Original Article

DOI: 10.7860/JCDR/2021/49569.15416

A Cross-sectional Study to Evaluate Causes of Maternal Mortality in Rural Areas of Punjab, India

Obstetrics and Gynaecology Section

SARBHJIT KAUR[1], NAVNEET KAUR[2], MANJIT KAUR MOHI[3], MANJEET KAUR[4], NEERAJ SINGH[5], SIMMI OBEROI[6]

ABSTRACT

Introduction: Maternal mortality is an index of reproductive health of the society. In India illiteracy, late referrals, low socio-economic status of the community and direct causes are responsible for high incidence of maternal deaths which contributes to one-fifth of the global burden.

Aim: To evaluate the causes of maternal death in rural areas of Punjab.

Materials and Methods: The present retrospective cross-sectional study was conducted in 10 districts of Punjab, India chosen from five different zones i.e., east, west, north, south and central zone for a period of one year from 2016 to 2017. Information of all the deaths was taken from the civil surgeon office of the chosen district and then data of maternal deaths occurring within 42 days of delivery was collected by visiting patient's residence and verbal autopsy was conducted. The data was collected and entered in predesigned proforma and percentages were calculated in Microsoft Excel version 2016.

Results: A total of 67 maternal deaths were noted from above five zones, out of total rural population of 94,59,553. Maximum (n=51) maternal deaths were between age range of 20-30 years. Of these 67, majority 29 (43.28%) were illiterate, 66 (98.5%) women belonged to middle and low socio-economic status, 55 (82.1%) deaths occurred in the postnatal period, 33 (49.25%) occurred at more than 37 weeks period of gestation and 51 (76.12%) were due to direct causes. Out of 67 deaths, haemorrhage (n=29) was the most common cause. Anaemia contributed to 16.7% (11) as an indirect cause of maternal death.

Conclusion: The maximum maternal deaths were contributed by illiterate women from middle and low socio-economic status. The most common cause was postpartum haemorrhage followed by pre-eclampsia/eclampsia.

Keywords: Anaemia, Maternal health services, Postpartum haemorrhage

INTRODUCTION

Maternal mortality reflects the reproductive health of the nation and society. High maternal deaths is an index of poor quality of maternal services, late referral and poor socio-economic status of the country [1]. The definition of maternal death given by World Health Organisation (WHO) is "the death of a female during pregnancy or within 42 days of termination of pregnancy, irrespective of the site and duration of the pregnancy, from any cause related to or aggravated by the pregnancy or its treatment but not from accidental or incidental causes [2]. The probability that a 15-year-old woman will eventually die from a maternal cause is one in 180 in developing countries versus one in 4900 in developed countries [3].

The WHO estimate in 2015 showed that out of the 529,000 maternal deaths globally each year, 136,000 (25.7%) were contributed by India [4]. Maternal mortality rate decreased from 212 deaths per 100,000 live births in 2007 to 178 deaths in 2012. The decline is due to key Government interventions such as the Janani Shishu Suraksha Karyakaram (JSSK) scheme launched in 2011 that encompasses free maternity services for women and children, a nationwide strengthening up of maternal death audits and emergency referral systems along with improvements in the management of health services at all levels [5]. Maternal mortality rate in Punjab in 2001 to 2003 was 178, in 2004 to 2006 was 192 which decreased to 172 in 2007 to 2009, 155 in 2010 to 2012 and 141 in 2013 to 2015 according to sample registration system [6].

Causes of maternal deaths are categorised as direct and indirect. Causes of direct deaths are haemorrhage, sepsis, unsafe abortion, hypertensive disorders, prolonged or obstructed labour and indirect deaths are due to anaemia, malaria, diabetes, cardiac, respiratory, renal, hepatic, metabolic and infectious diseases [7]. Maternal mortality vary greatly across rural, urban and different regions due to variations in socio-economic status, literacy rates, quality of Antenatal Care (ANC), anaemia rates, access to emergency obstetric care and other factors, contributing to non medical causes of death [6]. In developing nations, maternal mortality has been attributed to the "3 delays": delay in seeking care, delay in transport to reach the facility in time and delay in receiving adequate treatment [5].

India is in third stage of transition where Maternal Mortality Rate (MMR) is 299-50 maternal deaths per 100,000 live births and direct causes of mortality are still predominant. The quality of care is a major determinant of health outcome especially in overloaded health facilities because the large number of pregnant females has started visiting the health facilities. In such circumstances, secondary and tertiary prevention require specific attention to reduce the maternal mortality. To reduce the maternal mortality, quality of care with skilled birth attendance and appropriate management of complications and disabilities is the need of hour [6].

Verbal autopsy is a vital tool which is used to collect information from family members, relatives, and care providers on the events leading to the death of the mother during pregnancy, abortion, delivery and in postpartum period, to identify the medical and non medical causes of maternal death [8]. This study was designed to describe the causes of maternal deaths in rural areas of Punjab.

MATERIALS AND METHODS

This was a retrospective cross-sectional study done in 10 districts of Punjab, India between June 2016 to May 2017. The Ethical approval was taken before the start of the study from the Ethical Committee of Government Medical College, Patiala, Punjab, India with reference number BFUHS/2K17p-TH/133434.

Inclusion criteria: Deaths of the women within 42 days of delivery from five different zones of Punjab i.e., east, west, north, south and central zone to know the causes of maternal mortality in the rural areas of the state. The whole state was divided into five zones and two districts from each zone was selected by lottery method.

Exclusion criteria: Death of women visiting Punjab whose stay was less than six months, death after 42 days of termination of pregnancy.

It was a descriptive study in which deaths occurred in last 3-6 months of 10 districts were recorded to ascertain the causes of maternal mortality. The record of maternal deaths was collected from civil surgeon office of the chosen district. Verbal autopsy was conducted, according to the questionnaire form given by National Rural Health Mission (NRHM) in maternal death review guide book [6] (2010) to keep a record of the events that led to death, cause of death and the treatment taken [8]. It was done under the supervision of consultants of Department of Obstetrics and Gynaecology and Community Medicine of the study Institution along with paramedical staff providing care in that area. The record of deaths in six months were collected from the districts where deaths were less than five in previous three months to complete the sample size [Table/Fig-1]. After taking the record of the maternal death, the team visited the village of the deceased. The Lady Health Visitor, Auxiliary Nurse Midwife (ANM), Accredited Social Health Activist (ASHA), Sarpanch/Panch of the village were contacted to identify the house of the deceased for filling the verbal autopsy form by asking questions to the close relative of the deceased who was present at the time of death. The consent was taken from husband, close relative or any person related to the deceased women. A minimum of five and a maximum of 10 maternal deaths were noted down from each district. Each verbal autopsy form was interpreted and possible cause was assigned. The ANM/Health provider was also questioned about the events related to patient's disease progression and death. More information regarding death, surgery, supportive treatment and postmortem report was obtained from concerned centre/ hospital whenever required.

STATISTICAL ANALYSIS

The data was collected in the predesigned proforma and was compiled in Microsoft Excel version 2016. Observations and results were given in number and percentages.

RESULTS

A total of 67 maternal deaths were noted out of total rural population of 94,59,553 in 10 districts according to 2011 census [9]. The maximum number of verbal autopsies were done in district Amritsar 10 (14.93%) followed by Jalandhar 8 (11.94%) and Gurdaspur 8 (11.94%) [Table/Fig-1]. Out of 67 maternal deaths, maximum maternal deaths occurred between 20-30 years of age i.e., 51 (76.12%), 66 (98.51%) of the deceased mothers were housewives and only 1 woman (1.49%) was employed in a private job [Table/Fig-2]. Majority of women 65 (77.61%) had greater than three antenatal check-up during pregnancy. Twenty five (37.30%) women had antenatal check-up from civil hospital and 53 (79.10%) delivered in the Government hospital. Two (2.99%) women had no antenatal visit [Table/Fig-3].

Zone	Name of district	Mortality data collection in previous 3-6 months	No. of deaths	Percentage (%)
North	Amritsar	September 2016 to November 2016	10	14.93%
	Gurdaspur	September 2016 to November 2016	8	11.94%
South	Mansa	January 2016 to June 2016	5	7.46%
	Sangrur	April 2016 to June 2016	7	10.45%
East	Fatehgarh Sahib	February 2016 to April 2016	6	8.96%
	Roopnagar	March 2016 to May 2016	7	10.45%
West	Fazilka	December 2016 to May 2017	4	5.97%
	Ferozpur	December 2016 to May 2017	5	7.46%
Central	Jalandhar	July 2016 to October 2016	8	11.94%
	Ludhiana	June 2016 to August 2016	7	10.45%
Total			67	100%

[Table/Fig-1]: District-wise distribution of verbal autopsy done in the rural areas of Punjab.

Characteristics	Groups	No. of maternal deaths	Percentage (%)
Age at death (years)	<20	1	1.49%
	20 to 30	51	76.12%
	31 to 40	15	22.39%
Occupation	Private job	1	1.49%
	Government job	0	0
	Housewife	66	98.51%
Education level	Illiterate	29	43.28%
	Up to middle school	14	20.9%
	Up to secondary school	22	32.83%
	Graduation	2	2.99%
Socioeconomic status (according to Kuppuswamy classification)	Upper	1	1.49%
	Middle	51	76.12%
	Lower	15	22.39%
Gravidity	Primigravida	28	41.79%
	Multigravida	39	58.21%
Delivery status	Antenatal	12	17.91%
	Intranatal	0	0
	Postnatal	55	82.09%
Gestational age at death	Upto 28 weeks	10	14.93%
	28 to 37 weeks	24	35.82%
	>37 weeks	33	49.25%

[Table/Fig-2]: Characteristics of participants.

Characteristics	Groups	No. of maternal deaths	Percentage (%)
No. of ANC visits	Nil	2	2.99%
	1 to 3	13	19.40%
	>3	52	77.61%
Place of ANC visit	Primary healthcare	22	32.84%
	Community healthcare	6	8.95%
	Civil hospital	25	37.30%
	Medical college	2	2.99%
	Private hospital	10	14.93%
	No ANC care	2	2.99%
Place of delivery	Home	5	7.46%
	Government hospital	53	79.11%
	Private hospital	8	11.94%
	Transit	1	1.49%

[Table/Fig-3]: Distribution of women according to the number and place of antenatal visits and delivery.
ANC: Antenatal care

Only 2 (2.99%) women resided more than 20 km from the nearest health facility. Majority of deceased women 33 (49.25%) used 108 government ambulance and 24 (35.82%) reached the final health facility within one hour of detection of complications [Table/Fig-4]. Total 51 (76.12%) maternal deaths occurred due to direct causes, 12 (17.91%) due to indirect causes and 4 (5.97%) were not classified. The majority of women 34 (50.75%) died within 24 hours of detection of complication [Table/Fig-5].

Characteristics	Groups	No. of maternal deaths	Percentage (%)
Distance to nearest health facility (Km)	Up to 10	44	65.67%
	10 to 20	21	31.34%
	>20	2	2.99%
No. of health facilities visited before death	Up to 1	47	70.15%
	Up to 3	17	25.37%
	4	2	2.99%
	5	1	1.49%
Transport method	108 government ambulance	33	49.25%
	Private vehicle	23	34.33%
	Own vehicle	9	13.43%
	By bus	2	2.99%
Time taken to reach final place (where death occurred) (hours)	Not taken anywhere	3	4.48%
	<1	24	35.82%
	1 to 4	36	53.73%
	5 to 12	3	4.48%
	>12	1	1.49%

[Table/Fig-4]: Distribution of maternal deaths according to the distance of nearest facility, transport method and time taken.

DISCUSSION

Death of a mother is a tragic event. In practical life, it has an impact on the family, community and eventually, the nation. Verbal autopsy provides a way to identify preventable factors, the standard of care, missed opportunities and different factors contributing to three delays, forming the basis for targeted remedial actions to be taken to avoid similar deaths in future [10].

In the present study, majority of maternal deaths occurred in the postnatal period (82.1%) which is similar to the studies done by Yadav K et al., (72.16%) and Bhatia R et al., (77.77%) [11,12]. A 73.13% maternal deaths occurred at health facility which is similar to the study done by Kumar Y et al., (77.19%) but is more than the study by Montgomery AL et al., (36%) and Subha BS and Khanna R (48%) who reported more deaths at home [13-15]. Only 4.48% deaths occurred at home in the present study which is much less than reported by Kumar Y et al., Montgomery AL et al., and Subha BS and Khanna R [13-15]. In the present study, half of deaths (50.75%) occurred within 24 hours of detection of complication which is similar to the study done by Kumar Y et al., and Verma A et al., [13,16]. Majority of women (43.28%) delivered by vaginal route which is less than that reported in one of the similar studies by Verma A et al., (72.09%) and almost similar to Engin Ustun Y et al., (46.9%) [Table/Fig-6] [11-18].

Time (Hours)	No. of women	Percentage	Causes			
				Direct	51	76.12%
				Indirect	12	17.91%
				Not classified	4	5.97%
Within 24	34	50.75%	Postpartum haemorrhage (13/38.24%)			
			Abruptio placenta (2/5.88%)			
			Pre-eclampsia/Eclampsia (9/26.47%)			
			Ruptured uterus (1/2.94%)			
			Placenta Accreta (1/2.94%)			
			Suspected Pulmonary Embolism (3/8.82%)			
			Not classified (5/14.70%)			
24 to 48	11	16.43%	Eclampsia (1/9.09%)			
			Anaemia with CHF (4/36.37%)			
			Postpartum haemorrhage (3/27.27%)			
			Acute Respiratory Distress Syndrome (3/27.27%)			
48 to 72	7	10.45%	Status Eclampticus (1/14.28%)			
			Sepsis (2/28.58%)			
			Respiratory failure (1/14.28%)			
			Postpartum haemorrhage (2/28.58%)			
			Not classified (1/14.28%)			
>72	15	22.39%	Hepatic Failure (1/6.66%)			
			ARDS (2/13.34%)			
			MDR-TB (2/13.34%)			
			Eclampsia (2/13.34%)			
			Mitral Stenosis (1/6.66%)			
			Sepsis (6/40%)			
			Haemorrhage (PPH) with irreversible shock and multiorgan failure (1/6.66%)			
Total	67	100%				

[Table/Fig-5]: Distribution according to time interval between detection of complication and death.

The study by Montgomery AL et al., which was done in developing country is comparable to the index study where direct causes of maternal mortality were more than the indirect causes [14]. In developed countries, the indirect causes of maternal mortality contributed much significantly (55%) than direct causes (45%) as in the study by Engin Ustun Y et al., [17]. This reveals that direct causes are still the major factors in maternal deaths in our country and developing countries whereas in developed countries, indirect causes of death are dominant [Table/Fig-7].

Study	Death in			Maternal deaths within 24 Hours	Postnatal deaths	Vaginal delivery	LSCS
	Health facility	Home	Transit				
Yadav K et al., [11]	-	-	-	-	72.16%	-	-
Bhatia R et al., [12]	88.88%	7.41%	3.70%	-	77.77%	-	-
Kumar Y et al., [13]	77.19%	13.15%	9.60%	45.6%	-	-	-
Montgomery AL et al., [14]	36%	50%	14%	-	-	-	-
Subha BS et al., [15]	48%	26%	25%	-	-	-	-
Verma A et al., [16]	49.23%	16.92%	-	46.15%	66.15%	72.09%	20.93%
Engin Ustun Y et al., [17]	-	-	-	-	-	46.9%	53.1%
Priya N et al., [18]	-	-	-	54.63%	74.3%	64.10%	20.75%
Present study	49 (73.13%)	3 (4.48%)	15 (22.39%)	34 (50.75%)	55 (82.09%)	29 (43.28%)	26 (38.81%)

[Table/Fig-6]: Distribution according to place of maternal death, mode of delivery and distribution of deaths within 24 hours of detection of complication [11-18].

Study	Haemorrhage	Sepsis	Pre-Eclampsia/Eclampsia	Direct causes	Indirect causes
Vahiddastjerdy M et al., [7]	23.5%	3.5%	13.6%	61.3%	33.7%
Yadav K et al., [11]	31.9%	9.27%	24.41%	65.99%	34.01%
Bhatia R et al., [12]	20.37%	22.22%	25.92%	77.78%	22.22%

Montgomery AL et al., [14]	NIA	NIA	NIA	85%	15%
Engin Ustun Y et al., [17]	15.3%	2.2%	14.2%	45%	55%
Priya N et al., [18]	35.05%	11.34%	27.43%	74.3%	25.7%
Fernandes S et al., [19]	26.2%	11.9%	21.43%	90.48%	9.52%
Present study	29 (43.28%)	12 (17.91%)	10 (14.92%)	51 (76.12%)	12 (17.91%)

[Table/Fig-7]: Distribution according to common causes of death [7.11,12,14,17-19].

The leading cause of maternal death is haemorrhage (43.28%) which almost corresponds to that observed by Yadav K et al., Priya N et al., but Fernandes S et al., reported a lesser rate of deaths due to haemorrhage [11,18,19]. Second commonest cause is sepsis (17.91%) which is similar to Bhatia R et al., (22.22%) [Table/Fig-7] [12].

Limitation(s)

More studies similar to this study should be conducted to visualise the increase or decrease in the maternal mortality rate in the states so that more effective measures could be taken to strengthen the medical facilities at all the levels. The major limitation of the study was to visit all the districts and meet the civil surgeon for the records of the patients and it was little cumbersome and hectic as it takes out extra time from busy schedule.

CONCLUSION(S)

The largest share of maternal deaths is still contributed by illiterate women from low socio-economic status with rural background. In the present study, although maximum women got more than three ANC visits, they still developed pregnancy related complications and took more than two hours to reach final health care centre. So, there is a need for strengthening quality antenatal care, awareness and health education of all pregnant mothers by trainings and orientation workshops for the medical officers and skilled birth attendants, to identify the high risk pregnancies, complications during postpartum period, with timely and prompt referral to minimise the delays and streamlining the referral system with feedback. Women empowerment, curbing anaemia, early detection of postpartum haemorrhage, pre-eclampsia, couple counselling, proper and timely referral, with no delay in seeking or reaching care is the key to prevent avoidable maternal deaths helping us to achieve sustainable development goal of MMR <70/100,000 live births by 2030.

Acknowledgement

We are thankful to Director Health Services of Punjab and all the Civil Surgeons of Punjab for providing the financial, moral support and technical help for preparing for this original article. We are also grateful to Mr. Vicky Harinder Pal for typing data for this article.

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PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Obstetrics and Gynaecology, Government Medical College, Patiala, Punjab, India.
2. Assistant Professor, Department of Obstetrics and Gynaecology, Government Medical College, Patiala, Punjab, India.
3. Professor, Department of Obstetrics and Gynaecology, Government Medical College, Patiala, Punjab, India.
4. Professor, Department of Obstetrics and Gynaecology, Government Medical College, Patiala, Punjab, India.
5. Junior Resident, Department of Obstetrics and Gynaecology, Government Medical College, Patiala, Punjab, India.
6. Associate Professor, Department of Community Medicine, Government Medical College, Patiala, Punjab, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Navneet Kaur,
Assistant Professor, Department of Obstetrics and Gynaecology, Government Medical College, Patiala, Punjab, India.
E-mail: nav_neetu8@yahoo.in

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Mar 27, 2021
- Manual Googling: Jul 24, 2021
- iThenticate Software: Aug 18, 2021 (7%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 23, 2021**
Date of Peer Review: **May 29, 2021**
Date of Acceptance: **Jul 26, 2021**
Date of Publishing: **Sep 01, 2021**