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MATERNAL DEATH SURVEILLANCE: A PROSPECTIVE STUDY AT NSCB MEDICAL COLLEGE, JABALPUR

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ABSTRACT **Background:** Epidemiological data related to maternal mortality is valuable in each set up to assess the health care services of the society. This study was undertaken to evaluate causes of maternal death over period of 15 months at a Tertiary Care Center of Mahakaushal Region in Jabalpur, M.P., and India. **AIMS AND OBJECTIVES:** To calculate the Maternal Mortality Ratio in our Hospital, to assess epidemiological aspects of Maternal Mortality, to assess the direct and indirect causes of Maternal Mortality, to identify the avoidable factors leading to Maternal Death. **Methods:** Our Hospital NSCB Medical College Jabalpur is a 860 Bedded Multi specialty Hospital situated in Mahakaushal Region. It drains vast population from the Jabalpur City as well as peripheral rural areas. The average numbers of obstetric admissions are approximately 2000 per month. Detailed data regarding maternal Mortality was collected from case sheet of concerned patient and analyzed with respect to epidemiological parameters such as relationship with age, parity, locality, socioeconomic status, literacy, place of delivery, stage of pregnancy or labor, admission to death interval, referral status and direct and indirect causes of maternal death. **RESULTS:** The present study is Prospective and Observational study undertaken in the Department of Obstetrics and Gynecology for a period of 15 Months effective from 1st January 2018. A total of 122 maternal deaths occurred during 15 months study period from January 2018 to March 2019. Average MMR was observed to be 122/1,00,000 live births. Most of these (74.6%) were from rural area and 25.4% were from urban area. Of the total 122 maternal deaths, 34.4% delivered at Medical College whereas 63% delivered in District Hospital, present study showed that three-fourth (76%) Maternal Mortalities were reported in unbooked patients ,the frequency of Maternal Mortalities was highest (46.7%) among age group of 21 to 25 yrs, and 16.4% Mortalities were reported in illiterate women. **CONCLUSION:** The causes of maternal deaths are multi-factorial but preventable. The institutional maternal mortality rate for NSCB MCH is 122 per 1, 00,000 live births in the study. The maternal deaths could have been avoided with the help of early referral, quick, efficient, well equipped transport facilities, awareness regarding maternal and child health and by promoting overall safe motherhood practices. Causes for pregnancy related deaths can also be identified and taken care of at community level or in the institutional level by encouraging and promoting the importance of the antenatal care, regular visits, overcoming irrational rural beliefs and male-dominated culture.

KEYWORDS : JSSY, Maternal Mortality, MMR, NRHM, Prospective and Observational study

INTRODUCTION:

Maternal death or maternal mortality is defined by the World Health Organization (WHO) as "The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes."

UNFPA estimated that 303,000 women died of pregnancy or childbirth related causes in 2015.6 these causes range from severe bleeding to obstructed labour, all of which have highly effective intervention. As women have gained access to family planning and skilled birth attendants with backup emergency obstetric care, the global maternal mortality ratio has fallen from 385 maternal deaths per 100,000 live births in 1990 to 216 deaths per 100,000 live births in 2015, and many countries halved their maternal death rates in the last 10 years.7

Although attempts have been made in reducing maternal mortality, there is much room for improvement, particularly in impoverished regions. Over 85% of maternal deaths are from impoverished communities in Africa and Asia. The effect of a mother's death results in vulnerable families. Their infants, if they survive childbirth, are more likely to die before reaching their second birthday.8 Between 1990 and 2010, maternal mortality worldwide dropped by almost 50% but still it is very high. Almost all maternal deaths (99%) occur in developing countries. In any community mothers and children constitute a priority group. They account for large sector of population and also a "Vulnerable" (or) a special risk group. The risk is connected with child bearing & delivery in case of women and growth, development and survival in case of Infants and children. Global observations show that in developed regions maternal mortality ratio averages at 16 per 100000 live births but in developing regions the figure is 230 for the same number of live births. Further, the problem is largely preventable. Worldwide about 800 women die every day from pregnancy-child birth related causes. In 2013, 2,89,000 maternal deaths happened in the world and 99% of these deaths occurred in developing countries. Since 1990, maternal deaths worldwide have dropped by 45% related to Millennium Development Goals (MDG) adopted by international community in 2000. In Sub-Saharan Africa, a number of countries have halved their maternal mortality since 1990. In Asia & North Africa, even a greater headway has been made. In India 190/1,00,00 MMR was present in 2013. India contributes 17% of the world's maternal deaths4. The lifetime risk of maternal death in India as on 2013 is 1 in 190 whereas the same in USA is 1 in 1800.[11]

A woman is most vulnerable at the post partum period. About 50-70 percent maternal deaths occur in postpartum period, of which 45 percent of deaths occur in the first 24 hours after delivery and more than two-thirds during the first week puerperium while 11 to 17 percent of maternal deaths occur during child birth. Most maternal deaths are related to Obstetric complications including post partum hemorrhage (most common cause), infections, eclampsia, prolonged (or) obstructed labour and complications of abortions.

Maternal mortality rates (MMR) are very high in Asia and Africa compared with Northern Europe's 4/100,000 live births. An Indian hospital study found the MMR to be 4.21/1000 live births. 50-98% of maternal deaths are caused by direct obstetric causes (hemorrhage, infection, and hypertensive disorders, ruptured uterus, hepatitis, and anemia). 50% of maternal deaths due to sepsis are related to illegal abortion. In 1985 WHO reported that 63-80% of maternal deaths due to direct obstetric causes and 88-98% of all maternal deaths could probably have been prevented with proper handling. In India, coordination between levels in the delivery system and fragmentation

of care account for the poor quality of maternal health care. Mass illiteracy is another cause.

Economic, Status	Frequency	Percent
BPL	32	26.2
Lower	51	41.8
Middle	29	23.8
Upper middle	10	8.2
Total	122	100.0

METHODS:

Our Hospital NSCB Medical College Jabalpur is an 860 Bedded Multi specialty Hospital situated in Mahakaushal Region. It drains vast population from the Jabalpur City as well as nearby peripheral rural areas. The average numbers of obstetrics admissions are approximately 2000 per month.

The present study was Prospective and Observational study undertaken in the Department of Obstetrics and Gynecology for a period of 15 Months effective from 1st January 2018.

Detailed data regarding Maternal Mortality was collected from case sheet of concerned patient in our Hospital. The collected data was analyzed with respect to epidemiological parameters such as relationship with age, parity, locality, socioeconomic status, literacy, and place of delivery, stage of pregnancy or labour, admission to death interval, referral status and direct and indirect causes of maternal death.

The collected data was accurately analyzed with respect to their numbers, causes and contributory factors.

Interpretation of data was aimed at identifying trends in Maternal Mortality, demographic and sociogeographic context, risk factors and avoids ability of Deaths. The focus will remain on those factors which can be prevented and remedied.

The total number of live births during the study period was also collected. The cause of death ascribed for maternal death was recorded from the copies of attached death certificate and confirmed by cross checking the details from case files.

RESULTS:

The present study was an observational and prospective study of Maternal Death Surveillance undertaken at NSCB MCH JABALPUR , from 1st January 2019 to March 2019.There were 122 Maternal Mortalities per 1,00,000 live births in the study. Total live births in this study period were 8661 and maternal mortality ratio was 1408.

Table 1: Age Wise Distribution

Age Group	Frequency	Percent
<20 yrs	20	16.4
21-25 yrs	57	46.7
26-30 yrs	30	24.6
31-35 yrs	11	9
>35 yrs	4	3.3
Total	122	100

Majority of maternal deaths 57 {46.7% } was observed in women of age group 21- 25 years followed by ,less than 20 years age group 20 {16.4%}, 26- 30 year age group 30 {24.6%}, 31- 35 year age group 11 {9.0%}, >35 year age group 4 {3.3%}.

Table 2: Distribution As Per Educational Status

Education	Frequency	Percent
Illiterate	20	16.4
Primary	32	26.2
Middle school	26	21.3
High school	32	26.2
Graduate	12	9.8

16.4% of patients were illiterate, 26.2% were educated up to primary school, 21.3% were educated up to middle school, 32% were educated up to high school, 12% had completed graduation.

Table 3: Distribution As Per Economic Status

Out of 122 mortalities, 32% were from Below Poverty Line, 51 % belonged to lower economic class, 29% were from middle class and only 10% were form upper middle class.

Table 4: Distribution As Per Booking Status

No. of ANC Visits	Frequency	Percent
0	24	19.7
1	41	33.6
2	28	23.0
3	20	16.4
>4	9	7.3
Total	122	100.0

Antenatal visits of pregnant patients, indirectly reflects the antenatal care they received during antenatal period .Out of 122 patients, 19.7% did not have any antenatal visits , 33.6% had only 1 visit, 23% had 2 visits, 16.4% had 3 visits . Only 7.3% had more than 4 antenatal visits at their nearby Anganwadi, PHC, CHC. None of the patients had prior visit to NSCB Medical College Jabalpur.

Table 5: Distribution Of Gravida Status

Gravida Status	Frequency	Percent
Primigravida	55	45.1
2nd Gravida	40	32.8
3rd Gravida	14	11.5
Multigravida	13	10.6
Total	122	100

Majority of patients were G1 (45.1%) followed by G2 (32.8%), 11.5% were G3, and 10.6% patients were grand multigravidas.

Table 6: Distribution According To Locality

Rural / Urban	Frequency	Percent
Rural	91	74.6
Urban	31	25.4
Total	122	100

75% of Maternal Deaths are from rural areas whereas only 25 % were from Urban areas.

Table 7: Distribution Gestational Age

Gestational Age	Frequency	Percent
12-27 Wk	17	13.9
28-36 Wk	33	27
>36 Wk	72	59
Total	122	100

Out of 122 deaths majority of patients 72(59%) reached NSCB MCH at term or near term gestation, 33(27%) patients came between 28 to 36 th week of gestation, and remaining 17(13.9%) patients came between 12 th to 27th week of gestation.

Table 8: Distribution According To Obstetric High Risk Factors

Risk Factor	Frequency	Percent
Previous uterine scar	14	11.4
Multi Gravida	13	10.6
Cephalopelvic Disproportion	2	1.6
Twin Pregnancy	1	0.8
Total	30	24.5

Out of 122 patients, 30 (24.5%) patients had obstetric high risks predominantly previous uterine scar and multigravida i.e. 14(11.4%), 13(10.6%) respectively.

Table 9: Distribution According To Place Of Referral

Referred from	Frequency	Percent
Direct	20	16.4
PHC	5	4.1
CHC	17	13.9
DH	77	63.1
Pvt Hospital	3	2.5
Total	122	100.0

Almost all (83.6%) patients were referred from PHC, CHC, DH and Private Hospitals. Remaining (16.4%) patients came directly to NSCB without any referral.

Table 10: Distribution Of According To Referral To Admission Interval

Referral To Admission Interval	Frequency	Percent

<6 hrs	92	75.4
>6 hrs	30	24.6
Total	122	100

Out of 122 mortalities, 92 (75.4%) reached within 6 hrs of referring time from DH (secondary referral), and 30 (24.6%) took more than 6 hrs, which were primary referrals directly to NSCB MCH

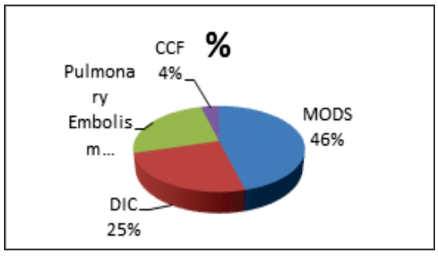
Table 11: Distribution According To Duration Of Stay In Hospital

Duration of Stay	Frequency	Percent
<24 hrs	54	44.3
24hrs-7days	53	43.4
>7days	15	12.3
Total	122	100

Out of 122 mortalities, 54(44.3%) patients died within 24 hrs, 53 (43.4%) died within 7 days and 15 (12.3) died after 7 days.

Table 12: Distribution According To Complications

Complication	Frequency	%
MODS	56	45.9
Pulmonary Embolism	31	25.4
DIC	30	24.59
CCF	5	4.09
Total	122	100



Out of 122, 56(45.9%) mortalities were developed multiple organs Dysfunction Syndrome, 31(25.4%) mortalities had Pulmonary Embolism, and Disseminated Intravascular Coagulopathy was associated with 30 (25.4%) mortalities. Remaining 5(4%) developed congestive cardiac failure.

Table 14: Distribution As Per Cause Of Death

Causes	Frequency	Percent
HDP	66	54.1
Hemorrhage	27	22.1
Sepsis	11	9
Fulminant Hepatitis	7	5.7
Severe Anemia	6	4.9
Cardiac Disease	3	2.5
Acute Febrile Illness	2	1.6
Total	122	100

54.1% (66) of patients died due to Hypertensive diseases of pregnancy , 22.1% (27) from Hemorrhage, 9%(11) from Sepsis, 5.7%(7) from Fulminant Hepatitis, 4.9%(6) from Severe Anemia, 2.5%(3) from Cardiac disease, 1.6%(2) from Acute Febrile illness.

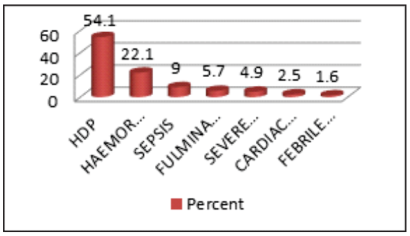


Table 15: Fetal Outcomes In Maternal Deaths

Outcome	Frequency	Percent
Live	50	40.9
IUD	53	43.4
SB	8	6.6
Not Delivered	4	3.3
Abortion	7	5.7
Total	122	100

Out of 122, 50(40.9%) fetus were live, 53(43.4%) fetus were IUD, 8(6.6%) fetus were stillborn, 7(5.7%) abortions were there. Remaining 4 (3.3%) patients died undelivered.

DISCUSSION:

Maternal mortality reduction has been one of the topmost priorities for the welfare of our community. The Millennium Development Goals and the WHO, make every mother and child count' initiative describe the importance of maternal mortality reduction as a healthcare issue. A recent systematic review of the causes of maternal mortality and its geographic distribution has shown that the Indian subcontinent has a significantly higher maternal mortality attributable to sepsis, infection and hemorrhage. Death of mother is a tragic event; it has a severe impact on the family, community and eventually the nation.

The present study was undertaken at NSCB Medical College & Hospital, a tertiary care centre catering to patients from all the districts in Madhya Pradesh. The MMR during the study period of 15 months was 122 per lac live births, attributable to large number of high risk referral patients at our institution.

In the present study, out of 122 Mortalities, 80.3 %(98) patients were brought in poor general condition at the time of admission. Majority (87.7%) of the patients succumbed within 24 hrs to 7 days of admission at Medical College. Similarly Priya Netal showed that 44.3% (54) of deaths were within 24 hours of admission, Puri A et al 45% of deaths within 24 hours of admission.

This was due to late reporting of the patients after the onset of complications to our hospital. Rashmi Singh, Nivedita Sinha et al reported, in the majority of cases (58.36%), the women went to the hospital more than 24 hours to less than 1 week after the onset of complications and 12.16% of the women went to the hospital more than 1 week after the onset of complications.

In our present study out of 122 Mortalities, 80.3 %(98) patients were in poor general condition. Puri A et al reported that most of the patients were in moribund state at the time of admission.

In present study out of 122 Maternal mortality, on admission 75.4 %(92) patients were antenatal. All the patients with high risk obstetric /medical disorders were induced for labor as an integral part of management and almost all patient 96.6% delivered before they died, Similar results have been obtained in other studies; Saini and Gupta et al reported 66.1% of post natal deaths; Puri A et al showed 63.08% of deaths in postnatal period.

In our present study at the time of death out of 122 patients, 57.3% (70) delivered vaginally,31.9% (39) patients had operative interventions,5.7%(7) patients had abortions, manual removal of placenta was done for (2) 1.6% of patients and only 3.27%(4) patients died undelivered. Janisp et al reported the status of the patients at the time of death, 58.53% if patients had normal vaginal delivery, 19.51% had LSCS, 14.63% were antenatal and 4.87% had Abortion.

In our present study Out of 122, 50(40.9%) fetus were live, 53(43.4%) fetus were IUD, 8(6.6%) fetus were stillborn, 7(5.7%) abortions were there. Remaining 4 (3.3%) patient's remained undelivered. This reflects that morbidity of pregnant women had adverse fetal outcome.

In the present study, both direct and indirect causes contributed to of maternal deaths. Direct causes were hypertensive disorders (54.1%), hemorrhage

(22.1%), sepsis (9%), fulminate hepatitis (5.7%), severe anemia (4.9%) heart disease (2.5%) and acute febrile illness (1.6%) complicating pregnancy. Paul, et al (4) reported that the most common cause of maternal death was hypertensive disorders of pregnancy (30%). Government of India and the WHO report published Hemorrhage as the most common cause of maternal mortalities. Direct cause contributed to 76.7% of all deaths in the hospital. In most of the hospital-based studies in India, the direct causes were responsible for 51% to 82% of maternal mortalities. A similar study by Oladapo et al. reported hypertensive Disorders of pregnancy (28%) as the most common cause of maternal death followed by hemorrhage (21.3%) and sepsis (20.0%). Similar results were seen in studies by Priya N et al who found postpartum hemorrhage 35.05% as the leading cause followed by hypertensive disorders 27.83% and anemia 25.7%; Yadav

K et al who reported hemorrhage 43.16%, hypertension 33.09% and sepsis 12.67% as direct causes and anemia 26.8% as leading indirect cause. Kittur S10 found causes of maternal deaths as hemorrhage 35%, hypertensive disorders 27.50% anemia 10%, pulmonary embolism 10% and heart disease 2.5% So it is quite clear from these studies that, hypertensive disorders, hemorrhage and anemia are leading causes of maternal deaths.

In present study 2nd most common cause of maternal mortalities is Hemorrhage which is 22.1 %(27). Out of 27, Atonic uterus, Abruptio placentae, Placenta Previa predominantly contributed to hemorrhage. Severe anemia, Hypertensive disorders of pregnancy and previous caesarean section can indirectly result these varieties of hemorrhage.
In our study anemia was seen in all of our cases, but anemia of severe degree contributed directly to maternal deaths was observed. Hemorrhage including antepartum hemorrhage because of abruption placenta and placenta previa and post partum hemorrhage also causes anemia. Out of all 122 mortalities, all patients had anemia as comorbidity. Out of these 44(36.1%) patients had

severe anemia, 52(42.6%) patients had moderate anemia, and remaining 26(21.3%) had mild anemia. Preexisting anemia worsens as pregnancy advances leading to cardiac failure and death. It also impedes the mother's ability to resist infection or cope with hemorrhage and increases the likelihood of her dying in childbirth by a factor of four.

According to Vasaikar et al14 illiteracy, ignorance, early marriages, malnutrition is responsible for making anemia the main cause of maternal death in rural area. Janisp et al reported the Indirect causes of maternal deaths in present study, Anemia was present in 12 (29.26%) of maternal deaths, cardiac disease was in 3 (7.31%), and jaundice was in 2 (4.87%) cases. These are consistent with studies of Jain, Jadhav, Pal, Onakewhor. Anemia is the major indirect cause of death responsible for 15-65% of deaths reported by various authors. Anemia is a preventable disease and measures should be taken to improve hemoglobin status pre-conceptionally and during pregnancy.

In present study out of 122 Maternal Mortalities, 20.4 %(25) mortalities were due to additive effect of medical illnesses .Febrile illnesses were leading cause for 6.5 %(8) Maternal mortalities. fulminant hepatitis was 2nd most common medical illness associated for 4.9%(6) maternal mortalities, Cardiac Diseases, Diabetes, Lower respiratory tract Infections were other important medical disorders contributing to 2.4%(30) Maternal Mortalities individually. Janisp et al reported that Cardiac diseases are the other major indirect cause of Maternal Mortality. . Hepatitis E is responsible for 8.33% of total maternal deaths. It can lead to fulminating hepatitis during pregnancy and leads to maternal morbidity and mortality. Bhaskar K Murthy, Mangala B Murthy stated that 27.5% of maternal deaths were due to indirect causes. Anemia, jaundice, and heart disease accounted for 10%, 9.16%, and 3.33% of maternal deaths respectively and miscellaneous cause like acute gastroenteritis accounted for 5% of Maternal Mortalities. Doddamani U et al. Reported. The indirect causes of maternal death were jaundice, heart disease, respiratory disorders and epilepsy. Anemia was the significant comorbid factor in our study which is comparable to study done by Paul et al.

In present study out of 122 Maternal Mortalities 24.5 %(30) had associated obstetric high risk factors. Previous uterine scar was the leading obstetric high risk contributing for 114 %(14) mortalities. Multigravida status of women were the 2nd leading obstetric high risk factor associated with 10.6 %(13) mortalities. Rashmi Singh, Nivedita Sinha, the highest number of maternal deaths occurred among those who were second or third gravida (48.94%) followed by fourth gravida and above (26.14%)

In present study out of 122 deaths MODS was the cause for 56(45.9%) mortalities, Pulmonary Embolism contributed 25.4% of Maternal Mortalities and Disseminated Intravascular Coagulation was the 3rd leading cause of Maternal Mortalities i.e. 24.5%. These findings are consistent with study of Jain, Jadhav, Pal, Onakewhor and Shah. DIC is a consumption coagulopathy and is a key Contributor to primary postpartum hemorrhage. About 50% of patients with DIC are obstetric patients having complications of pregnancy. Because of hypercoaguable state of pregnancy, presence of any provocative factors (such as abruption placenta, liquor amnii embolism, sepsis, and severe eclampsia and HELLP syndrome) can be easily upset normal balance leading to DIC. All these are preventable causes of maternal mortality provided the treatment is started promptly. Unfortunately, in many cases, patients were referred very late, in critical conditions and unaccompanied by healthcare worker.

Our study place ,NSCB MCH JABALPUR is a tertiary referral centre which accepts referral from all nearby peripheral health centres,community health centers and district hospitals .Obstetric and Gynecology Department has a fully equipped Obstetric Intensive care unit .Out of 122 Maternal Mortalities all the patients who came were in critical condition shifted to obstetric OICU where critical care management done and all the resuscitative measures i.e. Blood and Blood products transfusions, Ionotropic support , Intubation and Ventilator support given. Some of them needed central line canulation ,tracheostomy and Dialysis.Inspite of whole hearted efforts by ICU team which include Obstetrician, Anesthetist, Physician and other specialists ,the patients could not be revived and most of them succumbed within 7 days of admission at NSCB MCH JABALPUR .

CONCLUSION:

The analysis of maternal deaths in our study reflects ignorance regarding importance of antenatal checkups. The need of the hour is proper functioning of JSY and JSSK scheme under NRHM which encompasses the registration of antenatal cases, identification of high risk cases like Anemia, Hypertension etc, their timely treatment, cashless institutional deliveries, free to and fro transport, financial assistance, general public awareness regarding danger signs in pregnancy, importance of nutritional intake & iron rich diet, maintenance of personal hygiene and family planning. To prevent mishaps during childbirth, early referrals and prompt transportation services are required. The network of well trained ASHA workers should be strengthened as they form a vital link between pregnant women and health system.

In today's modern era of medicine most maternal deaths are seen in women from rural areas, uneducated, unbooked patients from low socioeconomic status, who had to travel a long distance to reach healthcare centre. High risk antenatal cases should be identified. Early referral, easy transport, continued skill based training, upgradation of hospitals, vigilance and monitoring of health services can effectively reduce maternal mortality.

"A stitch in time saves nine"

REFERENCES

1. World Health Organization, Regional Office for South-East Asia. Maternal Health in the South-East Asia Region 2015. New Delhi, India: WHO; 2015.
2. Juneja Y, Rai U. A five years review of maternal mortality. J ObstetGynecol India. 1993; 43:944-9.
3. Fox H. Pathology of maternal death. In haines and taylor obstetric and gynecological pathology. 6th ed. Churchill Livingstone; 1995. p. 1837-51.
4. K Park .Park's Textbook of Preventive and Social Medicine. 23rd edition, Jabalpur: Banarsidas Bhanot Publishers; Jan 2015. p558.
5. Maternal and child mortality and total fertility rates sample registration system. Office of registrar general, India census. Available at :http://www.india.gov.in/2011common/vitalstastics.html. Accessed 14th March, 2016.
6. Bhatt R Maternal mortality in India-FOGSHWHO study J ObstetGynecol India 1997:47; 207-214.
7. United Nations General Assembly. United Nations Millennium Declaration. A/RES/55/2. 1-9-2000. UN General Assembly, 55th session, agenda item 60(b).
8. Khan KS, Wojdyla D, Gulmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: A systematic review. Lancet. 2006; 367:1066-74.
9. Shrotri A N, Chaudhari N B maternal mortality at Sasson General hospital Pune. J ObstetGynecol India. 1994;46:225-30.
10. Goswami A, Kalita H. Maternal mortality at Gauhati Medical college hospital. J ObstetGynecol India. 1996;6:785-90.
11. Baul M K, Manjusha. Maternal Mortality: A ten year study. J Indian Med Assoc. 2004; 102:18-9, 25.
12. Swapnil Mane, Sindhu Chandra. Sickle cell anemia in pregnancy with hyperhaemolytic crisis Diagnostic dilemma. Bombay Hospital Journal.2011;Vol 53(2):259-260.
13. Kavatkar AN, Sahastabudhe NS, Jadhav MV, Deshmukh SD. Autopsy study of maternal deaths. Int J obstetGynecol.2003; 81: 1-8.
14. Jashnani KD, Rupani AB, Wani RJ. Maternal mortality: An autopsy audit. J Postgrad Med. 2009;55:12-6.
15. Vasaikar MS, Kanthikar SN, Tambse MP. Clinicopathological correlation of maternal death in rural areas of north Maharashtra. Int J Pharm Bio Sci. 2014;5(1B):449-456.
16. Panchabhai TS, Patil PD, Shah DR. An autopsy study of maternal mortality: A tertiary healthcare perspective. JPGM.2009; 55(1):8-11.
17. K Park. Preventive Medicine in Obstetrics, pediatrics and geriatrics. In: K Park ,Park Text Book of Preventive and Social Medicine, 23rd edition; M/S Banarsidas Bhanot,India;2015, Chapter 9..pp. 557.
18. Trends in maternal mortality 1990 to 2013. Maternal mortality estimates (cited may, 2014). Available from http://maternalmortalitydata.org/Definitions.html.
19. Saini V, Gupta M. Review of maternal mortality in an urban tertiary care hospital of North India: Intern J Basic Applied Medical Sciences 2013; 4(1): 59-64.
20. Puri A, Yadav I, Jain N. Maternal mortality in an urban tertiary care hospital of North India. J Obstetrics Gynaecology of India 2011;4: 280-85.
21. Bangal VB, Giri PA, Garg R. maternal mortality at a Tertiary care teaching hospital of rural India: A retrospective study. Inter J Biological Medical Research 2011; 2(4): 1043-46.
22. Priya N, Verma A, Verma S. Maternal mortality: ten years retrospective study. JK Science 2010;12(3): 134-36.

23. Yadav K, Namdeo A, Bhargava M. A retrospective and prospective study of maternal mortality in a rural tertiary care hospital of Central India. Indian J Community Health 2013; 25(1): 16-21.
24. Kittur S. A study of maternal mortality at the teaching hospital, Hubli, Karnatka. Int J Reproduction Contraception, ObstGynecol2013;2(1):74-79.
25. Bed N, Kambo I, Dhillon BS, et al. Maternal deaths in India preventable tragedies. (An ICMR Task Force Study). J ObstetGynecol India 2001; 51:86-92.
26. Yerpude PN, Keerti S Jogdand. A 5 year retrospective study of pattern of maternal mortality in a tertiary care hospital in South India. Int J Recent Trends SciTechnol 2014;11(3):310-2.
27. Wadhwa L, Gupta S, Jain A. Demography and a etiological profile of maternal mortality cases at a tertiary care centre of India – five and a half years retrospective analysis 2013 July-Dec. Indian J Med Specialties 2013;4(2):238-42.
28. Zaman S, Begum AA. Maternal mortality at a rural medical college of Assam: a retrospective study. J ObstetGynaecol Barpeta 2014;1(1):46-51.
29. Mukherjee S, Mukherjee S, Sarkar RR. A six year retrospective study of maternal mortality at a tertiary teaching institute in Uttarpradesh. Int J Med Sci Public Health 2014;3(11):1407-9.
30. Gurina NA, Vangen S, Forsen L, Sundby J. Maternal mortality in St. Petersburg, Russian Federation. Bull World Health Organization 2006; 84:283-9.
31. Bedi N, Kambo I, Dhillon BS, Saxena BN, Singh P. Maternal deaths in India: Preventable Tragedies (An ICMR Task Force Study) J ObstetGynecol Ind. 2001;51:86–92.
32. Purandare N, Singh A, Upadhya S, Sanjanwala SM, Saraogi RM. Maternal mortality at a referral centre: a five year study. J obstetric Gynaecology India 2007;57(3):248-50.
33. Kulkarni SR, Huligol A. Maternal mortality—10 year study. J Obstetric Gynaecol India 2001;51(2):73-6.
34. Priya N, Verma A, Verma S. Maternal mortality: ten years retrospective study. JK Sci 2010;12(3):134-6.
35. Jadhav CA, Prabhakar G, Shinde MA, Tirankar VR. Maternal mortality: five year experience in tertiary care centre. Indian J Basic Appl Med Res 2013;7(2):702-9.
36. Bangal VB, Giri PA, Garg R. Maternal mortality at a tertiary care teaching hospital of rural India: a retrospective study. Int J Biol Med Res 2011;2(4):1043–6.