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Risk Factors of Maternal Death in Jimma University Specialized Hospital: A Matched Case Control Study

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Abstract **Background:** Maternal death has devastating effects on the family she leaves behind and country level. Most of the literatures in our country are reviews of maternal death which are unable to determine the predictors of maternal death and do not consider change of time since there is variation in care given and did not identify timing of death. **Objective:** To assess risk factors of maternal death in Jimma University specialized hospital, Southwest Ethiopia from January 2010 to December 2014. **Methods:** A time matched case control study was conducted on 600 charts, 120 cases and 480controls. Data was collected using checklist adapted from maternal death surveillance review of Ethiopia guide line. Data were entered into epi data 3.1 and exported to Stata 13 for analysis. Conditional logistic regression was done to identify the independent predictors of maternal death. The adjusted matched odds ratio with the 95% confidence interval was reported and statistical significance was declared at p =<0.05. To ensure confidentiality only code was written on the check list. **Result:** More than two third (68%) of death occurred during post-partum period. Predictors of maternal death include: age group of 20 – 34 (AMOR= 0.299, 95% CI (0.113, 0.792)), being from rural area (AMOR = 2.594, 95%CI(1.001,6.726)), prolonged labour (AMOR=37.141, 95%CI(13.296, 103.750)), comorbidities (AMOR=9.631,95%CI(3.135, 29.588), referred cases from health center (AMOR=4.011, 95% CI (1.113, 14.464) and other health institution (AMOR=6.029, 95%CI(1.565, 24.626)). **Conclusion:** Duration of labour, age, comorbidities, residence and referral were the major factors that affect maternal death.

Keywords: *maternal death, risk factors of maternal death, maternal health, Jimma University*

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1. Introduction

Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. Loss of a woman from family because of death during pregnancy, delivery and within 6 weeks of postpartum can threaten the survival of the entire family. Women who die due to pregnancy-related causes are in the prime of new born baby and young children lives and are responsible for the health and well-being of their families. Many women shoulder a double burden of helping to support the family by working outside the home and taking full responsibility for household duties and child care. Yet, despite this vital role played by women in society, the health needs of a women is neglected which is evidenced by high level of maternal mortality in many poor countries [1,2].

Women's and children's health is directly affected by the social factors, institutional factors cultural factors and economic status. Issues such as their low socio economic status, harmful traditional practices, especially female genital mutilation, early marriage, and low female literacy, all have a direct negative impact on women's health [3,4]. Poverty or low socio economic status results in poor child and maternal health care services, lower skilled care and poor access to health care services are some of the consequences that have direct impact on health of mother. These things results in high maternal mortality rates. As a result, the use of antenatal care (ANC), skilled delivery attendants and postnatal care (PNC) are recognized as key maternal health services to improve health outcomes for women and children [3,4].

Maternal death has devastating effects on the family she leaves behind and country level. Women in developing countries lose more disability-adjusted life years (28 million) to maternal causes than to any other. Different literatures show that children less than 9 year are more likely to be chronically malnourished and to die than children who lost their father. Studies in developing countries indicate that the risk of death for children less than five years doubles or triples if their mother dies. Other studies estimate that children whose mothers have died are 3-10 times more likely to die within two years than those whose parents are both alive. The other consequence is economic burden on family, total lost

economic productivity and out of pocket expenditure of households with maternal death is 10 times higher than that in without maternal death [5,6,7,8]. Maternal mortality of a single person was found to reduce per capita gross domestic product by US$ 0.36 per year in WHO African region. The study has demonstrated that maternal mortality has a statistically significant negative effect on GDP [9].

Maternal mortality rate (MMR) globally has fallen by 45% from 523,000 (380/100,000) in 1990 to 289 000 (210/100,000) in 2013 yielding an average annual decline of 2.6%. It is one of the statistics showing the largest degree of disparity between developed and developing countries. In 2013, Developing countries account for 99% (286 000) of the global maternal deaths with sub-Saharan Africa (SSA) alone accounting for 62% (179 000) followed by Southern Asia (69 000). The MMR in developing regions was 14 times higher than in developed regions. In general in SSA there is 49% reduction from 990 to 510 per 100,000 but eastern Africa reduces MMR by 57% from 1000 to 440 per 100,000 which are highest in SSA. Ethiopia decreased maternal death from 1400 to 420 per 100,000 MMR between 1990 and 2013 which is making progress to achieve MDG 5a by 2015. Ethiopia is grouped under high MMR with 420/100,000 in 2013 [2,3,10].

The 2011 Ethiopia demographic and health survey (EDHS) (676/100,000) shows that there is bit increment of MMR from 2005 EDHS (673/100,000), even though the 95 % CI is coinciding. 2005 EDHS report (673/100,000) and joint estimation by WHO, UNICEF, UNFPD and world bank in same year (740/100,000) have wide variation [10,11,12,13,14].

Each maternal death has a story to tell and can provide indications on practical ways to address problems. There was four times risk of maternal death in the age group 35–49 years compared to the group of 25–34 years. Being primiparas and multipara increases the risk of maternal death having no attendance of ANC, distance from hospital, having comorbid complications on admission 9 times, having elevated pulse 10.7 times, and referral [15,16].

Most of the literatures are reviews of maternal death which are unable to determine the predictors of maternal death and previous literatures did not identify timing of death except single study done in Bonke wereda (community based cross sectional study). Besides high number of maternal death, there is scarcity of literatures in Ethiopia and particularly in the study set up, regarding duration and factors associated with maternal death.

1.1. Significance of Study

Maternal death is widely regarded as one of life's most tragic outcomes. There is a big pain in the death of a woman who is engaged in the act of creating life, and her death is an incomparable loss for any children who are left behind.

Even though, there are limited numbers of literatures in Ethiopia in general and study setup in particular, the already available literatures does not consider change of time, unable to determine the predictors of maternal death, old literatures and did not identify timing of death.

Therefore, the aim of this study was to assess duration and factors affecting maternal death in case of in Jimma university specialized hospital (JUSH). Information generated from this study can be used by health professionals, health care planners, managers and policy makers to save women's lives by improving the quality of care provided. It is intended that this information will help or contribute to change policies and practices that will lead to improvements in maternal health. It is also intended that this study can be used as input for JUSH, researchers and academicians.

2. Objectives

2.1. General Objective

- To assess risk factors of maternal mortality in JUSH, Ethiopia from January 2010 to December 2014.

2.2. Specific Objectives

- To describe duration or timing of death of mothers in JUSH from January 2010 to December 2014
- To determine risk factors of maternal mortality in JUSH from January 2010 to December 2014.

3. Methods

3.1. Location of Study

The study was conducted at Jimma university specialized hospital (JUSH). JUSH is located in Jimma town which is around 355 Km from Addis Abeba in south west direction, Jimma zone, Oromia regional state, Ethiopia. JUSH is one of the oldest public hospitals found in the south western part of the country that runs under Jimma University. It is currently the only teaching and specialized hospital in south west part of Ethiopia. The hospital serves as referral site and provides specialized care for south-western Ethiopia with a catchment population of about 15 million. The specialized care provided for the population are in internal medicine, surgery, obstetrics and gynecology, pediatrics, ophthalmology, psychiatry and dermatology [17].

3.2. Study Period

The study was conducted from March 14 – April 14, 2015 among women who visited maternal health services from January 2010 to December 2014.

3.3. Study Design

Institution based matched case control study was conducted.

3.4. Population

The **source Population** of this study was

All charts of mothers who visited JUSH for maternal health service utilization.

Whereas the **Study Population** was

Cases: all charts of mothers who died during pregnancy, delivery and 42 days after delivery in JUSH from January 2010 to December 2014

Controls: all charts of mothers who visited JUSH for maternal health service utilization from January 2010 to December 2014

Sample population

The sample population was randomly selected cards of cases and controls during the study period.

3.5. Inclusion and Exclusion Criteria

Inclusion criteria: cases that fulfill the standard definitions of maternal mortality given by international classification of disease – 10 and controls which came for maternal health service utilization.

Exclusion criteria: cases that are registered on the log book but whose charts' were missed. Charts that didn't include the assessment of admission and status of mother (dead or alive) during discharge were excluded from the study. Family planning users, ANC users are excluded.

3.6. Sample Size Determination and Sampling Procedures

Sample size determination

Sample size was determined by two population proportion using Epi info version 7 by taking the following assumptions: 95% CI, and 80% power, odds ratio of 0.06 (odds of nurses attending the delivery over odds of delivery attended by other) from study done in Tigray region, case to control ratio of 1:4 and the prevalence of exposure among controls were 6.5% (proportion of controls attended by nurse) taken from unmatched case control study done in Tigray regional state [12]. A total of 600 charts, 120 cases and 480 controls were included in the study.

Ascertainment of cases = the occurrence of death was ascertained based on the information on chart. If death is reported on the chart, it was taken as a case.

Sampling procedures

Charts of both cases and controls that fulfill the inclusion and exclusion criteria were selected from maternity ward, delivery ward, operation theatre, PNC ward and gynecologic ward.

First cases were identified from log book or registration book from respective wards and then sampling frame was prepared. Hundred twenty cases were selected randomly from sampling frame by using random number of cases in SPSS version 21.

After identifying cases included in the sample the time of procedures was identified for each selected cases. For each case four controls that were the nearby survived women after delivery within 48 hour were selected. But if there are more than four controls, who are candidates, lottery method is used in selection. Selected 120 maternal death and 480 controls charts were reviewed.

Charts that had missing values of more than 30% were replaced by random selection from available charts. When cases are replaced the control group is also replaced with controls nearer to cases.

3.7. Variables

Dependent variable

Maternal death

Matching variable

Time of event or death

Independent variable

Socio-demographic factors: Age, residence, distance of home from Jimma bus station

Delivery history: Length of labor, birth attendant, mode of delivery and place of delivery

Obstetric history: ANC, parity and gravidity

Antenatal/ intra natal risks: Placenta previa, previous ceaserean section, obstructed labour, multiple gestation and malpresentation

Comorbidities: Chronic hypertension, anaemia, HIV positive and malaria

3.8. Data Collection Instrument

Data collection instrument was adapted from Maternal Death Surveillance and Response Technical Guideline of Ethiopia [18]. The checklist consists of socio-demographic data, obstetric and delivery history, presence of comorbidities, cause of death, antenatal and intranatal risks and presence of complications.

3.9. Data Collectors

Three midwives and three health officers were recruited and trained for two days. The training covered: the contents of the tool, ethical considerations and way of extraction of necessary information from chart. Two supervisors, one midwife and one public health officer, monitored and followed data collection while the principal investigator supervised the overall data collection process.

3.10. Data Processing and Analysis

Data were entered into Epi Data version 3.1 and then exported for analysis to STATA version 13.0. Data were cleaned for inconsistencies and missing values. Variables that were missed in more than 40% of total sample were excluded from analysis.

Simple frequencies were done to see the overall distribution of the study subject with the variables under study and to see any missing data. Multicollinearity test was performed to see collinearity of variables.

Bivariate conditional logistic regression analysis was used to determine the association between different factors and the outcome variable and to select candidate variables for multivariate conditional logistic regression. Variables that had p value less than or equal to 0.20 was entered into multivariate conditional logistic regression to identify independent predictors of maternal death.

Significant variables from multivariate conditional logistic regression model were interpreted and discussed. Confidence interval of 95% was used to see the precision of the study and the level of significance was taken at p value =<0.05. The adjusted matched odds ratio with the 95%CI was reported.

3.11. Data Quality Assurance

To assure the quality of data, data collectors were trained and did pretesting of the checklist tool until they became well conversant with the instrument. Every day filled checklist was reviewed and checked for completeness and relevance by supervisors and principal investigator.

After data collection, each filled checklist was given a unique code by the principal investigator. Data was entered using Epi Data version 3.1 then exported to STATA version 13.0 for analysis. Accuracy was improved through double entry, 10 % of entered data was reentered

with the actual filled tool and compared the dataset using STATA. Frequencies were used to check for entry errors, missed values and outliers. Any errors identified were corrected after revision of the original data using the code numbers.

3.12. Operational and Definitions of Terms

Maternal health service: Health services including abortion, visit for pregnancy and pregnancy related complications during antenatal period, delivery and post-natal care within 6 weeks.

Time: time at which the event occurred. Time of control is the nearby time from time of case within one day.

Cause of death = the causes written on the chart is considered as cause of death.

Presence of comorbidity = the presence of at least one medical disease was considered.

Prolonged labour = duration of labour more than 24 hours.

3.13. Ethical Consideration

Prior to data collection, ethical clearance was obtained from Research and Ethics committee of the College of health sciences of Jimma University. Written permission letter was also received from JUSH CEO and other concerned bodies in the study set up. In order to establish anonymous linkage only the codes, not the names of the participant from the chart, was registered on the questionnaire. During the training of data collectors and supervisor, ethical issues was addressed as important component of the research.

4. Result

4.1. Descriptive Analysis of Variables

Socio - demographic characteristics

A total of 120 cases and 480 control charts were included in the study. From the variables, for which there was a plan to collect information for, the following are incomplete in 99% of charts: ethnicity, educational status, marital status, occupation, and income. As a result they are excluded from analysis.

More than half (52.5%) of cases were in the age group 20-34 whereas nearly two third of controls were in the age group 20-34. Although about three quarter (75.83%) of cases were from rural area, more than half (54.58%) of controls were from urban residence. Forty eight (40%) of cases came from 11-50km distance whereas hundred fifty four (32%) controls came from <= to 10 km distance. Most of cases (70.8%) and more than half (51.9%) of controls were referred from health centers. From not referred women most of them are not died (Table 1).

Fifty (41.67%) cases were prim-gravid women while 228 (47.7%) controls were gravida 2-4. Similarly most of cases (43.3%) were primi-paras whereas most of controls (47.7%) were para 2-4. Only 3(2.5%) cases and 12 (2.5%) controls had history of previous C/S. More than two third (67.5%) of cases were women who did not have ANC follow up whereas majority of controls (96.5%) had ANC follow up. From females who are booked for ANC only 7.8% females are dead. In the contrary from females who don't have ANC follow up most of them are dead. (Table 1).

Although 40 (34%) cases had obstructed labor, only 59 (12.7%) controls had obstructed labor. More than one quarter (26.7%) cases had malpresentation whereas only 13.75% of controls had malpresentation. More controls (12.3%) had prolonged rupture of membrane than cases (4.2%). Most of cases (83.3%) had prolonged labour while most of controls (82.9%) length of labour less than 24 hrs. Majority (92%) of cases and controls (81%) were attended by doctors. Fifty five (46%) cases have undergone ceaserean section or hysterectomy procedures followed by assisted vaginal delivery (27%). However, more than half (53%) of controls were delivered/gave birth by spontaneous vaginal delivery (Table 1).

4.2. Pregnancy Risk and Complication

In 97.5% (586) of women there are no multiple gestations. From 14 women who have multiple gestations only three (21.4%) are dead. From total deaths in occurring in women only three women (2.5%) have multiple gestations. The rest 97.5% of women are alive. Placenta previa only occur in 17 (2.83%) of women. From which 6 (32.3%) are dead. Abruptio placenta occur only in 23(3.83%) of women. From which 14 (61%) are dead which covers 12% from total death. only 9% (54) of women have APH from which 38 (70%) of them are dead. It covers 32% of total maternal death. Only 46 (8%) of women have PIH from which 23(50%) are dead in which it covers 19% from total deaths. 81% of women who dead did not have PIH.

Only 45(7.5%) of women have intra-partum or post-partum complications (chorioamnitis, wound infection and post-partum psychosis) from which 24(53%) of them are dead in which 20% of death from total death. Post term pregnancy occurred in only 26(4.33%) of women from which only 2 deaths occurred. 79 (13%) of women face other types of comorbidity from which 40(51%) of them dead which is 33% from total death.

Although 28 (23.3%) cases have experienced uterine rupture whereas only 9 (<2%) of controls have experienced uterine rupture. Similarly, though 37 (30.8%) cases have developed PPH only 5 (1%) controls have developed PPH. Seventeen (14%) cases have experienced puerperal sepsis while 7 (1.5%) controls have developed it. Even though three quarter (75%) of cases have experienced hemorrhage only 30 (6%) have experienced it. Thirty four (28%) cased had anemia whereas nearly 10% of controls had anemia (Table 1).

4.3. Timing of Death

Most deaths 82 (68%) occurred during post-partum period while 25% deaths occurred during intra-partum period. Only 8 (6.7%) happened during ante partum period (Figure 1). Out of 8 deaths that occurred during ante-partum period, five of them occurred during 14 – 28 weeks of ante-partum. Two deaths occurred in less than 14 weeks. Twenty eight deaths, out of 30 deaths during intra-partum, occurred during 29 – 37 weeks of intra-partum. Out of 82 deaths during post-partum period, 38 (46.34%) happened between 4 - 7 days whereas 29 (35.37%) happened within 3 days. The rest occurred in between 8 – 42 days.

Table 1. factors associated with maternal death in JUSH, May, 2015

variables	category	controls	cases	Total	CMOR (95% CI)	AMOR (95% CI)
age	<20	62(76.54)	19(23.46)	81	0.840 (0.448, 1.518)	1.582 (0.434, 5.762)
		12.92	15.83	13.5		
	20 - 34	315(83.33)	63(16.67)	378	0.558 (0.356, 0.874)	**0.299 (0.113, 0.792)**
		65.63	52.5	63		
	>=35	103(73)	38(26.95)	141	1	1
		21.46	31.67	23.5		
residence	rural	218(90)	91(10)	309(51.5)	2.250 (1.210, 4.210)	**2.594 (1.001, 6.726)**
		45.42	75.83	42.5		
	urban	262(70.55)	29(29.45)	291(48.5)	1	1
		54.58	24.17	43.67		
Estimated km of area from jimma	<=10	154(92.77)	12(7.23)	166	0.1801 (0.0875, 0.3705)	0.499 (0.134, 1.864)
		32.08	10	27.67		
	11 - 50	142(74.74)	48(25.26)	190	0.8116 (0.4700, 1.4014)	1.226 (0.436, 3.450)
		29.58	40	31.67		
	51 - 150	102(79.69)	26(20.31)	128	0.6374 (0.3518, 1.1546)	0.539 (0.171, 1.698)
		21.25	21.67	21.33		
	>=151	82(68.42)	34(31.58)	76	1	1
		17.03	28.33	19.33		
Referral	health center	249(74.55)	85(25.45)	334	6.6667 (3.0214, 14.7102)	**4.011 (1.113, 14.464)**
		51.88	70.83	55.67		
	Other HI	85(75.22)	28(24.87)	113	6.4467 (2.8696, 18.4521)	**6.209 (1.565, 24.626)**
		17.71	23.33	18.83		
	not referred	146(95.42)	7(4.58)	153	1	1
		30.42	5.83	25.5		
comorbidity	No	441(84.64)	80(15.36)	521	1	1
		91.88	66.67	86.83		
	Yes	39(49.37)	40(50.63)	79	15.3090 (2.7965, 83.8048)	**9.631 (3.135, 29.588)**
		8.13	33.33	13.17		
Parity	Primi	249(74.55)	85(25.45)	334	6.6667 (3.0214, 14.7102)	0.498 (0.031, 7.927)
		51.88	70.83	55.67		
	2 - 4	85(75.22)	28(24.87)	113	6.4467 (2.8696, 18.4521)	0.329 (0.042, 2.593)
		17.71	23.33	18.83		
	>=5	146(95.42)	7(4.58)	153	1	1
		30.42	5.83	25.5		
Gravidity	Primi	168(77.1)	50(22.9)	218	0.667 (.396, 1.124)	1.565 (0.108, 22.634)
		35	41.7	36.3		
	2 - 4	228(87.4)	33(12.6)	261	0.333 (0.195, 0.571)	1.489 (0.207,10.687)
		47.5	27.5	43.5		
	>=5	84(69.4)	37(30.6)	121	1	1
		17.5	30.8	20.2		
attendant	doctors	388(77.91)	110(22.09)	498	2.7196 (1.3473, 5.489)	1.028 (0.277, 3.821)
		80.83	91.67	83		
	Others	92 (90.25)	10(9.85)	102	1	1
		19.17	8.33	17		
obstructed labour	No	419(84.14)	79(15.86)	498	1	1
		87.29	65.83	83		
	Yes	61(59.8)	41(40.2)	102	3.4686 (2.1787, 5.5220)	0.695 (0.259, 1.869)
		12.71	34.17	17		
Malpresentation	No	414(82.47)	88(17.53)	502	1	1
		86.25	73.33	83.67		
	Yes	66(67.35)	32(32.65)	98	2.3736 (1.4459, 3.8966)	0.873 (0.301, 2.535)
		13.75	26.67	16.33		
Duration of labour	<24 hrs	398(95.22)	20(4.78)	410	1	1
		82.92	16.67	69.67		
	>=24 hrs	82(45.05)	100(54.95)	182	22.2254 (12.1072, 40.7996)	**37.141 (13.296, 103.750)**
		17.08	83.33	30.33		
Anemia	No	434(83.46)	86(16.54)	520	1	1
		90.42	71.67	86.67		
	Yes	46(57.5)	34(42.5)	80	3.5058 (2.1426, 5.7363)	2.204 (0.855, 5.679)
		9.58	28.33	13.33		
PROM	No	421(78.54)	115(21.46)	536	1	1
		87.71	95.83	89.33		
	Yes	59(92.19)	5(7.81)	64	0.293 (0.134, 0.759)	0.220 (0.036, 1.329)
		12.29	4.17	10.67		

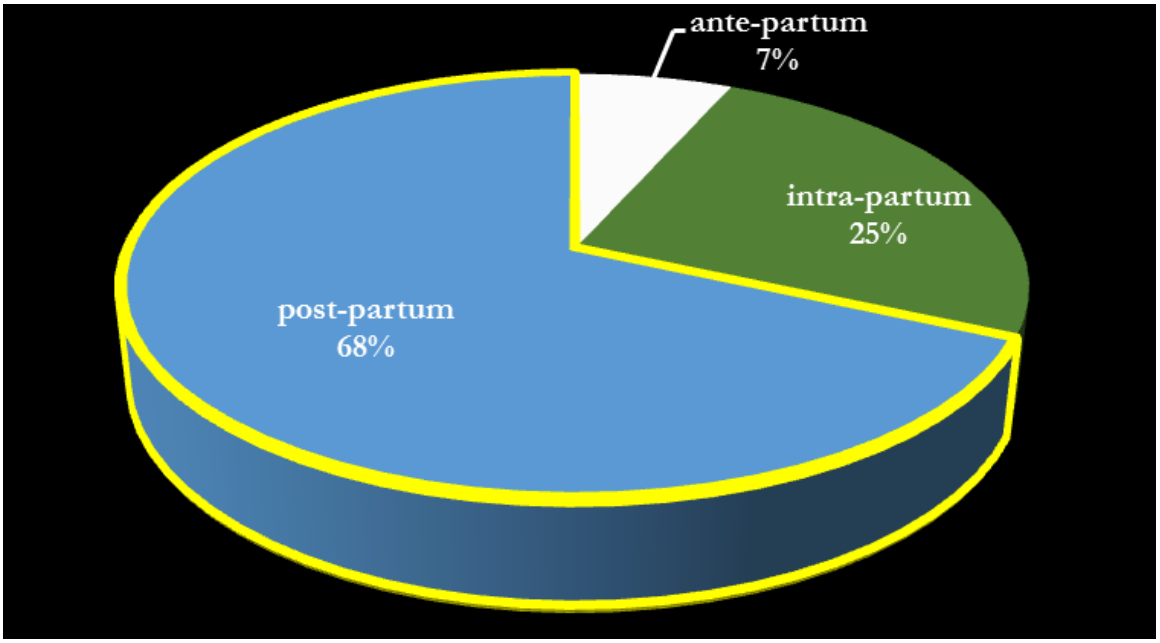

Figure 1. Timing of death of women in JUSH, May, 2015

4.4. Predictors of Maternal Death

Multiple gestation, post term pregnancy and previous ceaserean section were excluded from multivariate conditional logistic regression analysis since they have p>0.2 in bivariate conditional logistic regression. ANC and delivery method were excluded from multivariate conditional logistic regression analysis since they affect the precisions of significant variables.

Being in the age group of 20 – 34 is protective than being in the age group of >=35. A one women increase in the age group of 20 – 34, decreased the odds that a woman would die by 70.1% than being in the age group of >=35 (AMOR= 0.299, 95% CI (0.113, 0.792). Women who came from rural area are more likely would die 2.594 times than women who came from urban area (AMOR= 2.594, 95% CI (1.001, 6.726).

Women who were referred from health center were 4.011 times more likely to die than women who were not (AMOR=4.011, 95% CI (1.113, 14.464). Similarly women who referred from other health institutions (hospital and private or NGO clinics) were 6.209 times more likely they would die than women who didn't referred (AMOR=6.209, 95% CI (1.565, 24.626). Women who had prolonged labour were 37.141 times more likely the women would die than women who had less than 24 hour duration of labour (AMOR= 37.141, 95% CI (13.296, 103.750). Women who had comorbidities were 9.631 times more likely they would die than women who didn't have comorbidities (AMOR= 9.631, 95% CI (3.135, 29.588) (Table 1).

5. Discussion

5.1. Timing of Maternal Death

Most (68%) of maternal death occurred in post-partum period which is higher than finding from south west Ethiopia in Bonke wereda in which 51% of maternal death occurred in post-partum period. This might be because of difference in number of maternal death included in the study, 49 deaths were included in Bonke wereda but in this research 120 maternal death were included in the study. The other reason might be because of recall bias introduced in south west Ethiopia study since it is retrospective cross sectional house hold survey. However study from maternity hospital of Nigeria shows about 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 with this number and study period if it is data of five year it might be higher than this research finding [22,23]. 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.

The second period in which higher number of death occurred is the intra-partum period (25%). It is smaller than finding from Bonke wereda, south west Ethiopia which was 37%. This difference might be because of difference in site of delivery, 97% of delivery in JUSH is HI delivery in contrary to study of Bonke wereda, south west Ethiopia in which 92% of delivery occurred in home so that in home delivery complications are not managed well so high number of death may occur in intra-partum period. But it is much higher than from findings of maternity hospital of Nigeria which is 13.1%. This difference might be because of high antepartum death (10.7%) and death because of post-abortal complications (14.3%). in maternity hospital of Nigeria in which 25% of women died before reaching to intra-partum period but in our set up antepartum death including abortion complication is only 7%. This might be because of high prevalence of death associated with abortion relative to JUSH. The other reason might be absence of blood bank, difference in size and level of hospital and difference in the number of health professionals (low number) during the study period in maternity hospital of Nigeria might contribute to poor quality of care. The other reason might

be dramatic reduction of maternal death related with abortion due to the introduction of misoprostol or safe mother hood services in our country.

Ante partum death occurred in south west Ethiopia is 12% which is higher than this research finding 7%. There might be difference in awareness, this might create poor follow up of women during ante partum in south west Ethiopia study [19,20. These imply that proper care during antenatal period, reduce home delivery, intra-partum period and after abortion save the lives of many women in antenatal and intra partum period. In general the major reason of inflated postpartum death and relative small number of death in intra-partum and post-partum in JUSH as compared to Bonke wereda study is set up difference in which health institution death represents for 14% of females who utilize institutional delivery but the study of Bonke wereda represents 86% of females who did not utilize institutional delivery.

Implications of these findings are

- Management after terminating pregnancy might be poor or the women might not utilize postpartum care service.
- The risk of death during intra-partum period is high when the delivery is at home.

5.2. Factors Affecting Maternal Death

The commonest age group in which most maternal death (52.5%) occurred is 20 – 34. Most controls (65.63%) are also found in this age group. Likewise study done in Tigray regional states' hospitals in Ethiopia, most deaths (55%) occur in age group of 20 – 34 but it is not significant predictor. This might be because of representation of maternal death by less than half from this finding. When we compare this finding with study done in Tanzania Muhimbili national hospitals in 2011 most deaths (74.5%) occurs in age group of 20 – 34. This difference might be because of over representation of 20-34 due to high sample (141 deaths) and it might be because of poor quality of care given like inadequate or no blood transfusion. Even though most death occurred in this age group it is protective than being in the age group of >=35. A one women increase in the age group of 20 – 34, decreased the odds that a woman would die by 70.1% than being in the age group of >=35 with AMOR of 0.299 and 95% CI (0.113, 0.792) [12,16,21,22]. This finding implies that even though high maternal death occurred in this age group from total deaths, it is favorable age group when we compare death ratio within the age groups. From the total sample included in the age group of 20-34 only 16.7% are dead which is less than age group of <20 (23.5%) and >=35 (26.9%). Favorability of 20-34 is also seen in Tigray study in which only 15% of women in this age group are dead compared to 27.3% in <20 and 36.5% in >= 35 age group.

Three fourth of women who came from rural area are died as per the finding of this research. They would die 2.594 times more likely than women who came from urban area with AMOR of 3.572 and 95% CI (1.001, 6.726). Even though it is not significant predictor, study from Tigray region shows 75.6% of women who died came from rural part of area. This might be because of women who came from rural area are at higher risk than who came from urban women which is evidenced by from women who don't have ANC follow up 72.4%, from women who were grand multi parity 72.9%, from women who had APH 70.4%, from women who had PPH 69%, from women who had prolonged labour 62.6% and from women who had uterine rupture 78.4% of them came from rural area.

These imply that women who live in rural area are poor at utilization of maternal health services might be due to different reasons like awareness problem or inaccessibility or unavailability of maternal health services.

Around 94% of maternal deaths are referred cases. Referred cases from health center and other HI are 4.011 (95% CI **(**1.113, 14.464)) and 6.209 (95% CI (1.565, 24.626)) times more likely they would die as compared to women who are self-referred respectively. Study done in tertiary hospital of Kenya shows referred cases would die two times than who don't referred AOR of 2.1 and 95% CI (1.0–4.3) [16]. This might be because of cases are referred to a higher health institutions when it is complicated. This implies that there may be unnecessary delay from health institutions and from the family which is evidenced by 90% of referred women have prolonged labour.

When the duration of labour of women is 24 hour or more 37.141 times more likely the women would die than women who had less than 24 hour duration of labour with 95% CI (13.296, 103.750). OL is the underlying factors for different kind's risks during intra-partum period. Majorly it might lengthens the length of labour. Most (69%) of women who had OL had prolonged labour or unnecessary delay from patient side or HI which is evidenced by 90% of referred women have prolonged labour. The other reason might be around 40% of women came from more than 51km so it lengthens time without intervention. Research finding from Nigeria maternity hospital AMOR - 2.86 and 95% CI (1.39, 5.9) shows prolonged labour is the major risk factor for maternal death. Study from Tigray shows women whose length of labour is < 24 hours are protected from death than women whose length of labour is >= 24 hour with AOR of 0.27 and 95% CI (0.07-0.89) [15,22,35]. The major consequence following prolonged labour is uterine rupture – 78% women who had uterine rupture prior they are exposed for prolonged labour. These findings imply that prolonged labour is the major risk factor and exposes the women for another risk factor like uterine rupture. The other implication is OL and referral might be the great contributors for prolonged labour.

Seventy nine women (13%) had any type of comorbidities. They are 9.631 times more likely they would die than women who don't have comorbidities with AMOR of 9.631 and 95% CI (3.135, 29.588). In Kenya tertiary hospital also shows presences of comorbidities are significant predictors with AOR of 3.0 and 95% CI (1.7–5.3) [16]. It is known that pregnancy by itself is immune suppressive conditions if there is an additional disease it is dangerous. In this research half of women who had comorbidities are died.

5.3. Strength of Study

- Free of recall bias
- Time matching (indirectly controls for quality of care, expansion of services…)

- Study design – case control is preferable for rare event like maternal death and for determining associated factors.

5.4. Limitation of Study

- Selection bias due to intentional selection of controls
- Does not observe effect of some of socio demographic variables like economy, education…due to 99% missingnes of socio demographic variables.
- Wider confidence interval – due to rarity of events and lower sample size

6. Conclusion

Most of the women died in post-partum period particularly in between 4-7 days.

Women who reside in rural area, presence of comorbidities, women who referred from health institutions and women who had prolonged labour increases the likelihood of maternal death. Whereas being in the age group of 20 – 34 was the protective.

References

[1] Divya A. Patel, Nancy M. Burnett, BS Kathryn M. Curtis P. Maternal health epidemiology. 2003.

[2] WHO. International statistical classification of diseases and related health problems. 10th revision. Vol.2 Instruction Manual. 2010 Edition. Geneva: 2010;2.

[3] Baden S. Challenges to women ' s reproductive health : maternal mortality. 1996;44(38).

[4] The world bank. The millennium development goals for health to rising the challenges. 2004.

[5] Ye F, Wang H, Huntington D, Zhou H, Li Y, You F, et al. The Immediate Economic Impact of Maternal Deaths on Rural Chinese Households. 2012;7(6).

[6] Reed HE, Koblinsky MA, Mosley WH. The Consequences of Maternal Morbidity and Maternal Mortality. 2000.

[7] Bryce J, Victora C, Berman P, Lawn J, Mason E, Starrs A, et al. Fulfilling the Health Agenda for Women and Children The 2014 Report ER. 2014.

[8] BS Garg SC and SMZ. Safe motherhood : social , economic , and medical determinants of maternal mortality Women. 2006;(September). Available from: http://www.the-networktufh.org/publications_resources/trainingmodules.asp.

[9] Kirigia JM, Oluwole D, Mwabu GM, Gatwiri D, Kainyu LH. Effects of maternal mortality on gross domestic product (GDP) in the WHO African region. Afr J Heal Sci. 2006;13(1):86-95.

[10] WHO, world bank, UNFPA U and U. Trends in Maternal Mortality : 1990 to 2013. 2013.

[11] Koblinsky M, Tain F, Tesfaye S. Reducing maternal mortality and increasing use of skilled birth attendance: Ethiopia and MDG 5. 2010;4(1).

[12] 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.

[13] Central Statistical Agency [Ethiopia] and ICF International. Ethiopia Demographic and Health Survey 2011. 2011.

[14] Central Statistical Agency [Ethiopia] and ORC Macro. Ethiopia Demographic and Health Survey Preliminary Report. 2005.

[15] Evjen-olsen B, Hinderaker SG, Lie RT, Bergsjø P, Gasheka P, Kvåle G. Risk factors for maternal death in the highlands of rural northern Tanzania : a case-control study. BMC Public Heal 2008,. 2008;9.

[16] Yego F, Este CD, Byles J, Williams JS, Nyongesa P. Risk factors for maternal mortality in a Tertiary Hospital in Kenya : a case control study. BMC Pregnancy Childbirth. 2014;14(38).

[17] Jimma univeristy specialized hospital. services given in the hospital. 2015.

[18] Federal Democratic Republic of Ethiopia Ministry of Health. Maternal Death Surveillance and Response (MDSR) Technical Guideline. 2012.

[19] 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).

[20] Olopade, F.E. and Lawoyin T. Maternal Mortality in a Nigerian Maternity Hospital. African J Biomed Res. 2008;11(June):267-73.

[21] Garomssa H and ADD. Maternal mortality in Ambo Hospital: a five year retrospective review. Ethiop J Reprod Heal. 2008;2(1): 2-13.

[22] Pembe AB, Paulo C, Brenda SD, Roosmalen J Van. Maternal mortality at muhimbili national hospital in Dar-es-Salaam, Tanzania in the year 2011. BMC Pregnancy Childbirth. 2015;1-7.

[23] Adelaja LM, Taiwo OO. Maternal and Fetal Outcome of Obstetric Emergencies in a Tertiary Health Institution in South-Western Nigeria. Int Sch Res. 2011;2011.