

## Original Article

# Criteria-based clinical audit of the management of four leading obstetric complications in two public hospitals in Hawassa city, Sidama, Ethiopia

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## Abstract

**Background:** Despite important progress that has been made in the last few years, the performance of quality care in reducing maternal morbidity and mortality is still substandard, especially in developing countries. This criteria-based clinical audit aimed to prospectively assess the management of life-threatening obstetric conditions in two public hospitals in Hawassa city, southern Ethiopia.

**Methods:** From January 2020 to March 2020 G.C., an institutional-based cross-sectional clinical audit study was conducted to evaluate the actual practices of management of four leading causes of obstetric morbidities in two public hospitals in Hawassa city using a standardized criteria-based clinical audit checklist.

**Results:** Out of 367 mothers studied, 73.3% (280) were in the age group of 28–37 years. The gestational age of most participants (76.3%) was between 28 – 37 weeks. One hundred eighty-six (49.6%) cases of obstetric hemorrhage, 112 (30.5%) cases of eclampsia, 35 (9.5%) cases of obstructed labor, and 15 (4.1%) cases of uterine rupture were admitted during the auditing period. According to the registrations, the standard care that the women received was 69.8% (74 out of 106) for eclampsia, 46.8% (87 out of 186) for hemorrhage, and 38.2% (13 out of 34) for obstructed labor.

**Conclusion:** In the majority of cases, it was discovered that the documentation of services provided to women with the main causes of obstetrical morbidities was subpar. The standard of care provided to the women was likewise inadequate. We urge healthcare facilities to have proper documentation and a regular clinical audit system. Furthermore, we advocate for enhancing the standard of care for obstetric complications in accordance

with the established criteria.

**Key words:** clinical audit, obstetric complications, obstetric hemorrhage, eclampsia, obstructed labor , uterine rupture, Ethiopia

## Introduction

Auditing health care services allows us to detect disparities between what is being done and what standard services should be in order to maximize patient care (1, 2). Institutional quality of health care services like obstetric care can be measured by several tools, of which clinical auditing is one (3-6).

Maternal death is the death of a mother while pregnant or within 42 days of post-pregnancy, regardless of the duration and the site of the pregnancy, from any causes associated with or intensified by the pregnancy or its management, but not from inadvertent or incidental causes (5-7). The etiologies of maternal morbidity and mortality can be either direct, where complications are directly related to the pregnancy or indirect, where complications are caused by a preexisting illness that may be exacerbated by pregnancy (6, 8-10). The clinical audit findings revealed that the majority of maternal morbidity and mortality are preventable if detected and treated early (5, 6, 11, 12).

Despite significant reductions in maternal mortality from 1990 to 2015, maternal death remained a major concern globally, and particularly in Sub-Saharan Africa. In 2015, there were 303,000 maternal deaths worldwide, with Sub-Saharan Africa and South East Asia accounting for 99% of these deaths (2,5,13). At that time, the highest average (546 per 100,000 live births) of maternal mortality ratio (MMR) occurred in sub-Saharan Africa and the lowest average (12 deaths per 100,000 LB) in developed regions of the world. Due to pregnancy-related issues, South Africa, for instance, is losing about 1600 mothers annually (2, 5, 6, 12-15).

A high maternal morbidity in a certain country could be regarded as an indicator of poor health care services (5, 6, 13, 15, 16). Global data show maternal morbidity audits and interventions are important tools to narrow the gaps related to maternal morbidity and health care services (1, 15). The proportion of maternal morbidity due to obstetric complications has been a top priority for the evaluation of the quality of obstetric care services (15, 16).

According to the 2016 Ethiopian Demographic Health Survey (EDHS), there were 412 maternal deaths per 100,000 live births in Ethiopia, and the findings of a national Maternal Death Surveillance and Response (MDSR) carried out in 2013, indicated the presence of 430 maternal deaths across the entire nation, with the majority being from Tigray region (2, 5, 17).

Despite the fact that Ethiopia's Federal Ministry of Health has done a commendable job in reducing maternal morbidity and mortality, the country still has the highest morbidity and mortality rates in the world (5, 17). To the best of our knowledge, there is a lack of evidence regarding the clinical audit of the management of life-threatening obstetric conditions in the selected area. The goal of this study was to use a criteria-based clinical audit to assess the documentation and management of life-threatening obstetric conditions in two public hospitals in Hawassa city, with subsequent interventions on identified problems.

## Methods and materials

### Study Design and Period

The clinical audit was an institution based cross-sectional study that was carried out among patients admitted with four obstetric

complications in two hospitals: Hawassa University Comprehensive Specialized Hospital and Adare General Hospital. The clinical audit was carried out over a two-month period from January 2020 to March 2020. All patients with specific obstetric complications within the study period, who satisfied the working definition of the top four causes of maternal morbidity and mortality from the hospital's documents participated in the study. The selected obstetric complications were postpartum hemorrhage, eclampsia, obstructed labor, and uterine rupture. The level of obstetric care at both specified hospitals during the study period has been evaluated.

### **Study area**

The study area was Hawassa City, which is located in the Sidama National Regional State on the shore of Lake Hawassa in the Great Rift Valley, 273 km South of Addis Ababa, Ethiopia's capital. Hawassa city is bounded by Lake Hawassa on the East, Oromia region on the West, Wondogenet woreda on the North, East, and Shebadeno on the South.

The area of the city administration, which is made up of 32 kebeles and eight sub cities, is 157.2 square meters (km<sup>2</sup>). The clinical audit was conducted at two of Hawassa's health facilities. The first one is Hawassa University Comprehensive Specialized Hospital, which was established 20 years ago by the South Regional Health Bureau. The hospital was intended to serve the 3.5–5 million total populations at the beginning and now serves the whole Sidama region, the South region, and part of the Oromia region. The second study facility was Adare General Hospital, which is one of the youngest government hospitals found in Hawassa city, providing both preventive and curative services since February 2011. The hospital provides health care services to self-referred patients, referred by other health centers, hospitals, and clinics in the region. In the 2017/18 fiscal year,

the hospital served 106,168 outpatients and 5,103 inpatients, respectively.

### **Population**

All women who were admitted to Hawassa University Comprehensive Specialized Hospital and Adare General Hospital for pregnancy related care and services were the source population. All mothers who were admitted with the diagnosis of obstetric complications during the study period constituted the study population. All mothers who were admitted with the diagnosis of the four-life threatening obstetric complications during the study period were the study units.

### **Inclusion and Exclusion Criteria**

All women in delivery and postnatal rooms, and gynecologic wards or outpatient clinics who had specific obstetric complications and fulfilled the working definitions assigned for each obstetric complication within the study periods were included. All mothers with incomplete data on the management of the top four life threatening obstetric conditions were excluded from the study.

### **Sample Size Determination**

A single proportion population formula was used, and the sample size was calculated using the following assumptions: Because the proportion of clinical audit for the leading four maternal obstetric complications was not yet known nationally,  $p$  was taken as 50%, and the margin of error 5%. For a 95% confidence level,  $z$  was taken to be 1.96, and adjustment for a finite population size was done (annual delivery rate at Adare General Hospital = 4,526 and at HUCSH=5,263 with a total of 9,789 deliveries annually). And a 10% non-response rate was added to the final sample size. Accordingly, the final sample size was 407.

## Sampling procedure

This clinical audit was an institution-based study that focused on quality-of-care services; hence, two health institutions with large client flows were included. The sample size of women receiving obstetric care services was distributed proportionally between these hospitals (201 from Hawassa University Comprehensive Specialized Hospital and 166 from Adare General Hospital). Then, consecutive mothers who visited the two hospitals during the study period and fulfilled the eligibility criteria were recruited for the study until the sample size requirement was met.

## Data collection instrument and procedures

A standardized checklist (which was prepared in English) was utilized to evaluate the clinical practice of the specified hospitals by reviewing the documents. This checklist was entirely quantitative and was applied similarly at both hospitals. It is divided into two sections: sociodemographic and obstetric, each with its own set of criteria.

In the meantime, the level of obstetric care was compared with a set of best practices (criteria) adopted from different literatures and localized by senior experts in the field. The criteria for each of these obstetric complications are intended to identify poor quality management of one or more of the four leading obstetric complications, as well as ways to close gaps and improve the quality of obstetric care in the designated hospitals. The set criteria were commented on by three senior obstetricians before being applied to evaluate the clinical practice. Data pertaining to the management of the four leading causes of maternal-fetal conditions were abstracted by thoroughly reviewing patient case notes and registers.

To assure the validity of the checklist, after it was reviewed by three senior obstetrician/gynecologists who have been actively working in the field, it was pre-tested on 19 patient cards at

Tula Hospital, another public hospital in the city. Furthermore, data collectors (Bsc Nurses and midwives) were trained on how to properly fill out the checklist before the actual training began, and they were closely supervised while collecting actual data. The daily activity was supervised by the principal investigator, and necessary amendments were made as deemed important.

## Operational definition and measurement of variables

*Preeclampsia/ eclampsia:* Preeclampsia is the onset of hypertension and proteinuria after 20 weeks of gestation in a previously normotensive woman, while eclampsia is a new occurrence of generalized tonic-clonic seizures or a change in preeclamptic women's mentation.

*Uterine rupture:* rupture of the uterus during labor confirmed by laparotomy.

*Obstructed labor:* is failure of descent of the fetus in the birth canal for mechanical reasons in spite of good uterine contractions.

*Postpartum hemorrhage (PPH):* excessive genital bleeding which required management within 42 days of the delivery of a baby who is 28 weeks or older.

To measure the standard of care, a maximum score of 2 and a minimum score of 0 was assigned for each morbidity. The scoring system was as follows: if everything was done according to standard and optimal care was provided, a score of 2 was assigned. A score of zero was assigned when only some of the set criteria were met or when none of the criteria were met and the quality of care was deemed to be poor, and when it was thought to have a high likelihood of an erroneous maternal health outcome. And a zero-score meant to be sub-standard quality of care. For completeness of documentation, whether each parameter for each morbidity was documented or not was recorded and the

proportion of complete documentation was computed.

### **Data Analysis**

The data were carefully entered into the computer and cleaned using SPSS version 23.0. Any logical and consistency error identified during data entry were corrected after revising the original completed checklist. The data were descriptively analyzed.

## **Results**

### **Socio-demographic and obstetric characteristics of study participants**

Out of the 407 mothers, 367(90.2%) mothers had complete records and were included in the study. Of the included 367 mothers, 280 (73.3%) were in the age group of 28–37 years. Of these, 153 (41.7%) and 129 (35.1%) of the participants were housewives and ran their own businesses, respectively. Sidama ethnicity accounts for more than sixty percent of the study participants. The gestational age of most (76.3%) of the participants was between 28 and 37 weeks, and their pregnancy stages were antepartum (54.8%) and intrapartum (27.5% (101), respectively. Most (88.6%) of the mothers have a pregnancy history of 1 to 4 (Table 1).

### **Obstetric complications and general cares provided to participants**

Vital signs were reported in 250 (68%) of the 367 women. The Rh factor status of 224 (61%) of the mothers was documented. Hepatitis B antigen testing, HIV testing, and syphilis testing were three additional routine laboratory tests performed for patients, accounting for 236 (64.3%), 274 (74.7%), and 192 (52.3%) of the total, respectively. When we examined the documentation of physical examination findings

made during labor follow-up, we found that the mother's membrane status was noted in 254 (69.2%) of the cases, while the presence of a fetal heartbeat and cervical dilation were noted in 261 (71.1%) and 287 (78.2%), respectively (Table 2).

### **Specific cares provided to participants**

The documentation for the performance of services provided to women with PPH was greater than 90% (Table 3).

Almost all components of preeclampsia and eclampsia were fully recorded, but monitoring the preeclamptic mother's respiratory rate, urine output, and tendon reflex while administering magnesium sulfate was documented in only 90.6% (Table 4).

We found that for each of the 12 cases of uterine rupture, all of the characteristics utilized to assess the documentation and management of uterine rupture were employed completely. In terms of managing and documenting obstructed labor, practically all variables were handled or recorded correctly (100%) in accordance with the protocols (Table 5).

### **Standard of obstetric cares**

In terms of the proportions of complications among mothers admitted, PPH has the highest percentage, followed by eclampsia, and uterine rupture has the lowest percentage, with absolute numbers of 12. The most common mode of delivery for mothers in health facilities is SVD (57.7%), followed by C-section (35.69%). Regarding the provision of standard care, 69.8% (74 out of 106) of eclampsia cases, 46.8% (87 out of 186) of hemorrhage cases, and 38.2% (13 out of 34) of obstructed labor cases received care as per the expected standard, according to the registrations at the institutions (Table 6).

Table 1: General information on maternal characteristics and outcomes at Hawassa University Comprehensive Specialized Hospital and Adare General Hospitals, April 2020

Variable	Categories	Frequency	Percent
Age(years)			
	28-37	280	76.3
	38-42	87	23.7
	Total	367	100.0
Occupation			
	House wife	153	41.7
	Governmental employee	85	23.2
	Own business	129	35.1
	Total	367	100.0
Ethnicity			
	Sidama	237	64.6
	Amhara	14	3.8
	Oromo	61	16.6
	Wolayita	41	11.2
	others	14	3.8
	Total	367	100.0
Gestational age in week			
	28-37	280	76.3
	38-42	87	23.7
	Total	367	100.0
Pregnancy phase			
	Antepartum	201	54.8
	Intra-Partum	101	27.5
	Post-Partum	65	17.7
	Total	367	100.0
Source of referral of the mothers			
	Self	214	58.3
	Private health institution	26	7.1
	Health center	127	34.6
	Total	367	100.0
number of live births			
	No child	143	39.0
	1-6	224	61.0
	Total	367	100.0
number of pregnancies			
	1-4	325	88.6
	>=5	42	11.4
	Total	367	100.0

Table 2: Documentation of standard criteria for management of obstetric complication at Hawassa University Comprehensive Specialized Hospital and Adare General Hospitals, April 2020.

	Variables	Categories	Frequency	Percent
General conditions and clinical Examinations on admission	Blood pressure recorded	Not documented	4	1.1
		Documented	363	98.9
		Total	367	100.0
	Pulse of the mother	Not documented	19	5.2
		Documented	348	94.8
		Total	367	100.0
	Respiratory rate	Not documented	21	5.7
		Documented	346	94.3
		Total	367	100.0
	Temperature of the mother	Not documented	73	19.9
		Documented	294	80.1
		Total	367	100.0
	Number of ANC visit included in history	Not completed	29	7.9
		Completed	338	92.1
		Total	367	100.0
	Documentations of clinical status of the mother at arrival	Not completed	9	2.5
		Completed	358	97.5
		Total	367	100.0
	Time the mother arrived	Not completed	6	1.6
		Completed	361	98.4
		Total	367	100.0
	Uterine size of the mother	Not documented	76	20.7
		Documented	291	79.3
Total		367	100.0	
Fetal presentation	Not documented	71	19.3	
	Documented	296	80.7	
	Total	367	100.0	
Documentation of membrane status	Not documented	113	30.8	
	Documented	254	69.2	
	Total	367	100.0	
Fetal heart beat	Not documented	80	21.8	
	Documented	287	78.2	
	Total	367	100.0	
Cervical dilatation	Not documented	106	28.9	
	Documented	261	71.1	
	Total	367	100.0	
Drug administration	Drug chart available	Not documented	100	27.2
		Documented	267	72.8
		Total	367	100.0
	Completeness of the chart	Not documented	159	43.3
		Documented	208	56.7
		Total	367	100.0
	Signature of health care providers	Not documented	173	47.1
Documented		194	52.9	
Total		367	100.0	

Table 2 continued.

Variables	Categories	Frequency	Percent	
Laboratory analysis	Blood type	Not documented	38	10.4
		Documented	329	89.6
		Total	367	100.0
	Hepatitis B antigen test done	Not documented	131	35.7
		Documented	236	64.3
		Total	367	100.0
	RH factors	Not documented	143	39.0
		Documented	224	61.0
		Total	367	100.0
	HIV test	Not documented	93	25.3
		Documented	274	74.7
		Total	367	100.0
	Syphilis test	Not documented	175	47.7
		Documented	192	52.3
		Total	367	100.0
Monitoring during child birth	Time of placenta expulsion	Not documented	73	21.5
		Documented	266	78.5
		Total	339	100.0
	Time of oxytocin given	Not documented	129	35.1
		Documented	238	64.9
		Total	367	100.0

Table 3: Criteria of PPH management that were being performed at Hawassa University Comprehensive Specialized Hospital and Adare General Hospitals, April 2020.

Variable	Categories	Frequency	Percent	
Iv line	Documented	186	100.0	
	Not documented	0	0	
	Total	186	100.0	
Patient hemoglobin/hematocrit determined	Documented	186	100.0	
	Not documented	0	0	
	Total	186	100.0	
Cross matching and typing should be performed	Not documented	4	2.2	
	Documented	182	97.8	
	Total	186	100.0	
Coagulation time documented	Not document	10	5.4	
	Documented	176	94.6	
	Total	186	100.0	
Crystalloid infused until cross matched blood available	Not documented	1	.5	
	Documented	185	99.5	
	Total	186	100.0	
Vital sign monitoring every 15 minute for 2 hours	Not documented	1	0.5	
	Documented	185	99.5	
	Total	186	100.0	



Table 3 continued.

Variable	Categories	Frequency	Percent
Urine output measured hourly	Not documented	3	1.6
	Documented	183	98.4
	Total	186	100.0
20 IU oxytocin should run at 60 drops per minute to treat PPH	Not documented	4	2.2
	Documented	182	97.8
	Total	186	100.0
Genital tract exploration should be monitored to cease PPH	Not documented	27	14.5
	Documented	159	85.5
	Total	186	100.0
Vaginal examination should not be done unless placenta Previa has been excluded	Not documented	2	1.1
	Documented	184	98.9
	Total	186	100.0
Women with APH, decision on the time and types of delivery depends on diagnosis	No documented	14	7.5
	Documented	172	92.5
	Total	186	100.0
Type of APH, severity and period of gestation	Not documented	7	3.8
	Documented	179	96.2
	Total	186	100.0
Women uterus should be massaged	Not documented	4	2.2
	Documented	182	97.8
	Total	186	100.0
Bladder should be emptied	Not documented	3	1.6
	Documented	183	98.4
	Total	186	100.0
If Placenta is not delivered, try to deliver by Controlled Cord Traction	Not documented	12	6.5
	Documented	174	93.5
	Total	186	100.0

Table 4: Criteria for the management of preeclampsia/eclampsia that were being done at Hawassa University Comprehensive Specialized Hospital and Adare General Hospitals, April 2020

Variables	Categories	Frequency	Percent
Anti-hypertensive treatment given to patient with severe hypertension	Documented	106	100
	Total	106	100
Treatment with magnesium sulphate	Not documented	4	3.8
	Documented	102	96.2
	Total	106	100
Respiratory, urine output and tendon reflex are monitored when magnesium sulphate is given	Not documented	10	9.4
	Documented	96	90.6
	Total	106	100
Antepartum/intrapartum fluid balance checked	Not documented	2	1.9
	Documented	104	98.
	Total	106	100
Hemoglobin and renal investigation done at least once	Not documented	9	8.5
	Documented	97	91.5
	Total	106	100

Table 4 continued.

Variables	Categories	Frequency	Percent
Delivery achieved within 12 hours of the first convulsion	Not documented	7	6.6
	Documented	99	93.4
	Total	106	100
BP and urine output monitoring continued for at least 48 hrs	Not documented	3	2.8
	Documented	103	97.2
	Total	106	100
Fetal heart rate and vital signs are taken and recorded at least hourly	Documented	106	100
	Total	106	100

Table 5: Criteria for the management of Obstructed Labor that were being done at Hawassa University Comprehensive Specialized Hospital and Adare General Hospitals, April 2020

Variables	Categories	Frequency	Percent
Prompt delivery within 2 hours of diagnosis	Completed	34	100.0
	Total	34	100.0
Bladder drained	Not documented	4	11.8
	Completed	30	88.2
	Total	34	100.0
Observational chart filled every 15-30 minute	No documented	1	2.9
	Completed	33	97.1
	Total	34	100.0
IV and hydration should be achieved	No	1	2.9
	Completed	33	97.1
	Total	34	100.0
Cross matching and typing done	No	1	2.9
	Completed	33	97.1
	Total	34	100.0
Reason for route of delivery recorded to fetus and patient condition	Completed	34	100.0
	Total	34	100.0
Observation chart	Completed	34	100.0
	Total	34	100.0
Exploration and evacuation	Completed	34	100.0
	Total	34	100.0

## Discussion

This clinical audit was based on internationally developed criteria of best practice to assess the quality of emergency obstetric care through a regular clinical death audit (6, 18). The audit result showed shortages in the documentation and management of obstetric hemorrhage,

preeclampsia/eclampsia, and obstructed labor as compared to the standards, regardless of the availability of guidelines and protocols when compared against the recommended care and clinical practice.

Overall, according to our findings, the documentation of the clinical care given to the women, including the vital signs of the patients,

was not complete. Without appropriate medical records, it is difficult to intervene on the identified gaps in the audit findings. Besides, inadequate record-keeping can be life-threatening in some cases. And hence, it is critical for the patient's well-being to record the patient's vital signs at specific times, as well as what medications were given and operations were performed. Failing to document clinical events in the patient's record might also result in

Table 6: The care that the women have received as per the standard at Hawassa University Comprehensive Specialized Hospital and Adare General Hospitals, April 2020.

Obstetric cases	Standard of care	Number (%)
PPH	Standard	87(46.8%)
	Not standard	99(53.2%)
	total	186(100%)
Eclampsia	Standard	74(69.8%)
	Not standard	32(30.2%)
	Total	106(100%)
Obstructed Labor	Standard	13(38.2%)
	Not standard	21(61.8%)
	Total	34(100%)
Uterine rupture	Standard	6(100%)
	Total	6(100%)

missed treatment and outcome improvements. Because of the lack of records, problems may go unrecognized. Thus, audits to improve patient information are mandatory. However, the documentation for the performance of services provided to women with PPH was greater than 90%. This might be due to the fact that in PPH there might be visible bleeding, and the laboring mother will even complain, so the health care provider will give it more emphasis. Lack of documentation could be due to a lack of staff commitment, increased patient flow and workload, and poor clinical audit and feedback at the institutions. All of these could be manageable if regular clinical audit and timely interventions are implemented(18-23).

In our study, PPH (49.6%) was the leading cause of obstetric admission, followed by eclampsia (30.5%), with uterine rupture (4.1%) accounting for the smallest percentage. This contradicts the earlier studies that had been done in Ghana, Malawi, and Ethiopia (2, 5, 24), where complications arising from obstructed were the major causes. This could be attributed to advancements in the early detection of obstructed labor and early intervention on the route of delivery. In fact, the findings in this clinical audit have been backed by the findings from Nigeria and Thailand, in which cases, complications from obstetric hemorrhage were the leading cause of admission. (18, 25, 26).

According to the registrations, the standard care that the women received was 69.8% for eclampsia, 46.8% for hemorrhage, and 38.2% for obstructed labor in the present clinical audit. In the study that has been conducted in Nigeria, the standard care that the women received in baseline assessment were; obstructed labor (81.7%), hemorrhage (61%), and eclampsia (54.3%). In this clinical audit, there was dissimilarity in the care that was given to the women, which might be due to the health care provider's responsiveness, considering some standards as simple and giving less attention to those that would have a significant effect on care. The encouraging aspect of clinical audits is that substandard care has been improved universally after the initial feedback on the finding, with full staff commitments as justified by studies conducted in the United Kingdom, the Netherlands, and other countries (18-23). And we call for this study to be followed by timely intervention.

## Conclusion

In the majority of cases, it was discovered that the documentation of services provided to women with the main causes of obstetrical morbidities was subpar. The standard of care provided to the women was likewise inadequate.

We urge healthcare facilities to have proper documentation and a regular clinical audit system. Furthermore, we advocate for enhancing the standard of care for obstetric complications in accordance with the established criteria.

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## Ethical considerations

This clinical audit was conducted with the permission of Hawassa University Comprehensive Specialty Hospital. Ethical clearance was obtained from the Institutional Review Board at the College of Medicine and Health Sciences, Hawassa University.

## Data Availability

The datasets used the current study are available upon reasonable request from the corresponding author.

## Conflict of interest

The authors declared no conflicts of interest exist.

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## References

1. Carine R WJ. Maternal Survival 1. Maternal mortality: who, when, where, and why. The Lancet Maternal Survival Series steering group. 2006;368:1189–200.
2. Leontine A DC, Daniel H, Sanqian Z, Ann-Beth M, Alison et.al. on behalf of the United Nations Maternal Mortality Estimation Inter-Agency Group collaborators and technical advisory group. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. Lancet. 2015;6736(15):838-7.
3. Graham W, Wagaarachchi P, Penney G, McCaw-Binns A, Antwi KY, Hall MH. Criteria for clinical audit of the quality of hospital-based obstetric care in developing countries. Bull World Health Organ. 2000;78(5):614-20.
4. Hunyinbo K, Fawole A, Sotiloye O, Otolorin E. Evaluation of criteria-based clinical audit in improving quality of obstetric care in a developing country hospital. African journal of reproductive health. 2008;12(3).
5. Tessema GA, Laurence CO, Melaku YA, Misganaw A, Woldie SA, Hiruye A, et al. Trends and causes of maternal mortality in Ethiopia during 1990–2013: findings from the Global Burden of Diseases study 2013. BMC public health. 2017;17(1):1-8.
6. Pirkle CM, Dumont A, Zunzunegui M-V. Criterion-based clinical audit to assess quality of obstetrical care in low-and middle-income countries: a systematic review. International Journal for Quality in Health Care. 2011;23(4):456-63.
7. Ozimek JA, Kilpatrick SJ. Maternal mortality in the twenty-first century. Obstetrics and Gynecology Clinics. 2018;45(2):175-86.
8. World Health Organization (WHO). Health statistics and health information systems.

- Maternal mortality ratio (per 100,000 live births). WHO; 2014. [www.who.int/healthinfo/statistics/indmaternalmortality/en/](http://www.who.int/healthinfo/statistics/indmaternalmortality/en/)
9. Tessema, G.A., Laurence, C.O., Melaku, Y.A. et al. Trends and causes of maternal mortality in Ethiopia during 1990–2013: findings from the Global Burden of Diseases study 2013. *BMC Public Health*. 2017; 17: 160.
  10. Hurt L, Ronsmans C. Time since pregnancy and mortality in women of reproductive age in Matlab, Bangladesh. *British Society for Population Studies*. 2002.
  11. Hurt L, Ronsmans C. Time since pregnancy and mortality in women of reproductive age in Matlab, Bangladesh. Paper presented at the British Society for Population Studies. 2002.
  12. Stacie EG AR, Caitlin EG, E. Jane M, Francesca S, Beverley L. . A global view of severe maternal morbidity: moving beyond maternal mortality. *Geller et al Reproductive Health* 2018;15(1).
  13. DerSarkissian M, Thompson CA, Arah OA. Time series analysis of maternal mortality in Africa from 1990 to 2005. *J Epidemiol Community Health*. 2013;67(12):992-8.
  14. Organization WH. Trends in maternal mortality: 1990 to 2015: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. Geneva: 2015.
  15. Hunyinbo K FA, Sotiloye O, Otolorin E. . Evaluation of Criteria-Based Clinical Audit in Improving Quality of Obstetric Care in a Developing Country Hospital. *African Journal of Reproductive Health*. 2008;12(3).
  16. Geller SE, Koch AR, Garland CE, MacDonald EJ, Storey F, Lawton B. A global view of severe maternal morbidity: moving beyond maternal mortality. *Reproductive health*. 2018;15(1):31-43.
  17. Alene M, Yismaw L, Berelie Y, Kassie B. Health care utilization for common childhood illnesses in rural parts of Ethiopia: evidence from the 2016 Ethiopian demographic and health survey. *BMC Public Health*. 2019;19(1):1-12.
  18. Catherine MP AD, Maria-Victoria Z. . Criterion-based clinical audit to assess quality of obstetrical care in low- and middle-income countries: a systematic review. *International Journal for Quality in Health Care*., 2011;23(4):456-63.
  19. Knight M BK, Tuffnell D, et al. . On Behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care - Lessons Learned to Inform Maternity Care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2014-16. Oxford: National Perinatal Epidemiology Unit, University of Oxford. Available from: <https://www.npeu.ox.ac.uk/downloads/files/mbrrace-uk/reports/MBRRACE-UK%20Maternal%20Report%202018%20-%20Web%20Version.pdf>. Accessed December, 2020.
  20. Schutte JM SE, Schuitemaker NW, et al. Rise in maternal mortality in the Netherlands. *BJOG*. 2010;117:399–406.
  21. World Health Organization. International statistical classification of diseases and related health problems 10<sup>th</sup>. Available: [http://www.who.int/classifications/icd/ICD10Volume2\\_en\\_2010.pdf?ua=1](http://www.who.int/classifications/icd/ICD10Volume2_en_2010.pdf?ua=1). Accessed 27 December 2022.
  22. Hasan SM SL, Nathanael H, Atul AG, Angela L, Priya A , Jonathan S. Audit identified avoidable factors in maternal and perinatal deaths in low resource settings: a systematic review. *BMC Pregnancy and Childbirth*. 2014.
  23. Every Death Counts. Saving the lives of mothers naciSAwdgzdrsp. Saving the lives of mothers, newborns and children in South Africa. [www.doh.gov.za/doc/reports/savings/pdf](http://www.doh.gov.za/doc/reports/savings/pdf).
  24. Rulisa S, Umuziranenge I, Small M, van Roosmalen J. Maternal near miss and mortality

in a tertiary care hospital in Rwanda. *BMC pregnancy and childbirth*. 2015;15(1):1-7.

25. Pattarawalai T T. Clinical Audit of Postpartum Hemorrhage at District-Level and Referral-Level Hospitals in Southern Thailand. *Thai. J Med Assoc* 2012; 95(10).

26. Talungchit P, Liabsuetrakul T. Clinical audit of postpartum hemorrhage at district-level and referral-level hospitals in southern Thailand. *Journal of the Medical Association of Thailand*. 2012; 95(10):1244.