Admission death interval	<24 hours	31	77.5%
	>24 hours	9	22.5%

Table 6: Maternal mortality in relation to blood transfusion (n=40)

		N	Percentage
Blood Transfusion	NO	15	37.5%
	YES	25	63.5%

Table 7- Maternal mortality in relation to associated risk factors

		N	Percentage
Associated co-morbidity	Anemia	18	40.9%
	Hypertensive disorders	12	27.2%
	Fever	06	13.6%
	Obesity	04	9.0%
	Previous C-section	03	6.8%
	Rheumatic heart disease	01	2.2%

Table 8: Maternal mortality in relation to cause of death

Cause of Death	Frequency	Percent
Preeclampsia, eclampsia, HELLP	12	30.0
Hemorrhage	10	25.0
Sepsis	07	17.5
Congestive cardiac failure	04	10.0
Rupture uterus	3	7.5
Pulmonary embolism	02	5.0
Amniotic fluid embolism	02	5.0
Total	40	100.0

Results

During the study there were 40 maternal deaths out of 20787 live births and the MMR was 192 per 1,00,000 live births. Among 40 maternal deaths 18 (45.0%) occurred in age group 21-25 years, 14 (35.0%) occurred in age group >25 years and 8 (20.0%) occurred in age < 20 years. It was observed that 30 (75.0%) maternal deaths were reported in rural patients and 10 (25.0%) deaths were reported in patients residing in urban areas. During the study duration, there were 28 (70.0%) deaths among illiterate patients, 12 (30.0%) deaths among literate patients. There were 12 (30.0%) maternal deaths among patients belonging to above poverty line and 28 (70.0%) maternal deaths in patients belonging to below poverty line.

It was noted that among 40 maternal deaths, 10 (25%) were primi, 11 (27.5%) were second gravida and 19 (47.5%) were third gravida and more. It was noted that there were 25 (62.5%) deaths of referred patients as compared to 15 (37.5%) deaths of patients who were not referred. It was observed that among 40 deaths, 15 (37.5%) died in antepartum period and 25 (63.5%) died in postpartum period. There were 5 (12.5%) home deliveries, 6 (15.0%) LSCS and 14 (35.0%) vaginal delivery. In respect of duration between admission to death of patient we concluded that 31 (77.5%) died in less than 24 hours and 9 (22.5%) patients died after 24 hours.

It was noted that blood transfusion was required among 25 (63.5%) patients and not

required among 15 (37.5%). Various risk factors associated with maternal deaths were anemia (40.9%), hypertensive disorder (27.2%), fever (13.6%), obesity (9.0%), previous C-section (6.8%) and rheumatic heart disease (2.2%). The causes of death in our study were preeclampsia, eclampsia, and HELLP (30%), hemorrhage (25%), sepsis (17.5%), CCF (10%), rupture uterus (7.5%), pulmonary embolism (5%) and amniotic fluid embolism (5%). During the study period it was noticed that among 40 maternal deaths there were 17 (42.5%) deaths of patients who received antenatal care and 23 (57.5%) deaths of patients who didn't receive antenatal care.

Statistical Analysis:

The maternal mortality forms which were filled by the treating doctor under guidance of senior faculty were scrutinized and cause of death was derived. All the parameters were analyzed using descriptive statistics (percentages and proportions) were calculated.

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures Independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was considered to be statistically significant.

Discussion

The maternal mortality ratio in our study is 192 per lakh live birth. The MMR in various study ranged from 66 to 802 per lakh live births . Patients from various villages, towns and districts like Harsud, Khalwa, Mundi and Burhanpur are referred to our hospital which explains the high MMR. [1,12-14]

Maximum number of maternal demise occurred in the age group of 21-25 years which corresponds with Sundari et al. Majority of deaths were seen in patients who were illiterate, residing in rural areas, with poor socioeconomic status and did not receive antenatal care (Table-1).Thus, an educated woman has more awareness and access to health resources which clearly illustrates low MMR in Kerala which has high literacy rate. The probability of maternal demise was higher in multigravida (Table-2). This may be due to higher prevalence of risk factors like hypertensive disorders, anemia and obesity in multiparous women. These results are coherent with other studies Horwood G et al and Kapote et al [1,7,15].

There were 25 deaths reported in referred patients (Table-3). Most of the patients referred were in moribund state. Hence, improving the quality of medical care, referring the patient before irreversible damage occurs, strengthening the transport facilities can reduce this number [15].

There were 63.5% (25) deaths reported in postpartum women (Table-4) which is comparable to Khumanthem et al and Kapote et al. Home delivery was recorded in 12.5% (5) of individuals and all were multigravida. The apprehensive and humiliating behavior of health care workers towards them make them insecure in hospitals. There were 31 (77.5%) deaths within 24 hours which is comparable to 60% in the study by Khumanthem et al [11,15].

Most common associated risk factor was anemia (40.9%) which explains the high requirement of blood transfusion (63.5%).

Anemia can lead to decreased immunity and high rate of infections and sepsis, early maternal exhaustion with increased instrumental delivery, congestive cardiac failure (CCF), muscular hypoxia of living ligature of uterus leading to postpartum hemorrhage in third stage.

The classic triad - hypertensive disorders in pregnancy, hemorrhage and sepsis continues to be the major cause of death with preeclampsia, eclampsia and HELLP syndrome to be the topmost cause. These observations were parallel to the studies of Sundari et al and Ashraf ali et al. Prophylactic use of magnesium sulphate in severe preeclampsia and antihypertensives at the time of referrals can reduce the preeclampsia-eclampsia syndrome and its complications. Obstetric hemorrhage (25%) is another hurdle to be dealt with. Anticipating postpartum hemorrhage in antepartum hemorrhage patients, intervention in the golden hour and expeditious availability of blood and blood products can help mitigate it. Administrating antibiotics in cases of premature rupture of membranes, fever, operative vaginal deliveries can decrease death due to maternal sepsis (17.5%). The death due to rupture uterus was seen in 3 (7.5%) patients and all had undergone cesarean section in their previous pregnancy. [1,16]

Fahim F et al studied trends in maternal mortality in tertiary care hospital in Peshawar-Pakistan. Medical records of 371 maternal deaths were retrospectively reviewed to determine the trends and likely cause of each death over the study period. Hemorrhage consistently remained the leading cause accounting for 38.89% of maternal deaths followed by Eclampsia, Multiparas accounted for more deaths. Lack of seeking antenatal care was observed to be major determinant of maternal mortality. Improvement in the quality of skilled maternity care, community education on the need to avail antenatal care, provision of family planning

services, among other factors, can drastically curtail the preventable causes of maternal deaths & reduce MMR. [17, 18]

Joseph KS et al made their paper on maternal mortality in the United States - recent trends, current status, and future considerations. This overview of maternal mortality underscores the need for better surveillance and more accurate identification of maternal deaths, improved clinical care, and expanded public health initiatives to address social determinants of health. Challenges with ascertaining maternal deaths notwithstanding, several causes of maternal death (unaffected by surveillance artifacts) show significant temporal declines, even though there remains substantial scope for preventing avoidable maternal death and reducing disparities. [19]

Kumar S et al tried hard in reducing maternal mortality in India. Timing of maternal deaths is clustered around labor, delivery, and immediate postpartum period. Therefore, a health center, intrapartum care strategy would be most likely to bring down MMR. This could be in terms of a focus on promoting institutional deliveries supported by round-the-clock comprehensive emergency obstetric transport facilities. The Central and state governments must allocate higher resources to the provision of public health care including MCH services. Need to bring about a societal momentum to transform the "silent emergency" of maternal deaths into a war cry for ensuring basic human rights for survival and social justice for women. [20]

Joe W, Sharma S et al reviewed trends and patterns of maternal mortality in India. Whereas Vora KS et al did a case study on similar subject. India's goal is to lower maternal mortality to less than 100 per 100,000 livebirths but that is still far away despite its programmatic efforts and rapid economic progress over the past two decades. The case study analyzes the trends

in maternal mortality nationally, the maternal healthcare-delivery system at different levels, and the implementation of national maternal health programmes, including recent innovative strategies. It identifies the causes for limited success in improving maternal health and suggests measures to rectify them. It recommends better reporting of maternal deaths and implementation of evidence-based, focused strategies along with effective monitoring for rapid progress. It also stresses the need for regulation of the private sector and encourages further public-private partnerships and policies, along with a strong political will and improved management capacity for improving maternal health. [21,22]

Meh C et al in 2022 in BJOG wrote about national and regional trends and causes-specific distribution of maternal mortality in India. They studied about 10 000 maternal deaths among 4.3 million live births over two decades and analysed trends in the maternal mortality ratio (MMR) from 1997 through 2020. The MMR declined in India by about 70% from 398/100 000 live births to 99/100 000 in 2020. Maternal deaths mostly occurred in poorer states (63%) and among women aged 20–29 years (58%). The MMRs for Assam (215), Uttar Pradesh/Uttarakhand (192) and Madhya Pradesh/Chhattisgarh (170) were highest, surpassing India's 2016–2018 estimate of 113 (95% CI 103–123). After adjustment for education and other variables, the risks of maternal death were highest in rural and tribal areas of north-eastern and northern states. The leading causes of maternal death were obstetric haemorrhage (47% ; higher in poorer states), pregnancy-related infection (12%) and hypertensive disorders of pregnancy (7%). It was concluded that India could achieve the UN 2030 MMR goals if the average rate of reduction is maintained. [23,24]

Conclusion

It is regrettable that most of the causes of death are treatable. The Anganwadi

workers, Accredited social health activist (ASHA) and Auxillary nurse midwife (ANM) are the connecting link between patients living in remote areas and doctors, therefore conducting training programmes for them can bring a major change. They can identify high risk cases and educate them about various red flag signs so that they can be treated by tertiary care centre on priority basis. Organising Basic Emergency Obstetrics Care (BEMOC) and Skilled Attendant at Birth (SAB) training for medical officers and staff nurses in rural areas can also reduce the burden of preventable maternal death and burden of referral we need a holistic approach involving volunteers from various fields to ensure basic health care facilities equally to every women. [17]

Declarations:

Funding: None **Conflicts of interest/Competing interests:** None **Availability of data and material:** Department of Obstetrics and Gynaecology Nandkumar Singh Chauhan GMC Khandwa **Code availability:** Not applicable **Consent to participate:** Consent taken **Ethical Consideration:** There are no ethical conflicts related to this study. **Consent for publication:** Consent taken

Contribution by Different Authors

First author Dr. Nisha Mandloi Associate Professor Department of Obstetrics and Gynaecology

Nandkumar Singh Chauhan GMC Khandwa Concept and Guidance

Second and Corresponding author Dr. Nandini Singh Bhati Senior Resident Department of Obstetrics and Gynaecology Gandhi Medical College, Bhopal Data collection and statistical analysis

Third author: Dr. Sunil Bajoliya Assistant Professor Department of ENT Nandkumar Singh Chauhan GMC Khandwa References and Discussion

Fourth author Dr. Shailja Garg Senior Resident Department of Obstetrics and Gynaecology.

Nandkumar Singh Chauhan GMC Khandwa Data collection and statistical analysis

References

1. Sundari KP, Jayanthi RD, Ramasamy B. Trends in maternal mortality in a tertiary care hospital. *Int J Reprod Contracept Obstet Gynecol* 2016;5: 36 59-62.
2. Registrar General of India Sample registration system. Special Bulletin on maternal mortality in India 2014-16 sample registration system, SRS Bulletin 2018;91:16-18.
3. Kranti S. Vora, Dileep V. Mavalankar, K.V. Ramani, Mudita Upadhyaya, Bharati Sharma, Sharad Iyengar, Vikram Gupta, Kirti Iyengar. Maternal Health Situation in India: A Case Study. *J Health Popul Nutr.* 2009 Apr; 27(2): 184–201.
4. Khosla R, Zampas C, Vogel JP, Bohren MA, Roseman M, Erdman JN. International human rights and the mistreatment of women during childbirth. *Health Hum Rights* 2016; 18:131-43.
5. RGI (2011) Special bulletin on maternal mortality in India 2007-09. New Delhi : Office of the Registrar General.
6. United Nations. Sustainable Development Goal 3 2017 [cited 2017 August 5]. Available from: <https://sustainabledevelopment.un.org/sdg3>.
7. Horwood G, Opondo C, Choudhury SS, et al. Risk factors for maternal mortality among 1.9 million women in nine empowered action group states in India: secondary analysis of Annual Health Survey data. *BMJ Open* 2020; 10:e038910.
8. Purandare C, Bhardwaj A, Malhotra M, et al. Every death counts: electronic tracking systems for maternal death review in India. *Int J Gynaecol Obstet* 2014;127:S35–9.

9. Gupta M, Rao C, Lakshmi PVM, et al. Estimating mortality using data from civil registration: a cross-sectional study in India. *Bull World Health Organ* 2016;94:10–21.
10. Rane TM, Mahanta TG, Islam S, et al. Civil registration system (CRS) for birth and death registration in Assam – a rapid assessment. *Clin Epidemiol Glob Health* 2020;8:117–22.
11. Khumanthem PD, Chanam MS, Samjetshabam RD. Maternal mortality and its causes in a tertiary center. *J Obstet Gynaecol India*. 2012 Apr;62 (2):168-71.
12. Harish KM, Shwetha N, Nalini N. Maternal mortality in a tertiary care hospital: a 3- year retrospective study. *Int J Reprod Contracept Obstet Gynecol* 2021;10:474-8.
13. Doddamani U, Rampure N, Kaveri, Pooja. A study of maternal mortality in a tertiary care hospital. *Int J Reprod Contracept Obstet Gynecol* 2018;7:24 46-8.
14. Singh S, Doyle P, Campbell OMR, Murthy GVS. Management and referral for high-risk conditions and complications during the antenatal period: Knowledge, practice and attitude survey of providers in rural public healthcare in two states of India. *Reprod Health*. 2019;16:100.
15. Kapote DS, Syed AB, Gawai SC, Desai AS, Mohite AM. Trends of maternal mortality at a tertiary health care centre in India. *Int J Reprod Contracept Obstet Gynecol* 2020; 9:37 54-8.
16. Ashraf Ali M, Babitha MC, Lokeshchandra HC, Sharma KD, Zehra M, Reddy MS. A study of changing trends of maternal mortality at the tertiary care centre, MMC & RI Mysore, India. *Int J Reprod Contracept Obstet Gynecol* 2015;4:239-42.
17. Murthy BK, Murthy MB, Prabhu PM. Maternal Mortality in a Tertiary Care Hospital: A 10-year Review. *Int J Prev Med*. 2013;4(1):105-9.
18. Fahim F, Nabeel N, Utman N. Trends in maternal mortality in tertiary care hospital in Peshawar-Pakistan. *JPMI: Journal of Postgraduate Medical Institute*. 2012 Oct 1;26(4).
19. Joseph KS, Boutin A, Lisonkova S, Muraca GM, Razaz N, John S, Mehrabadi A, Sabr Y, Ananth CV, Schisterman E. Maternal mortality in the United States: recent trends, current status, and future considerations. *Obstetrics and Gynecology*. 2021 May; 137(5):763.
20. Kumar S. Reducing maternal mortality in India: policy, equity, and quality issues. *Indian journal of public health*. 2010 Apr 1;54(2):57.
21. Joe W, Sharma S, Sharma J, Shanta YM, Ramanathan M, Mishra US, Sri BS. Maternal mortality in India: a review of trends and patterns. *E Social Sciences Working Papers*. 2015 Sep (id: 7568).
22. Vora KS, Mavalankar DV, Ramani KV, Upadhyaya M, Sharma B, Iyengar S, Gupta V, Iyengar K. Maternal health situation in India: a case study. *Journal of health, population, and nutrition*. 2009 Apr;27(2):184.
23. Meh C, Sharma A, Ram U, Fadel S, Correa N, Snelgrove JW, Shah P, Begum R, Shah M, Hana T, Fu SH. Trends in maternal mortality in India over two decades in nationally representative surveys. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2022 Mar;129(4):550-61
24. Atbib Y., Essad A., Zhar H., Tadlaoui yasmina., Ait El Cadi M., & Bousliman Y. Impact de l'immunothérapie dans la prise en charge du cancer du poumon. Etude rétrospective menée à l'Hôpital Militaire d'Instruction Mohammed V-Rabat. *Journal of Medical Research and Health Sciences*, 2022;5(9): 2221–2243.