Original Research Article

Determinant factors of maternal near miss in selected health facilities of Berak Woreda, Oromia national regional state, Ethiopia

Bilal Abdulrazaq[1], Mulusew Getahun[2]*, Ahmed Mohammed[3], Shemsu Kedir[4], Negash Nurahmed[4], Yemane Abrha[5], Awad Mohammed[4], Zerihun Kura[6]

[1]Department of Public Health, Ministry of Health, Addis Ababa, Ethiopia
[2]Department of Immunology, Ethiopian Public Health Institute, Addis Ababa, Ethiopia
[3]Department of Public Health, Ethiopian Public Health Institute, Addis Ababa, Ethiopia
[4]Department of Diagnostic and Public Health Microbiology, Ethiopia Public Health Institute, Addis Ababa, Ethiopia
[5]Department of Applied Genetics, Ethiopian Public Health Institute, Addis Ababa, Ethiopia
[6]Department of Public Health, Jimma university, Jimma, Ethiopia

*Correspondence:
Dr. Mulusew Getahun,
E-mail: mulusewgetahun@yahoo.com

ABSTRACT

Background: Maternal near miss is one of the related concepts to maternal mortality where women survive merely by chance, luck, or by good hospital care. The present study was aimed to fill the prevailing knowledge gap on maternal near miss ratio and events and identify factors associated with near miss in selected health facilities of berak woreda. To determine associated factors of maternal near miss in selected health facilities of Berak woreda, Oromia national regional state, Ethiopia.
Methods: Institutional based case control study was conducted in selected health facilities of barek woreda to asses determinant factors of maternal near miss among delivered women. Data of 1272 (344 cases and 928 controls) women were included in the analysis registered from 11 September 2014 to 30 March 2018. Cases were women due to severe acute maternal morbidity while controls were women for normal labor. Simple random sampling technique was used in the delivery unit. The data were collected using WHO standard tool. Data were entered using epi data version 3.1 and exported to SPSSV.20 for data analysis.
Results: Majority of cases were due to obstructed labor 270 (78.8%) followed by hemorrhage 33 (9.6%), preeclampsia 29 (8.14%), abortion 6 (1.74%), anemia 3 (0.87%), congenital heart disease 2 (0.58%) and gestational infection 1 (0.29%).
Conclusions: Independent variables residence, duration of labor, ANC utilization, past obstetrics complication and number of live births were statistically significant with the outcome variable near miss. Maternal health policy needs to be concerned preventing major cause of near miss.

Keywords: Maternal near miss, Complication, Outcome, Near miss events

INTRODUCTION

Today, approximately 830 women die daily from pregnancy or childbirth globally. Almost all of these deaths occur in low-resource settings and most could be prevented.[1] Among developing regions, sub-saharan Africa (SSA) has the highest maternal mortality ratio (MMR) at 640 per 100,000 live births.[1,2]

Recently, review of cases at the severe end of maternal morbidity spectrum, who nearly died during delivery, has been found to complement assessment of maternal health services.[3,4] These cases are variably called maternal near miss (MNM) or severe acute maternal morbidity (SAMM).[4,5] SAMM refers to a life-threatening disorder that can end up in near miss with or without residual morbidity or mortality. Severe maternal outcome (SMO) is the near-miss cases and maternal death.[6]

Great variation is seen in published articles in defining near-miss. One year prospective multi-center study defined near miss as an acute organ system dysfunction, which if not treated appropriately, could result in death.[7,8] Several studies have defined 'near-miss' as obstetric intensive care admissions or prolonged hospital stays and re-admissions or Serious maternal morbidity after childbirth: prolonged hospital stays and admissions.[8-11] It is also defined near-miss morbidity as ICU admission, emergency unplanned return to the operating room or delivery room for hemorrhage, eclampsia, emergent hysterectomy, cardiac arrest, cerebral anoxia, shock and embolism. MNM is one of the related concepts to maternal mortality where women survive merely by chance, luck, or by good hospital care.[12] According to World Health Organization (WHO), a near-miss event is a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy[13]. Maternal morbidity and near miss have two causes namely direct and indirect obstetrics causes. The direct causes are obstructed or prolonged labor, postpartum hemorrhage, infections, ruptured uterus, severe preeclampsia, eclampsia and unsafe abortion. Among the indirect causes of maternal morbidity and mortality anemia, malaria, hepatitis, tuberculosis and cardiovascular disease.[14] Hemorrhage, hypertensive disorders, sepsis and obstructed labor are the most important causes in the developing countries. Hemorrhage was the leading cause of maternal deaths in Africa (33.9%) and in Asia (30.8%) while in Latin America and the Caribbean, hypertensive disorders were responsible for 25% deaths. Anemia was reported as an important cause in 12.8% deaths in Asia, 3.7% in Africa and none in the developed countries.[15,16]

Studies in Ethiopia have also reported anemia as an important cause and contributor to maternal mortality and severe maternal morbidity.[17] However there is a lack of study on magnitude and cause of near miss in rural Ethiopia.

Generally developing countries have a high burden of maternal mortality and morbidity which may be attributed to improper management of obstetric emergencies at referring hospitals, poor referral practices, and poor access/utilization of health care services.[18] This study was aimed in generating data on maternal near miss ratio, and near miss events in selected health centers of berak woreda, to fill the prevailing knowledge gap in Ethiopia.

METHODS

Study design

Institutional based case control study design was conducted in selected heath facilities of berak woreda at Sandafa and Walego health center in a study period of 11 September 2014 to 30 March 2018.

Study population

Mothers who had a medical record of attending ANC or delivery or abortion or had post-natal care within 42 days of termination of pregnancy or who presented to the health centers with or without the conditions stated in the WHO criteria for near miss during the study period.

Inclusion criteria

Mothers who were in labor or had delivered or aborted or had post-natal care within 42 days of termination of pregnancy or who presented to the health centers with or without the conditions stated in the WHO criteria for near miss during the study period.

Exclusion criteria

Mothers who were in ANC follow up during the study period and incomplete record case notes were excluded from the study.

Sample size and sampling technique

Sample size was determined by single population proportional formula considering 95% confidence level in mothers who presented with or without complication during delivery and 42 days' post-partum. Using simple random sampling technique from a total of 4830 delivered mother 1272 records was selected in randomly selected health facilities of Welago and Sandafa from delivery registration logo book during study period.

Data collection and analysis procedures

Data relating to the most important variables were abstracted from the medical record of the participants using the WHO data abstraction tool, with some modifications.[13] Data collection tool was checked to include the necessary variables and data collection taken by two trained health officer based on their previous experience on data collection and supervision carrier.

Initially 5% pretesting of the total samples was done and modification made in the check list in accordance with the available information on the medical records.

Data processing and management

Data were entered using epi data version3.1 and exported to SPSS version 20 for analysis. Descriptive statistics

frequency, percentage, mean, and standard deviation with their respective measure of dispersion were calculated. Linear regression analysis was conducted to check multi collinearity by holding VIF (variance inflation factor) <5. To calculate crude odds ratio and adjusted odds ratio at 95% CI bivariate and multivariable analysis was done. Independent variables with level of significance P value< 0.25 and P value< 0.05 were considered statistically significant for multivariable analysis and multivariable analysis respectively.

Data quality management

The questionnaires were also first pre-tested in the participating health facilities to verify the appropriateness of the tool. The standardized WHO criteria were used to identify maternal near-miss cases. Trained data collectors in all participating health facilities were responsible for collecting complete data. The enumerators filled the date and signed in each questionnaire, which was later checked, edited and signed by the principal investigators regularly at each health facility. The data that were collected using hard copies were kept. Following this, the data were entered in to epi info software version 3.1.

Ethical approval

Acceptable ethical standards were strictly adhered to throughout the study process. The study was first approved by the institutional review board of the college of health sciences, Jimma university. Adequate explanation about the purpose of the study and a letter of support was given to all concerned bodies. In addition, letters of permission were obtained from berak woreda administrative health bureau.

RESULTS

A total of 4830 delivery was recorded from which 4789 were live birth, 41 still births and 8 maternal deaths in two selected health facilities with in the study period. According to the data, a total of 344 near-miss cases were found in registration book of 1272 medical records that were reviewed from selected health facility of Sandafa and Walego health center. One thousand two hundred seventy-two medical records reviewed 308 near miss cases and 36 near miss cases were obtained in Sandafa and Walego health center respectively.

Socio demographic status of near miss mothers

The mean age of the participants was 24.95 (SD=4.5) years. Nearly one third 135 (39.24%) of the mothers were in the age group of 20-24 years. Out of the total mothers 339 (20.4%) were married women while the remaining 5 (1.5%) were single. The majority of cases 207 (60.2%) reported from Urban and 137 (39.8%) were rural (Table 1).

Table 1: Socio demographic status of near miss mothers in selected health centers of berak woreda.

	Variables	Frequency (344)	Percentage (%)
Age of the mother	15-19	33	9.6
	20-24	135	39.24
	25-29	120	34.9
	30-34	39	11.34
	35-39	15	4.4
	≥40	2	0.6
Marriage	Married	339	98.5
	Single	5	1.5
Residence	Urban	207	60.2
	Rural	137	39.8

Obstetrics related factors of near miss mothers

Three hundred two (87.8%) near miss mothers had ANC follow up. Of these, the majority 256 (74.4%) had 2-4 visit and 25 (7.3%) had 5 times visit, and 21 (6.1%) were only 1 visit. While the remaining 42 (12.2%) near miss mothers have no follow up. Two hundred eighty-eight (83.72%) of respondents had labor. Of which, 113 (39.24%) mothers stayed less than or equal to 8 hours and 175 (60.76%) mothers stayed more than 8 hours. On the other hand, 56 (16.3%) mothers had no labor (Table 2).

Table 2: Obstetrics related factors of near miss mothers from September11, 2014-March 30, 2018 in selected health centers of berak woreda.

Variables	Categories	Frequency (344)	Percentage (%)
ANC	No	42	12.2
	Yes	302	87.8
Number of ANC	0	42	12.21
	1	21	6.1
	2-4	256	74.4
	≥5	25	7.3
Labor	Yes	288	83.72
	No	56	16.3
Labor duration	≤8 h	113	39.24
	>8 h	175	60.76

Reproductive health factors of near miss mothers

Of the total near miss mothers 249 (72.4%) were primigravida. Whereas, 95 (27.6%) were multigravida mothers. Women who had nulliparous account 260 (75.6%), primiparous 44 (12.8%) and multiparous 40 (11.6%). Two hundred sixty (75.6%) women had no live birth, 44 (12.8%) had one live birth and 40 (11.6%) had 2-4 live birth. In our study, mothers with no or single live births are more likely to develop near miss than their counterparts (Table 3).

Table 3: Reproductive health related factors of near miss mothers from September 1, 2014 to March 30, 2018 in selected health centers of berak woreda.

	Variables	Near miss (344)	Percentage (%)
Gravida	1	249	72.4
	2-4	91	26.4
	≥5	4	1.2
Parity	0	260	75.6
	1	44	12.8
	2-4	40	11.6
Number of live births	0	260	75.6
	1	44	12.8
	2-4	40	11.6

Past obstetrics history related factors related to near miss mothers

Of the total near miss mothers who had past obstetrics complication were 13 (3.8%) while 331 (96.2%) didn't had complication (Table 4).

Table 4: Past obstetrics history related factors of near miss mothers from September 01, 2014-March 30, 2018 in selected health centers of berak woreda.

	Variables	Near miss (344)	Percentage (%)
Past obstetrics complication	Yes	13	3.8
	No	331	96.2

Clinical factors related to near miss mothers

The mean gestational ages of the mothers were 36.6 weeks +3.02 (SD) (Table 5). Out of 344 near miss, 192 (55.81%) of cases were admitted in the gestational age of 37-42 weeks, 143 (41.6%) in 29-36 weeks and 9 (2.6%) were less than 28 weeks.

Table 5: Clinical factors related to near miss mothers from September 01, 2014-March 30, 2018 in selected health centers of berak woreda.

	Variables	Near miss (344)	Total N (%)
Gestational age (weeks)	<28	9	2.6
	29-36	143	41.6
	37-42	192	55.81

Magnitude and cause of near miss mothers

The overall prevalance of near miss cases in Sandafa and Walego health centers was 344 (27.04%) during the study period. According to, WHO approach disease specific criteria of near miss, obstructed or prolonged labor was the major cause which accounts 270 (78.5%), hemorrhage 33 (9.6%), preeclampsia-eclampsia 29

(8.43%), abortion 6 (1.74%), anemia 3 (0.87%), CHD 2 (0.58%) and infection 1 (0.29%) of near miss cases (Figure 1).
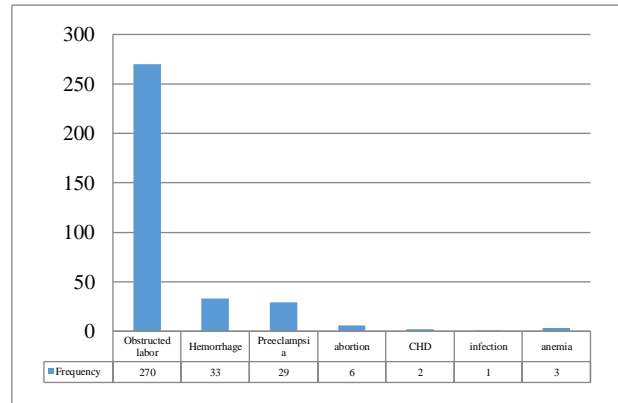

Figure 1: Bar chart showing the distribution of causes of near miss in selected health centers of berak woreda.

Outcome of pregnancy of near miss mothers

Out of total near miss cases, 19 (5%) had spontaneous vaginal delivery, 319 (93%) were referred to Addis Ababa for better care and complication management and 6 (2%) had abortion outcome.

Factors associated with near miss from

Linear regression analysis was conducted to check multi collinearity by considering VIF (variance inflation factor <5 a standard cut off point). Independent variables gravidity and parity were excluded from the bivariate and multivariable analysis due to multi collinearity because VIF was greater than 5. During bivariate analysis, independent variables with level of significance $p<0.25$ were considered as significant for multivariable analysis. Accordingly, independent variables residence, duration of labor, ANC visit utilization, past obstetrics complication and number of live births of the mother were statistically significant.
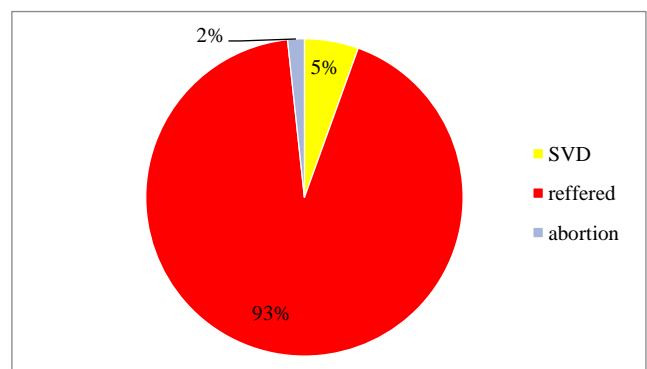

Figure 2: Pie chart showing the outcome of pregnancy of near mothers in selected health centers of berak woreda.

Table 6: Factors associated with near miss from September 11, 2014-March 30, 2018 in selected health centers of berak woreda.

	Variables	Near miss N (%)	Non near miss N (%)	COR	AOR
		N (%)	N (%)		
Age in years	15-19	33 (24.8)	100 (75.2)	1	1
	20-24	135 (28)	348 (72)	1.2 (0.75, 1.83)	-
	25-29	120(27)	325 (73)	1.12 (0.72, 1.75)	-
	30-34	39 (24.8)	118 (75.2)	1.1 (0.6, 1.71)	-
	35-39	15 (30)	35 (70)	1.1 (0.63, 2.67)	-
	≥40	2 (50)	4 (50)	3.03 (0.41, 22.4)	-
Marital status	Yes	339 (26.8)	925 (73.2)	4.5 (1.1, 19.13)	-
	No	5 (62.5)	4 (37.5)	1	-
Residence	Urban	207 (24.7)	631 (75.3)	1	1
	Rural	137 (31.6)	297 (68.4)	1.41 (1.1, 1.82)*	1.4 (1.04,1.85)**
ANC visit	Yes	42 (53.2)	37 (46.8)	1	1
	No	302 (25.3)	891 (74.7)	0.3 (0.2, 0.47)*	0.3 (0.18,0.5)**
Labor duration	≤8 hrs	169 (17.8)	783 (82.2)	1	1
	>8 hrs	175 (54.7)	145 (45.3)	5.6 (4.2, 7.4)*	5.03(3.7,6.9)**
Live birth	0	260 (35.3)	477 (64.7)	1	1
	1	44 (13.9)	273 (86.1)	0.3 (0.21, 0.42)*	0.54(0.37, 0.8)**
	2-4	40 (19.6)	164 (80.4)	0.45 (0.3, 0.6)*	0.87(0.5, 1.32)
Past obstetrics complication	No	331(26.6)	913 (73.4)	1	1
	Yes	13 (50)	13 (50)	2.8 (1.3, 6.1)*	3.45(1.51, 7.9)**

*Variables significant during bi variable analysis, **significant during multivariable analysis.

During multivariable analysis after controlling possible confounder's and considering independent variables with level of significance p<0.05 to be statistically significant, independent variables residence, duration of labor, ANC utilization, past obstetrics complication and number of live births were statistically significant with the outcome variable near miss.

Mothers from rural area were 1.4 times more likely to experience near miss than their counterparts (AOR, 1.4 at 95% CI= 1.04, 1.85). Mothers who had no ANC follow up were 0.3 times more likely to develop near miss

outcome than those who had ANC during pregnancy (AOR 0.3, at 95 % CI =0.18,0.5). Mothers with labor duration longer than 8 hours were 5 times more likely to experience near miss events than those with labor duration shorter than or equal to 8 hours (AOR 5.03 at 95% CI=3.7,6.9). Mothers who had past obstetrics complication were 3.4 times more likely to develop near miss outcome than their counter parts (AOR 3.45 at 95%CI=1.5, 7.9). Mothers with single live birth were 0.54 times more likely to experience near miss events than those with two or more live birth (AOR 0.54 at 95% CI=0.37,0.8).

DISCUSSION

Clear understanding of the prevalence and associated factors of maternal near misses is very useful for the planning of preventive measures and the development of policies. The present study revealed the overall prevalence of maternal near miss to be 344 (27.04%). The finding is in line with the prevalence of maternal near misses reported in different parts of Ethiopia, east gojjam, debre markos referral hospital 403 (29.7%) and Addis Ababa, tikur anbessa referral hospital (30.7%).[17,19] However, it is higher than the studies done in Bahirdar 23.3 % and in some other countries Uganda (10.61%), Nigeria (12%), Brazil (15.8%), Indonesia (17.3%), and Pakistan (4%).[20,22-26]

In our study near miss ratio was 72 near miss cases per 1000 live births. It is higher than previously done in Addis Ababa, Ethiopia 8.01 per 1000 live births.[19]

Surprisingly, our finding is considerably lower than the ratio of near miss obtained from debre markos referral hospital which was 385 cases per 1000 live births.[17] The difference could be explained by different health delivery strategies, socio-demographic characteristics of the populations and in case definitions. In the present study, maternal near miss was defined according to the WHO disease specific criteria.

The leading underlying cause of maternal near-miss in our study was obstructed labor, hemorrhage, sever preeclampsia. This finding is compatible with the study conducted in different studies conducted elsewhere in Africa.[17,27,28]

Pregnancy-related infection was the least mentioned cause of near-miss in our study and was also reported to be the least likely cause in most of the studies conducted in different parts of Ethiopia.[17,29,30] The rate was also

much lower as compared to some of the other African countries that had been studied.[31,32] The lower percentage of infection as a cause of maternal near-miss could be explained by the presence of early management of the cases with appropriate antibiotics at each health facility.

Anemia was found to be the major indirect obstetrics cause of near misses. This finding is in line with the study done in Ghana.[33] And also comparable with studies from some middle-income countries such as Iraq, India, and Pakistan.[34-36] The presence of anemia in women can be attributed to nutritional and iron deficiency during pregnancy. It could also result from the presence of previous malaria. Hence, there is a need to deeply assess the causes of anemia in women with a maternal near miss case to determine the most appropriate action.

The finding of the present study revealed that near miss events occurring 1.4 times more among rural women compared to their urban counterparts. This finding is in agreement with previous studies conducted in other areas of the country.[17,34] This might be due to the fact that urban women had better access to information, and to delivery services. On the other hand, far rural areas are mostly influenced by traditional practices.

Pregnant mothers who had no ANC follow up were 0.3 times more likely affected by maternal near misses than mothers who have ANC follow up. This is consistent with various studies conducted worldwide.[17,20,29] This is because ANC follow up helps to detect and manage complications earlier and provide the opportunity for mother's health education and information regarding the danger of signs of pregnancy and the advantage of skilled birth attendance.

Our findings revealed that 75% of near miss cases occurred among nulliparous mothers. This is contrary with the finding of the study conducted in which states that mothers with higher parity and gravidity were important predictors for the occurrence of maternal near miss events.[17,21,37] This might be partly explained by the fact that women who experienced prior peaceful labor at home delivery might believe that things go similarly every time in pregnancy and might decide to give birth at home.

The present study also showed that mothers with previous obstetrics complication to be 2.5 times more likely to experience near miss events compared with their counter parts. This finding is comparable in the following studies conducted.[17,37] Even though every pregnancy entails risk to all mothers, those mothers with known risks could have higher risk than those with no known risk factors.

Limitation of the study

One of the limitations of this study is weakness of retrospective method, the unavailability of complete records of variables such as ethnicity, religion, educational status and occupational status of the mothers on the medical records.

CONCLUSION

Present study used WHO disease specific criteria of near miss to identify the cause of near miss events. As a result, a high magnitude of maternal near miss at berak woreda health facilities is seen. Contributory causes of maternal near-miss should be dig out national wide to design evidence-based interventions to optimize management of life-threatening obstetric complications, pre-eclampsia eclampsia, obstetric hemorrhage, hemorrhage, abortion, gestational infection, anemia and CHD to reduce the occurrence of maternal near-miss problems occurring. The study also found mothers who are from rural area prone to experience near miss events relative to their counter parts. Therefore, health managers should strengthen their effort in management of cause and associated factors of near miss.

Recommendations

Community educations on the importance of antenatal care follow up and institutional delivery has to be strengthened in the region. Access to maternal health care services has to be increased. The national maternal policy maker should incorporate maternal near miss approach as an indicator of maternal health. Studies should be conducted related to magnitude and associated factors of near miss in different regions of Ethiopia as it helps in generating data and implementing intervention for promotion of maternal health at national level.

ACKNOWLEDGEMENTS

REFERENCES

1. World Health Organization. Maternal mortality fact sheet no. 348, 2015.
2. Who U. UNFPA, the World Bank, and the United nations population division. Trends in maternal mortality: 1990 to 2013. World Health Organization. 2014;201456.
3. Ronsmans C, Filippi V. Reviewing severe maternal morbidity: learning from survivors of life-threatening complications. Beyond the numbers: Reviewing maternal deaths and complications to make pregnancy safer complications. Geneva: World Health Organization. 2004.

4. Vandecruys HI, Pattinson RC, Macdonald AP, Mantel GD. Severe acute maternal morbidity and mortality in the Pretoria Academic Complex: changing patterns over 4 years. European J of Obstetrics, Gynecology and Reproductive Biology. 2002;102(1):6-10.

5. Pattinson RC, Hall M. Near misses: a useful adjunct to maternal death enquiries. British medical bulletin. 2003;67(1):231-43.

6. Chhabra P. Maternal near miss: an indicator for maternal health and maternal care. Indian J Comm Med. 2014;39(3):132.

7. Mantel GD, Buchmann E, Rees H, Pattinson RC. Severe acute maternal morbidity: a pilot study of a definition for a near-miss. BJOG: An Int J Obs Gynaec. 1998;105(9):985-90.

8. Okong P, Byamugisha J, Mirembe F, Byaruhanga R, Bergstrom S. Audit of severe maternal morbidity in Uganda-implications for quality of obstetric care. Acta obstetriciaet gynecologica scandinavica. 2006;85(7):797-804.

9. Waterstone M, Murphy JD, Bewley S, Wolfe C. Incidence and predictors of severe obstetric morbidity: case-control study commentary: Obstetric morbidity data and the need to evaluate thromboembolic disease. BMJ. 2001;322(7294):1089-94.

10. Requejo JH, Bryce J, Barros AJ, Berman P, Bhutta Z, Chopra M, et al. Countdown to 2015 and beyond: fulfilling the health agenda for women and children. The Lancet. 2015;385(9966):466-76.

11. Hebert PR, Reed G, Entman SS, Mitchel EF, Berg C, Griffin MR. Serious maternal morbidity after childbirth: prolonged hospital stays and readmissions. Obstetrics and Gynec. 1999;94(6):942-7.

12. Filippi V, Ronsmans C, Gohou V, Goufodji S, Lardi M, Sahel A, et al. Maternity wards or emergency obstetric rooms. Incidence of near-miss events in African hospitals. Acta obstetriciaet gynecologica Scandinavica. 2005;84(1):11-6.

13. World Health Organization. Evaluating the quality of care for severe pregnancy complications: the WHO near-miss approach for maternal health, 2011.

14. Ntirushwa D. A strategic framework for malaria prevention and control during pregnancy in the African region. Brazzaville: WHO Regional Office for Africa. 2004;4(1):1-38.

15. Khan KS, Wojdyla D, Say L, Gulmezoglu AM, Van PF. WHO analysis of causes of maternal death: a systematic review. The lancet. 2006;367(9516):1066-74.

16. Walraven G, Telfer M, Rowley J, Ronsmans C. Maternal mortality in rural Gambia: levels, causes and contributing factors. Bulletin of the World Health Organization. 2000;78:603-13.

17. Gedefaw M, Gebrehana H, Gizachew A, Taddess F. Assessment of maternal near miss at Debre Markos referral hospital, Northwest Ethiopia: five years' experience. Open J of Epidemiol. 2014;4(04):199.

18. Pandey A, Das V, Agarwal A, Agrawal S, Misra D, Jaiswal N. Evaluation of obstetric near miss and maternal deaths in a tertiary care hospital in north India: Shifting focus from mortality to morbidity. The J of obstetrics and gynecology of India. 2014;64(6):394-9.

19. Liyew EF, Yalew AW, Afework MF, Essen B. Incidence and causes of maternal near-miss in selected hospitals of Addis Ababa, Ethiopia. Plos one. 2017;12(6):0179013.

20. Dile MA, Seyum T. Proportion of maternal near misses and associated factors in referral hospitals of Amhara regional state, Northwest Ethiopia: institution based cross sectional study. Gynecol Obstet (Sunnyvale). 2015;5(308):2161-2.

21. Ayele B, Amenu D, Gurmessa A. Prevalence of Maternal Near Miss and Maternal Death in Atat Hospital, Ethiopia. J Womens Health, Issues Care 3. 2014;6:2.

22. Kaye D, Mirembe F, Aziga F, Namulema B. Maternal mortality and associated near-misses among emergency intrapartum obstetric referrals in Mulago Hospital, Kampala, Uganda. East African medical journal. 2003;80(3):144-9.

23. Adeoye IA, Onayade AA, Fatusi AO. Incidence, determinants and perinatal outcomes of near miss maternal morbidity in Ile-Ife Nigeria: a prospective case control study. BMC pregnancy and childbirth. 2013;13(1):93.

24. Amorim MM, Katz L, Avila MB, Araujo DE, Valença M, Albuquerque CJ, et al. Admission profile in an obstetrics intensive care unit in a maternity hospital of Brazil. Revista Brasileira de Saude Materno Infantil. 2006;6:55-62.

25. Adisasmita A, Deviany PE, Nandiaty F, Stanton C, Ronsmans C. Obstetric near miss and deaths in public and private hospitals in Indonesia. BMC Pregnancy and Childbirth. 2008;8(1):10.

26. Bibi S, Ghaffar S, Memon S, Memon S. Severe acute maternal morbidity (SAMM) in postpartum period requiring tertiary Hospital care. Iranian J of reproductive medi. 2012;10(2):87.

27. Berhan Y, Berhan A. Causes of maternal mortality in Ethiopia: a significant decline in abortion related death. Ethiopian J Health Sci. 2014;24:15-28.

28. Say L, Chou D, Gemmill A, Tunçalp O, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. The Lancet Global Health. 2014;2(6):323-33.

29. Chou D, Inoue M, Mathers C, Oestergaard M, Say L, Mills S, et al. Trends in maternal mortality: Estimates developed by WHO UNICEF UNFPA and The World Bank, 1990 to 2008.

30. Souza JP, Cecatti JG, Parpinelli MA, Serruya SJ, Amaral E. Appropriate criteria for identification of near-miss maternal morbidity in tertiary care facilities: a cross sectional study. BMC pregnancy and childbirth. 2007;7(1):20.

31. Adeoye IA, Onayade AA, Fatusi AO. Incidence, determinants and perinatal outcomes of near miss

maternal morbidity in Ile-Ife Nigeria: a prospective case control study. BMC pregnancy and childbirth. 2013;13(1):93.

32. Akker T, Rhenen J, Mwagomba B, Lommerse K, Vinkhumbo S, Roosmalen J. Reduction of severe acute maternal morbidity and maternal mortality in Thyolo District, Malawi: the impact of obstetric audit. PLOS one. 2011;6(6):20776.

33. Tunçalp O, Hindin MJ, Bonsaffoh K, Adanu RM. Assessment of maternal near-miss and quality of care in a hospital-based study in Accra, Ghana. Int J Gynecol Obstetr. 2013;123(1):58-63.

34. Jabir M, Salam AI, Suheil DM, Hilli AW, Hassan AS, Zuheiri A, et al. Maternal near miss and quality of maternal health care in Baghdad, Iraq. BMC Pregnancy and Childbirth. 2013;13(1):11.

35. Chhabra P, Guleria K, Saini NK, Anjur KT, Vaid NB. Pattern of severe maternal morbidity in a tertiary hospital of Delhi, India: a pilot study. Tropical doctor. 2008;38(4):201-4.

36. Mustafa R, Hashmi H. Near-miss obstetrical events and maternal deaths. J Coll Physicians Surg Pak. 2009;19(12):781-5.

37. Alemu FM, Fuchs MC, Vitale TM, Salih MA. Severe maternal morbidity (near-miss) and its correlates in the world's newest nation: South Sudan. Int J Women Health. 2019;11:177.