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The study of factors affecting maternal mortality in tertiary care teaching institute in tribal region of eastern Maharashtra: paving a way forward

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Abstract

Background: Maternal mortality is defined as the death of any women while being pregnant or within 42 completed days of termination of pregnancy, irrespective of the duration or site of pregnancy, from any cause related to or aggravated by pregnancy, but not from accidental or incidental causes. Maternal mortality rate (MMR) is defined internationally as the maternal mortality rate per 100,000 live births. Even today 20% global maternal deaths occur in India. MMR in India is reduced by 77%, from 556 per 100,000 live births in 1990 to 130 per 100,000 live births in 2016 according to WHO & Millennium Development Goal (MDG) of 109 per 100,000 live births by 2015. Sustainable Development Goal (SDG3) goal of MMR less than 70 per 100,000 live births by year 2030 [21]. The main direct cause of maternal death in developing countries include haemorrhage, sepsis, obstructed labor and hypertensive disorders. These are mostly preventable through regular antenatal checkup, proper diagnosis and management of labor complications.

Aim and Objectives: 1.To assess the Maternal Mortality Rate(MMR) and causes of maternal mortality in given time period.2.Determine the relationship between maternal education, maternal age at first pregnancy and antenatal care attendance with maternal mortality.

Material and Methods: A retrospective analysis of all maternal deaths (including their age at first pregnancy, education, antenatal visits) occurring in the Department of Obstetrics and Gynecology of a tertiary care hospital of eastern Maharashtra over a period of five years from January 2014 to December 2018. Data collected from death register of Medical Record Section of same institute.

Statistical analysis: Data was expressed as count or percentage using MS Excel.

Results: 21 maternal mortalities occurred during five year span with 35,205 live births giving MMR of 59.65 per 100,000 live birth. 42.86% mothers were of age group 20-24 yrs. Mothers with age between 15-34 yrs were also present. Out of all possible places of deaths 31 maternal mortalities occurred, most mortalities 67.74% occurred in hospital and 22.58% on the way to referral center. 52.38% mothers were educated upto 10th standard and 28.57% had done primary schooling. 42.86% mothers were with 4/4 ANC visits and 4.76% with only one ANC visit. 38.09% mothers were with parity 1 and 9.52% with parity 4/4. Major direct cause of death was hemorrhagic shock (47.61%) then eclampsia/pre-eclampsia (19.04%) and placenta previa (14.28%), sepsis (9.52%). Indirect causes were heart diseases (42.85%), anaemia (38.09%), respiratory diseases (14.28%) and sickle cell crisis (4.76%).

Conclusion: As our MMR found to be 59.65 per 100,000 live births so we achieved the SDG goal 3. Staff should be trained for emergency cases and health services to pregnant women should be improved. Referral/ transportation system should be improved as most mortalities were preventable. Educating mothers and awareness camps should be arranged to strengthen motherhood and reduce MMR.

Keywords: maternal mortality rate (MMR), tribal region, eastern Maharashtra, global maternal deaths

Introduction

Maternal mortality is defined as the death of any women while being pregnant or within 42 completed days of termination of pregnancy, irrespective of the duration or site of pregnancy, from any cause related to or aggravated by pregnancy, but not from accidental or incidental causes [1]. Maternal mortality ratio (MMR) is defined internationally as the maternal mortality per 100,000 live births [2]. Maternal mortality remains one of the most discouraging public health problems in India. Even today 20% global maternal deaths occur in India [3]. MMR in India is reduced by 77%, from 556 per 100,000 live births in 1990 to 130 per 100,000 live births in 2016 according to WHO & Millennium Development Goal (MDG) of 109 per 100,000 live births by 2015 [4].

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The main direct cause of maternal death in developing countries include haemorrhage, sepsis, and obstructed labor and hypertensive disorders [5]. Other factors are unsafe abortion, eclampsia, infection etc. The other contributory causes are early marriage, adolescent pregnancy, poverty, malnutrition, harmful traditional practices, illiteracy/ ignorance, etc [6]. These mortalities are mostly preventable through regular antenatal checkup, proper diagnosis and management of labour complications [7]. Hemorrhage has been found to be the major reason for maternal deaths in India [8, 9, 10, 11, 12].

Maternal deaths, too often solitary and hidden events, go uncounted. This is not because of a lack of clarity in defining a maternal death, but because of an inherent weakness in health information and recording systems. Estimates based on systemic reviews of available information indicate a problem of considerable magnitude. A majority of maternal deaths occur in Asia (253,000) and Africa (251,000). Thirteen countries accounted for 67% of all maternal deaths. India has the dubious distinction of having the highest estimated number of maternal deaths in any country (136,000). Developed countries in contrast have a maternal mortality ratio of around 20 per 100,000 live births [13]. The national health policy (1982) aimed at reducing the maternal mortality in India from over 400 per 100,000 live births to less than 200 per 100,000 live births by the end of year 2000. We, even in 2005, are far from this target [14]. India's maternal mortality ratio (MMR) stood at 570 in 1990, which fell to 470 per 100,000 live births in 1995, 390 in 2000, 280 in 2005, and 230 in 2008 [15]. Widespread regional variation, besides higher concentration of maternal mortality in specific social groups (religion, cast, or tribe), has also been evident from past studies [16, 17, 18]. The decline in maternal mortality ratio (MMR) among Asian and North African countries was only 2.3% per year between 1990 and 2015 [19]. There are 10 fast-track countries including Bangladesh, Nepal, Cambodia, China, Egypt, Ethiopia, Lao PDR, Rwanda and Vietnam [20], that have invested in high-impact health interventions, such as quality care at birth, immunization and family planning. Sustainable Developmental Goal 3 (SDG-3) has a target to reduce the global MMR to less than 70 per 100,000 births by 2030 [21]. The maternal health inequalities are not only between countries, but within countries, and between rich and poor women residing in villages, cities and slums [22, 23, 24, 25]. Layers of maternal health inequalities can be traced in the provision of maternal care services as well as across socio-economic gradient in India [26, 27]. These inequalities lead to conditions that make some women more vulnerable to death than others.

Pregnancy is a vulnerability that puts a woman at risk of dying [22]. Biomedical causes and health system conditions that lead to maternal deaths are well recognized [28]. Maternal mortality is an indicator of the quality of obstetrics care in a community, directly reflecting the utilization of healthcare services available. One of the most important goals of the MDGs is to reduce the maternal mortality. Health systems functioning with adequate equipment, resources and trained personnel to handle maternal complications can reduce the risk of mortality.

Review of literature

This narrated review utilized a structured literature review strategy. It drew from English language articles, reports and other literature focused on the reduction of Maternal Mortality by reducing the influencing factors at state level, country level and at the level of other countries. No specific start date was selected for the literature in order to look at as broad as the time-frame as possible.

Databases searched were PubMed, World Bank e-librarium, Google Scholar search engine. Several search strategy were employed using key-words includes, "Maternal Mortality, MDG, Factors affecting it and MMR, etc"

The search strategy didn't include study design filters in order to capture all information of potential interest in the review. Purposeful search of google and bibliographies of papers retrieved, from year 1991 to 2018.

1. An Indian hospital study by Prakash A *et al.* on Current status and strategies for reduction of maternal mortality in India in year 1991, found the MMR to be 4.21/1000 live births. 50-98% of maternal mortalities were due to direct obstetric causes as haemorrhage, infection, obstructed labor, hepatitis, anaemia and hypertensive disorders. 50% were due to sepsis relating to illegal induced abortion. 88-98% maternal deaths could have been prevented with proper handling, mass illiteracy is another cause. Effective strategies for reducing MMR are, to place high priority on maternal and child health, to give attention to care during labor and delivery as it's the most critical period for complications, to improve quality of care at rural community level at PHC and to improve transportation.
2. The study of Demographic socio-economic and medical factors affecting maternal mortality by PN Anandalakshmy *et al.* carried out in year 1993 at Safdarjung Hospital in New Delhi. Data collected through one to one pairing a Case Control study applied to 252 cases of maternal deaths during year 1983-85. The risk factors identified were severe anaemia with Hb% below 8.5%, haemorrhage, toxemia of pregnancy, short birth interval, and maternal age below 20 and above 35 years and high parity of 5 and more of mothers. Concluded that all women need to teach how to prevent nutritional anaemia and importance of iron and folic acid provision and intake during antenatal period with importance of routine and ANC check-ups should be emphasized.
3. A study of factors and maternal mortality carried out in Ejisu district of Ghana in year 1994 by Martey JO, *et al.* A community based survey found 44 women who died in pregnancy, delivery or puerperium. 59% were aged between 20-34 years, 82% were married and 66% were with at least primary education. Main causes were postpartum haemorrhage (45.5%), jaundice in pregnancy (22.7%), obstructed labor (6.8%). 59% died in hospital and 7% during referral from health facility. 34% mothers who died had not attended any antenatal check-ups during pregnancy. Improvement in quality of care during delivery at all levels of the district health system should be implemented and maintaining a resident doctor for emergencies should be done to reduce MMR.
4. The study on Operational factors affecting Maternal Mortality carried out in year 1997 in La district of Tanzania by Ernest Urassa *et al.* Follow up done of 117 cases, 79% received medical care and 11% arrived late for treatment. It was found that husband (29%) and mother (31%) of women decided her care in case of complication. Delay in transport was common so the complications were not managed on time in cases of abortion. Inadequate treatment was identified by district health staff in 61% and by referral centres in 12% cases. Concluded that lack of equipment at referral centre and wrong decision at district centre were main reasons. So the provision of resources, supplies and clear protocol of management and referral necessary for maternal survival.

5. Study on maternal mortality: the real issue carried out in Nigeria in year 1997 by Harrison KA *et al.* High maternal mortality estimated to be 1,000 per 100,000 births due to three fundamental issues as mass poverty with gross inequalities, unbooked emergencies and illiteracy. Rampant corruption constituted a major aggravator of poverty. Poverty should be managed and eradicated also per capita income of families should be increased, all should be taught regarding safe motherhood and all complications, emergencies management should be taught to prevent the increasing maternal mortality rate.
6. Retrospective analysis of Safe Motherhood: A long way to achieve in year 2001 by Majhi AK, *et al.* carried out in a tertiary care hospital, Kolkata India. There were 203 maternal mortalities and 29,563 live births giving MMR of 686.67/100,000 live births. 25.6% mothers were of age 20 or less than 20. Majority (73.4%) were unbooked, mostly from rural (59.6%) or urban slum (20.2%) and from low socio-economic status (59.6%). Most (60.1%) were multiparous and 50.74% died within 24 hrs of hospital admission. Toxemia (53.2%) was leading cause others being haemorrhage (16.75%), sepsis (12.31%), and severe anaemia (6.4%). Factors responsible were high parity, low socio-economic status, illiteracy and inadequate health facility. An active community based health care system is the most effective approach to achieve safe motherhood.
7. A ten year review of maternal mortality in Sokoto, Northern Nigeria carried out by LR Audu *et al.* in year 2002. A descriptive study based on hospital case records of teaching hospital in Nigeria with objective to determine MMR, risk factors, causes and ways to prevent and reduce maternal mortality. 197 maternal deaths, 9,158 live births giving MMR of 2,151/100,000 live births. Mean age of death was 27 years. Risk factors included nulliparity, poverty, illiteracy and lack of prenatal care. Main causes were ruptured uterus, eclampsia, infection and haemorrhage. Conclusion: MMR is high, most of maternal deaths could have been prevented by prenatal care and prompt treatment of obstetrics emergencies.
8. A population based study of maternal mortality in Northern Nigeria by Yusuf M Adamu *et al.* carried out in year 2003 with objective to determine incidence and cause of maternal mortality. A total of 4154 maternal deaths occurred among 171,621 deliveries giving MMR of 2420 per 100,000 live births. 50% of maternal deaths occurred due to eclampsia, anaemia and ruptured uterus. Reached at a conclusion of reduction in MMR rate by half at study site with effective interventions targeted to prevent deaths from eclampsia, anaemia and ruptured uterus.
9. A seventeen-year review of Factors affecting maternal mortality carried out in North-central Nigeria in 2005 by IAO Ujah *et al.* Maternal mortality ratio in Nigeria is one of the highest in the world. A facility based study to determine the magnitudes, trends, characteristics causes before and after launch of Safe-motherhood in Nigeria. Cases reviewed between 1985 to 2001,38,768 deliveries and 267 maternal deaths occurred giving MMR of 740/100,000 live births. The mean age of maternal death was 26.4(SD8.1) years. High maternal mortality seen in multiparous, illiterate and women with age less than 15 and more than 40 yrs. Major direct causes of death were haemorrhage(34.6%), sepsis(28.3%) and indirect causes are hepatitis (18.6%), anesthetic death and anaemia in pregnancy each(14.6%). 79% deaths occurred in 24 hrs of admission. Most of the deaths were preventable. A regional specific programme should be planned to reduce maternal mortality rate.
10. A Retrospective descriptive survey on maternal mortality carried out in year 2005 at the Queen Elizabeth central teaching hospital, Blantyre, Malawi by Lema VM, *et al.* with objective to identify social, demographic and reproductive profiles of women and main immediate cause of maternal death. Maternal mortality found to be 204 with 19,859 live births giving MMR of 1027.2/100,000 live births. Ages ranged from 16-40 yrs. 20.6% were adolescent and majority 56.4% were of 15-24 yrs age. Major causes were puerperal sepsis (29.4%), post-abortal complications (23.5%), infection (20.1%) and haemorrhage (10.6%). Operational factors responsible were unsafe induced abortion, poor quality services and obstetric care. Most of deaths were easily avoidable, so recommended that the country needs to make more investment and commitment to mitigate these deaths.
11. Maternal mortality in health institutions with emergency obstetric care facilities in Enugu state, Nigeria carried out in year 2005 by HE Onah *et al.* A retrospective analysis to assess the current level of maternal mortality. Within 5 year period from 1999-2003, 141 maternal deaths with 18,257 live births giving MMR of 772/100,000 live births. Type III delay was commonest delay and referral delay accounting for 46.4% of all cases. Leading causes were obstetric haemorrhage (19.1%), sepsis (18%), prolong obstructed labor (16.9%). Most of referral come from private hospitals, hence the need to retrain the private practitioners in emergency obstetric care.
12. A retrospective data analysis of Trends and Causes of maternal mortality in S.N. Medical College and hospital Agra, India by Jain A, *et al.* in year 2009. Records are collected from medical record section of hospital from 1999-2007. 192 maternal deaths occurred on 6,386 live births giving MMR of 30.07/100,000 live births. 51.04% deaths were due to indirect causes. Main causes were anaemia (24.48%), haemorrhage (18.23%), toxemia (18.23%) and septicemia (19.23%). Improvement in obstetric care, availability of skilled staff are required to reduce MMR.
13. An analysis of causes and characteristics of maternal deaths, facility based review in three districts of central region of Malawi carried out by Kongnyuy EJ, *et al.* in year 2009. 43 maternal deaths were reviewed during one year period. 65.1% were direct and 34.9% of indirect obstetric deaths, major causes were postpartum haemorrhage (PPH) (25.6%), postpartum sepsis (16.3%), HIV/AIDS (16.3%) and ruptured uterus (7%). Two third (51.2%) women were referred from another health facility. The major problems were inadequate resuscitation of workers (69.8%), lack of skills (60.5%), and delay in starting treatment (46.5%) most importantly was lack of blood for transfusion (20.9%). So the adequate training on obstetric skills and raising awareness among people should be encouraged.
14. A study by LO Omo-Aghoja *et al.* on Maternal mortality and Emergency Obstetric care in Benin city, South Nigeria in year 2010 where delivery records of tertiary care teaching hospital over 2 years were analyzed to estimate MMR, type III delays and obstetrics care services provision. MMR found was 2,356/100,000 live births. Major causes of death were HIV/AIDS (20.2%), eclampsia (12.4%), puerperal sepsis (11.9%) associated causes of death were Type III delay (61.9%) due to delayed referral, Type I delay (28.6%)

- and Type II delay (0%). Other causes were lack of equipments, oxygen and blood. So the Tertiary health institute should step up their emergency obstetric services and reach out to other care providers to build greater understanding of issues relating to safe motherhood.
15. A case control survey based study carried out in desert districts of Rajasthan on Maternal mortality ratio and predictors of maternal deaths by Gupta SD, *et al.* in year 2010. This study covers 25,926 households in 411 villages, a total of 32 maternal deaths and 6,165 live births were identified with MMR of 519. Haemorrhage (31%) was the major because others being obstructed labor, severe anaemia, puerperal sepsis and abortion. Young age at child birth and poverty independently associated with increased risk of maternal death along with complications during antenatal period and childbirth at home. This study provides clear evidences for renewed program efforts and strategies for reducing complications and maternal deaths.
 16. A descriptive observational study carried out in Mahottari district of Nepal on Maternal and Infant mortality by Shah R, *et al.* in the year 2010. This study was undertaken by Nepal Health Research Council. MMR found t was 380/100,000 live births. Highest maternal deaths were among Muslims. Major cause of maternal death was post-partum haemorrhage. Conclusion: MMR of the district was higher than the national average and appeared commensurate with the socio-economic status and health facility of the district when compared with other district Terai district of Bara.
 17. A retrospective study of maternal mortality from 1996-2006 carried ou in Greece by Vrachnis N, *et al.* in year 2011. Maternal mortality found 29 deaths giving MMR of 2.63/100,000 live births. The leading direct cause of death was haemorrhage and indirect cause was cardiac diseases. MMR was significantly higher at extremes of reproductive age range. Maternal mortality in Greece is low compare to previous studies. Concluded that knowledge of causes of maternal death can lead to prevention of MMR and safer motherhood.
 18. A retrospective analysis of maternal deaths in Shanghai from 2000-09 carried out by Qin M, *et al.* in year 2011 with objective to find problems in systemic management of maternal death and provide evidence for developing effective intervention. 262 maternal deaths occurred with 1,279,010 live births giving MMR of 20.48/100,000 live births. The top 5 causes of maternal death were obstetric haemorrhage (26.3%), pregnancy induced hypertension (10.3%), heart diseases (9.2%), live diseases (6.5%), amniotic fluid embolism and ectopic pregnancy(5.7%). 53.8% deaths were due to direct cause and 46.2% due to indirect obstetric cause. It showed that main reasons of maternal deaths were due to poor knowledge and skills of medical staff. Development of new services and management mode with increase in skills of staff, availability of equipment and educating people can reduce MMR.
 19. A secondary analysis of prospective study collected community based data on changing epidemiology of maternal mortality in rural India: Time to reset strategies for MDG-5 carried out in tribal area of Gujarat by Shah P, *et al.* in the year 2014 with objective of implementation of community based interventions that can inform policies to reach MDG-5. Total pregnancies registered were 32,893, with 29,817 live births and 80 maternal deaths giving MMR of 161/100,000 live births. Comparison institutional deliveries increased from 23% to 65%. Most maternal deaths occurring at hospital are due to indirect causes. It would be essential to now prioritize management of indirect causes during pregnancy at community and at hospitals for further reduction in maternal deaths to achieve MDG-5.
 20. A study carried out in USA, Next steps to reduce maternal morbidity and mortality in year 2015 by Kilpatrick SJ, *et al.* MMR increased from 10/100,000 to 17/100,000 live births from 1990-2012. Most of deaths were preventable, haemorrhage caused 93% of deaths, 60% due to hypertension and 40% of cardiovascular disease were preventable. Communication and collaboration between all stake holders involved in perinatal health, creation of national guidelines or bundles addressing key maternal care areas and researches to be carried out to study the causes and prevent /reduce the maternal mortality.
 21. A study on Maternal mortality and morbidity, its classification, causes, preventability and critical care obstetric implications carried out in United States in 2018 by Troiano NH, *et al.* US has experienced a steady rise in maternal mortality over three decades out of which approx. 50% were preventable. National, multidisciplinary, collaborative efforts are required to effectively address this problem. Systemic, multidisciplinary review of maternal mortality and morbidity events continues to generate meaningful data and recommendations for improvement. The preventability of maternal mortality is also explored including evidence based best practices and strategies.

Aim and Objectives

This study aims at following,

1. To assess the maternal mortality ratio (MMR)
2. To study the causes of MMR
3. To study various factors as maternal age and education, affecting maternal mortality.
4. To find out influences between antenatal care attendance and maternal mortality.

Material and Methods

Study setting: Tertiary care teaching hospital in tribal region of Eastern Maharashtra.

Study design: A Retrospective study.

Study subject: All females registered for antenatal care (33,004 pregnant women) in the department of obstetrics and gynaecology during (Jan 2014 – Dec 18).

Study sample: Maternal deaths occurred in five years of time span from Jan 2014 to Dec 18 amongst female seeking health care in department of obstetric and gynaecology.

Data collection: Complete information about maternal death obtained from Department of Obstetrics and Gynaecology MRD section of tertiary care teaching institute in given time period.

Study duration: Study carried out in duration of two months (1st June- 31st July 2019) with cases from death register in 2014-2018 five years span.

Study tool: Case –Record form is filled & used to collect the details of each case.

All analysis are restricted to datasets representative of

population. Maternal deaths are analysed from datasets reporting at least four major causes eg: haemorrhage, sepsis, eclampsia, abortion etc. and contribution of these causes to maternal mortality at country level.

Prior permission of Institutional Ethics Committee (Reg. no. ECR/1033/Inst/MH/2018) was taken.

Identity of recorded cases not revealed.

Informed consent and permission to go through the death records was taken from The Dean and Professor and Head of Department of Obstetrics and Gynaecology was taken before the start of study.

This is a retrospective analysis of all maternal deaths (including their age at first pregnancy, education, antenatal visits) occurring in the Department of Obstetrics and Gynaecology of a tertiary care hospital of eastern Maharashtra over a period of five years

from January 2014 to December 2018.

Statistical analysis: Data will be expressed as count or percentage using MS Excel.

Results

The total number of antenatal cases registered during the five year span was 33,004 pregnant women. The maternal mortalities in five year span from January 2014 to December 2018 found to be 21 amongst 35205 live births over the given period of study giving an MMR of 59.65 per 100,000 live births. As shown in table no.1, highest maternal deaths i.e. 6 occurred in 2016 with 7347 i.e. highest live births giving highest MMR of 81.67 per 100,000 live births among given period of five years. Year 2018 have lowest Maternal deaths i.e. 2 and MMR of 28.62 per 100,000 live births with 6988 live births.

Table 1: Year wise distribution of maternal mortalities and associated events

Year	Intra uterine deaths (IUD)	stillbirth	Live birth	Maternal deaths (Total 21) N (%)	Lower segment caesarian section (LSCS)	MMR (maternal mortality rate per 100000 live births)
2014	134	4	6806	5(23.8%)	2492	73.46
2015	203	12	6988	3(14.3%)	2380	42.93
2016	137	27	7347	6(28.57%)	2914	81.67
2017	169	37	7076	5(23.8%)	2962	70.66
2018	165	12	6988	2(9.52%)	2542	28.62

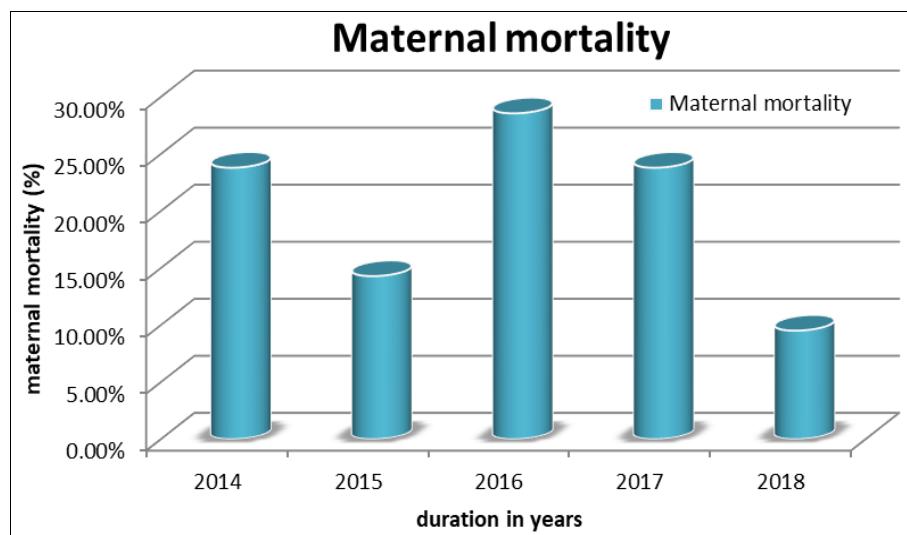
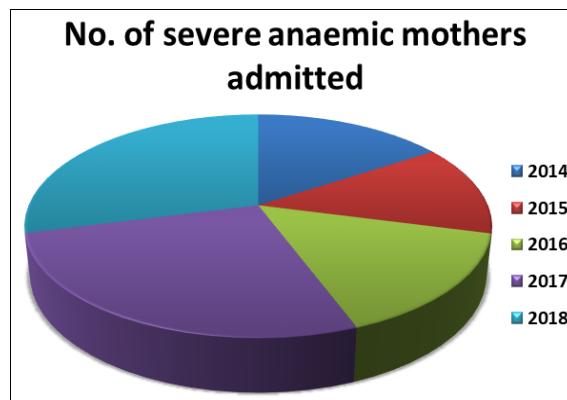


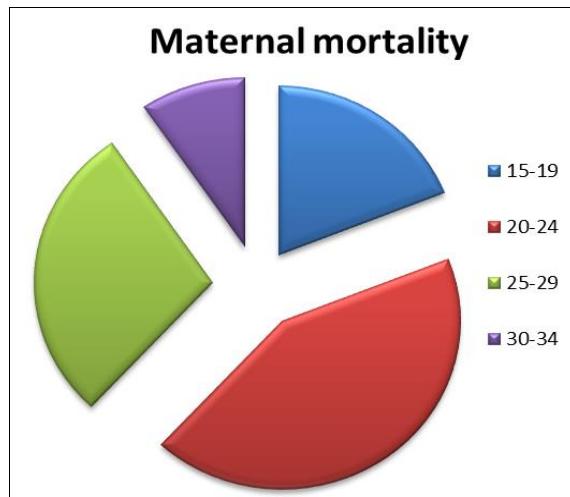
Fig 1: Year wise (2014-18) distribution of maternal mortality cases (n=21)

Table 2: showing the total number severe anaemic pregnant women visited the hospital (n=2655 mothers) where Hb is 4-6.9 g/dl, revised guidelines for prevention of maternal anaemia (ICMR-1989)

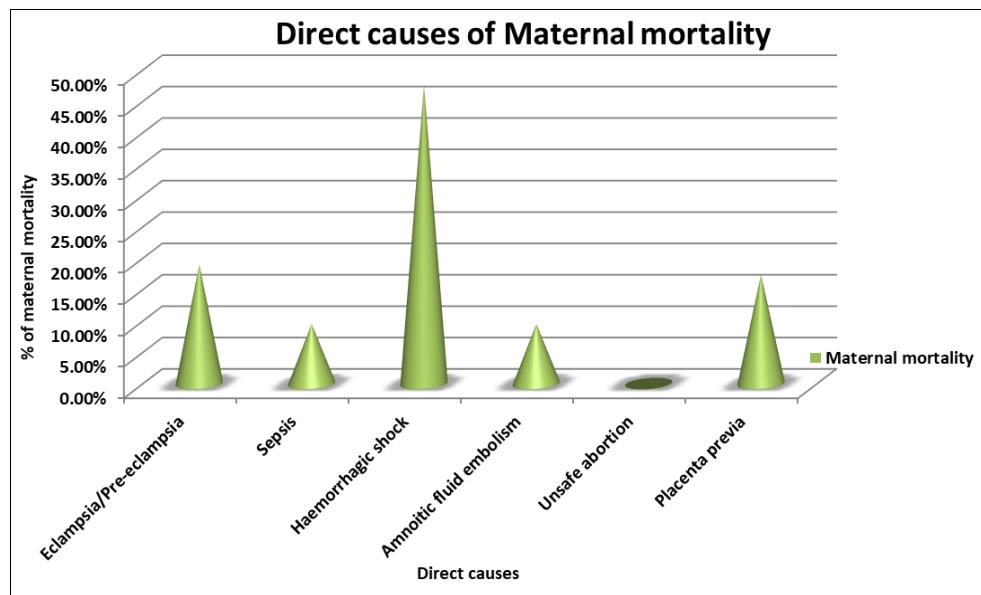
Year	No of mothers admitted (n=2655)	No of mothers admitted (%)
2014	415	15.63
2015	348	13.11
2016	400	15.06
2017	705	26.55
2018	787	28.64

**Fig 2:** Showing severe anaemic pregnant women visited the hospital from 2014 to 2018.**Table 3:** Sociodemographic characteristics (where n=21)

Sociodemographic character	Cases(n)	Percentage (%)
Age of mother at time of death(age groups)		
15-19	4	19
20-24	9	42.86
25-29	6	28.57
30-34	2	9.52
Total	21	100
Places of maternal deaths	(here, n=31)	%
Hospital(Tertiary care teaching institute)	21 (Institutional maternal mortalities).	67.74
On the way	7	22.58
At home	3	9.68
Total (Includes all possible places of maternal mortality including our tertiary care hospital)	31	100
Socioeconomic status of these mothers (according to color of ration card)	(n=21)	(%)
APL	3	14.28
BPL	18	85.71
Total	21	100
Education of mothers		
Primary schooling and upto 8 th standard	6	28.57
SSC (upto 10 th)	11	52.38
HSC (upto 12 th)	3	14.28
Diploma / graduation	1	4.76
Total	21	100
ANC visits of mother		
0	Nil	0.00
1	1	4.76
2	5	23.8
3	6	28.57
4 />4	9	42.86
Total	21	100
Type of delivery attended		
LSCS	9	42.86
Normal	12	57.14
Total	21	100
Type of outcome		
Stillbirth	4	19.04
Live birth	14	66.67
IUD	2	9.52
Twin	1	4.76
Total	21	100
Period during death		
ANC	2	9.52
Intranatal	5	23.8
postnatal	14	66.67
Parity of mothers		
0	2	9.52
1	8	38.09
2	4	19.04
3	5	23.8
4/>4	2	9.52

**Fig 3:** Age wise distribution of maternal deaths.**Table 4:** Direct and Indirect Causes of maternal deaths

Direct causes	No. of maternal deaths	Percentage
Eclampsia/pre-eclampsia	4	19.04
Sepsis	2	9.52
Haemorrhagic shock	10	47.61
Amniotic fluid embolism	2	9.52
Placenta previa	3	14.28
Unsafe abortion	0	0.00
Total	21	100
Indirect causes		
Anaemia	8	38.09
Heart diseases	9	42.85
Respiratory diseases	3	14.28
Sickle cell crisis	1	4.761
Renal diseases	0	0.00
Total	21	

**Fig 4:** Showing direct causes of maternal mortality

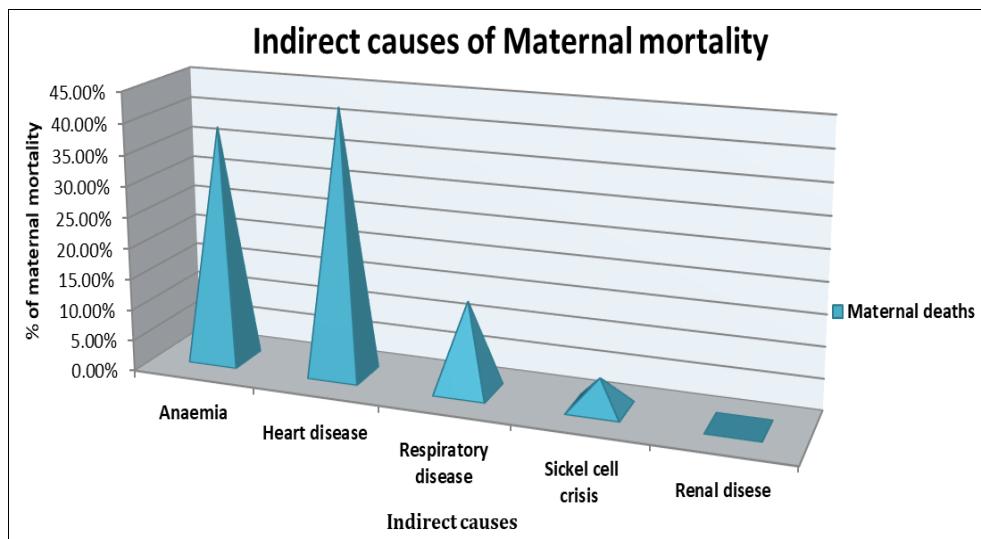


Fig 5: Showing Indirect cause of maternal mortality

In table no.2, total of 2,655(100%) mothers with severe anaemia were admitted to OPD during 2014 to 2018 that is five year duration, out of which 28.6% (maximum) mothers admitted in year 2018 and least with 13.11% in year 2015.

As shown in Table no.3, most of mothers out of 21(100%), 42.86% mothers were of 20-24 year of age group, reported age at the time of death. 19% mothers of age group 15-19yrs, 9.52% of age group 30-34yrs and 28.57% mothers were of age group 25-29 yrs. In this, all mothers were of reproductive age groups from 15-34yrs. But 19% mothers were of 15-19 yrs. age group, which is considered as underage/early age of marriage for girls in India and for pregnancy. In whole district 31 maternal mortalities occurred during this five year duration out of which most of the maternal mortalities i.e. 67.74% occurred in hospital, 9.68% reported maternal mortalities at home and 22.58% occurred on the way to hospital from home. 85.72% mothers out of 21(100%) were BPL (Below Poverty Level) card holding and 14.28% were above poverty level (APL). 52.38% mothers were educated upto 10th standard (SSC), 28.57% were educated upto Primary Schooling (8th standard). Least number of 4.76% were graduated and 14.28% were Higher Secondary educated (HSC). ANC visits of mother were maximum of 4 or more than 4 visits of 42.86% mothers and only once visited by 4.76% mothers. 57.14% mothers were delivered Normal while 42.86% had Cesarean section (LSCS). 66.67% (max.) Mothers delivered live births while 9.52% mother with intrauterine deaths (IUD), 19.04% stillbirth and one case of Twins (4.76%) occurred. Most of mothers (66.67%) died during Postnatal period, 9.52% during ANC(Antenatal Care) and 23.8% during Intranatal period. 38.09% mothers died during the first child birth with parity one with least number 9.52% mothers were multiparous (Parity of 4/more than 4). As shown in table no.4, 47.61% (max.) maternal deaths occurred due to Haemorrhagic shock, 9.52% due to sepsis and amniotic fluid embolism each. Other direct causes reported are Eclampsia/Pre-eclampsia (19.04%), Placenta previa (14.28%), no death occurred due to unsafe abortion. Among Indirect causes, 42.85% mothers died of Heart disease which was associated with other direct causes. One mother (4.76%) was with sickle cell crisis, other indirect causes are Anaemia (38.1%), Respiratory disease (14.28%) and renal disease (0%).

Discussion

Medical and Socio-economic factors leading to maternal mortality are largely preventable. It remains a major public-

health challenge in various states of India, the states need specific policies/programmes, targeting maternal health. Pregnancy is a vulnerability that put a woman at risk of dying [22]. Maternal mortality is an indicator of the quality of obstetrics care in a community, directly reflecting the utilization of healthcare services available. The study finds that most of the deceased were poor, housewives and with low education indicating that the certain sections of the society are more prone to maternal mortality [50, 51]. Marriage exposes a women to the risk of pregnancy, and early marriage puts a women into longer exposure to pregnancy and child delivery complications [52]. The age at pregnancy of 42.86% mothers was between 20-24 yrs and 19% with age of 15-19 yrs. (Table.3.). The low age at marriage and pregnancy has also been noted in previous studies [53, 54]. 28.57% mothers were studied upto 8th standard that is primary education and the most 52.38% mothers upto 10th, only 4.76% mothers had graduated or with diploma course(Table.3.), so low education of mothers affected our study. The association of maternal education with empowerment and knowledge of safe motherhood practices, leading to reduction in maternal mortality, has been observed in other studies [55, 56]. In the present study, among five years maximum maternal deaths occurred in 2016 (28.57%) followed by 2014 and 2017 each with (23.8%) with less number in 2018(9.52%) (Table.1.). MMR in India is reduced by 77%, from 556 per 100,000 live births in 1990 to 130 per 100,000 live births in 2016 according to WHO & Millennium Development Goal (MDG)of 109 per 100,000 live births by 2015 [4].

Maximum mothers (85.72%) were BPL (Below Poverty Level) card holders only (14.28%) were with APL (Above Poverty Level) and total of 2,655(100%) mothers were with severe anaemia admitted to OPD during the span of 5 years, maximum mothers (28.64%) admitted in 2018. (Table.2.) The socio-economic status of mothers adversely affecting access to health care services, leading to high maternal mortality and morbidity, most mothers avoid hospital ANC visits due to lack of money and they can't afford cost to travel. The study of (Goli, Doshi and Perianayagam, 2013 India) shows relationship between socio-economic status and utilization of care. The payment of cost of ANC services has great bearing on utilizing the health facility. Cost may reduce women's use of maternal heath sevices and refrain them from having hospital-based deliveries or seeking care even when complications arise [57]. Severe anaemic mothers were with low nutritional status during pregnancy may

be due to any disease associated with pregnancy, no visits to hospital or ANC check-ups or due to improper intake of iron and folic acid tablets during ANC period, awareness and education regarding ANC visits, institutional deliveries and complications during pregnancy should be given to each women either a mother or an adolescent girl. Antenatal Care (ANC) presents an opportunity for early detection and treatment of anaemia in pregnancy. Additionally, culturally-appropriate nutritional counseling should be provided during antenatal care.

22.58% mothers died on the way to hospital and 9.68% at home, the delays that have been found to be the major reasons for maternal mortality may be due to inadequate awareness of maternal complications.

Moreover, untrained dais should be trained to recognize the obstetric complications at an early stage as they are first one to be informed and refer the high-risk cases for adequate management. Women dying because of delivery complications mostly at home reveals the poor quality of delivery and emergency obstetric care services in the community, besides inadequate awareness of complications. Distance to the health facility also contributes to the decrease access to health care services [58, 59].

In our study, most 47.61% maternal mortality caused due to hemorrhagic shock followed by pre-eclampsia / eclampsia 19.04%, placenta previa with 14.28% and sepsis about 9.52%. This is similar to findings from another study [60]. The period around delivery and few hours or days after delivery accounts for most of the deaths. It is thus important to stress the need for active management of labor and the immediate post-partum period to all care providers. In Indirect causes, Heart diseases account the most deaths of 42.85% followed by anaemia 38.09%, respiratory diseases 14.28% and sickle cell crisis 4.761%. (Table.4.) In a study, (Desai, Phillips-Howard, Odhiambo, Katana, Ouma, Hamel, &...Laserson, 2013) found HIV/AIDS the main indirect cause of maternal mortality in Kenya. Most of studies found high parity as a contributory factor in high maternal mortality rate but in this study, mothers with para 1 (38.09%) were at highest rate of maternal mortality and 9.52% mothers were with para 4>4. So high parity in other studies contributed to high maternal mortality ratio but in our study high parity contributed less than low parity to MMR.

Studies have shown that community level interventions bring about reduction in maternal mortality [61]. Poor awareness and use of the maternal healthcare services urge the need for reinforcement of home-visits by the grassroots-level healthcare providers.

Adequate training of physicians and equipping all PHCs, First Referral Units (FRU), and district hospitals in the provision of comprehensive obstetric care would address the high burden of obstetric complications. Gynaecologists /Obstetricians should be deployed round the clock in all Community Health Centers (CHCs). Obstetric record keeping should be improved to monitor the performance of health facilities. Educating women and their families about the benefits of delivery by skilled birth attendants and encouraging family preparedness in terms of arrangement of money, accompanying persons, and transport facility.

Awareness of the financial benefits to mothers delivering in an institution through the “Janani Suraksha Yojana (JSY)”, scheme under the National Rural Health Mission (NRHM) would further enhance institutional deliveries, along with reducing the delay in decision making for some families. Efforts to strengthen the home visits by existing ANMs or ASHAs (Accredited Social Health Activists) would certainly be helpful.

Limitation of study: Maternal mortalities occurred in tertiary care teaching institute during Jan 2014 to Dec 2018 five year span.

Conflict of Interest: Nil

Conclusion

In the present study,

1. Maternal mortalities during five year duration from Jan 2014 to Dec 2018 found to be 21, highest being in 2016 with 6 (28.57%) maternal deaths among these five years and lowest in 2018 i.e. 2(9.52%).
2. MMR of this study is 59.65 per 100,000 live births so we achieved SDG3 goal of MMR less than 70 per 100,000 live births by year 2030 [21].
3. Haemorrhagic shock found to be main direct cause of maternal mortality with 47.61% highest mortality among other causes, followed by eclampsia 19.04%, placenta previa 14.28%, amniotic fluid embolism and sepsis each with 9.52%.
4. Heart disease (42.85%) found to be main indirect cause among other indirect causes which was associated with other direct causes. One mortality (4.76%) was due to sickle cell crisis, other indirect causes are Anaemia (38.1%), Respiratory disease (14.28%) and renal disease (0%).
5. 42.86% mothers were of 20-24 age group and only 9.52% were of 30-34 yr age group. 19% mothers were of 15-19 age group, so here maternal age affected the MMR to raise a little.
6. Low education status also affected our MMR, here most mothers 52.38% educated upto 10th and 19.04% were educated upto 12th and above.
7. Among 21 (100%) mothers, 42.86% mothers attended ANC visits 4>4 during antenatal care were also victim of mortality and only 4.76% mothers who died were with 1 ANC visit, so even after attending ANC visits mothers exposed to mortality risks.
8. Parity also contributed to MMR, 38.09% (highest)mothers were with parity 1 and 9.52% (lowest) were with parity 4>4, so high parity contributed very less as compared to low parity to MMR.
9. Maternal mortality (highest) 66.67% occurred during postnatal period, 23.8% intranasal and 9.52% antenatal period, so post-delivery complications led to high MMR.
10. Socio-economic status of mothers contributed most to rise in maternal deaths as 85.72% mothers were below poverty and only 14.28% above poverty level.

Maternal mortality in India continues to be a serious public health problem and contributes to the low life expectancy among women in India and all parts of world as well. India's present MMR is below the MDG (Millennium Development Goal) target and puts the country on track and Sustainable Developmental Goal 3 (SDG-3) has a target to reduce the global MMR to less than 70 per 100,000 births by 2030 [21]. The majority of women died during pregnancy, child birth or the puerperium had accessed care at a health care facility during the time preceding their deaths. Effective emergency care is depend upon health care providers ability to recognize that an abnormal condition exists, that the condition has a level of severity warranting intervention and that an intervention is available to treat the condition. Improving availability and quality of emergency obstetric care services is needed if maternal deaths are to be prevented. As seen in study poverty is the main contributory factor for maternal deaths. Most of the women had

done only primary schooling so the lack of education and awareness contributes to the loss of motherhood in rural tribal India. Institutional deliveries should be encouraged. Early age of marriage and parity contributes to raise MMR. About one fifth of deaths occurred on the way to referral center, prompt referral and improvement in transportation can reduce the MMR as most of the deaths were preventable. Staff should be educated and trained for handling emergency cases, availability of staff, doctors and equipment's to handle the cases are required. We should look forward for availability of blood as most deaths were due to haemorrhagic shock.

The government should subsidize the health care services and establish MSDPs to reduce the problem of distance and further brings health care services closer to rural population. Health education and mass enlightenment should be strengthen to create greater awareness on pregnancy complications and zero non-institutional delivery tolerance. MMR can be reduced by improving women access to productive resources and income also improving woman's nutritional status.

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References

- UNICEF. Maternal and Perinatal death enquiry and response. Empowering communities to avert maternal deaths in India. [Online]. Available at: <http://www.unicef.org/india/MAPEDIRMaternal-and-Perinatal-Death-Inquiry-and-Response-India.pdf>. (last accessed on Nov 12,2015).
- International Classification of Diseases (ICD), 11th Revision, Geneva, World Health Organization 2018.
- Yerpude PN, Keerti S, Joggand A. 5 year retrospective study of pattern of maternal mortality in a tertiary care hospital in South India. *Int J Recent Trends Sci Technol* 2014;11(3):310-2.
- Govt. Of India (Sample Registration System), Maternal Mortality in India 1997. Trends, Causes and Risk Factors, Registrar General, India, New Delhi in collaboration with Centre for Global Health Research, Toronto 2003.
- Khan S, Wojdyla D, Say L, Gulmezoglu A, Van Look P: WHO analysis of cause of maternal death: a systemic review. *Lancet* 2006;367:1066-1074. doi:10.1016/S0140-6736(06)68397-9.
- 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 year retrospective analysis 2013 July-Dec. *Indian J Med Specialities* 2013;4(2):238-42.
- Zaman S, Begum AA. Maternal mortality at a rural medical college of Assam: a retrospective study. *J Obstet Gynae col Barpeta* 2014;1(1):46-51.
- Aggarwal A, Pandey A, Bhattacharya BN. Risk factors for maternal mortality in Delhi slums: a community-based case-control study. *Indian J Med Sci* 2007;61:517-26. [PubMed] [Google Scholar]
- Mills S, Bos E, Lule E, Ramana GNV, Bulatao R. Obstetric care in poor settings in Ghana, India and Kenya. Washington, DC: The World Bank 2007, 161. (Health, Nutrition and Population (HNP)Discussion Paper) [Google Scholar]
- India, Ministry of Home Affairs. Maternal mortality in India: 1997-2003; trends, causes and risk factors; sample registration system. New Delhi: Office of Registrar General, Ministry of Home Affairs, Government of India 2006, 29.[Google Scholar]
- Chhabra S, Sirohi R. Trends in maternal mortality due to haemorrhage: two decades of Indian rural observations. *J Obstet Gynaecol* 2004;24:40-3. [PubMed] [Google Scholar]
- Institute for Research in Medical Statistics, Indian Council of Medical Research. Estimates of maternal mortality ratios in India and its states: a pilot study. New Delhi: Institute for Research in Medical Statistics, Indian Council of Medical Research 2003, 33. [Google Scholar]
- WHO, UNICEF, UNFPA. Maternal mortality in 2000: Estimates developed by WHO, UNICEF, UNFPA. Geneva: WHO 2003.
- National Health Policy, Ministry of Health and Family Welfare 1982.
- World Health Organization. Trends in maternal mortality: 1990-2008; estimates developed by WHO, UNICEF, UNFPA and the World Bank, Geneva: World Health Organization 2010, 45. [Google Scholar]
- India. Ministry of Home Affairs. Special bulletin on maternal mortality in India 2004-06: sample registration system. New Delhi: Office of Registrar General, Ministry of Home Affairs, Government of India 2009, 4. [Google Scholar]
- Das NP, Parel R, Shah U. Maternal mortality in India: levels, differential and causes. Vadodara: Population Research Centre, The Maharaja Sayajirao University of Baroda 2007, 56. [Google Scholar]
- Bhat PN. Maternal mortality in India: an update. *Stud Fam Plann* 2002;33:227-36. [PubMed][Google Scholar]
- World Health Organization. Maternal mortality-Fact sheet 2016. [cited 2017 July 5]. Available from: <http://www.who.int/mediacentre/factsheets/fs348/en/>.
- World Health Organization. Success factors for women and children's health. Policy and program highlights from 10 fast-track countries 2014.
- United Nations. Sustainable Development Goal 3 2017 [cited 2017 August 5]. Available from: <https://sustainabledevelopment.un.org/sdg3>.
- Gwatkin DR, Rutstein S, Johnson K, Suliman E, Wagstaff A, Amouzou A. Socio-economic differences in health, nutrition and population within developing countries: an overview. *Niger J Clin Pract* 2007;10(4):272-82. pmid18293634.
- Goldenberg RL, McClure EM. Disparities in interventions for child and maternal mortality. *Lancet* 2012;379(9822):1178-80. doi:10.1016/S0140-6736(12)60474-7pmid:22464372;PubMed Central PMCID:PMCPMC3957338.
- Gupta M, Angeli F, Bosma H, Rana M, Prinja S, Kumar R et al. Effectiveness of Multiple-Strategy Community Intervention in Reducing Geographical, Socioeconomic and Gender Based Inequalities in Maternal and Child Health Outcomes in Haryana, India. *PloS one* 2016;11(3):e0150537. doi:10.1371/journal.pone.0150537.pmid:27003589.
- Gupta M, Bosma H, Angeli F, Kaur M, Chakrapani V, Rana

- M et al. Impact of a Multiple-Strategy Community Intervention to Reduce Maternal and Child Health Inequalities in India: A Qualitative Study in Haryana. PLoS one. 2017;12(1):e0170175. doi:10.1371/journal.pone.0170175. pmid:28099465.
26. Singh A, Pallikadavath S, Ram F, Ogollah R. Inequalities in advice provided by public health workers to women during antenatal sessions in rural India. PLoS One 2012;7(9):e44931. doi:10.1371/journal.pone.0044931. pmid:23028688.
 27. Singh A, Padmadas SS, Mishra US, Pallikadavath S, Johnson FA, Matthews Z. Socio-economic inequalities in the use of postnatal care in India. PloS one 2012;7(5):e37037. doi:10.1371/journal.pone.0037037. pmid:22623976.
 28. Montgomery AL, Ram U, Kumar R, Jha P, Collaborators MDS. Maternal mortality in India: causes and healthcare service use based on a nationally representative survey. PloS one 2014;9(1):e83331. doi:10.1371/journal.pone.0083331. pmid:24454701.
 29. Prakash A, Swain S, Seth A. Maternal Mortality in India: Current Status and Strategies for Reduction. Indian Pediatr 1991;28(12):1395-400.
 30. PN Anandalakshmy, PP Talwar, K Buckshee, V Hingorani. Demographic Socio-economic and Medical Factors Affecting Maternal Mortality- an Indian Experience. Journal of Family Welfare 1993;39(3):1-4.
 31. Martey JO, Djan JO, Twum S, Browne EN, Opoku SA. Maternal Mortality and Related Factors in Ejisu District, Ghana. East Afr Med J 1994;71(10):656-60.
 32. Ernest Urassa, Siriel Massawe, Gunilla Lindmark, Lennarth Nystrom. Operational Factors Affecting Maternal Mortality in Tanzania. Health policy and planning 1997;12(1):50-57.
 33. Kelsey Harrison A. Maternal Mortality in Nigeria: The Real Issues. African Journal of Reproductive Health/La Revue Africaine de la Sante Reproductive 1997;1(1):7-13.
 34. Majhi AK, Mondal A, Mukherjee GG. Safe Motherhood- A Long Way to Achieve. Journal of the Indian Medical Association 2001;99(3):132-137.
 35. Audu LR, Ekele BA. A Ten Year Review of Maternal Mortality in Sokoto, Northern Nigeria. West African Journal of Medicine 2002;21(1):74-76.
 36. Yusuf Adamu M, Hamisu Salihu M, Nalini Sathiakumar, Greg Alexander R. Maternal Mortality in Northern Nigeria: a Population Based study. European Journal of Obstetrics and Gynaecology and Reproductive Biology 2003;109(2):153-159.
 37. Ujah IAO, Aisien OA, Josiah Mutahir T, Dorothy Vanderjagt J, Glew RH, Uguru VEd. Factors Contributing to Maternal Mortality in North-Central Nigeria: a Seventeen-Year Review. African Journal of Reproductive health 2005, 27-40.
 38. Lema VM, Changole J, Kanyighe C, Malunga EV. Maternal Mortality at the Queen Elizabeth Central Teaching Hospital, Blantyre, Malawi. East Afr Med Journal 2005;82(1):3-9.
 39. Onah HE, Okaro JM, Umeh U, Chigbu CO. Maternal Mortality in Health Institutions with Emergency Obstetric Care Facilities in Enugu State, Nigeria. Journal of obstetric and Gynaecology 2005;25(6):569-574.
 40. Jain A, Gupta SC, Misra SK, Singh R, Bhagoliwal AK, Kaushal SK. Trend and Causes of Maternal Mortality Among Women Delivering in S.N. Medical College Hospital, Agra. Indian J Public Health 2009;53(1):47-8.
 41. Eugene Kongnyuy J, Grace Mlava, Nynke Van Den Broek. Facility-Based Maternal Death Review in Three Districts in the Central Region of Malawi: an Analysis of Causes and Characteristics of Maternal Deaths.
 42. Omo-Aghoja LO, Aisien OA, Akause JT, Staffan Bergstrom, Friday E Okonofua. Maternal Mortality and Emergency Obstetric Care in Benin City, South-south Nigeria. Journal of Clinical Medicine and Research 2010;2(4):055-060.
 43. Shiv Gupta D, Anoop Khanna, Rajeshwari Gupta, Nand Sharma K, Narottam Sharma D. Maternal Mortality Ratio and Predictors of Maternal Deaths in Selected Desert Districts in Rajasthan: a Community-Based Survey and Case Control Study. Women's Health Issues 2010;20(1):80-85.
 44. Shah R, Maskey MK. Maternal and Infant Mortality in Mahottari District of Nepal. J Nepal Health Res Counc 2010;8(1):35-9.
 45. Nikolaos Vrachnis, Stamatina Iliodromiti, Evi Samoli, Zoe Iliodromiti, Spyridon Dendrinos, Georgios Creatasas. Maternal Mortality in Greece, 1996-2006. International Journal of Gynecology and Obstetrics 2011;115(1):16-19.
 46. Qin M, Zhu LP, Zhang L, Du L, Xu HQ. Analysis of Maternal Deaths in Shanghai from 2000-2009. Zhonghua Fu Chan Ke Za Zhi 2011;46(4):244-9.
 47. Pankaj Shah, Shobha Shah, Raman Kutty V, Dhiren Modi. Changing Epidemiology of Maternal Mortality in Rural India: Time to Reset Strategies for MDG-5. Tropical Medicine & International Health 2014;19(5):568-575.
 48. Sarah J Klipatrick. Next Steps to Reduce Maternal Morbidity and Mortality in the USA. Women's Health 2015;11(2):193-199.
 49. Troiano NH, Witcher PM. Maternal Mortality and Morbidity in the United States: Classification, Causes, Preventability and Critical care Obstetric Implications. J perinat Neonatal Nurs 2018;32(3):222-231. doi:10.1097/JPN.0000000000000349.
 50. Bhat PN. Maternal mortality in India: an update. Stud Fam Plann 2002;33:227-36.
 51. Das NP, Patel R, Shah U. Maternal mortality in India: levels, differentials, and causes. Vadodara: Population Research Centre, The Maharaja Sayajirao University of Baroda 2007, 56.
 52. National Population Commission (NPC) [Nigeria] and ICF Macro. Nigeria Demographic and Health Survey 2013. Abuja: NPC and ICF Macro 2014.
 53. Raj A, Boehmer U. Girl child marriage and its association with national rates of HIV, maternal health, and infant mortality across 97 countries. Violence against Women 2013;19(4):536-551.
 54. United Nations Fund for Population Activities [webpage on Internet] state of World population 2004.
 55. Okereke E, Aradeon S, Akerele A, Tanko M, Yisa I, Obonyo B. Knowledge of safe motherhood among women in rural communities in northern Nigeria: implications for maternal mortality reduction. Reprod Health 2013;10(57):1-12.
 56. Karlsen S, Say L, Souza JP et al. The relationship between maternal education and maternal mortality among women giving birth in health care institutions: analysis of the cross sectional WHO Global Survey on Maternal and Perinatal Health. BMC Public Health 2011;11(606):2-10.
 57. Azuh DE. Socio-demographic factors influencing health programme usage by mothers in Nigeria: implications for policy action; Paper submitted for Sixth African Population

- Conference-African Population: Past, Present and Future;
December Burkina Faso: Ouagadougou 2011.
- 58. Federal Ministry of Health (FMOH) Integrated Maternal, Newborn and Child Health Strategy. Abuja: Federal Ministry of Health 2007.
 - 59. Adepoju AO, Akanni O, Falusi AO. Determinants of child mortality in rural Nigeria. World Rural Obs 2012;4(2):38-45.
 - 60. Ezugwu EC, Agu PU, Nwoke MO, Ezugwu FO. Reducing maternal deaths in a low resource setting in Nigeria. Niger J Clin Pract 2014;17(1):62-6.
 - 61. Kidney E, Winter HR, Khan KS, Gulmezoglu AM, Meads CA, Deeks JJ *et al.* Systemic review of effect of community level interventions to reduce maternal mortality. BMC Pregnancy Childbirth 2009;20(2):9.