

# Factors associated with maternal near-miss at Public hospitals of South-East Ethiopia: An institutional based cross-sectional study

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*Maternal near miss, women, age at first marriage*

## Abstract

Background Maternal near-miss precedes maternal mortality and women are still alive indicating that the numbers of near misses occur more often than maternal mortality. This study aims to assess the prevalence of maternal near-miss and associated factors at public hospitals of Bale zone, Southeast Ethiopia.

Methods Facility-based cross-sectional study design was carried out from October 1, 2018, to February 28, 2019, among 300 women admitted to maternity wards. A structured questionnaire and checklist were used to collect data. Epi-info for data entry and statistical package for social science for analysis were used. The descriptive findings were summarized using tables and text. Adjusted odds ratio with 95% confidence interval and p-value <0.05 were used to examine the association between the independent and dependent variables.

Result The prevalence of maternal near-miss in our study area was 28.7%. Being age less than 20 years, age of first marriage less than 20 years, having husband with primary school complete and being from rural residence are factors significantly associated with maternal near miss. The zonal health department in collaboration with the education department and Justice Office has to mitigate early marriage by educating the community about the impacts of early marriage on health.

## Plain English Summary

The world health organization defined maternal near-miss as “a woman who almost dies but survives the complication which happened during pregnancy, childbirth or within 42 days after the end of pregnancy.” Obstetrics related hemorrhages and pregnancy induced hypertension are the most important causes of maternal near-miss. The other essential issue is that the occurrence of long-term morbidities like renal failure, respiratory tract disorder, and sudden death within a year is high compared to the general population. Currently maternal near-miss morbidity and mortality are becoming a concern by more and more peoples because of their increased awareness. Therefore, auditing maternal near-miss plays important role for improving maternal health care service since the case of maternal near-miss are more prevalent than maternal death.

Maternal mortality rate and infant mortality rate are the indicators for the status of health care in a

community. Because of this, maternal death is one of the most overwhelming events in obstetrics with extensive implications on both the family and obstetrics care providers involved. Therefore, women are at risk for this sudden and unexpected event occurring during pregnancy, childbirth and postnatal period. This indicates that the continuum of maternal morbidity begins with a normal healthy pregnancy and ends with death though maternal deaths are rare events. Most of the obstetrics complication can be preventable by providing timely and proper intervention. But near-miss cases share many characteristics with maternal mortality and can provide information regarding the obstacles to overcome after the onset of acute complication.

Our current finding revealed that the prevalence of maternal near-miss is 28.7%. Our study also identified age < 20 years, age at first marriage < 20 years, husbands educational status and residence are factors significantly associated with maternal near-miss.

## Background

Maternal morbidity is defined as ill-health in a woman during pregnancy, irrespective of pregnancy site or duration, which is caused or aggravated by the pregnancy or its management, but which is not caused by accident or incident. This concept ranges from mild to severe maternal morbidity. Maternal near-miss (MNM) and potentially life-threatening conditions (PLTC) are included as severe maternal morbidity (SMM) [1].

The World Health Organization (WHO) Working Group on Maternal Mortality and Morbidity Classification modified three pre-existing separate definitions of MNM and defined it as one, "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy." Moreover, a severe maternal complication is defined as a potentially life-threatening condition occurring during the antepartum, intrapartum or postpartum period [1-3].

The disease-specific criterion to identify MNM which was developed by WHO based on five core diagnostic groups were used in this study; (1) hemorrhage leading to emergency hysterectomy, shock, coagulation or need two or more units of blood transfusion; (2) pregnancy-induced hypertension including pre-eclampsia and eclampsia with clinical or laboratory indication

necessitating termination of pregnancy to save the life of women; (3) dystocia leading to uterine rupture and imminent uterine rupture due to prolonged obstructed labour or previous caesarean section; (4) infections causing hypothermia or hyperthermia or clear manifestation of infection and (5) anemia with hemoglobin level of less than 6 g/dl or clear clinical sign of anemia [4].

Globally, every day around 800 women loses their life due to pregnancy-related causes which are easily preventable. In most Sub-Saharan African countries, the improvement of maternal health made sluggish progress. The estimated global maternal mortality rate in 2013 was 289,000 per year and from this, the Sub-Saharan African countries share the highest burden. Even though, the high maternal deaths are occurring within these countries, the exact figure for each center categorizes these events as rare. This leads to a reduced level of power to allow the studies to investigate the potential risk factors. In this situation, MNM can serve as a proxy for maternal death which could help to evaluate the quality of maternity care in certain health facilities [5].

In 2014 WHO report, indicated that nine million women are victimized by near-miss. Because of this, in low and middle-income countries specifically among the humblest women the burden of MNM is high [1-3, 6]. The magnitude of MNM ranges up to 0.04% using management-based criteria and as high as 15% using disease-specific criteria. Furthermore, the burden of this problem is worse among low and middle-income countries [7 8]. For instance, the incidence of MNM in Ethiopia ranges from 8-29% [9-11]. This could emasculate the normal functioning of women [12]. Age of women above 35 years [13-15], being from rural residence, having an uneducated male partner [16], not having formal education or having low educational levels, and low socioeconomic status [17] were factors significantly associated MNM. Furthermore, lack of knowledge about danger sign during pregnancy, presence of first delay in decision making [18], having history of chronic hypertension and anemia [9, 19] and having previous caesarian section and/or abortion were significantly associated with MNM [15].

One of the major public health concerns globally including Ethiopia is maternal near miss. Therefore, for achieving the sustainable development goal 3 of target 1, reducing the incidence of MNM is crucial [20]. Besides, investigating the causes of MNM will benefit maternity care practitioners for providing

quality care by enhancing the readiness of the facilities. Moreover, investigating MNM events rather than maternal death has the following merits; MNM is more common than maternal mortality, reviewing near-miss yields more likely palpable evidence on the pathways that lead to severe maternal morbidity, since the women survived, examining the care received is less threatening to providers, we can learn from the women themselves since they can be witness and every near-miss case can be used as a free lesson and opportunity for improving maternity care. Therefore, this study intends to assess the prevalence of MNM and associated factors at public hospitals of Bale zone, Southeast Ethiopia.

## Material And Methods

### **Study design, population and sampling procedures**

A facility-based cross-sectional study design was carried out from October 1, 2018, to February 28, 2019 at three public hospitals of Bale zone namely Robe, Ginnir and Delomena. Bale zone is located in Southeast Ethiopia which is 435 Km far from the capital city of Ethiopia.

All women who are admitted at the maternity units of the selected hospitals during pregnancy, childbirth or postpartum period are the source population. Whereas, all women who are admitted at the maternity unit of the selected hospitals during pregnancy, childbirth or postpartum period during the data collection period were the study population.

With the basic assumption of 95% CI, 5% margin of error and 23.3% proportion of MNM [11] a single population proportion formula was used to calculate the sample size. Then, by adding a 10% non-response rate, the final calculated sample size was 300. The final sample were proportionally allocated across the three hospitals based on the annual caseloads admitted at maternity unity. Therefore, 115 samples were allocated to for Robe, 100 for Ginnir and 85 for Delomena hospitals. Finally, using a systematic random sampling method every 7<sup>th</sup> interval the study participants were selected from all selected hospitals.

### **Data collection tools and procedure**

Using a pre-tested structured questionnaire, data were collected using a face-to-face exit interview about demographic, personal, community, obstetric, administrative and care provider related

variables. To diagnosis MNM the disease-specific criteria developed by WHO were used. Ten nurses were involved as a data collectors.

### **Data quality assurance**

The questionnaires were designed and modified in English and then were translated to the local languages (Amharic and Afan Oromo). Then, translated back to English to ensure consistency of content. A pre-test was conducted at Goba referral Hospital on 5% of the sample. One day training was given to data collectors and supervisors. The supervisor was monitored the data collection process to assure the quality of data. Daily, the field supervisor checked the completeness of the collected data. Before data entry, the completeness, accuracy, and consistency of data were checked. Then, incomplete questionnaires were excluded from the analysis. Furthermore, data were entered into Epi Info, version 7.2, and checked for outliers. The interview was conducted privately. Patients' card was reviewed to determine the occurrence of MNM.

### **Data processing and analysis**

The coded data were checked and cleaned by entering into Epi Info version 7.2.1 and exported to statistical package for social science (SPSS) version 21 for analysis. The descriptive part of the results was presented using tables, frequencies, mean, standard deviation and text. To present the analytic part of the findings, bivariate logistic regression analysis was done. Those variables with a significance level (p-value) <0.05 in the bivariate analysis were entered into a multivariable logistic regression model for further analysis and to adjust the confounding factor. Adjusted odds ratio (OR) with 95% of CI and significance (p-value) <0.05 was used to examine the degree of association between the independent variables and MNM.

### **Result**

Two hundred ninety six (296) women completed the interview making the response rate of 98.7%.

#### **Socio-demographic variables**

From 296 study participants involved in the study, 240(81.1%) women age is between 20-34 years with the mean age of 25.1(±5.2). Two hundred seventy (91.2%) women are married, 188(63.5%) are Oromo ethnic group and the majority of the study participants accounting 74.7% are housewives (Table 1).

Table 1: Shows the distribution of socio-demographic characteristics of study participants in public hospitals of Bale Zone, 2019.

Variables	Frequency	Percentage
Age of respondent		
<20 Years	41	13.9
20-34 years	240	81.1
>34 years	15	5.1
Marital status of respondents		
Married	270	91.2
Single/Divorced/widowed	26	8.8
The ethnicity of the respondents		
Oromo	188	63.5
Amhara	88	29.7
Others	20	6.8
Religion		
Muslim	129	43.6
Orthodox	105	35.5
Protestant/Catholic	62	20.9
Occupation of the respondents		
Housewife	221	74.7
Farmer	18	6.1
Government employee	17	5.7
Others *	40	13.5
Educational status of women		
Unable to read and write	54	18.2
Able to read and write	60	20.3
Primary school	101	34.1
Secondary school	50	16.9
Above secondary school	31	19.5
Income of the women		
Low	61	20.6
Moderate	165	55.7
High	70	23.6
Husbands educational status		
Unable to read and write	49	16.6
Able to read and write	12	4.1
Primary school	81	27.4
Secondary school	103	38.8

Diploma and above	51	17.2
Residence area of the respondents		
Rural	157	53
Urban	139	47
Distance from health facility		
<10km	126	42.6
>10km	170	57.4

Others \*= student, daily laborer merchant, private employee and unemployed.

#### Obstetrics related variables

About 233 (78.7%) of our study participants were booked for antenatal care (ANC) service and 173 (58.4%) were self-referred. From a total of 296 study participants, 211 (71.3%) reported that the current pregnancy is planned and wanted whereas regarding parity 130 (43.9%) of the participants were multiparous (**Table2**).

Table 2: Shows the distribution of obstetrics related variables in public hospitals of Bale Zone, Southeast Ethiopia, 2019.

Variables	Frequency	Percentage (%)
ANC history		
Booked	233	78.7
Not booked	63	21.3
Number of ANC visit		
First visit	43	18.5
Second visit	56	24.0
Third visit	68	29.2
Fourth visit	38	16.3
More than four visit	28	12.0
Type of ANC visit		
First visit	44	18.9
Repeat visit	189	81.1
Source of referral		
Self-referred	173	58.4
Health facility	123	41.6
Type of pregnancy		
Planned and wanted	211	71.3
Others	85	28.7
Parity of the women		

Primiparous	136	45.9
Multiparous	130	43.9
Grand multiparous	30	10.1
Gestational age		
Unknown	21	7.1
<27 weeks	37	12.5
28-36 weeks	20	6.8
37-42 weeks	214	72.3
>42 weeks	4	1.4
Duration of labor		
Less than 24 hours	253	85.5
More than 24 hours	43	14.5
Type of complication		
Obstructed labor	14	4.7
HDP	26	8.8
Abortion	30	10.1
Hemorrhage	10	3.4
Sepsis	12	4.1
No complication	192	64.9
Others	12	4.1
Type of care providers		
Specialist/ emergency surgeon	55	18.6
Midwife	206	69.6
General practitioner	35	11.8
Duration of hospital stay		
Less than 7 days	238	80.4
More than 7 days	58	19.6

#### Administrative and medical personnel related variables

Out of 296 study participants, 8 (2.7%) reported that there was a power supply problem during their hospital stay, 22 (7.4%) encountered delay in decision making and 47(15.9%) reported that there was a delay in receiving care (**Table 3**).

Table 3: Distribution of administrative and medical personnel related variables in public Hospitals of Bale zone, Southeast Ethiopia, 2019.

Variables	Frequency	Percentage (%)
Presence of a power supply problem		
Yes	8	2.7
No	288	97.3
Lack of transportation		
Yes	18	6.1
No	278	93.9
Lack of lifesaving materials		
Yes	12	4.1
No	274	95.9
Availability of blood product		
Yes	144	48.6
No	152	51.4
Presence of delay in decision making		
Yes	22	7.4
No	274	92.6
Presence of delay in receiving care		
Yes	47	15.9
No	249	84.1
Presence of senior care provider		
Yes	86	29.1
No	210	70.9

#### Prevalence of maternal near-miss

From the five parameters used to measure the occurrence of MNM 22(7.4%), women encountered severe hemorrhage leading to shock. Also, 48 (16.2%) of our study participants developed pregnancy-induced hypertension with a clinical or laboratory indicating termination of pregnancy to save the life of mothers. The overall prevalence of MNM is 85 (28.7%) (**Table 4**).

Table 4: Shows the prevalence of MNM in public hospitals of Bale Zone Southeast Ethiopia, 2019.

Variables	Frequency	Percentage (%)
Severe hemorrhage		
Yes	22	7.4
No	274	92.6
Severe pre-eclampsia or eclampsia		
Yes	48	16.2
No	248	83.8
Dystocia		
Yes	8	5.1
No	288	94.9
Sepsis		
Yes	15	5.1
No	281	94.9
Anemia with < 6g/dl		
Yes	30	10.1
No	266	89.9
The overall prevalence of maternal near-miss		
Yes	85	28.7
No	211	71.3

#### Factors associated with the prevalence of MNM

In binary logistic regression analysis, those variables significantly associated were exported to multivariable logistic regression analysis to control confounding factors. Those variables significantly associated in binary logistic regression are age of respondent, age at first marriage, educational status, monthly income of the respondent, husband educational status, residence area, distance from the health facility, source of referral, type of care provider, lack of transportation and delay in receiving care. Finally, age of respondent, age at first marriage, husband's educational status, and residence area are factors significantly associated in multivariate analysis after adjusting confounding factors.

Those women age less than 20 years almost 4 times more likely to develop MNM compared to their counterparts ( AOR=3.72; 95% CI: 2.68-7.11). The odds of experiencing MNM is almost 3 times more likely to encounter women with age at first marriage is less than 20 years compared to their counterpart (AOR=2.69; 95% CI: 1.32-5.48). Women whose husband educated up to primary school are 1.26 times more likely to develop MNM compared to those husbands are educated up to diploma or above (AOR=1.26; 95% CI: 1.08-2.92). Those women from rural areas are almost 2 times more

likely to encounter MNM compared to those urban resident women (AOR= 1.79; 95% CI: 1.07-4.43) (Table 5).

Table 5: Bivariable and Multivariable logistic regression analysis of factors associated with the prevalence of MNM in public hospitals of Bale zone, Southeast Ethiopia, 2019.

Variables	MNM		Crude OR with 95% CI	A
	Yes	No		
Age of respondent				
<20 years	10	31	3.54(1.02-12.24)	3
20-34 years	61	173	2.95(1.03-8.46)	3
>=35 years	8	7	1.00	1
Age at first marriage				
>20 years	44	82	1.69(1.02-2.81)	2
20-34 years	41	129	1.00	1
Educational status				
Unable to read and write	22	32	0.22(0.07-0.70)	1
Able to read and write	29	31	0.16(0.05-0.51)	1
Primary school	21	80	0.56(0.18-1.79)	2
Secondary school	9	41	0.68(0.99-2.41)	2
Diploma and above	4	27	1.00	1
Monthly income of the respondent				
Low	24	37	0.17(0.07-0.44)	0
Middle	54	111	0.23(0.10-0.53)	0
High	7	63	1.00	1
Husband educational status				
Unable to read and write	22	27	0.23(0.09-0.59)	0
Able to read and write	4	8	0.37(0.09-1.54)	0
Primary school	30	51	0.32(0.13-0.76)	1
Secondary school	21	82	0.76(0.30-1.78)	0
Diploma and above	8	43	1.00	1
Respondents residence area				
Rural	60	97	0.36(0.21-0.61)	1
Urban	25	114	1.00	1
Distance from health facility				
<10km	23	103	1.00	1
>10km	62	108	0.39(0.23-0.67)	1
Source of referral				
Self-referred	62	111	0.41(0.24-0.71)	0

Health facility referred	23	100	1.00	1
Type of care provider				
Specialist/emergency	20	35	1.00	1
Midwife	48	158	1.65(0.70-3.91)	2
General practitioner	17	18	3.11(1.49-6.50)	1
Lack of transportation				
Yes	12	6	0.18(0.06-0.49)	0
No	73	205	1.00	1
Delay in diagnosing the problem				
Yes	9	38	0.20(0.08-0.50)	1
No	76	173	1.00	1

NOTE: \*p value is significant at  $p < 0.05$  1.00=Reference for category

## Discussion

The prevalence of MNM in our study area is 28.7% which is higher than the study done in developing countries ranging from 0.14–0.75 [22–24]. Also, this finding is higher than the finding in middle-income countries accounting from 1.5–7.7% [25–27]. This variation could be attributed because of socio-demographic variation, tools used to assess MNM and the presence of advanced technologies used to detect the occurrence of MNM early and intervene it.

A study done in Brazil indicated that the prevalence of MNM ranges up to 2.11% which is lower than the current findings and 3.2% in a university hospital of Syria [14, 26, 28]. This difference could be caused by the variation in socio-demographic characteristics and tools used to measure MNM.

The prevalence of MNM in Sub-Saharan African countries ranges from 2.21 to 12% which is lower than the current finding [18, 29–31]. Majority of our study participants are from rural area where transportation access is difficult. Therefore, those women from rural area reaches at health facility after developing near-miss. This could attributes the variation in prevalence of maternal near-miss. The study conducted in central Uganda revealed that the MNM is 27% which is consistent with the current finding. This similarity could be attributed because of similar socio-economic status of the countries.

The study done in Amhara regional state referral hospital identified that the prevalence of MNM as 23.3% which is in line with our current finding. This similarity might be because of the same socio-demographic characteristic and tools used to measure the current finding [11].

Those women age less than 20 years had almost 4 times more likely to develop MNM compared to their counterparts (AOR = 3.72; 95% CI: 2.68–7.11). This finding is contrary to the other study revealing that age above 35 years is a risk factor for MNM. This variation could be because in our study area there is a high prevalence of early marriage which can lead to high MNM [13, 15]. The odds of experiencing MNM is almost 3 times more likely to encounter women with age at first marriage is less than 20 years compared to their counterpart (AOR = 2.69; 95% CI: 1.32–5.48). This could be attributed because of the presence of early marriage that can result in an increased incidence of obstructed labor, cesarean section, pregnancy-induced hypertension, and others. This all can result in an increased incidence of MNM.

Women whose husband educated up to primary school are 1.26 times more likely to develop MNM compared to those husbands are educated up to diploma or above (AOR = 1.26; 95% CI: 1.08–2.92). This finding supports the study done by Mulugeta and others revealing that having an uneducated partner and having a low educational level are factors significantly associated with the occurrence of MNM [11].

## Conclusion

The overall prevalence of MNM in our study area is high. Age less than 20 years, age at first marriage less than 20 years, attending less than secondary school and being from rural areas are factors significantly associated with the prevalence of MNM. Ministry of health in collaboration with different stakeholders has to mitigate early marriage by educating the community on its impact on women later life.

## Declarations

### **Ethic approval and consent to participate**

Ethical clearance was secured from the ethical review board of Madda Walabu University. Then, an ethical clearance letter was submitted to the respective hospitals. After obtaining permission from respective hospitals, the purpose of the study was explained to study participants and informed verbal consent was secured from them. Also, to assure the privacy and confidentiality of the information, participants name or address wasn't be recorded.

## **Consent for publication**

Not applicable in this section

## **Availability of data and materials**

In the main paper all the available data and material used are presented and upon request data will be forwarded by corresponding authors.

## **Competing interests**

The authors declare that they have no competing interests.

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This survey was funded by Madda Walabu University but the funder has no role in designing, analysis, data interpretation and publication of the finding.

## **Authors' contributions**

AM, GF, KS, GG, SD, DA and AN designed the study and were involved in drafting, statistical analysis and correcting the manuscript. All the authors read the manuscript, critically revised it for important intellectual content and approved the final version of the manuscript.

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