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Original Research Article

## Evaluation of preventable causes and risk factors of maternal mortality

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### ABSTRACT

**Background:** The primary objective was to evaluate preventable causes of maternal deaths at tertiary, second and primary care in Patiala district, Punjab. Secondary objective was to determine impact of socio-demographic characteristics, anemia and three delays on maternal death.

**Methods:** This is a retrospective observational study carried out between 1. 7. 2013 till 30. 6. 2014, for period of one year in department of a tertiary care hospital and district health authorities catering to secondary and primary care deaths for evaluation of preventable causes and risk factors for maternal deaths at tertiary, secondary and primary level.

**Results:** A total of 54 maternal deaths with MMR of 170.42/100000 live births, occurred in stipulated period, 87.03% at tertiary care, one at second care, 7.41% at home and 3.7% on the way to tertiary care. Majority of maternal deaths (92.6%) were unbooked, between 21-30 years (64.82%) of age, primi or second gravida (35.18%), para 1 or 2 (37.03%), illiterate (40.74%), low income group (57.41%) with rural background (59.26%). Majority of maternal deaths (77.7%) occurred in postpartum period. Most of maternal deaths (75.93%) were due to direct causes, pre-eclampsia 25.93% followed by sepsis (22.2%) and haemorrhage (20.3%). Anemia was contributory factor in 79.63% maternal deaths. 7.4% maternal deaths occurred at home with delay in seeking care while 29.62% died due to delay in reaching care. In 40.42% maternal deaths, it took more than two hours to reach tertiary care hospital.

**Conclusions:** Skilled antenatal, intranatal and postnatal care, women empowerment, counseling, early diagnosis and referral of pre-eclampsia and other high-risk cases with curbing anemia at grass root level is need of millennium. Preventing delay in seeking care or reaching care-a step towards sustainable development goals (SDG) to reduce MMR.

**Keywords:** Anemia, Haemorrhage, Maternal mortality, Preeclampsia, Sepsis

### INTRODUCTION

On an average 830 women die everyday due to avoidable pregnancy and childbirth related causes across the globe while 120 of these women die everyday in India alone.<sup>1,2</sup> WHO defines maternal death as death of a woman when pregnant or within 42 day of termination of pregnancy from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental causes.<sup>3</sup> The maternal mortality ratio (MMR) expressed as maternal deaths per 100,000 live birth over a period of

time is an important measure of quality of obstetric care and maternal health.<sup>4</sup> MMR is 239/100,000 live births in developing countries as compared to 12 per 100,000 live births in developed world.<sup>1</sup> 99% of all maternal deaths are still occurring in the developing world being higher in women living in rural areas and among poor communities. Though millennium development goal-5 (MGD-5) to achieve MMR of 109, could not be achieved by India till 2015, there has been steady decline in MMR from 398 in 1997-98, 301 in 2001-03 to 212 per 100,000 livebirths in 2007-09 and 167 in 2011-12 and likely to

decline to 140 by 2015.<sup>2</sup> Patiala with a population of 1895686 is a prosperous district of Punjab, a high empowered state of north India with a population of 2.77 crore. MMR in Punjab has declined from 172 (2007-09) to 141 per 100,000 live births by 2015, however aim was to reach MMR of 95 by 2015 and further 78 per 100,000 live births by 2017.<sup>5</sup> Global strategy for women, children and adolescents health towards Ending Preventable Maternal Mortality (EPMM) has set up Sustainable Development Goals (SDGs)-a transition from MDGs with an average global MMR of <70/100,000 live births by 2030.<sup>6</sup> Critically analyzing preventable causes and associated risk factors i.e. age, parity, socio-economic status, education, area of residence, leading to maternal death is need of hour with a focus on whether maternal death is in antenatal, intranatal or postnatal period. Anemia as indirect cause still contributes to majority of maternal deaths in India. To reduce MMR further it is highly essential to stress whether the delays occurred in seeking care, reaching care or receiving care. Any of the three delays can tilt the balance between life or maternal death.<sup>7</sup>

## METHODS

It was a retrospective observational study carried out between 1<sup>st</sup> July 2013 till 30<sup>th</sup> June 2014 for a period of one year in department of Obstetrics and Gynaecology, in Government Medical College and Rajindra Hospital, Patiala and Patiala district health authorities.

### Inclusion criteria

- All consecutive maternal deaths in antenatal, intranatal or postnatal period within 42 days of delivery, or, direct or indirect causes of termination of pregnancy/ pregnancy related complications, in the given period were included in the study.
- All above mentioned maternal deaths at home, primary, secondary or tertiary care, during stipulated time period, were included and critically analysed.

### Exclusion criteria

- Maternal deaths due to accidental causes or poisoning were excluded from the study.

Impact of socio-demographic characteristics and degree of anaemia on maternal death were analyzed. Any delays in seeking care, reaching care or receiving care was also noted. Period of death whether antenatal, intranatal or postnatal was also recorded.

## RESULTS

A total of 54 maternal deaths occurred in Patiala district w.e.f. 1.7.2013 to 30.6.2014 with 33,927 deliveries and 31,687 live births. MMR of Patiala district was 170.42/100,000 live births. Only 21 (38.9%) maternal deaths occurred for Patiala residents while majority 33

(61.1%) maternal deaths were among patients referred from adjoining districts of Punjab or Haryana State (Table1).

**Table 1: MMR of Patiala district, Punjab.**

	No.	Percentage
Maternal deaths among residents of Patiala district	21	38.9
Maternal death among refer in (adjoining district + Haryana)	33	61.1
Total maternal deaths	54	100
Total deliveries	33927	-
Total live births	31687	-
MMR of Patiala	170.42/ 100,000 live births	-

A total of 47 (87.03%) maternal deaths occurred at tertiary care hospitals, 44(81.45%) in Emergency labour room/ICU Department of Obstetrics and Gynaecology, GMC, Rajindra Hospital, Patiala catering to whole of Punjab and parts of Haryana state. 3.7% (two) maternal deaths occurred in government T.B. hospital while one maternal death (1.85%) was reported from private sector tertiary care Columbia Asia hospital. 1.85% (one mother died at second care Civil Hospital, Nabha). 7.41% (four) maternal deaths occurred at home without any primary care. Two maternal deaths (3.70%) occurred on the way to tertiary care hospital, Rajindra Hospital (Table 2).

**Table 2: Distribution of maternal deaths according to level of care.**

Place of maternal death	No.	Percentage
<b>Tertiary care hospital</b>	47	87.03
GMC/ Rajindra hospital	44	81.48
Govt. T.B. hospital	2	3.70
Private Columbia Asia hospital	1	1.85
Death at civil hospital (second care)	1	1.85
Death at home (before primary care)	4	7.41
Death on the way to tertiary care	2	3.70
Total	54	100

Majority (92.6%) of maternal deaths were unbooked pregnancy with occasional checkups while only 7.4% were booked. Majority 35 (64.82%) of maternal deaths occurred in peak reproductive age group of 21-30 years. While 12.96% (seven) maternal deaths were in women <20 years of age. Two maternal deaths (3.70%) each were in 36-40 years age group and >41 years respectively. 51.85% (28) dying pregnant women came in antenatal period while 26(48.14%) were admitted in postnatal period. Among antenatal, 14.81% (eight) were primigravida, eleven (20.37%) second gravida and 14.81% (eight) were gravida-4. Among 48.14% postnatal admissions, 27.77% (Fifteen) were para one, 9.26% (five) para-2 and 7.40% (four) were para-3. Only two women (3.70%) were para-5. Majority 59.26% (32) of maternal deaths occurred in rural residents while 40.74% (22)

dying women were from urban area. 40.74% (22) were illiterate, 25.92% (14) were educated up to ≤class VIII. 14.81% (eight) studied ≤class XII. Only 7.4% (four) deaths were in women educated up to graduation. Majority of 57.41% (31) maternal deaths occurred in women from lower socio-economic status while 22.22% (12) cases were from lower middle class and only 20.37% (11 cases) from upper middle class (Table 3).

**Table 3: Socio-demographic characteristics in relation to maternal deaths.**

	No.	Percentage
Booked	4	7.4
Unbooked/ occasional checkup	50	92.6
<b>Age in years</b>		
< 20	7	12.96
21-25	21	38.89
26-30	14	25.93
31-35	8	14.81
36-40	2	3.70
≥ 41	2	3.70
<b>Gravidity/ parity at admission</b>		
Antenatal admission	28	51.85
Primigravida	8	14.81
G2	11	20.37
G3	1	1.85
G4	8	14.85
Postnatal admission	26	48.14
Para-1	15	27.77
Para-2	5	9.26
Para-3	4	7.40
Para-4	-	-
Para-5	2	3.70
<b>Residence</b>		
Rural	32	59.26
Urban	22	40.74
<b>Education</b>		
Illiterate	22	40.74
≤Class VIII	14	25.92
≤Class X	6	11.11
≤Class XII	8	14.81
≤Up to B.A.	4	7.40
<b>Socio-economic status</b>		
Lower	31	57.41
Lower middle	12	22.22
Upper middle	11	20.37
High	-	-

**Table 4: Maternal deaths in relation to period of pregnancy.**

Period of pregnancy at time of death	No.	Percentage
Antenatal	11	20.37
Intranatal	1	1.85
Postnatal	42	77.77
Total	54	100

77.77% (42) maternal deaths were in postnatal period, while 11 (20.37%) were in antenatal period and only one (1.85%) maternal death occurred during delivery (Table 4).

**Table 5: Causes of maternal death.**

Causes	No.	Percentage
<b>Direct causes</b>		
Haemorrhage	11	20.37
APH	4	7.41
PPH	7	12.96
Sepsis	12	22.22
Severe preeclampsia and eclampsia	14	25.93
Pulmonary embolism	2	3.70
Obstructed labour with rupture uterus	2	3.70
<b>Indirect causes</b>		
Anemia	43	79.63
Cardiac disease in pregnancy	5	9.26
Jaundice in pregnancy	5	9.26
Pulmonary tuberculosis	2	3.70
Epilepsy	1	1.85

Majority of maternal deaths 75.93% (n=43) were due to direct causes. Severe preeclampsia and eclampsia were most important direct cause, leading to 14 (25.93%) maternal deaths. Sepsis was second important direct cause leading to 22.22% (12) maternal deaths. 20.37% (11) women died of haemorrhage of which four (7.41%) were due to antepartum haemorrhage and seven (12.96%) were due to PPH. Pulmonary embolism and obstructed labour with rupture uterus were responsible for two deaths (3.70%) each. 24.07% (13) maternal deaths were due to Indirect causes. Five deaths (9.26%) each occurred due to cardiac disease and jaundice respectively. Two (3.70%) maternal deaths occurred due to pulmonary tuberculosis and one (1.85%) death due to epilepsy (Table 5).

**Table 6: Anemia in relation to maternal deaths.**

	No.	Percentage
Anemia present	43	79.63
Mild anemia (Hb 9 to <11 g/dl)	3	5.55
Moderate anemia (Hb 7 to <9 g/dl)	27	50
Severe anemia (Hb 4 to <7g/dl)	5	9.26
Very severe anemia (Hb <4 g/dl)	8	14.81
No anemia (Hb≥11 g/dl)	11	20.37
Total	54	100

Anemia as indirect cause of maternal death was present in 79.63% (43) of maternal deaths. Moderate anemia was present in 50% (27) maternal deaths. 14.81% (8) maternal deaths had very severe anemia and 9.26% (five cases) had severe anemia (Table 6).

A total of 47 maternal deaths occurred at tertiary care hospitals. Only 8.51% (four) of these were booked at tertiary care. Out of total 47, 91.48% (43) maternal deaths were referred patients. 24 (51.06%) being referred with in

travel distance of two hours, while 19 (40.42%) cases referred from other hospitals had to travel a distance more than two hours to reach tertiary care from referring centre. Seven (14.89%) maternal deaths were among patients referred from adjoining state Haryana while 20 (42.54%) of dying women were referred from adjacent districts of Punjab. Only 16 (34.07%) maternal deaths were from Patiala district itself (Table 7).

**Table 7: Analysis of maternal deaths at tertiary care.**

Analysis in relation to distance travelled	No.	Percentage
Total maternal deaths at tertiary care	47	100
Booked at tertiary care	4	8.51
Maternal deaths in patients referred from peripheral hospitals	43	91.48
Within $\leq 2$ hours travel distance	24	51.06
Patiala-Punjab	16	34.04
Sangrur-Punjab	5	10.64
Fatehgarh Sahib-Punjab	3	6.38
$>2$ hours travel distance	19	40.42
Ludhiana-Punjab	6	12.76
Barnala-Punjab	5	10.64
Mansa-Punjab	1	2.12
Haryana	7	14.89

There was delay in seeking care in 7.4% (four) cases where maternal death occurred at home itself due to lack of awareness regarding health care facilities. There was delay in reaching tertiary care in a total of 16 (29.62%) cases, as one case (1.85%) died at secondary care level, two (3.70%) cases died on the way to tertiary care level. While 24.07% (13) one quarter of maternal deaths occurred within six hours of reaching tertiary care (Table 8).

**Table 8: Analysis of maternal deaths in relation to type of delay.**

Type of delay	No.	%age
Delay in seeking care (Home deaths)	4	7.24
Delay in reaching tertiary care	16	29.62
Death at second care	1	1.85
Death on way	2	3.70
Death within 6 hr. of reaching tertiary care	13	24.07
Delay in receiving care	-	-

## DISCUSSION

MMR of Patiala district for year 2013-14 during study period was 170.42/100,000 live births. MMR is 239/100,000 live births in developing countries. MMR of India and Punjab is 167 per 100,000 live births and 141 per 100,000 live births respectively.<sup>2,5</sup> Present is a tertiary

care centre catering to majority of Punjab district and adjoining state of Haryana, hence a little higher MMR. Majority of (92.6%) maternal deaths occurred in unbooked pregnancies, during peak reproductive (64.82%) age group of 21-30 years, in illiterate (40.74%) women with rural (59.26%) background with low/ low-middle socioeconomic group (79.63%). Bhasker K. Murthy et al. 2013 also observed similar results.<sup>8</sup>

Majority (75.93%) maternal deaths were due to Direct causes while 24.07% deaths occurred due to indirect causes in present study. Kausar R also reported majority (81%) of maternal deaths due to direct causes.<sup>9</sup> Severe preeclampsia and eclampsia (25.93%) followed by sepsis (22.22%) and haemorrhage (20.37%) were leading direct causes of maternal death in present study. Pre-eclampsia and eclampsia remain leading cause of mortality worldwide as other comorbidities like post-partum haemorrhage and infections are being managed in a better way.<sup>10</sup> A FOGSI study also observed hypertension (29.4%) as leading direct cause of maternal death followed by haemorrhage and sepsis.<sup>11</sup> 75% of maternal deaths are due to direct causes mainly haemorrhage, infections, preeclampsia, complications from delivery and unsafe abortions.<sup>12</sup> Paul B et al reported hemorrhage, sepsis, abortion, hypertensive disorders and obstructed labour as important direct causes of maternal mortality.<sup>13</sup>

Anemia was associated indirect cause in 79.63% of maternal deaths in present study. 50% of dying women had moderate anemia while 24.07% maternal deaths had severe or very severe anemia. Sarin A.R. also reported severe anemia in 34.5% of maternal deaths.<sup>14</sup> Anemia remains the most common (48.8%) contributory cause of maternal death.<sup>5</sup> 77.77% maternal deaths occurred after childbirth in postnatal period while 20.37% in antenatal period and one death occurred during intrapartum period in present study. However, Barnet S observed quarter of maternal deaths in antenatal and postnatal and half in intrapartum period.<sup>15</sup> Majority of maternal deaths (91.4% occurred in patients referred from other hospitals. Only 16 (34.04%) maternal deaths were from Patiala district while rest were referred in patients from adjoining district of Punjab and Haryana state. 24 (51.06%) refer in maternal deaths at tertiary care had to travel up to two hours to reach tertiary care referral centre while in 40.42% (19) maternal deaths, it took more than two hours to reach tertiary care hospital in present study. Maternal death review by NRHM reported that majority, 60% critical women reached referral institute within ten hours.<sup>5</sup> Out of total 54 maternal deaths, 47 (87.03%) occurred at tertiary care. Four (7.41%) maternal deaths occurred at home without seeking care. Poverty, lack of information, inadequate services and distance from health care facility prevent women from seeking care.<sup>12</sup> One-woman (1.85%) died at secondary care, two women (3.70%) died on the way to tertiary care while 13 (24.07%) women died within six hours of reaching tertiary care. Thus, a total of 16 (29.62%) approximately one third maternal deaths occurred due to Delay in

reaching care. Delay in seeking, reaching care and receiving care remain major causes of avoidable maternal death. Delays at different levels has a vital role in maternal death.<sup>5</sup>

## CONCLUSION

MMR of Patiala district in present study was 170.42/100,000 live births. Majority of maternal deaths still occur in unbooked, illiterate women from low socio-economic strata with rural background. The bulk of maternal deaths are in postnatal period stressing need for not only antenatal check-ups but mandatory four postnatal visits on day 1,3,7 and six weeks postpartum for all mothers. Pre-eclampsia and eclampsia are now leading direct cause of maternal death followed by sepsis and haemorrhage. Anemia as indirect cause is present in majority of maternal deaths with severe and very severe anaemia in quarter of maternal deaths. Deworming all mothers at 16 weeks and strict compliance for oral iron to be emphasized. Strengthening at primary care grass root level by trainings and orientation- workshops for medical officers and skilled birth attendants with timely and prompt referral can prevent many an avoidable maternal death. Counselling of couples at each antenatal visit regarding life threatening maternal complications shall be a step in preventing delay in seeking care. Mandatory public private partnership for maternal near miss refer in within two hours travel distance shall be a cornerstone in preventing any delay in reaching care. Women empowerment, skilled antenatal/ intranatal, postnatal care, curbing anemia, early detection of preeclampsia, couple counselling with no delay in seeking or reaching care and prompt referral shall go long way to prevent avoidable maternal deaths and help us to achieve sustainable development goal (SDGs) MMR <70/100,000 live births much before 2030. Focus on high risk women and hard to reach community is need of millennium.

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