

Using Criteria-Based Audit to Improve the Management of Postpartum Haemorrhage in Resource Limited Countries: A Case Study of Malawi

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Abstract *Objective* The goal of this study was to assess and improve the management of postpartum haemorrhage (PPH) in maternity units in Malawi. The main objective was to determine whether criteria-based audit can improve adherence to standards for the management of PPH. *Methods* We used a before-and-after design and univariate statistics for data analysis. A retrospective review of 40 consecutive cases of PPH was conducted in eight hospitals and the results compared with standards for PPH, established based on World Health Organisation manuals. Results of the audit were presented to healthcare providers who made and implemented recommendations for improvement. A re-audit (45 cases) was conducted 3 months later. *Results* There was a significant improvement in adherence to three standards: typing and cross-match carried out (65.0% vs. 84.4%; $P = 0.034$), patient's hematocrit or haemoglobin established (67.5% vs. 86.7%; $P = 0.029$), and fluid intake/output chart maintained (0.0% vs 33.3%; $P < 0.001$). There was no significant change in close monitoring of vital signs (32.5% vs. 53.3%, $P = 0.065$) and case fatality rate (10.0% vs. 6.7%, $P = 0.702$), intravenous access achieved and intravenous fluids administered (100.0% vs. 97.8%; $P = 0.735$), and oxytocic drugs administered (100.0% vs. 95.6%; $P = 0.357$). *Conclusion* Introduction of criteria-based audit can improve the management of postpartum

haemorrhage in countries with limited resources. Future studies should consider using larger sample size to evaluate the effect of criteria-based audit on mortality.

Keywords Standards · Postpartum haemorrhage · Criteria-based audit · Obstetric emergency complication · Malawi

The World Health Organisation (WHO) defines postpartum haemorrhage (PPH) as vaginal bleeding in excess of 500 ml after childbirth [1]. Globally, PPH occurs in 10.5% of live births [2]. It is a leading cause of maternal mortality worldwide (25%) and a major contributor of maternal deaths in Africa (33.9%) [3, 4].

Factors associated with PPH include increasing maternal age, primiparity, foetal macrosomia, multiple pregnancies, fibroids, antepartum haemorrhage, history of PPH, previous Caesarean section, prolonged labour, and episiotomy [5, 6]. However, none of these factors has an adequate positive predictive value for a good screening tool.

Experts recommend that all women should benefit from active management of the third stage of labour, the main intervention known to prevent PPH [1]. Active management of the third stage of labour reduces the incidence of PPH by one third. However, a proportion of women will proceed to develop PPH despite this active management [7]. All skilled birth attendants must at least be competent in early recognition and initial management of PPH.

In Malawi, 43% of women give birth outside health facilities [8], implying that these women do not have access to timely and quality emergency obstetric care. Therefore in health facilities, birth attendants should take extra care and respond rapidly to any signs of moderate to

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excessive bleeding especially as the prevalence of anaemia in pregnancy is high [9].

A confidential enquiry into institutional maternal death in Malawi revealed that obstetric haemorrhage is the cause of 26.7% of maternal deaths that occur within 24 h of admission and identified poor quality of care as a major contributing factor [10]. This enquiry recommended the use of criteria-based audit to improve the quality of emergency obstetric care in Malawi. An assessment of three districts in Central Malawi found sub-optimal quality of care was prevalent in health facilities [11]. Examples of sub-standard care with respect to PPH include lack of close monitoring and slow administration of intravenous fluid. Safe Motherhood Protocols for Emergency Obstetric Complications (including PPH) developed by the Malawi Ministry of Health are found in some health facilities and are used by healthcare providers.

Criteria-based audit has just recently been introduced in developing countries [11–13]. Earlier studies assessed the feasibility of criteria-based audit in maternity units in Uganda [11], and Ghana and Jamaica [12, 13]. Criteria-based audit was found to improve the management of PPH [13].

We sought to assess and improve the management of postpartum haemorrhage in Malawi by introducing criteria-based audit in hospitals in three districts. Specifically, our main objective was to determine whether criteria-based audit could improve adherence to standards for the management of postpartum haemorrhage.

Methods

Study Setting

We conducted the criteria-based audit as part of an international collaborative programme to improve quality of maternity care and reduce maternal mortality and morbidity in the three districts (Lilongwe, Kasungu and Salima) in the Central Region of Malawi. The population of the three districts is estimated at 2,812,183 and there are about 127,000 deliveries per year of which only 40% take place in the health facilities [14]. All the eight hospitals that provide Comprehensive Emergency Obstetric Care in the three districts were included in the study (four mission hospitals, two district hospitals, one government community hospital and one tertiary referral hospital). Maternity care (services, drugs and supplies) is free in all government health facilities in Malawi, but private and mission facilities charge user fees which limit access to their services. However there is hidden cost in Government facilities such as transport from home to health facilities. These eight hospitals receive obstetric emergencies from 60 health

centres and numerous traditional birth attendants. Each hospital has at least one ambulance, but each ambulance serves several health centres implying that it is almost impossible to handle several emergencies simultaneously especially as each ambulance serves many health centres and all types of emergencies (not just Emergency Obstetric Complications [11]). Each health centre has a shortwave radio that links the health centre to a hospital, but only about half of the radios are actually functioning. Other challenges include insufficient staff, shortages of medication and supplies, and poor quality of maternity care.

Study Design

We used a before-and-after design to improve the quality of the management of PPH. An initial audit (“before”) was carried out to measure the current practice. Current practice was compared with standards for PPH and recommendations made and implemented. A re-audit (“after”) was carried out to assess improvements in the management of PPH.

Clinical Audit Cycle

The classic steps of a clinical audit cycle were followed in this study (Fig. 1) [15]. The first audit was conducted in May and June 2007 (2 month period) and the second audit in October and November 2007 (2 month period). All cases of PPH recorded in the participating hospitals during the study periods were included in the study. In-between the two audits, we allowed a period of 3 months to implement the changes.

Step 1: Establishment of Standards for Postpartum Haemorrhage

We used evidence from existing guidelines, namely Malawi national guidelines and WHO manuals [16, 17].

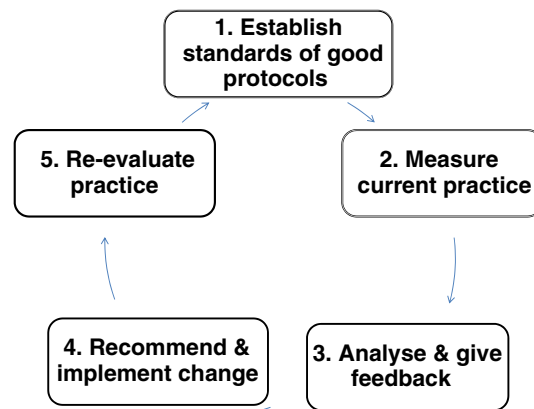


Fig. 1 Clinical audit cycle

Where necessary this was supplemented by evidence from the Cochrane database, standard textbooks and articles from peer-reviewed journals. A multidisciplinary team (including maternal health experts and policy makers) established local standards for postpartum haemorrhage, during a workshop that brought participants from the three districts. At the end of this 2 day workshop, the participants agreed on 10 objectives and developed the structure, process and outcome criteria for each objective. The initial list of 205 criteria was reduced to a shorter list of 6 criteria by identifying the most important criteria for the management of PPH. The “most important criteria” in this case referred to criteria which the participants believed there would be poor adherence at baseline. The criteria were arrived at based on a simple consensus. The drop from 205 to 6 criteria is explained by the fact that criteria on early recognition of PPH by patients/families and criteria on the diagnosis of PPH in the hospitals were not included in the list of 6 criteria. Postpartum haemorrhage was defined as bleeding from genital tract within 24 h of delivery with gestational age ≥ 24 weeks with at least one of the following: perceived blood loss of more than 500 ml and signs of shock (pulse >110 mmHg and systolic blood pressure <90 mmHg). Six criteria were agreed for the management of PPH in the three districts in Malawi.

Step 2: Measurement of Current Practice

Current practice was measured by a retrospective review of case notes. A multidisciplinary quality improvement team (made up of nurses, midwives, laboratory technicians, clinical officers, and doctors) was established in each hospital. The teams reviewed the cases of PPH in May and June 2007 and extracted the data into a data collection sheet. Data were extracted from case files into a data collection specifically designed for that purpose. The data sheet has two sections, namely patients’ characteristics and the six criteria for the management of PPH (see Step 1). Forty cases of PPH were reviewed in the eight hospitals. The data sheet was piloted on 12 patients in Kamuzu Central Hospital before use.

Step 3: Analysis of Findings and Feedback

The percentage of attainment of each standard was calculated and the results presented during a quality improvement workshop that brought together representatives from the eight hospitals. The percentage of attainment of each standard was defined as the number of cases of PPH in which the standard was attained expressed as a percentage of all cases of PPH. The method of feedback was dissemination of printed materials to clinicians and presentation of results during educational meetings.

Step 4: Recommendation and Implementation of Change

The gaps between current level of care and agreed standards were identified and discussed during the quality improvement workshop (see step 3). Most recommendations made were common to all hospitals, although a few recommendations were specific to some hospitals. When the participants returned to their hospitals, they briefed the rest of the staff and management about the gaps identified and the recommendations made during the workshop. The staff and management then worked jointly to implement the recommendations. The recommendations made and implemented by the healthcare providers in the three districts are presented in Table 1.

Step 5: A Re-Audit of Standards to Assess Progress

Three months later after the first audit, a second audit was performed to assess the progress made. Forty-five case notes were reviewed during this second audit.

Statistical Analyses

It was estimated that a minimum sample size of 37 was required for a power of 80% to detect a 30% increase (that is from 25% to 55%) in standard attainment between the first and second audits with 95% confidence interval. The 25% baseline value was obtained when a pilot assessment showed that 25% (3/12) of women with PPH were properly managed according to standards in the Kamuzu Central Hospital in Lilongwe.

Statistical analyses were performed with the SPSS version 15.0 for Windows. Data were pooled from the eight hospitals included in this study. Univariate analysis was used to compare standards attainment in the initial audit and the re-audit. The baseline characteristics of patients in the initial audit and the re-audit were similar. Categorical variables were compared by Chi-square test (or Fischer’s exact test if a cell had an expected frequency <5) and continuous variables were compared using Student’s *t*-test (or Mann–Whitney *U* test if the distribution was skewed). All significance tests were two-tailed.

This study was conducted after receiving permission from the Malawi Ethical Committee and Ministry of Health.

Results

Criteria for the Management of Postpartum Haemorrhage

Six criteria for the management of PPH in the three districts (Kasungu, Salima and Lilongwe) were agreed by

Table 1 Recommendations made and implemented after the initial audit*Recommendations made and implemented*

1. When setting up an intravenous line in patients with postpartum haemorrhage (PPH), blood should be collected for haemoglobin or hematocrit measurement
2. Typing and cross-match should be done routinely in all patients with PPH
3. Sufficient blood should be made available in blood banks in all hospitals. Hospitals took the commitment to predict properly and order blood in a timely manner from the Malawi Blood Transfusion Service, which collects bloods centrally, store and distribute to hospitals across the country
4. Oxytocic drugs should be administered routinely (or repeated if it has been given before) in all patients with PPH
5. A fluid intake/output chart is maintained in all patients with PPH
6. Workshops to improve the technical skills and foster positive behaviours of staff with respect to data recording in maternity registers and completeness of case notes
7. Strengthen the referral system by repairing non-functioning shortwave radios in health facilities across the districts
8. Maternity staff be trained in life saving skills—emergency obstetric care, especially on the diagnosis and management of hypovolemic shock
9. Standards for the management of postpartum haemorrhage should be displayed permanently in the labour and maternity wards
10. Commitment to proper stock inventory (good predictions, and timely ordering of drugs and supplies from the Central Drug Store) to prevent frequent shortages of drugs and supplies
11. Proper supervision and follow-up of traditional birth attendants (TBA) by TBA coordinators
12. Review work schedules and make sure staff are available especially at night to handle emergencies quickly and properly

Further actions taken by individual hospitals

1. Kasungu District Hospital positioned health surveillance assistants at the entrance of the hospital to receive all labouring women with or without obstetric emergencies and guide them to the labour ward in order to reduce institutional delay in starting treatment
2. Nkhoma Hospital (a mission hospital) developed a new maternity register that was user-friendly and captures data that was missing from the old register
3. Measures were taken to strengthen infection prevention in Kasungu District Hospital, Salima District Hospital and Kamuzu Central Hospital

Recommendation made but was not implemented

1. Number of qualified staff in maternity units should be increased

representatives of eight hospitals in the three districts and Malawi Ministry of Health. Table 2 presents the six criteria.

Patients' Characteristics

The mean age of patients with PPH was 25 years in the initial audit and 24 years in the re-audit. There was no statistically significant difference in age ($P = 0.646$) (Table 3). Similarly, median parity and percentage of primiparous women were similar in the two groups of women. There was no significant difference in perinatal mortality ($P = 1.000$) as well as in case fatality rate ($P = 0.702$). Case fatality was defined as the women who died of PPH

Table 2 Standards for the management of postpartum haemorrhage

1. Intravenous line (IV) should be set up and IV fluids (crystalloids or colloids) given continuously until cross-match blood is available
2. Typing and cross-match is done
3. Patient's haemoglobin or hematocrit is established
4. Vital signs (pulse and blood pressure) are monitored at least half hourly for 2 h
5. A fluid intake/output chart (IV fluid and urine output) is maintained
6. Oxytocic drugs are administered

expressed as a percentage of all women with PPH. All patients in both the initial audit and the re-audit had vaginal delivery.

Audit Results

When the first audit was performed, wide gaps were identified between current practice and four standards: typing and cross-match carried out (65.0%), patients' haemoglobin or hematocrit carried out (67.5%), vital signs monitored closely (32.5%), and fluid intake/output chart set

Table 3 Baseline characteristics

Characteristic	Initial audit ($n = 40$)	Re-audit ($n = 45$)	P value
Mean age in years (SD)	25 (6)	24 (6)	0.464
Median parity (range)	3 (1–9)	3 (1–10)	0.384
Primiparity (%)	17.5	20.0	0.684
Perinatal mortality (per 1,000)	50	44	1.000
Case fatality rate (%)	10.0	6.7	0.702

Perinatal mortality = stillbirths + early neonatal deaths

Case fatality rate = proportion of women with PPH who die

Table 4 Attainment of standards in the first and second audits

Criteria	Initial audit (<i>n</i> = 40)	Re-audit (<i>n</i> = 45)	OR (95% CI)	<i>P</i> value
IV set up and IV fluids given until cross-matched blood is available	40 (100.0%)	44 (97.8%)	0.00 (0.00–21.38)	0.735
Typing and cross-match of blood done	26 (65.0%)	38 (84.4%)	2.92 (1.03–8.61)	0.034
Patient's hematocrit or haemoglobin	27 (67.5%)	39 (86.7%)	3.13 (1.05–9.82)	0.029
Vital signs monitored closely at least half hourly for 2 h	13 (32.5%)	24 (53.3%)	2.37 (0.97–5.88)	0.065
Fluid intake/output chart (IV fluid and urine output) maintained	0 (0.0%)	15 (33.3%)	infinity (5.45–infinity)	<0.001
Oxytocic drugs administered	40 (100.0%)	43 (95.6%)	0.00 (0.00–3.89)	0.357

up (0.0%). Two standards were attained in 100% of cases: intravenous (IV) access and continuous administration of IV fluid until cross-match blood was available, and administration of oxytocic drugs.

When the second audit was conducted, there was a significant improvement in three standards (Table 4): typing and cross-match carried out (65.0% vs. 84.4%; $P = 0.034$), patient's hematocrit or haemoglobin established (67.5% vs. 86.7%; $P = 0.029$), and fluid intake/output chart maintained (0.0% vs. 33.3%; $P < 0.001$). There was a trend towards an improvement in the close monitoring of vital signs (32.5% vs. 53.3%; $P = 0.065$). There was no significant change in two standards in which attainment was 100% during the first audit: IV line set up and IV fluids given (100.0% vs. 97.8%; $P = 0.735$), and oxytocic drugs administered (100.0% vs. 95.6%; $P = 0.357$).

Discussion

This study describes the use of criteria-based audit to assess and improve the management of PPH in Malawi. There were significant improvements in some aspects of PPH management, namely typing and cross-match, carrying out patient's hematocrit or haemoglobin, maintaining fluid intake/output chart. However, there was no significant change in the close monitoring of vital signs, administration of IV fluids and oxytocic drugs, which could be explained by many reasons including the fact that almost all women with PPH in both audits received IV fluids and oxytocic drugs, and the fact that the sample size was small. The introduction of criteria-based audit helped standardise and improve the management of PPH in the three districts.

Similar to findings from previous studies, we found that criteria-based audit was feasible in resource-limited countries. However, the way we established standards for PPH differed from traditional methods described by other authors [11–13]. Traditionally, standards have been developed by an external panel of experts. We involved health care providers themselves from the very process of

developing standards and this promoted ownership and sustainability among the health care providers. We equally involved policymakers and managers from the early stages of criteria-based audit and this facilitated organisational changes, release of finances and resources, and approval where necessary to help implement the changes recommended by the audit.

We encountered some challenges in the process of introducing criteria-based audit in Malawi. These challenges included shortage of staff, difficulty changing old practice, inadequate knowledge and skills to manage emergency obstetric complications, poor documentation, and lack of resources. Three months between the initial audit and the re-audit was too short for us to expect a significant change in staffing level. However, criteria-based audit helped improve documentation especially cases notes and maternity registers, and devised ways of introducing new practice without making the providers feel threatened [18]. Quality improvement is generally believed to be a very expensive process. Fortunately, criteria-based audit is an inexpensive tool. Therefore, using criteria-based audit we were able to implement effective and locally appropriate recommendations using very few resources.

This study has some limitations. Like all before-and-after studies the results can only indicate associations and not causation. Moreover, we pooled data from different hospitals together and so the findings could be affected by the inherent differences in the management of cases of PPH in different hospitals despite the fact that the baseline characteristics of patients in the initial audit and the re-audit were similar. In addition some characteristics that were not examined such as the use of antenatal care by patients could differ between the first and second audits. One of the key objectives of having audits is to reduce mortality. However due to the small sample size it was not possible to accurately assess maternal and perinatal mortality in our study. The six criteria audited were not necessarily the best criteria to save women's lives but rather what participants considered were not being done appropriately. For that reason blood transfusion was not included in the list of criteria audited. Further is a possibility that

audit improved recording in case notes rather than quality of care. The period of follow up was very short and this raises the issue of sustainability. However, there are plans to continue auditing the management of PPH over a longer period.

In conclusion, criteria-based audit can improve the management of PPH in countries with limited resources. We discovered that the process of introducing criteria-based audit enabled health care providers themselves to explore their clinical practice, the impact of the care they provide patients and their personal working environment. Future studies should consider using larger sample sizes in order to assess the effect of criterion-based audit on maternal and perinatal mortality.

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Authors' Contributions E. J. Kongnyuy: Conception, design, drafting of the protocol, analysis, interpretation and write-up of all versions of the manuscript. G. Mlava and N. van den Broek: Critically reviewed the final manuscript for important intellectual content.

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