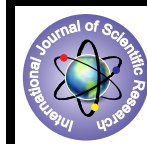


## A root-cause analysis of Maternal Mortality in a tertiary care hospital



### Medical Science

**KEYWORDS :** Eclampsia, Anemia, Hemorrhage, Septicemia, Hepatitis

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### ABSTRACT

*In this retrospective study, total 84 maternal deaths were analysed during last six years. 54.76% patients were below 25 years. 61.9% patients were from rural community. 72.6% patients died during late pregnancy. Only 33.3% patients had received adequate antenatal care. 52.4% were referred patients and 35.7% were emergency patients. Only 9.09% referred patients received adequate treatment. Nearly half of the patients took more than 12 hours before reaching to our hospital. 48.8% patients admitted during antenatal period, followed by 21.42% while during labor, 25% postpartum and 4.76% after having abortion. Total 19 patients were delivered before death. Highest number of deaths occurred during postnatal period (47.67%), followed by antepartum (44.04%), postabortal (4.76%) and intrapartum (3.57%) period. Top five causes of maternal mortality were haemorrhagic complications (26.19%), followed by hypertensive disorders of pregnancy (19.04%), liver disease during pregnancy (16.7%), septicemia (15.47%) and anemia (9.52%).*

### Introduction

In woman's life, pregnancy is a blessed event that brings endless joy to her family. But, although widely claimed as a very well understood natural bio-physiological process; pregnancy is among few medical conditions where outcome also depends upon personal, socio-cultural, economic and environmental factors [8]. And so, Maternal Mortality has been called 'the most neglected tragedy of our times', and considered as an important health indicator (sentinel event) to understand the efficiency of any country's health care system [6]. Surprisingly, among all health indicators, maternal mortality reveals the greatest gap between rich and poor women, both between and within countries. A total of 99% of all maternal deaths occur in developing countries, where 85% of the population lives [7]. Different studies in various countries have proven that timely community based antenatal intervention can prevent 26% of these deaths. Nonetheless, another 48% of maternal deaths can be avoided by easy access to quality and essential obstetrical care. Teenage pregnancy has 25% (70,000) share in maternal mortality [5].

### Indian scenario

Each year roughly 28 million women become pregnant and around 26 million have a live birth. Around 56,000 maternal deaths occurred in India during the year 2010, accounting for 19% of global maternal deaths [1]. The Millennium Development Goals (MDGs), guided by former UN Secretary General Kofi Annan, are set to improve worldwide health of women. Unfortunately among the six important goals, the least progress is noted in the goal number five aiming to reduce the maternal mortality ratio by 75% by the year 2015 [2]. For India the target is 109, far from reach from current national average of 221 [7]. So far, only Kerala, Tamil Nadu and Maharashtra have achieved this goal. Gujarat (MMR – 148 in year 2010) is in closer proximity to the MDGs target [3, 4].

### Materials and methods

It is a retrospective study. All the maternal deaths that occurred in the Department of Obstetrics and Gynecology of Sheth L.G. hospital, Ahmedabad, during the last 6 years are included in the study. The individual records of each maternal death occurred from 1st January 2007 to 31st December 2012 were studied and cause of death and other factors contributing to death were analysed.

### DATA ANALYSIS AND DISCUSSION

**Table 1: Maternal Mortality ratio from Year 2007 to year 2012**

Year	Total no of maternal death out of total deliveries	No of live birth	MMR (Per lakh)
2007	15	4118	364.25
2008	13	4489	289.60
2009	13	4259	305.23
2010	15	4440	337.83
2011	14	4127	339.23
2012	14	4510	310.42

As shown in table above, almost each year maternal mortality ratio was above 300 and more or less consistent, almost double than Gujarat's MMR of 148.

**Table 2: Analysis of patients' demographic factors**

	No	Percentage
Age (yrs)	<20 years	4.76
	20-25 years	50
	26-30 years	28.6
	>30 years	16.7
Parity	Primi	60.7
	Multi	39.3
Locality	Urban	38.1
	Rural	61.9
Gestational age (wks)	<20 weeks	11.9
	20 - <37 weeks	72.6
	≥ 37 weeks	15.5

In our study, 54.76% patients were below 25 years. Primipara, accounted for 60.7%; that remains higher in both antenatal and postnatal maternal death. 4.76% of postabortal maternal death patients were multigravida. 61.9% patients were from rural and 38.1% from urban community. 72.6% of patients were died during their late pregnancy from week 20 to 37.

**Table 3: Analysis of provision of basic and emergency obstetric care to pregnant women including Antenatal care and feasibility of emergency transportation to tertiary care hospital**

		No	Percentage
Antenatal care	Adequate	28	33.3
	Inadequate	38	45.2
	Nil	18	21.4
Type of patient	Booked	10	11.9
	Un-booked	30	35.7
	Referred	44	52.4
Referred patients	Received First-aid and Obstetric care	4	9.09
	Received only First-aid	26	59.09
	Received no treatment	14	31.82
	Total	44	100
Admission to death interval in hours	<24 hours	42	50
	24-48 hours	28	33.3
	48-72 hours	9	10.7
	>72 hours	5	5.95
Transportation time in hours from home/hospital	<6 hours	14	16.7
	6-12 hours	29	34.5
	12-24 hours	33	39.3
	>24 hours	8	9.52

Unfortunately, only one third (33.3%) patients had received adequate antenatal care according to standard guidelines that includes regular check-up, fetal ultrasonography and routine blood work-up. Nearly half of the patients (45.3%) were having antenatal visits less than three times during entire pregnancy and had not taken suggested precautions. Nearly one third (21.4%) patients, most of residing in rural communities, had not received antenatal care at all.

Our institute is a tertiary care hospital situated in the middle of metro city and enjoys availability of multi-specialty care with all lifesaving equipment. So, apart from routine antenatal patients, we are fortunate to serve many high risk antenatal patients who have either started visiting our hospital after being categorized in high risk pregnancy outside or were directly referred from outside hospital (primary care center or private hospital) in the critical stage with major complications. This explains very high maternal mortality in referred patients (52.4%), followed by patients who were not able to take regular follow-up in our clinic (35.7%). One tenth of maternal mortality was noted in our registered patients with regular follow-up visits.

Referred patients were analysed based on their general conditions, if they had received basic essential treatment for the risk factors, resuscitative efforts to secure airway and circulation, as well as life saving measures taken during their transportation from one hospital to other. Out of 44 referred patients, less than one tenth patients were referred with life support system provided by accompanying medical/paramedical personnel. 59.09% patients were provided only first-aid treatment and then referred without any accompanied qualified medical personnel or in emergency medical transportation vehicle without lifesaving equipment such as oxygen, suction machine, intravenous fluids, etc. 31.82% patients, despite of seeking medical care soon after onset of illness, were referred unattended.

Once any critical patient comes to a hospital and risk factors are

diagnosed, the most important next step would be to initiate lifesaving and curative therapy to sustain life of mother and her fetus. Unfortunately, our primary health care centers are still fully operational with round the clock present of enough numbered qualified medical staff and latest lifesaving instruments such as Operation Theater or ventilator. So, it becomes extremely crucial to shift the patient in outer tertiary care centre where such facility exists. And hence, time duration for transportation become a matter of life and death. In our study, only 16.7% patients were able to reach within golden hours – six hours. 34.5% patients came after 6 to 12 hours of initiating warning symptoms. Nearly half of patients (48.82%) were able to reach after 12 hours. Majority of the late arrivals had worsened conditions during transport, around 70% of them in irreversible stages of shock or coma. Out of 84 patients, 42 (50%) patients died within one day of their admission, followed by 28 (33.3%) on second day of admission, 9 (10.7%) on third or fourth day and only 5 (5.95%) could fought for their lives for more than four days.

**Table 4: Analysis of Place of delivery & Pregnancy status at the time of admission and death**

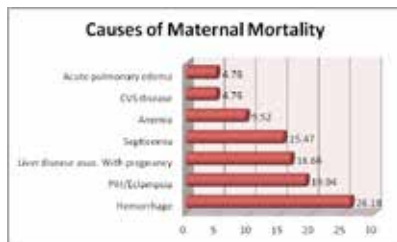
		No	Percentage
Place of delivery	Home delivery	14	16.66
	Peripheral health center	4	4.76
	Private hospitals	7	8.33
	Our institute	22	26.19
	Un-delivered	37	44.04
	Total	84	100
Maternal pregnancy status at the time of admission	Antepartum	41	48.8
	Intrapartum	18	21.42
	Postpartum	21	25
	Postabortal	4	4.76
	Total	84	100
Total category wise Maternal death in our Institute	Antepartum	37	44.04
	Intrapartum	3	3.57
	Postpartum	40	47.61
	Postabortal	4	4.76
	Total	84	100

Total 59 (antepartum and intrapartum) patients were brought to our institute, out of them 26.19% patients delivered before death and 44.04% died antepartum. Post-partum period accounted maximum 47.61% mortality, followed by 44.04% antenatal deaths, 3.57% intra-partum deaths and 4.76% postabortal deaths.

**Table 5: The root-cause analysis of Maternal Mortality**

		No	percentage	
Direct	PPH	Atony	7	8.33
		Uterine rupture	5	5.95
		Inversion	1	1.19
	APH	Abruptio	4	4.76
		Placenta previa	3	3.57
		Adherent placenta	2	2.38
	PIH / Eclampsia	16	19.04	
	Septicemia	Puerperal sepsis	8	9.52
		Septic induced abortion	2	2.38
		Others	3	3.57
	Acute pulmonary edema	Amniotic fluid embolism	3	3.57
		Pulmonary embolism	1	1.19
	Indirect causes	Anemia	8	9.52
		CVS disease	4	4.76
Liver disease in pregnancy		14	16.70	
Epilepsy		1	1.19	
Others		2	2.38	

Chart 1: Causes of Maternal Mortality



We categorized causes of Maternal Mortality into direct (65.41%) and indirect (34.59%) deaths according to 9th revision of international Classification of Diseases (ICD). In almost all cases, more than two factors were responsible for maternal death; the most accountable cause was calculated. The most common associated factors were anemia and altered coagulation profile. The most common cause of maternal mortality was hemorrhagic shock in 26.18% followed by hypertensive disorders of pregnancy in 19.04%, liver disease in pregnancy in 16.66%, septicemia in 15.47% and anemia in 9.52% cases. Other comparatively less liable causes were cardiovascular diseases in pregnancy and acute pulmonary edema in 4.76% each and epilepsy in 1.19% case.

Out of 22 women who died due to hemorrhagic shock, the postpartum hemorrhage (PPH) was present in 13 cases. In 7 cases it was due to atonic uterus, traumatic injury to uterus and lower genital tract in 5 cases and acute irreversible uterine inversion in one case. Antepartum hemorrhage (APH) was responsible for in hemorrhagic shock in 9 patients; that included abruptio in 4 cases, placenta previa in 3 cases and in two cases adherent placenta was present after aborted at home by untrained persons. If diagnosed early, PPH is considered as the most preventable cause of maternal mortality due to availability of blood transfusion, higher antibiotics and ventilator support. In our study we found out that, around 80% of patients visited our hospital after more than 12 hours has been passed since unstoppable bleeding started. Apart from few, they were not given any kind of intravenous fluids while on the run to hospital, resulted into irreversible hypovolemic shock and the most patients expired within 24 hours of admission.

16 women died of hypertensive disorders of pregnancy, 10 from eclampsia and 6 from pre-eclampsia. Among eclampsia patients, five patients experienced convulsion during antenatal period, 2 during intrapartum and three after being delivered. Out of 10, 8 patients convulsed again while on the way to the hospital and were not given any Magnesium Sulphate therapy nor was their airway secured. Almost all patients died immediately after admission due to prolonged respiratory distress associated with pulmonary edema and aspiration while having episodes of convulsion. Out of six pre-eclampsia victims; three were having severe anemia, one with severely altered coagulation profile and having abruptio placenta and one patient was having associated chronic renal diseases ultimately lead to multi-organ failure before death.

In our study, 14 patients died due to liver disease associated with pregnancy. 10 patients were Hepatitis virus E (HEV) positive, one with acute fatty liver of pregnancy, one patient was Hepatitis virus B (HBsAg) reactive and one patient was in HELLP syndrome. Almost all patients pregnancy was unsupervised that worsened gradually and ultimately lead into hepatic encephalopathy, coma and death.

Out of 13 patients died due to septicemia, 12 patients died after

delivery while only one patient died while still pregnant. Four patients died after LSCS; one after long trial of normal labor and two after obstructed labor with prolonged intra-uterine death of fetus. Three patients had septicemia after normal delivery with a history of prolonged leaking per vagina. Two patients suffered septicemia after aborted by self-induced unhygienic methods at home. In three patients with septicemia, exact cause of prolonged fever was not identified till death.

Eight patients died predominantly due to severe anemia (<5 gm %). Out of eight, 5 patients were having associated pregnancy induced hypertension; two patients were having AIDS syndrome and one with active tuberculosis. None of anemic patients had taken any kind of ante-natal care or were seeking expert help for associated diseases. Three patients were brought in semi-unconscious state and collapsed within 12 hours of admission. Five patients were actively managed with different components of blood and higher antibiotics, but later on expired due to altered coagulation and septicemia. All patients died during their antenatal period.

Four patients died due to complicated heart disease, three were diagnosed before pregnancy and one during second trimester of pregnancy. One patient was a known case of epilepsy, died due to hemorrhagic stroke during third trimester after having consecutive three episodes of convulsion. Neither heart disease patients nor epileptic patients were taking adequate high risk antenatal care due to lack of proper awareness regarding severity of condition, remote residence from the tertiary care hospital and un-affordability of timely costly surgical intervention.

Four patients died due to acute pulmonary edema, otherwise having normal pregnancy. Three of them developed acute breathlessness within six to twelve hours of delivery and one collapsed on-table while she was undergoing caesarean section for obstructed labor. Although not definitely confirmed due to lack of consent from relatives for medical autopsy, series of clinical events were strongly correlated with amniotic fluid embolism and pulmonary embolism. In two patients, primary cause of death was not identified at all as patients were brought unconscious and were collapsed within few hours of admission.

## Conclusion

In this study, authors realized that majority of the maternal deaths occurred due to a complex, inter-related, and preventable series of events during pregnancy; that ultimately emerged as an unexpected and unprepared disaster in a place where damage control was not possible due to absence of well-equipped hospital with qualified professional medical personnel. Maternal mortality is a multifaceted issue that needs to be addressed not only by the health care professionals but also experts from community leaders and the governance, such as 'Janani Shishu Shuksha Karyakram (JSSK) implemented by government of Gujarat in hospitals to improve overall maternal health and reduce maternal mortality rate. These means provision of collaborative and multi-disciplinary care to mother by doctors, nurses, social workers, emergency referral and medical transportation services. Almost all maternal deaths could have been prevented if each pregnant lady had an easy and affordable access to basic health care services capable of advising nutritious needs during pregnancy such as regular intake of iron tablets to prevent anemia and regular blood pressure monitoring in hypertensive mothers. Presence of community awareness and professional dedication of well-trained qualified health care workers from grass-root level can help us to fight four well known 'delays' that can lead to maternal death: delay in identifying complications, delay in making decision to seek treatment, delay in getting the women to health care centre and delay in receiving quality treatment.

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