

Causes of maternal death in Mizan Aman and Gebretsadik shawo general hospitals from 2011 – 2015: A case - control study using propensity score matching analysis

مسببات وفيات الامهات للمدة من 2011-2015: دراسة الشاهد والحالة بتوظيف تحليل درجة مطابقة الميل في مستشفيات الميزان امان و جبيريتسادك العاميين

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Abstract

Objective: To identify causes of maternal death in Mizan Aman and Gebretsadik shawo general hospitals

Methodology: A case control study on 595 charts, 119 cases and 476 controls was conducted in Mizan Aman & Gebretsadik shawo general hospitals. Data was analyzed by STATA 13.1. Propensity score matching analysis was used to see causes of maternal death.

Results: Hemorrhage were the main direct causes of maternal death which accounts 47.9% ($\beta = 0.58$ (95% CI (0.28,0.87)) in hospital but when projected to population based the sample ($\beta = 0.26$ (95% CI (0.22,0.31)). Followed by infection 36 (25.21%) ($\beta = 0.50$ (95% CI (0.08, 0.92)). when projected to population based the sample PIH 7.6%) is significant cause ($\beta = 0.16$ (95% CI (0.13, 0.19)). Most death (74.8%) occurred during post-partum period.

Recommendation: The health professionals must work on awareness creation on early arrival at health institution for delivery before development of different complications.

Key words: Causes, maternal death, Ethiopia

Introduction

Each year an estimated 500,000 women die worldwide due to complication pregnancy with approximately 96% of these deaths are reported to be in Sub Saharan Africa (SSA), which carries the largest burden (1, 2). A woman's lifetime risk of dying as a result of pregnancy or childbirth is 1 in 39 in SSA as compared to 1 in 4,700 in industrialized countries (3).

The maternal mortality rate (MMR) in developing regions in 2013, which is 230/100,000, which were 14 times higher than in developed countries, which is 16/100,000. This figure indicates that death of woman is most commonly burden of developing countries. Africa has the highest MMR in the world which is 460/ 100,000. SSA covers the highest range maternal death including our country Ethiopia. Sera Leone and 15 countries (all in SSA) in the world have extremely high MMR and very high MMR respectively. Ethiopia is categorize in high MMR countries with 420/100,000 in 2013 (4).

Understanding the underlying factors that lead to the deaths for successful reduction of MMR is important. 70–80% of maternal death is due to direct obstetric causes, and

these maternal deaths could be prevented through actions that are proven to be effective and affordable, even in the poorer countries of the world (5). In Ethiopia Abortion was the major cause in 1980s; however in 2000 sepsis become the major causes. Currently pregnancy induced hypertension is an increasing cause of maternal death as observed in Tigray region (6,7).

Even though our country reduces the maternal death from previous times as the report of international organizations, still the number of death that occurs currently is high as WHO maternal death classification. So the need of further study is unquestionable to identify the causes of maternal death. This study aimed at identify causes of maternal death in Mizan Aman & Gebretsadik shawo general hospitals among women's delivered from 2011 – 2015 in the hospitals.

Methodology

Institution based unmatched case - control study was conducted in mothers which were attended for maternal health services from 2011 – 2015 at Mizan Aman & Gebretsadik shawo general hospitals, southwestern Ethiopia. The theoretical

population of the study was all charts of women which were attended Mizan Aman & Gebretsadik shawo general hospitals for obstetrics and gynecology service. While the study population was all charts of women's who fulfill the standard definitions of maternal mortality in study area from 2011 – 2015 were cases. The death of the mothers was confirmed based on the outcome status written on the chart. All charts of the women's who attend both hospitals for obstetric and gynecology facility utilization 2011 to 2015 were considered as Controls.

Records of both cases and controls were chosen from all units which gives different maternal health services, which full fills the inclusion and exclusion criteria of the study. First participant of cases were selected from the record of mothers attend in the hospitals, which were found in the study period, from respective units.

A total of 595 selected charts with ratio of case to control of 1 to 4 (119 maternal death (cases) and 476 controls) charts were reviewed. One to four ratios of cases to controls were involved in the study and for each cases a proximate preceding control were nominated. The tool that helps data extraction were adopted the technical guideline which helps to assess maternal

death of Ethiopia (8). Three midwives were selected for data collection, and then training was provided about the technique of data collection and confidentiality. Each data extraction sheet was given exclusive identification number by researchers then entered to Epi Data version 3.1 then transferred to STATA version 13.1 for analysis. After data entry was completed using frequency distribution any data was cleaned before the data analysis.

Graphical presentation such as tables and bar charts was used to present the result findings. Cause of death of women was identified by the WHO applications of ICD-10 to maternal death. The distribution of cause of death was observed using frequency distribution. Propensity score matching analysis was used to inference the cause of death. The model estimate causation in sample (called average treatment effect in treated - ATET) and population (called average treatment effect - ATE). Causal inference is determined at the level of significance of $p \text{ value} \leq 0.05$. The coefficient was reported and interpreted in 95% CI level of precision from ATET.

Before the data collection ethical clearance was get from Research and Ethics committee of the College of Health sciences

Mizan-Tepi University. In addition a written approval letter was also secured from both hospitals. Confidentiality was maintained starting from data collection until analysis by using code rather than name in the data extraction tool.

Results

The results of the study were presented based on a descriptive analysis followed by propensity score matching analysis to determine the causes of maternal mortality. A total of 119 cases (dead women charts) and 476 controls (survived women charts)

were involved in the analysis study. Majority of women's aged with 20-34 years which were 397(66.7%). The least age group was age greater or equal to 35 years old. More than 22% of women died from the age group of 20 – 34. From age group of less than 20 years 15% of women were died. From women who were above 35 years 15.8% of them were died.

Age distribution

Majority of the women age was with 20-34 years which were 397(66.7%). The least age group is age greater or equal to 35 years old. More than 22% of females died from the age group of 20 – 34 (Figure 1).

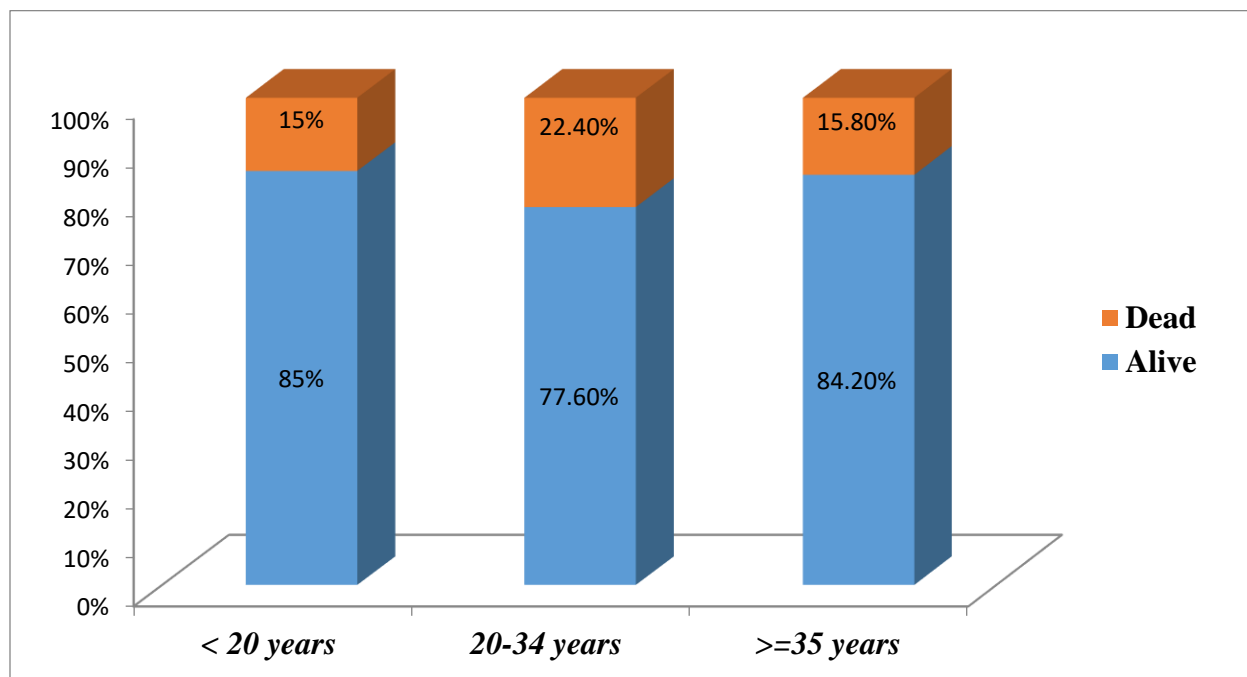


Figure 1: Shows age of women delivered from 2011 -2015 at Mizan –Aman and Bonga hospitals 2016

Majority of the mother who were alive were death were among women who did not gravity 1 and 2 were 321(81.7%) and attend ANC which accounts majority of the dead were gravity 3 to 4 66(36.3%)(Table 1). which were 32(26.4%). Majority of the

Table (1): Shows obstetric and delivery history among women delivered from 2011 -2015 in Mizan –Aman and Bonga hospitals, 2016

Variables	Status of the women	
	Alive	Dead
Gravidity		
1-2	321(81.7%)	72(18.3%)
3-4	89(73.6%)	32(26.4%)
>=5	66(81.5%)	15(18.5%)
Parity		
0-2	388(80.8%)	92(19.2%)
3-4	55(72.4%)	21(27.6%)
>= 5	33(84.6%)	6(15.4%)
Attending ANC		
Yes	360(87.2%)	53(12.8%)
No	116(63.7%)	66(36.3%)
Number of visit		
1 visit	44(74.6%)	15(25.4%)
2 visit	54(85.7%)	9(14.3%)
3 visit	90(86.5%)	14(13.5%)
4 & above visit	172(92.0%)	15(8.0%)

Obstetric complications

Among women who were developed infection 9(90%) were dead and among women having uterine rupture were 53(82.8%) were dead. Having hemorrhage were contributed 24(828%) to death (Table 2).

Table (2): Obstetric complications among women delivered from 2011 -2015 at Mizan Aman and Gebretsadik shawo hospitals, 2016

Obstetric complication	Status of women	
	Alive	Dead
Presence of obstetric complications		
Yes	79(44.6%)	98(55.4%)
No	397(95%)	21(5%)
Hemorrhage	5(17.2%)	24(82.8%)
PIH	14(70%)	6(30%)
Abortion	3(20%)	12(80%)
Infection	1(10%)	9(90%)
OL	34(50.7%)	33(49.3%)
Uterine rupture	11(17.2%)	53(82.8%)
APH	15(45.5%)	18(54.5%)
Postdate pregnancy	7(70%)	3(30%)

From the total women 177(29.7%) were developed different types of obstetric complications. The leading obstetric complications were obstructed labor (OL), and uterine rupture which accounts 67 (37.9%), and 64 (36.2%) respectively. From women who developed infections majority were died. The second killer was uterine rupture and hemorrhage.

Determinants of maternal death

The major causes of maternal mortality in the study area were hemorrhage, which were 57(47.9%) and followed by infection which were 36 (25.21%). From the indirect causes of maternal death anemia accounts 14 (11.76 %) (Figure 2).

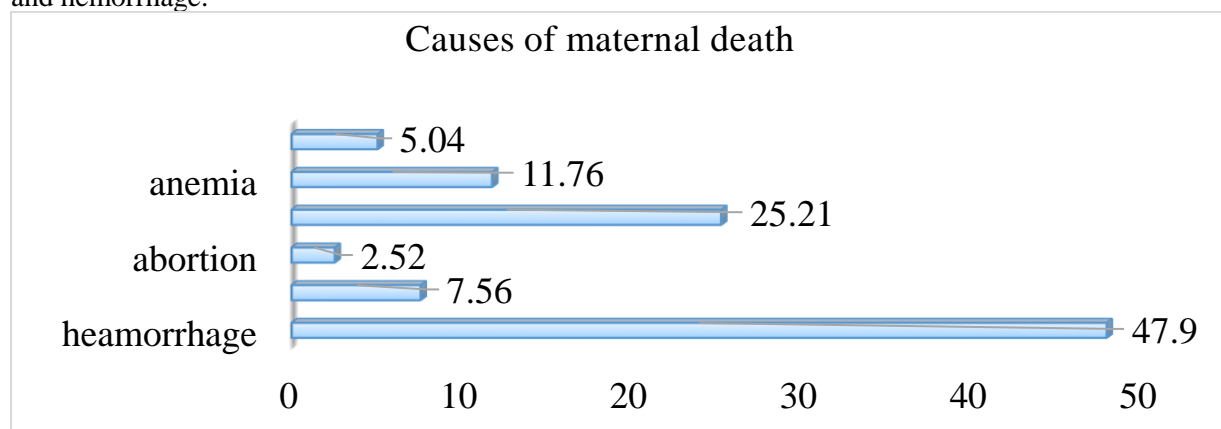


Figure 2: Causes of maternal death among women delivered from 2011 -2015 at Mizan Aman and Gebretsadik shawo hospitals, 2016

Table 3: Causes of maternal death on samples by propensity score matching analysis in among women delivered from 2011 -2015 at Mizan Aman teaching and Gebretsadik shawo hospitals, 2016

Causes	β	Robust SE	P – value	[95% CI]
hemorrhage	0.58	0.15	<0.001	(0.28, 0.87)
PIH	0.07	0.09	0.45	(-0.12, 0.25)
Infection	0.50	0.21	0.02	(0.08, 0.92)
Abortion	0.56	0.11	<0.001	(0.34, 0.78)
Anemia	-0.13	0.17	0.46	(0.45, 0.20)

The propensity score matching analysis shows that postpartum hemorrhage, infection and abortion were significant causes of maternal death. As the result shows if 100 females came with Hemorrhage in hospital 58 of females would die exclusively because of hemorrhage, if 100 women came with infections 50 of women would die exclusively because of infections and if 100 women came with abortions 56 of women would die exclusively because of abortion.

If projected to population or community based on our data only hemorrhage and pregnancy induced hypertension are significant causes of maternal death. As the result shows in the following table if 100 females caught with Hemorrhage in the community 26 of women would die exclusively because of hemorrhage and if 100 women caught with pregnancy induced hypertension in the community 16 of women would die exclusively because of pregnancy induced hypertension.

Table 4: Causes of maternal death on population by projection by propensity score matching analysis in among women delivered from 2011 -2015 at Mizan Aman teaching and Gebretsadik shawo area, 2016

Causes	β	Robust SE	P – value	[95% CI]
hemorrhage	0.26	0.03	<0.001	(0.22, 0.31)
PIH	0.16	0.02	<0.001	(0.13, 0.19)
Infection	-0.07	0.07	0.35	(-0.21, 0.07)
Abortion	0.03	0.02	0.20	(-0.01, 0.07)
Anemia	0.06	0.25	0.79	(0.42, 0.55)

Most death 89(74.8%) occurred during post-partum period. From post-partum period the first three days is crucial. From 89 deaths in post-partum period 69(77.5%) of deaths occurred within 72 hours of delivery.

Discussion

Hemorrhage was the commonest (47.90%) cause of maternal death which is much higher than study done in Ghana (22.8%) and in Senegal Dakar hospital which is 21% (9,10). This might be because of one third of pregnant females die due to malaria and viral hepatitis in Ghana and Senegal before reaching to intrapartum period. In addition, there is classification error of underlying causes of maternal death in both study. They put uterine rupture as single classification which is the major source of hemorrhage. This under estimate the figure of hemorrhage in the study of Ghana and Senegal. Comparing with studies performed in Ambo and Tigray hospital. The finding of this study is still higher than Tigray's study in which the highlighted percentage was 39% (7). This might be because of 56% of dead mothers in our finding are referred cases from different health institutions. Referral may result delay in reaching the hospital. So, they may die by long lasting hemorrhage. The other reason might geographical differences. In our study set up there are many ups and down which is headache for ease transportations. The finding of this study is lower than another study done at Ambo hospital in which the estimated percentage

was 54.8% (11). This might be because of difference of time, the study of ambo was done before 15 years back but ours is recent five years. Thus the health seeking behavior of females may improve.

Fatality of hemorrhage is also observed in propensity score matching analysis. If 100 females came with Hemorrhage in hospital 58 of females would die exclusively because of hemorrhage ($\beta = 0.58$ (95% CI (0.28, 0.87)). If projected to population based on our data if 100 females caught with Hemorrhage in the community 26 ($\beta = 0.26$ (95% CI (0.22, 0.31)) of females would die exclusively because of hemorrhage.

Infection accounts 30(25.21%) to maternal death, this finding is inline with study finding in Ambo hospital which was 30.2% and study done in Nigeria (23.8%). But this current finding is much higher than findings in Tigray which was 8%. This might be because of around 56% of dead mothers in our finding are referred cases from different health institutions and 47% of women have prolonged labour before they die. However, findings at Tigray hospital showed that only 22% mothers who died had prolonged labour before they die (7). Therefore, the above reasons might expose the women for sepsis and infections.

Fatality of infection is observed in propensity score matching analysis. If 100 females came with infection in hospital 50 of females would die exclusively because of infection ($\beta = 0.50$ (95% CI (0.08, 0.92)). If projected to population based on our data it is not significant.

7.6% of maternal mortality was attributed to PIH. When compared with the findings of Tigray hospital, the estimated percentage was 19% , indicating higher difference.(7). The reason for this discrepancy might be, as this study area is tropical rainforest areas, reach in spices, fruits and vegetables. Therefore, the difference might be their feeding difference. Study from India shows that PIH accounts 8 (10 %) of maternal mortality, which is in line with our finding (12). The Indian study has classification error. It includes late referral as one cause of death. Therefore, the presence of this classification may underestimate the figure.

By propensity score matching analysis, if projected to population based on our data if 100 females caught with pregnancy induced

Conclusion: Majority of the maternal death occurred because of direct obstetric causes. Hemorrhage is the commonest direct obstetric cause of maternal death in this study. Infection and anemia were the other major indirect causes of maternal death. In causal inference

hypertension in the community 16 of females would die exclusively because of pregnancy induced hypertension.

Most of death (74.8%) occurred during postpartum period. It is consistent with study done in India , which revealed that postpartum deaths accounted for about 70% (12). But it is higher than finding from Bonke wereda (51%). This might be because of difference in case sample, 49 deaths in Bonke wereda but in this research 119 maternal death were included. However, study from maternity hospital of Nigeria shows 61.9% of the maternal deaths occurred in post-partum period which is lower than this finding. This might be because of only 84 maternal deaths in two year study period were included (13,14). Higher number of maternal death in post-partum period implies that the management following delivery and during delivery might be poor. Prolonged period of labour due to OL or due to not having timely intervention might contribute a lot for death occurring in post-partum period.

estimation: hemorrhage, Infection and anemia were the significant cause of maternal death.

Recommendations: The health professionals must work on awareness creation on early arrival at health institution for delivery before development of different

complications. Academicians and researchers should dig out associated socio-economic factors for maternal death.

References

1. World Health Organization. (2013). Maternal mortality ratio (per 100,000 live births). Retrieved from <http://www.who.int/healthinfo/statistics/indmaternalmortality/en/>
2. Ziraba, K.A. Ezeh, A. Kyobutungi, C. Madise, N. Mills, S. (2009). Maternal mortality in the informal settlements of Nairobi city: what do we know? *Biomed central- Reproductive Health*: 1-8.
3. World Health Organization, UNICEF, UNFPA and The World Bank, "Trends in Maternal Mortality: 1990-2010," 2012
4. WHO, world bank, UNFPA U and U. Trends in Maternal Mortality : 1990 to 2013. 2013;
5. WHO. Reviewing maternal deaths and complications to make pregnancy safer *Beyond the Numbers*. 2004;
6. Koblinsky M, Tain F, Tesfaye S. Reducing maternal mortality and increasing use of skilled birth attendance: Ethiopia and MDG 5. 2010;4(1).
7. Gidey G. PATTERNS OF MATERNAL MORTALITY AND ASSOCIATED FACTORS; A CASE-CONTROL STUDY AT PUBLIC HOSPITALS IN TIGRAY REGION, ETHIOPIA. *Int J Pharm Sci Res*. 2013;4(5):1918–29.
8. Federal Democratic Republic of Ethiopia Ministry of Health. Maternal Death Surveillance and Response (MDSR) Technical Guideline. 2012.
9. Benedict O Asamoah, Kontie M Moussa MS and GM. Distribution of causes of maternal mortality among different socioeconomic status. *BMC Public Health*. 2011;11(159).
10. Garenne M, Mbaye K, Bah MD, Correa P. Risk Factors for Maternal Mortality Control Study in Dakar : a Case- Hospitals (Senegal). *Afr J Reprod Heal* 1997;1 (1)14-24. 1997;1(1):14–24.
11. Garomssa H and ADD. Maternal mortality in Ambo Hospital: a five year retrospective review. *Ethiop J Reprod Heal*. 2008;2(1):2–13.
12. Devi, Khumanthem Pratima Devi , Chanam Mangle Singh SR. Maternal Mortality and Its Causes in a Tertiary Center. *J Obstet Gynecol India*. 2012;62(April 2012):168–71.
13. Yaya Y, Eide KT, Norheim OF, Lindtjørn B. Maternal and Neonatal Mortality in South-West Ethiopia : Estimates and Socio-Economic Inequality. *PLoS ONE* 9(4) e06294. 2014;9(4).
14. Olopade, F.E. and Lawoyin T. Maternal Mortality in a Nigerian Maternity Hospital. *African J Biomed Res*. 2008;11(June):267–73.