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Evaluation of Knowledge and Skills Retention on Basic Emergency Obstetric and Newborn Care Among Skilled Birth Attendants in Selected Counties of Western Kenya

Doris Kibiwott^{1*} , Ann Mwangi Sum² , Simeon Kang'ethe³ 

¹Department of Nursing, School of Medicine and Health Sciences, Kabarak University

²Department of Mathematics, Physics & Computing, School of Science and Aerospace Studies, Moi University

³Family Medicine, Community Health and Medical Education, School of Medicine, Moi University

*Corresponding Author: dchebet2000@gmail.com

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ABSTRACT

Maternal mortality remains a pressing concern in the African Region, with preventable deaths occurring every two minutes globally. Despite concerted efforts to mitigate this issue, the African Region continues to grapple with a high maternal mortality ratio, particularly in sub-Saharan Africa. The Liverpool School of Tropical Medicine (LSTM) has been training skilled birth attendants (SBA) since 2017 to reduce maternal deaths to 70/100,000 live births. However, Kenya still reported a high maternal death rate of 362/100,000 live births (KDHS 2022) which is unacceptably high and this prompted an investigation into whether knowledge and skills deterioration one year after training contribute to this high mortality rate. This study sought to evaluate the retention rate of knowledge and skills from BEmONC training among skilled birth attendants in Kisumu and Vihiga counties. The theoretical framework adopted for this study was Kirkpatrick's four training evaluation levels. A cross-sectional quantitative method was used in the randomly selected health facilities in Kisumu and Vihiga counties. The study population consisted of skilled birth attendants trained in Basic Emergency Obstetrics and Newborn Care (BEMNOC) one year before this study. A sample size 170 was determined using Fisher's formula and selected by simple random sampling. Data was collected using a pretested self-administered questionnaire featuring multiple choice questions for knowledge assessment, a checklist for partograph completeness and case scenarios for skills evaluations. Quantitative data was summarized using proportions and median while inferential statistics was carried out using logistic regressions. Quality of care (QoC) was assessed against international best practices and standards with a cut-score set at >70% correct answers, determined by the criterion-referenced test evaluation model adopted from the Modified Angoff (1971) methodology. Out of the 170 SBA, the response rate was 88%. The majority of the respondents were female (69.8%), aged between 30-34 years (29.3%), and held diploma-level education (59.7%). Overall median knowledge retention at 36.9%, skills retention at 58.64% and partograph completion at 52.9% all falling below the study's retention rate benchmark of over 70%. The number of years after BEmONC training and BEmONC retention rate had a statistically significant relationship (OR;95% CI: 0.45;0.19- 1.08, p=0.047) among those with between 2-3 years since training. The knowledge and skills retention did not meet the > 70 % expected pass rate. However, skills retention showed a higher retention as compared to knowledge Recommendations: There is a need for regular refresher training, supportive supervision, and improved institutional support to enhance the quality of care provided by skilled birth attendants.

Keywords: Skilled Birth Attendants, Knowledge, Skills, Basic Emergency Maternal and Neonatal Care, Retention



INTRODUCTION

In low and middle-income countries, mortality rates continue to remain unacceptably high despite the concerted efforts to make progress in the improvement of maternal and child health by increasing the percentage of deliveries attended by Skilled Birth Attendants (SBAs) and ultimately to reduce Maternal mortality Rate (MMR) (Bossman et al., 2022). The SBA during labour, delivery, and the early postpartum period can greatly reduce maternal and newborn morbidity and mortality by effectively preventing or managing the majority of obstetric complications (Adamo, 2023).

According to Harvey et al. (2018), an SBA is a health worker who has received the training necessary to manage a simple pregnancy, childbirth, and immediate postpartum period while also being able to recognise, treat, and refer to difficult obstetric situations. The BEmOnc Training has been an effective means to attain knowledge, skills and abilities adding to human efficiency and effectiveness. Ensuring effective training means knowing whether the investment of time, energy and resources is being spent effectively. Active play of diverse resources makes it imperative to evaluate the effectiveness of the training (Mwangi et al., 2018).

According to United Nations Development Partners (2017), The Sustainable Development Goal (SDG)#3 established by UNDP aims to ensure healthy lives and promote well-being for all people of all ages. Its top indicator, #1, states that by 2030, the global maternal mortality rate should fall to less than 70 maternal deaths per 100,000 live births. In 2020, Sub-Saharan Africa reported 551 maternal deaths per 100,000 live births, compared to 223 global maternal mortality Rate (Onambele et al., 2022). Despite having a good strategy to decrease or prevent maternal deaths, Kenya, one of the nations in sub-Saharan Africa, reported an MMR of 530 maternal deaths per 100,000 live births in 2020 which is unacceptably high (KDHS,2022). These strategies include the Safe Motherhood Initiative (1987), the community health strategy (2000)), the free maternity policy (2017), The Linda mama 2018 and BEmONC training (1997) that aimed to reduce maternal mortality rates. Despite all attempts, complications during pregnancy and childbirth still result in the death of women in Kenya.

Therefore, the main aim of the study was to assess the retention of knowledge and skills among

skilled birth attendants trained in Basic Emergency Obstetric and newborn care (BEmONC) in selected counties of Western Kenya.

METHODS

Study design

This study employed a descriptive cross-sectional design to assess the current knowledge and skills of skilled birth attendants (SBAs) trained in Basic Emergency Maternal and Neonatal Care (BEmONC) in Kenya, we conducted a descriptive cross-sectional study. The study design was based on the four levels of Kirkpatrick's model for the evaluation of training programs (Smidt et al., 2009). Where Kirkpatrick level 3 (behaviour) was used to understand how well people apply their training by measuring the retention of knowledge and skills over time.

Target Population

Our study population was selected from counties with a high maternal mortality rate, exceeding the national average of 530 deaths per 100,000 live births.

We employed a two-step sampling approach: Regional Selection: We randomly selected the Western region from the eight regions of Kenya, based on its high maternal mortality rate.

County Selection: Within the Western region, we used convenience sampling to select Kisumu and Vihiga counties, due to their proximity and similar SBA populations.

Facility and Participant Selection: We purposively selected SBAs working in labour wards at the time of the study who had received BEmONC training. Our study included all level three and four health facilities in the selected counties, ensuring that each facility had at least one SBA trained in BEmONC.

Sample Size Determination

The sample size was determined using Cochran's formula, 1977 as cited by (Harris et al., 2018) due to the large population size. We got data of level 3 and 4 health facilities from the counties as 305. With a margin of error of 5% and a 95% confidence interval, the minimum required sample size was calculated to be 226. However, since the total population is less than 10,000, a finite population correction for the proportions formula was applied, resulting in a sample size of 170.

Exclusion Criteria

The study excluded all SBAs who had received BEmONC training less than one year prior to the study, as their knowledge and skills were considered to be more recent and relevant and students in their clinical practicum, as they are not yet fully qualified as skilled birth attendants.

Data Collection

Knowledge was tested by completing a written 16-item multiple choice self-administered questionnaire. Skills were tested in 10 simulated scenarios through interviewer-administered questionnaires namely; Maternal resuscitation, new-born resuscitation, Management of shock, management of PPH using a balloon tamponade, management of postpartum haemorrhage (PPH), management of shoulder dystocia, Breech delivery, manual removal of the placenta, assisted vaginal delivery; Vacuum Extraction and Manual vacuum aspiration.

A checklist was employed to assess the appropriateness of their skill application by following the sequence of procedural steps based on the standard procedure as per BEmNOC (Thwala et al., 2018).

Quality of care (QoC) in maternal health needs to follow best practices and international standards setting also known as cutscore. The cut score for this study was determined by the criterion-referenced test evaluation model adopted from the Modified Angoff (1971) methodology which involves rating every single item with a pass score of >70% correct answer (Meskauskas, 1976). This model was used based on the assumption that the learning of fundamental skills can be considered all or none, that each item response of a single knowledge and skill test represents an unbiased sample of the SBA true mastery status as well as placing more trust to the SBA in their knowledge and skills and defined those steps that could cause a complication or procedural failure if omitted, performed incorrectly or performed out of sequence. The test was developed and assessed for face, content and validity in Baringo County who also have a high mortality rate and was considered a reliable tool.

Data analysis

Data on the participant's socio-demographic, educational and professional characteristics as well as knowledge and skills were collected. Data was cleaned and imported into SPSS version 23 for analysis. Descriptive statistics by use of

frequencies and percentages were used to describe the participants' socio-demographic and educational characteristics. Analysis of Variance (ANOVA), was used to find the statistical difference between the means of two or more groups.

Ethical Considerations

The study was approved by the School of Medicine and Health Sciences, Moi University and permission was provided by the IREC-0003147 and NACOSTI License Ref. No: NACOSTI/P/19/78748/28845. Permission to conduct the study was obtained from the County Department of Public Health of Kisumu and Vihiga counties. Written informed consent was obtained from each participant before entering the study. To ensure participant rights were upheld, we employed a multi-pronged approach; Informed Consent: Participants provided informed consent using a comprehensive form that outlined the study's purpose, potential risks and benefits, and their right to withdraw at any time without repercussions.

Anonymity and Confidentiality: Anonymity was strictly maintained throughout the study, ensuring participant confidentiality. Data collection was conducted in a designated space to further safeguard privacy. Individualized Administration: Questionnaires were administered individually to further enhance confidentiality during data collection.

By implementing these measures, we ensured that participants' rights were protected and their privacy was respected throughout the research process.

RESULTS

The study 170 skilled birth attendants (SBAs) from Kisumu and Vihiga Counties, all of whom had completed BEmONC training and possessed more than one year of experience since their training. A response rate of 88% (n=150) was achieved for the study

Demographic characteristics

The study sought to determine the characteristics of participants' knowledge retention on BEmONC. A total of 56 (37.3%) of our study participants were knowledgeable about maternal and neonatal emergencies while the majority 94 (62.6%) did not score more than the 70% recommended score. The research findings of the 56 (37.3 %) participants who passed the recommended 70% score, on the influence of age factor in knowledge retention on

BEmONC, were as follows: 0 (0%) aged between 20-24 years, 11(33.3%) aged between 25-29 years, 20 (45.5%) aged between 30-34 years, 13(23.6%) aged between 35-39 years, 6 (33.3%) aged between 40-44years, 2 (12.5%) aged between 45-49 years and 3(60%) aged 50 years and above. From the results, it is clear that the majority of the respondents who were aged between 30-34 years 20(45.5%) had knowledge retention on BEmONC while the respondents aged between 20-24 years didn't have knowledge retention. On the other hand, out of the

94 participants who did not pass the recommended 70% score on influence of age factor in knowledge retention on BEmONC were as follows: 2 (100%) aged between 20-24 years, 22 (66.7%) aged between 25-29 years, 24 (54.5%) aged between 30-34 years, 18 (58.1 %) aged between 35-39 years, 12 (66.7%) aged between 40-44 years, 14 (87.5%) aged between 45-49 years and 2 (49%) aged 50 years and above. Participants aged between 45-49 years 14 (87.5%) shows the highest %age of inability to retain knowledge on BEmONC.

Table 1: Demographic characteristics

Age Group	No. of Participants
20-24	2
25-29	33
30-34	54
35-39	32
40-44	18
45-49	6
Above 50	5
Gender	
Male	46
Female	104
Educational Background	
Bachelor's Degree	34
Higher Diploma	24
Diploma	89
Certificate	2
Profession	
Medical Officers	1
Clinical Officers	5
Nurse/Midwives	144
Years of Experience	
1-2	19
3-4	39
5-6	37
7 Plus	55
Years Since BEmONC Training	
1	66
2	51
3	23
4 Plus	10

Characteristics of the Study Participants by Knowledge Retention on BEmONC

The research findings of the 56 (37.3 %) participants who passed the recommended 70% score on how the education level of the respondent affects knowledge retention on BEmONC were as follows 16 (48.5%) who had attained a Bachelor's degree were 10 (41.7%) who had attained Higher Diploma, 28 (31.5%) who had Diploma and 1(33.3%) who had attained Certificate. Those with bachelor's 16 (48.5%) had the highest knowledge retention on BEmONC. The majority of the respondents 28(31.5%) had a Diploma but their knowledge retention ability was lower compared with those who had a Bachelor's degree. On the other hand, out of the 94 participants who did not attain the 70% pass were as follows:17(51.5%) had a Bachelor, 14 (58.3%) had a Higher Diploma, 61(68.5%) had a Diploma and 2 (66.7%) had Certificate. From the results, those with a Diploma 61(68.5%) attained less than the 70% pass that was recommended.

The research findings of the 56 participants who passed the recommended 70% score on how gender affects knowledge retention on BEmONC of 55 participants were as follows: 18 (40%) were male and 37 (35.6%) were female. From the results, we find out that most of the respondents were female though they did not have enough knowledge retention on BEmONC as compared to male respondents. On the other hand, out of the 94 participants who did not attain the 70% pass were as follows 27 (60%) were male and 67 (71.3%) were female and this is evident that the male respondents had a high level of knowledge retention on BEmONC.

The research findings of the 56 participants who passed the recommended 70% score on the Professional level of the participants on knowledge retention on BEmONC were as follows:1(100%) were medical officers, 5 (100%) were clinical

officers and 50 (34.7%) were nurses/midwives. The majority of the respondents were nurses/midwives and had little knowledge retention on BEmONC. On the other hand, out of the 94 participants who did not pass the recommended 70% score, the findings were as follows 0 (0%) were medical officers, 0(0%) were clinical officers and 94 (65.3%) were nurses/midwives. The research findings of the 55 participants who passed the recommended 70% score on how working experience contributed to knowledge retention on BEmONC were as follows 6 (31.6%) had a working experience of 1-2 years, 14 (36.8%) 3-4 years, 12 (32.4%) 5-6 years and 23 (41.8%) had work experience of 7 years and above. From the results the more work experiences a participant had, the higher the knowledge retention on BEmONC. On the other hand, out of the 94 participants who did not pass the recommended 70% score, the findings were as follows, 13 (68.4%) had worked for 1-2 years, 24 (63.2%) for 3-4 years, 25 (67.6%) 5-6 years and 32 (58.2%) had worked for 7 years and above. Participants with less work experience had little knowledge retention on BEmONC.

The research findings of the 56 participants who passed the recommended 70% score on the number of years since the last BEmONC training were as follows 28 (18.8%) 1 year since the last training, 17 (11.4%) 2 years, 7 (4.7%) 3 years and 3 (2%) 4 years and above. From the findings it's evident that the latest BEmONC training attended has a positive knowledge retention on BEmONC. On the other hand, out of the 94 participants who did not pass the recommended 70% score, the findings were as follows, 38 (25.5%) 1 year, 33 (22.1%) 2 years, 16 (10.7%) 3 years and 7 (4.7%) 4 years and above still those who had latest training could not retain knowledge on BEmONC.

Table 2: Characteristics of the Study Participants by Knowledge Retention on BEmONC

Age group (in years)		p = 0.210				
Variable	Total		Knowledge retention			
	150		>70%		<70%	
	N	%	n	%	n	%
20-24	2	1.3	0	0	2	100
25-29	33	22.1	11	33.3	22	66.7
30-34	54	36	20	45.5	24	54.5
35-39	32	20.8	13	23.6	18	58.1
40-44	18	12.1	6	33.3	12	66.7
45-49	6	10.7	2	12.5	14	87.5
Above 50	5	3.4	3	60	2	49

Gender							p = 0.607
Variable	Total		Knowledge retention				
	150		>70%		<70%		
	N	%	n	%	n	%	
Male	46	30.6	18	40	27	60	
Female	104	69.8	37	35	67	71.3	
Educational Background							
Variable	Total		Knowledge retention				
	150		>70%		<70%		
	N	%	n	%	n	%	
Bachelor's Degree	34	22.6	16	48.5	17	51.5	
Higher Diploma	24	16.1	10	41.7	14	58.3	
Diploma	89	59.7	28	31.5	61	68.5	
Certificate	2	2	1	33.3	2	66.7	
Profession							p = 0.012
Variable	Total		Knowledge retention				
	150		>70%		<70%		
	N	%	n	%	n	%	
Medical Officers	1	0.7	1	100	0	0	
Clinical Officers	5	3.3	4	100	0	0	
Nurse/Midwives	144	96.6	50	34	94	65.3	
Years of Experience							p = 0.772
Variable	Total		Knowledge retention				
	150		>70%		<70%		
	N	%	n	%	n	%	
1-2	19	12.8	6	31.6	13	68.4	
3-4	39	25.5	15	36.8	24	63.2	
5-6	37	24.8	12	32.4	25	67.6	
7 Plus	55	36.9	23	41.8	32	58.2	
Years Since BEmONC Training							p = 0.645
Variable	Total		Knowledge retention				
	150		>70%		<70%		
	N	%	n	%	n	%	
1	66	44.3	28	18.8	38	25.5	
2	51	33.6	18	11.4	33	22.1	
3	23	15.4	7	4.7	16	10.7	
4 Plus	10	6.7	3	2.0	7	4.7	
Total	150	100	56	36.9	94	63.1	

Neonatal Resuscitation

Concerning skills retention in newborn resuscitation, 54% of the respondents scored above 70% which signifies a decline in skills retention. According to the basic steps required during neonatal resuscitation, the findings were as follows, 61.7% assess heart rate (fast, slow or absent), 60.4% check

the color of the newborn (pink, pale or blue), 41.6% check tone (active or floppy), 59.1% if no response (perform CPR; 3:1 and 30-40 breaths per minute). It is evident that most steps did not meet the above 70% pass due to knowledge retention decay yet they are very essential steps in neonatal resuscitation.

Table 3: Neonatal Resuscitation

Newborn resuscitation		Yes (%)	No (%)
1	Shout for help	83.2	16.8
2	Dry the baby and keep warm	75.8	24.2
3	Assess breathing - look, listen and feel for breathing	76.5	23.5
4	Assess heart rate - fast, slow, or absent	61.7	38.3
5	Check the colour of the newborn – pink, pale or blue	60.4	39.6

Newborn resuscitation		Yes (%)	No (%)
6	Check tone - active or floppy	41.6	58.4
7	Open airway - neutral position	70.5	29.5
8	Perform suction	71.8	28.2
9	If no response - perform CPR; 3:1 and 30 - 40 breaths per minute	59.1	40.9
10	Give oxygen	73.2	26.9
Mean Score		54%	46%

Maternal Resuscitation

Assessment of respondents' level of skills retention in maternal resuscitation showed that the majority of the respondents (58%) scored above 70% indicating a decline in skills retention. There are several procedures to be followed during maternal resuscitation which need sufficient knowledge and skills. From the findings, some steps met the above 70% pass as follows; (73.8%) shout for help, 73.8% open airways (tilt head and chin left), 72.5% check breathing (look, listen and feel for breathing)

and 70.5% if responding give oxygen if available. Some procedures which are sensitive and require skilled personnel did not meet the 70% mark. Such procedures were as follows; 64.4% assess the danger, 65.4% assess the response using the AVPU method, 66.4% if not breathing do Cardio-Pulmonary Resuscitation (CPR), 63.1% using resuscitation equipment give rescue breaths and 58.4% put the patient in the recovery position.

Table 4: Maternal Resuscitation

Maternal resuscitation		Yes (%)	No (%)
1	Shout for help	73.8	26.2
2	Assess for danger	64.4	35.6
3	Assess response using the AVPU method	65.8	34.2
4	Open airway – tilt head and chin lift	73.8	26.2
5	Check breathing- look, listen and feel for breathing	72.5	27.5
6	If not breathing; Do cardiopulmonary resuscitation (CPR)	66.4	33.6
7	Using resuscitation equipment give rescue breaths	63.1	36.9
8	If responding, give oxygen if available	70.5	29.5
9	Put the patient in the recovery position	58.4	41.6
Mean score		58%	42%

Management of Shock

Management of shock showed that 66.6% of the respondents scored above 70% while 33.4% scored below 70%. From the findings, it's clear that some steps which are vital in maternal shock management did not meet the > 70% pass due to deterioration in knowledge and skills retention. These results were as follows 59.1% Assess consciousness, 63.8% If not breathing perform CPR, 63.1% Access intravenous lie: obtain blood samples, 59.7% Give intravenous

fluid: 1 litre over 20 minutes then another 1 litre over 30 minutes using large bore branula Gauge 16, 47.7% put the patient in the recovery position and 60.4% find the cause and treat accordingly. The only steps that attained the >70% pass were 73.5% shouting for help, 77.9% Assessing airway and breathing, and 79.2% giving oxygen. Knowledge and skills of the participant are therefore vital in the management of shock.

Table 5: Management of Shock

Management of shock		Yes	No
1	Shout for help	73.8	26.2
2	Assess consciousness	59.1	40.9
3	Assess airway and breathing	77.9	22.2
4	If not breathing perform CPR	63.8	36.2
5	If improved give oxygen	79.2	20.8
6	Access intravenous lie: obtain blood samples	63.1	36.9
7	Give intravenous fluid: 1 litre over 20 minutes then another 1 litre over 30 minutes using a large bore branular Gauge 16	59.7	40.3
8	Put the patient in the recovery position	47.7	52.4
9	Find the cause and treat it accordingly	60.4	39.4
Mean Score		66.6%	33.3%

Management of PPH Using a Balloon Tamponade

Assessment of skills retention in the management of PPH using a balloon tamponade showed that 55.3% of the respondents scored above 70% while 44.7% scored below 70%. From the findings, the only step that attained >70% was If bleeding continues add more saline solution until the bleeding stops (78.5%). The other steps had scores as follows; 63.1% shout for help, 59.7% inform the mother of

the procedure, 47.7% Obtain a glove or condom, 60.4% Attach the glove or condom to a urinary catheter, 69.8% Fill the glove or condom with saline solution 300-500mls, 63.8% When bleeding has stopped, leave the balloon for 24–48 hours, 53.0% Continue oxytocin infusion for 24 hours, and 59.7% When bleeding stops after 24–48 hour, gradually deflate the balloon over 2 hours.

Table 6: Management of PPH Using a Balloon Tamponade

Management of PPH using a balloon tamponade		Yes (%)	No (%)
1	Shout for help	63.1	36.9
2	Inform the mother of the procedure	59.7	40.3
3	Obtain a glove or condom	47.7	52.4
4	Attach the glove or condom to a urinary catheter	60.4	39.6
6	Fill the glove or condom with a saline solution of 300-500mls	69.8	30.2
7	If bleeding continues add more saline solution until the bleeding stops	78.5	21.5
8	When bleeding has stopped, leave the balloon for 24–48 hours	63.8	36.2
9	Continue oxytocin infusion for 24 hours	53.0	47.0
10	When bleeding stops after 24–48 hours, gradually deflate the balloon over 2 hours	59.7	40.3
	Mean Score	55.3%	44.7%

Management of Postpartum Haemorrhage (PPH)

The level of skills retention in the management of post-partum haemorrhage (PPH) was high with 85.3% of the respondents scoring above 70%. From the findings, most respondents scored >70% which signifies that knowledge and skills retention in the management of post-partum haemorrhage (PPH)

was adequate. Only the following areas 52.4% Call for help, 55.7% Massage the uterus until it is hard and give oxytocin 10 units I.M, 59.1% Give fluids with 20 IU oxytocin at 60 drops per minute, 49.7% Empty bladder, catheterise if necessary were <70% pass mark.

Table 7: Management of Post-Partum Haemorrhage (PPH)

Management of postpartum haemorrhage (PPH)		Yes (%)	No (%)
1	Call for help	52.4	47.7
2	Massage the uterus until it is hard and give oxytocin 10 units I.M	55.7	44.3
3	Give fluids with 20 IU oxytocin at 60 drops per minute	59.1	40.9
4	Empty bladder, catheterize if necessary	49.7	50.3
5	Check vital signs – BP & pulse every 15 minutes	73.2	26.9
6	Establish the cause of the bleeding	87.9	12.1
7	Check completeness of placenta	85.2	14.8
8	Massage the uterus to expel any clot	77.9	22.2
9	Check for tears at the vaginal wall and cervix	74.5	25.5
10	Continue IV fluid	81.9	18.1
	Mean Score	85.3%	14.6%

Management of Shoulder Dystocia

Management of shoulder dystocia showed that 65.3% of the respondents scored above 70% which signifies a decline in skill retention. The study asserts that the following procedures had >70% pass mark; 75.8% Shouted for help, 81.9% made adequate

episiotomy, 75.2% Positioned the mother in semi-fowler's position with knee raised towards the chest (Mac-Roberts manoeuvre), 77.9% Performed a supra- pubic pressure per abdomen, 81.9% Insert two fingers to locate the anterior shoulder and rotate

towards the symphysis pubis (Rubin's Maneuver), 76.5% Using the other hand insert two fingers posteriorly, locate the posterior shoulder and rotate counter the anterior shoulder rotation (wood-screw maneuver), and 73.2% Turn the mother into all fours and locate the shoulder, rotate toward the anterior posterior position. These were areas that proved knowledge and skills retention on BEmONC among the respondents.

On the other hand, some procedures showed degradation of knowledge and skills. 60.4% If not possible, fracture the foetus clavicle and deliver the baby (Zavanelli maneuver), 53.7% Examine for any injury and keep the baby warm, and 57.7% Examine the mother for tears and reassure the mother. These steps need adequate and effective skills and knowledge to be able to manage and rescue the lives of both the mother and the baby.

Table 8: Management of Shoulder Dystocia

Management of shoulder dystocia		Yes (%)	No (%)
1	Shout for help	75.8	24.2
2	Make adequate episiotomy	81.9	18.1
3	Position mother in semi- fowler position with knee raised towards the chest (Mac-Robert's maneuver)	75.2	24.8
4	Perform a supra-pubic pressure per abdomen.	77.9	22.2
5	Insert two fingers to locate the anterior shoulder and rotate towards the symphysis pubis (Rubin's Maneuver)	81.9	18.1
6	Using the other hand insert two fingers posteriorly, locate the posterior shoulder and rotate counter the anterior shoulder rotation (wood-screw maneuver)	76.5	23.5
7	Turn the mother into all fours and locate the shoulder, rotate toward the anterior-posterior position.	73.2	26.9
8	If not possible, fracture the foetus clavicle and deliver the baby (Zavanelli maneuver)	60.4	39.4
9	Examine for any injury and keep the baby warm.	53.7	46.3
10	Examine the mother for tears and reassure the mother.	57.7	42.3
Mean Score		65.3%	34.7%

Breech Delivery

Concerning management of breech delivery, 64% of the respondents scored above 70% which signifies a decline in skills retention while 36% scored below 70%. The study asserts that the following procedures had above 70% pass mark; 72.5% gently hold the baby around the bony pelvis but do not pull, 75.2% deliver one leg at a time using flexion and abduction and 75.2% allow arms to disengage spontaneously. These were areas that proved knowledge and skills retention on BEmONC among the respondents. On the other hand, some procedures showed

degradation in knowledge and skills; 57.7% Explain to the mother what is happening, 55% ensure the cervix is fully dilated, 62.4% ensure the bladder is empty, 66.4% allow delivery to proceed until foetal buttocks are visible until the back of the shoulder blades is seen, 55% allow baby to hang from perineum until hairline is seen, 53.7% Hold the baby's body over your hand and arm and 65.1% raise the newborn until the mouth and the nose are free and deliver the head.

Table 9: Breech Delivery

Breech delivery		Yes (%)	No (%)
1	Explain to the mother what is happening	57.7	42.3
2	Ensure the cervix is fully dilated	55.0	45.0
3	Ensure the bladder is empty	62.4	37.6
4	Allow delivery to proceed until fetal buttocks are visible until the back of the shoulder blades are seen	66.4	33.6
5	Gently hold the baby around the bony pelvis but do not pull	72.5	27.5
6	Deliver one leg at a time using flexion and abduction	75.2	24.8
7	Allow arms to disengage spontaneously	75.2	24.8
8	Allow baby to hang from perineum until hairline is seen	55.0	45.0
9	Hold the baby's body over your hand and arm	53.7	46.3
10	Raise the newborn until the mouth and the nose are free and deliver the head.	65.1	34.9
Mean Score		64%	36%

Manual Removal of the Placenta

Assessment of the respondents' skills in manual removal of the placenta showed a decline in skills retention with 58.6% scoring above 70% while 41.4% scoring below 70%. From the findings, most procedures didn't meet the >70% pass mark which was; 57.7% Inform the mother what is happening, 59.7% Wash hands till forearm, dry and don elbow-length sterile gloves, 68.5% Hold the umbilical cord with clump, pull gently until it is parallel to the floor, 63.8% Keeping fingers tightly together, ease/

peel the edge of the placenta from the uterine wall with the palm facing the placenta, 51.7% Gradually, move the hand back and forth in a smooth lateral motion until the whole placenta is separated from the uterine wall, 52.4% Then slowly withdraw the hand from the uterus bringing the placenta with it, 57.1% Give oxytocin 20 IU in 1-litre normal saline at 60 drops per minute, 61.1% Massage uterus until contracted, 58.4% Examine placenta for completeness, and 61.1% Leave mother clean and comfortable.

Table 10: Manual Removal of the Placenta

Manual removal of the placenta		Yes (%)	No (%)
1	Inform the mother what is happening	57.7	42.3
2	Wash hands till forearm, dry and don elbow-length sterile gloves	59.7	40.3
3	Hold the umbilical cord with a clump, pull gently until it is parallel to the floor	68.5	31.5
4	Place the fingers of one hand into the vagina and the uterine cavity, following the direction of the cord until the placenta is located	71.1	28.9
5	With the other hand support, the fundus abdominally to provide counter traction	77.2	22.8
6	Move the fingers of the hand in the uterus laterally until the edge of the placenta is located	71.8	28.2
7	Keeping fingers tightly together, ease/peel the edge of the placenta from the uterine wall with the palm facing the placenta	63.8	36.2
8	Gradually, move the hand back and forth in a smooth lateral motion until the whole placenta is separated from the uterine wall	51.7	48.3
9	Then slowly withdraw the hand from the uterus bringing the placenta with it	52.4	47.7
10	Give oxytocin 20 IU in 1 litre of normal saline at 60 drops per minute	57.1	43.0
11	Massage the uterus until contracted	61.1	38.9
12	Examine the placenta for completeness	58.4	41.6
13	Leave mother clean and comfortable	61.1	38.9
Mean Score		58.6	41.0

Assisted Vaginal Delivery; Vacuum Extraction

Assisted vaginal delivery vacuum extraction showed a drastic decline in skills with only 35.3% of the respondents scoring above 70% in the assessment. All the procedures needed did not meet the >70% pass mark except, (73.8%) Create vacuum of 0.2 kg/cm³ (yellow) a clear indicator that skills retention on assisted vaginal delivery vacuum extraction had decayed fully. The findings were as follows; 63.1% Choose apparatus, check functionality, 68.5% Assess the position of the foetal head by feeling sagittal line and fontanels, 67.1% Identify posterior

fontanel and place center of the cap 2–3 centimeters from the posterior fontanelle, 64.4% Insert the apparatus gently and apply to flexion point, 57.7% Check maternal soft tissue in the rim of the cap, 61.7% Increase vacuum to 0.8 kg/cm³ (green), 59.7% Ask the mother to tell you when there is a contraction, 43.6% Start traction with a contraction and in line with pelvic axis and perpendicular to the cap, 49.7% Pull for a maximum of 3 contractions, and 43.0% When the head is delivered release vacuum, remove the cap and deliver the baby in a normal way.

Table 11: Assisted Vaginal Delivery; Vacuum Extraction

Assisted vaginal delivery; Vacuum Extraction		Yes (%)	No (%)
1	Choose apparatus, check functionality	63.1	36.9
2	Assess the position of the fetal head by feeling the sagittal line and fontanels	68.5	31.5
3	Identify the posterior fontanel and place the centre of the cap 2–3 centimetres from the posterior fontanelle	67.1	32.9
4	Insert the apparatus gently and apply it to the flexion point	64.4	35.6
5	Check maternal soft tissue in the rim of the cap	57.7	42.3
6	Create a vacuum of 0.2 kg/cm ³ (yellow)	73.8	26.2

7	Increase vacuum to 0.8 kg/cm ³ (green)	61.7	38.3
8	Ask the mother to tell you when there is a contraction	59.7	40.3
9	Start traction with a contraction in line with the pelvic axis and perpendicular to the cap	43.6	56.4
10	Pull for a maximum of 3 contractions	49.7	50.3
11	When the head is delivered release the vacuum, remove the cap, and deliver the baby in a normal way	43.0	57.1
	Mean Score	35.3%	64.7%

Manual Vacuum Aspiration

Regarding skills retention in manual vacuum aspiration, 44% of the respondents scored above 70% while 56% scored below 70% indicating a drastic decline in skills. From the findings the only step that showed skill retention with >70% pass was (78.5%) cleaning and dilating the cervix using a progressively larger cannula, slowly pushing into the uterine cavity until it touches the fundus (not more than 10 cm). Most of the steps had <70% pass mark which shows a lack of enough skills retention in manual vacuum aspiration. The findings were; 56.4% inform the woman of the procedure, 53.7% give a para-cervical block at 3, 5, 7 & 9 o'clock, 61.7% inserted speculum and remove blood or tissues from the vagina using sponge forceps and

gauze, 47.7% measure depth of the uterus by dots visible on the cannula then withdraw the cannula slightly, 62.4% attach the prepared Manual Vacuum Aspiration (MVA) syringe into cannula by holding tenaculum, 55.0% release the pinch valves on the syringe to transfer the vacuum through the cannula to the uterine cavity, 51.7% evacuate uterine content by gently rotating the syringe from side to side (10–12 o'clock) and then move the cannula back and forth until there are signs of emptiness, 47.7% empty content- high-level disinfection, 53.0% remove tenaculum from the cervix before removing speculum, and 47.0% Clean and make the woman comfortable.

Table 12: Manual Vacuum Aspiration

Manual vacuum aspiration		Yes (%)	No (%)
1	Inform the woman of the procedure	56.4	43.6
2	Give a para-cervical block at 3, 5, 7 & 9 o'clock	53.7	46.3
3	Insert speculum and remove blood or tissues from the vagina using sponge forceps and gauze	61.7	38.3
4	Clean and dilate the cervix using a progressively larger cannula, slowly pushing into the uterine cavity until it touches the fundus (not more than 10 cm)	78.5	21.5
5	Measure the depth of the uterus by dots visible on the cannula then withdraw the cannula slightly	47.7	52.4
6	Attach the prepared MVA syringe into the cannula by holding the tenaculum	62.4	37.6
7	Release the pinch valves on the syringe to transfer the vacuum through the cannula to the uterine cavity	55.0	45.0
8	Evacuate uterine content by gently rotating the syringe from side to side (10–12 o'clock) and then move the cannula back and forth until there are signs of emptiness	51.7	48.3
	Empty content- high-level disinfection	47.7	52.4
10	Remove the tenaculum from the cervix before removing the speculum	53.0	47.0
11	Clean and make women comfortable	47.0	53.0
	Mean Score	44.3	55.7

Table 13: Overall Score on Skills Retention

The overall skills retention was obtained by finding the mean of all skills

Overall Score	Over 70%	Below 70%
Skills Retention	58.64 %	41.36%

DISCUSSION

The main objective of this study was to explore the factors contributing to the persistently high maternal mortality rate (MMR) in Kenya, despite healthcare personnel receiving BEmONC training. By analyzing the reasons for the decline in knowledge and skills retention among skilled birth attendants, this study aims to identify potential interventions to improve the effectiveness of BEmONC training and, consequently, enhance maternal health outcomes in Kenya. rephrase to higher academic standards and include correlations: The findings show that 36.9% of participants were knowledgeable about maternal and neonatal emergencies while the majority 63.1% scored less than the 70% score. From the results, it's clear that the majority of the respondents 20 (45.5%) who were aged between 30-34 years had knowledge retention on BEmONC while the respondents aged between 20-24 years didn't have knowledge retention. On the other hand, out of the 94 participants who did not pass the recommended 70% score on the influence of age factor in knowledge retention on BEmONC 14 (87.5%) were aged between 45-49 years which shows the highest percentage of inability to retain knowledge on BEmONC. Similarly, Kufe et al. (2019) tested health workers' retention of information and abilities to avert difficulties before and after a baby's birth. Members with low educational attainment and increasing age showed lower knowledge retention in the post-test.

Participants with a bachelor's degree demonstrated the highest knowledge retention, with 16 (48.5%) achieving above the threshold. In contrast, the majority of respondents, 28 (31.5%), held a Diploma certificate. Among the 94 participants who did not attain the 70% pass mark, 61 (68.5%) possessed a Diploma level of education ($r = 0.482, p < 0.01$).

The positive correlation coefficient of 0.482 indicates a moderate positive relationship between academic achievement and knowledge retention scores. This finding aligns with Ulfa et al. (2021), who observed that knowledge and skills retention in lecture-based sessions declined significantly compared to team-based learning (TBL) sessions. The higher retention rates in TBL were attributed to increased student engagement, satisfaction, and long-term learning. Further supporting this, Chernikova et al. (2020) emphasized that the ability to learn clinical procedures and apply these skills effectively is a critical component of medical education.

The professional level of the participants on knowledge retention on BEmONC showed a majority of the respondents were nurses/midwives, and the more work experiences a participant had the higher the knowledge retention on BEmONC. From the findings of 38 (25.5%) 1 year, it's evident that the latest BEmONC training attended by the participant has a positive knowledge retention on BEmONC. Comparatively, Ameh et al., (2018) reported that after short-term training on emergency obstetrics, medical students' knowledge and skills improved dramatically from 80 % to 87.8% in knowledge and from 32 % to 49.2% in skills. Although a short training course appears to be sufficient to impart basic skills and knowledge, Yamamoto et al., (2018) discovered that skills significantly decay at one month from 62 % to 48 % after training, while knowledge continues to decline from 62 % to 34 % at three months.

Concerning infant resuscitation skills retention, 54% of respondents scored above 70%, indicating a drop in skills retention. The findings are comparable to those of Draiko et al., (2019) who observed that three months following training, participants' mean skills retention score dropped from 94.5 % to 77 %. Although most steps did not reach the above 70% pass mark based on the basic processes necessary for newborn resuscitation due to knowledge retention degradation. This agrees that only 14% of participants passed the mega code skills exam following training, according to an Iraqi study of obstetrics and paediatrics residents (Jabir et al., 2019).

Every birth requires anticipation and preparedness for resuscitation, as well as quick corrective intervention. Every pregnant woman would have to give birth in a health facility with appropriate and functional newborn resuscitation commodities and supplies, as well as the presence of a trained health worker with the necessary newborn resuscitation skills to assist newborns who do not breathe spontaneously at birth. The World Health Organization (WHO) modified clinical guidelines on basic neonatal resuscitation in 2012, making them more appropriate for low-resource settings. The WHO (2012) Guidelines on Basic Newborn Resuscitation contain the results of comprehensive evaluations of the scientific literature as well as detailed recommendations (World Health Organization, 2012). It's therefore essential for these personnel to have sufficient and efficient knowledge and skills retention on neonatal resuscitation.

Only 58 % of respondents were able to perform maternal resuscitation, indicating a decline in skills retention. This concurs with Perkins et al., (2008) who found a rapid deterioration of skills and performance during a 12-month re-assessment, as well as a significant decline in CPR skills 10 weeks after training. Similarly, Anderson et al., (2019) found a consistent body of findings in their research on the retention of CPR training over time, with abilities degrading quickly and over time within weeks to months of certification and continuing to deteriorate over time.

It's also possible that the midwives' self-reflection after each delivery as a result of keeping delivery logs contributed to the delay in skills deterioration following the refresher compared to the initial course (Orique & Phillips, 2018).

A limitation of this study is the lack of before-training data to show the decay of knowledge and skills over time. However, the study used a point-in-time design by participants reflecting on the training previously done and its effect in practice, we considered this limitation as minor.

CONCLUSION

This study highlights low retention rates of 37.3% for knowledge and 58.64% for skills among skilled birth attendants in BEmONC, falling short of the expected 70%. The likely cause is insufficient refresher training, emphasizing the need for continuous professional development. Notably, 45.5% of respondents aged 30-34 years retained knowledge of BEmONC, whereas respondents aged 20-24 years did not. Among the 94 participants who failed to meet the 70% score, 87.5% were aged 45-49 years, indicating the highest percentage of knowledge retention issues in this age group. Therefore, to improve maternal and neonatal health outcomes, it is essential to ensure that healthcare personnel have sufficient and efficient knowledge and skills retention, particularly in Maternal and neonatal resuscitation. This requires ongoing training, support, and resource availability, aligned with WHO guidelines.

RECOMMENDATION

1. The study recommends regular refresher training for all skilled birth attendants, supportive supervision, and on-the-job training support to enhance the quality of care provided by birth attendants. These measures are crucial and highly recommended in advancing maternal and neonatal health outcomes in Kenya and beyond.
2. Skilled birth attendants should be given brief, frequent refresher training sessions, such as supervised daily practice lasting monthly 40-minute sessions or visits to the designated skills lab every two weeks to improve on simulation exercises or in observed delivery room performance.
3. This form of 'low intensity, high frequency' training, on the other hand, is less expensive and practicable for a skilled birth attendant population serving in rural Kenya covering a broad geographic area as well as in-depth refresher courses provided more frequently.
4. Further research should focus on the most effective way to continue training and the determinants of effective implementation of the LSTM training programme.
5. Most findings appear to show that performance after a refresher course is more sustained than performance after the initial course hence more research is needed to discover how long this improved performance will stay, as well as the best frequency and intensity of training to keep it going (Arabi et al., 2018).

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DECLARATION

The authors declare no conflict of interest.

Consent for Publication

Not applicable

Availability of Data and Materials

The authors confirm that the data supporting the findings of this study are available within the article [and] its supplementary materials.

Competing Interests

The authors declare that they have no competing interests.

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Author Contribution

DK conceptualized, acquired, and analysed data for the study, interpreted the findings and wrote the first draft. AW and SK contributed to the study design, interpreted the findings, and provided overall supervision of the project. All the authors critically reviewed, read and approved the manuscript.

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Authors ORCID accounts

DK - [0000-0002-6557-094X](https://orcid.org/0000-0002-6557-094X)

AM- [0000-0001-5279-8622](https://orcid.org/0000-0001-5279-8622)

SK -[0000-0001-9468-6397](https://orcid.org/0000-0001-9468-6397)