

The determinants of staff retention after Emergency Obstetrics and Newborn Care training in Kenya: A cross-sectional study

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Research Article

Keywords: emergency obstetrics and newborn care, skilled health personnel, staff retention, maternal and newborn health, maternity, Kenya

Posted Date: May 17th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-484003/v1>

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Abstract

Introduction Kenya's maternal mortality ratio is relatively high at 342/100,000 live births. Confidential enquiry into maternal deaths showed that 90% of the maternal deaths received substandard care with health workforce related factors identified in 75% of 2015/2016 maternal deaths. Competent Skilled Health Personnel (SHP) providing emergency obstetric and newborn care (EmOC) in an enabling environment reduces the risk of adverse maternal and newborn outcomes. The study objective was to identify factors that determine the retention of SHP 1 – 5 years after EmOC training in Kenya.

Methods A cross-sectional review of EmOC SHP in five counties (Kilifi, Taita Taveta, Garissa, Vihiga and Uasin Gishu) was conducted between January-February 2020. Data was extracted from a training database. Verification of current health facilities where trained SHP were deployed and reasons for non-retention were collected. Descriptive data analysis, transfer rate by county and logistic regression for SHP retention determinants was performed.

Results A total of 927 SHP were trained from 2014-2019. Most SHP trained were nurse/midwives (677, 73%) followed by clinical officers (151, 16%) and doctors (99, 11%). Half (500, 54%) of trained SHP were retained in the same facility. Average trained staff transfer rate was 43%, with Uasin Gishu lowest at 24% and Garissa highest at 50%. Considering a subset of trained staff from level 4/5 facilities with distinct hospital departments, only a third (36%) of them are still working in relevant maternity/newborn/gynaecology departments. There was a statistically significant difference in transfer rate by gender in Garissa, Vihiga and the combined 5 counties ($p < 0.05$). Interval from training in years (1 year, AOR=4.2 (2.1-8.4); cadre (nurse/midwives, AOR=2.5 (1.4-4.5); and county (Uasin Gishu AOR=9.5 (4.6- 19.5), Kilifi AOR=4.0 (2.1-7.7) and Taita Taveta AOR=1.9 (1.1-3.5), $p < 0.05$, were significant determinants of staff retention in the maternity departments.

Conclusion Retention of EmOC trained SHP in the relevant maternity departments was low at 36 percent. SHP were more likely to be retained by 1-year after training compared to the subsequent years and this varied from county to county. County policies and guidelines on SHP deployment, transfers and retention should be strengthened to optimise the benefits of EmOC training.

Introduction

Globally, estimated 295,000 maternal deaths occurred in 2017, 2.5 million newborns died in 2018, and 2.6 million stillbirths occurred in 2015 with 99 percent, 77 percent and 98 percent of them occurring in low- and middle-income countries (LMICs) respectively (1-3). The majority of these deaths occurred around the time of childbirth (4). Kenya continues to experience a high burden of maternal and newborn deaths above the global sustainable development goal (SDG) targets of less than 70/100,000 live births for maternal mortality and 12/1000 live births for newborn mortality respectively (5). In Kenya, the maternal mortality ratio was estimated at 342/100,000 live births in 2017 (6), perinatal mortality (stillbirths and early neonatal deaths) rate at 29/1000 in 2014 and neonatal mortality rate reduced to 22/1000 live births in 2014 (7). The first Kenya Confidential Enquiry into Maternal Deaths report (2017) showed that substandard care was identified in 9 out of 10 maternal deaths with three quarters of the deaths associated with health workforce related deficiencies in knowledge and skills in emergency obstetric care (EmOC). The most frequently identified health workforce related factors were delay in starting treatment (32.9%), inadequate clinical skills (28.1%) and inadequate monitoring (26.9%) (8).

The medical and surgical interventions necessary to prevent this loss of life are known, and most maternal and newborn deaths are in principle preventable. Improving access to midwifery (including family planning & interventions for maternal and newborn health), could avert 83 percent of all maternal deaths, stillbirths and neonatal deaths (9). Evidence shows that availability and utilisation of EmOC reduces maternal and newborn mortality (10). Skilled health personnel (SHP), commonly referred to as skilled birth attendants, should be trained to have the required competencies (11), and should work as part of an integrated team of maternal and newborn professionals (including midwives, nurses, obstetricians paediatricians and anaesthetists) performing all the signal functions of emergency obstetric and newborn care. Such care provided with an 'enabling environment' that includes drugs, supplies, appropriate policies and a functional referral system is likely to result in optimisation of the health and well-being of women and newborns (12, 13). In addition to competent, well resourced, multi-disciplinary maternal and newborn health (MNH) teams, country-level workforce management is required to ensure optimal recruitment, distribution and retention of and supervision of health workers is essential to improve access to high-quality care (14).

Kenya is committed to reducing preventable maternal and newborn deaths through the inclusion of EmOC training in its national health sector strategic and investment development plans (15, 16) and Vision 2030 (17) in the attainment of universal health coverage targets. It developed its first emergency obstetric care training curriculum in 2006 and this was rolled-out in 2009 in 10 level 5 hospitals in the country in 2009 under the Making it Happen (MiH) I program supported by Liverpool School of Tropical Medicine (LSTM). In 2012, a revised Ministry of Health Kenya emergency obstetric and newborn care curriculum was implemented by LSTM to cover 15 additional counties located in the former Nyanza, Western and Central provinces. In 2014, the MiH program expanded the coverage of the trainings across all the 47 counties of Kenya. The MiH program had the objective to build the capacity of at least 80 percent of a multi-professional team of skilled health

personnel (nurse/midwives, clinical officers and medical doctors including specialist obstetricians and paediatricians) working in the maternity units of health facilities to improve the availability and utilisation of EmOC and quality of maternal and newborn health outcomes.

Human resources for health, also known as the health workforce, is one of the building blocks proposed by the World Health Organization (WHO) Health Systems Framework and is central to achieving universal health coverage (UHC) and enhancing the achievement of the SDGs (18). The proportion of births attended by SHP increased from 42% in 2003 to 62% in 2014 (7). Despite this increase and the in-service EmOC trainings, the quality of maternal and newborn care provision is still sub-optimal (8). Evidence on the status of emergency obstetric and newborn care services in Kenya has largely concentrated on the readiness and availability of these in health facilities, specifically focusing on equipment and supplies (19-22). The results of three annual health facility assessments on availability and quality of EmOC services in Kenya between 2014 and 2016 in 18 counties showed that availability of equipment to perform all seven basic EmOC (BEmOC) signal functions (Table 1) increased progressively over the three annual assessments. In 2016, essential items for performing all seven BEmOC signal functions were available in 28 percent of health centres and dispensaries (a 14-fold increase from 2014) and 54 percent of hospitals (a two-fold increase from 2014) (20). Little is documented on the availability of the trained SHP to provide essential EmOC services in the health facilities and poor staff retention after training may be reducing the optimal effect of the SHP strategy under the Ending Preventable Maternal Mortality global strategy and the Kenya strategic health sector development plan. For progress towards achievement of SDG targets, high quality health systems should focus on the population’s health needs and expectations, governance of the health sector and partnerships across sectors, platforms for care delivery, workforce numbers and skills, and tools and resources, from medicines to data (23).

The objectives of this study were to determine the availability and staff transfer rates of SHP trained in EmOC, and to identify the determinants of their retention within maternity units up to five years after the training to inform local and national solutions to optimise the impact of EmOC trainings.

Table 1: Emergency obstetrics and newborn care (EmOC) signal functions

BEmOC signal functions
(1) Administer parenteral antibiotics
(2) Administer uterotonic drugs (i.e., parenteral oxytocin)
(3) Administer parenteral anticonvulsants for preeclampsia and eclampsia (i.e., magnesium sulphate)
(4) Manually remove the placenta
(5) Remove retained products of conception (e.g., manual vacuum aspirations, misoprostol for medical evacuation)
(6) Perform assisted vaginal delivery (e.g., vacuum extraction, forceps delivery)
(7) Perform basic neonatal resuscitation (e.g., with bag and mask)
CEmOC signal functions
Perform all seven components of BEmOC, plus the following:
(8) Caesarean section
(9) Blood transfusion

BEmOC – basic emergency obstetrics care; CEmOC – comprehensive emergency obstetrics care

Methods

Study Design

This was a cross-sectional review of EmOC trained SHP in five counties (Kilifi, Taita Taveta, Garissa, Vihiga and Uasin Gishu) supported by LSTM for a 5-year period from 2014 to 2019. Data collection was conducted between January-February 2020.

Study Setting

The assessment was conducted in the five counties (Kilifi and Taita Taveta from the coast, Garissa from the North Eastern Kenya, Vihiga from Western Kenya and Uasin Gishu from Rift Valley) supported by LSTM (Figure 1). These counties in collaboration with LSTM conduct in-service EmOC trainings and other capacity building initiatives using a sustainable cost-sharing model. In this model, counties budget for and implement EmOC capacity building activities in their annual workplans. Multidisciplinary hands-on training within existing training facilities

were organised without compromising the provision of services. Training and capacity building initiatives in EmOC target SHP working in maternity departments (mother and child health (MCH) clinics, maternity units, newborn units & gynecology units. Garissa and Kilifi were two of the 15 counties in Kenya with the highest burden of maternal mortality in 2014 (24). Each of the counties has a single county referral hospital (except Uasin Gishu that has the national Moi Teaching and Referral Hospital) in addition to subcounty hospitals/faith-based/private hospitals, health centres and dispensaries providing basic and comprehensive emergency obstetrics and newborn care as appropriate according to the level, infrastructure and staffing levels of the facilities as per the minimum package of MNH services at different levels (25).

Data collection

Data was extracted from an LSTM maintained in-service training database (staff gender, cadre, year trained, hospital level, and hospital location-sub-county or county). Verification of current health facility in which trained SHP were deployed was confirmed using a specifically designed data collection tool by the respective county reproductive health departments (in collaboration with the subcounty reproductive health coordinators and the facility in-charges) and the study team. The data collection tool captured information about whether the SHP was still working at the same facility they were working in when they were trained in EmOC during the study period and still working in maternity department. If they were not still working in the training facility, the reasons for this (transferred, resigned, went for further education, retired or died) were documented.

Variables and measurements

The dependent variable was retention in maternity department, which was a binary outcome (yes or no). Retention in maternity department referred to a staff working in any of the following sections: mother and child health (MCH) clinics, maternity units (antenatal, intrapartum and postpartum), newborn units & gynecology units where they provide at least one EmOC signal function. The independent variables were: gender (male, female), cadre (nurse/midwife, medical doctor or clinical officer), interval from training in years (1, 2, 3, 4, 5 years), type of facility (dispensary, health centre, subcounty/county hospital) and county (Kilifi, Uasin Gishu, Taita Taveta, Garissa and Vihiga). Other variables (binary response; yes/no) included – staff still working at training facility, still working in maternity department, transferred, resigned, retired, died or unknown.

Data analysis

Data was entered in Microsoft Excel 2016, cleaned and responses coded as binary (yes = 1 and no = 0). This was then exported to StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP for statistical analysis. Descriptive data analysis – frequencies and proportions of EmOC trained SHP and transfer rate by county were calculated. The association between staff transfers and gender in the counties was tested through two-sample test of proportions and p-values less than 0.05 were considered statistically significant. Associations between independent variables (gender, cadre, hospital level, county and interval from training in years) and the dependent/outcome variable (retention in maternity department) were tested using binary logistic regression to identify the determinants of EmOC trained SHP retention. Odds ratios, 95% confidence intervals and p-values were reported. Independent variables with p-values less than 0.05 were considered statistically significant as determinants of EmOC trained SHP retention.

Results

Distribution of EmOC trained healthcare workers

A total of 927 SHP were trained in the five counties between 2014 and 2019. Most trained SHP were nurse/midwives (677, 73%) followed by clinical officers (151, 16%) and medical doctors (91, 11%). At the level of facility, the majority of the SHP (621, 67%) were from the hospitals, followed by health centres (219, 24%) and dispensaries (87, 9%) (Table 2).

Table 2: Distribution of EmONC trained SHP per level of facility per county

Facility level	Garissa	Kilifi	Taita Taveta	Uasin Gishu	Vihiga	Total	Total %
Dispensary (level 2)	47	35	5	0	0	87	9
Health centre (level 3)	66	56	38	4	55	219	24
Hospital (level 4/5)	241	91	86	101	102	621	67
Total	354	182	129	105	157	927	100%

Overall, 427 (46.1%) were still working in the facility where they worked when they received the EmOC training, 394 (42.5%) had been transferred to other health facilities, 63 (6.8%) had resigned and the reason for non-retention was not known for 32 (3.5%) EmOC trained SHP. Uasin Gishu county had the highest proportion of trained SHP still working in the same facility as when they were trained in EmOC, (72.4%) with Vihiga county having the lowest at 28.7%. Regarding staff transferred, in Garissa county half (50.3%) of its trained SHP had been transferred to other facilities while Vihiga had the highest proportion of trained SHP resigning (28%). Kilifi and Taita Taveta counties had 7.7% and 13.2% of the trained SHP with unknown status as their availability could not be accounted for by the health facilities (Table 3). A total of 26 SHP were in school for further education with the majority (16, 62%) being doctors followed by nurse/midwives (8, 31%) and clinical officers (2, 8%). Overall, 18% (16 of 91) of the doctors, one percent each for nurse/midwives (8 of 677) and clinical officers (2 of 151) trained were pursuing further education at the time of the assessment.

Table 3: 5-year status of EmONC trained SHP in the five counties

County	Garissa	%	Kilifi	%	Taita Taveta	%	Uasin Gishu	%	Vihiga	%	Total	%
Still in training facility	158	44.6	96	52.7	52	40.3	76	72.4	45	28.7	427	46.1
Transferred	178	50.3	66	36.3	59	45.7	25	23.8	66	42	394	42.5
Resigned	14	4.0	1	0.5	0	0	4	3.8	44	28	63	6.8
Retired	1	0.3	5	2.7	1	0.8	0	0	1	0.6	8	0.9
Died	2	0.6	0	0	0	0	0	0	1	0.6	3	0.3
Unknown	1	0.3	14	7.7	17	13.2	0	0	0	0	32	3.5
Total	354	100	182	100	129	100	105	100	157	100	927	100

Period of training

Overall, the distribution of SHP per year of EmOC training was highest in 2019 (207) and lowest in 2015 (161) with no major differences between the years for the combined counties. However, variations existed across the counties with Garissa receiving at least one training course in each of the five years while Kilifi, Uasin Gishu and Vihiga received three training courses each in the 5-year period. No EmOC training course was supported in 2018 across any of the five counties (Table 4).

Table 4: Period of EmOC training and number of SHP trained in the 5 counties between 2014 – 2019

County/year	2014	2015	2016	2017	2019
Garissa	128	63	67	64	32
Kilifi	-	-	38	80	64
Taita Taveta	47	23	33	26	
Uasin Gishu	-	-	59	6	40
Vihiga	11	75	-	-	71
All 5 counties	186	161	197	176	207

Association between staff transfers and gender per county

There was a statistically significant difference in staff transfer rate by gender in Garissa and Vihiga counties with more male SHP (58%) transferred in Garissa compared to females (42%), $P=0.0015$ with the reverse for Vihiga with more females (47%) compared to males (27%), $P=0.0109$. There were no statistically significant differences in the transfers by gender for Kilifi, Uasin Gishu and Taita Taveta counties ($P>0.05$) (Table 5).

Table 5: Association between staff transfers and gender per county

COUNTY	MALE			FEMALE			P-VALUE
	Total trained	Transferred	% Transferred	Total trained	Transferred	% Transferred	
Garissa	189	109	58	165	69	42	0.0015*
Kilifi	53	19	36	129	47	36	0.4703
Taita Taveta	39	17	44	90	42	47	0.3737
Uasin Gishu	23	6	26	82	19	23	0.3858
Vihiga	41	11	27	116	55	47	0.0109*

*P<0.05 statistically significant

Retention of SHP in maternity departments

Data from hospitals was analysed as SHP in these are facilities are deployed to serve in distinct service departments (e.g maternity department, medical/surgical department etc), as opposed to health centres and dispensaries where there are no distinct departments and SHP work across all the departments in most cases, usually under one roof. Overall, only 223 (36%) of the trained SHP were still working in maternity departments. This varies significantly across counties with Uasin Gishu county having the highest staff retention rate of 73% while Garissa had the lowest retention rate of 19% (Table 6).

Table 6: 5-year staff retention in maternity departments per county

County	Working in Maternity department	Total Trained	% Working in Maternity department
Garissa	46	241	19
Kilifi	49	91	54
Taita Taveta	24	86	28
Uasin Gishu	74	101	73
Vihiga	30	102	29
Total	223	621	36

Determinants of staff retention for EmOC trained SHP in maternity departments

County, cadre of staff and interval period from training were statistically significant determinants for staff retention in maternity departments. Compared to clinical officers and doctors, nurse/midwives were 3 times more likely to be retained in maternity departments (AOR 2.5, 95%CI 1.4 - 4.5, P<0.0001). Compared to Garissa and Vihiga counties, EmOC trained SHP were 10 times in Uasin Gishu (AOR 9.5, 95%CI 4.6 - 19.5, P<0.0001), four times in Kilifi (AOR 4.0, 95%CI 2.1 - 7.7, P<0.0001) and twice in Taita Taveta (AOR 1.9, 95%CI 1.1 - 3.5, P=0.032) more likely to be retained in maternity departments. Skilled health personnel were four times more likely to be retained in maternity departments during the first year after EmOC training (AOR 4.2, 95%CI 2.1 - 8.4, P<0.0001). However, there was no association between 2 – 5 years interval since EmOC training and staff retention in maternity departments in the five counties (P>0.05). Besides, there was no association between gender and staff retention in maternity departments (P>0.05) (Table 7).

Table 7: Regression analysis for determinants of EmONC trained staff retention in maternity departments in the five counties

Factor	AOR	95% C.I.		P-value
		Lower	Upper	
Gender				
Female (Ref)	1.0			
Male	0.8	0.5	1.2	0.213
Cadre				
Clinical Officer (Ref)	1.0			
Nurse/Midwife	2.5	1.4	4.5	<0.0001*
Medical Doctor	0.9	0.4	1.9	0.784
County				
Garissa (Ref)	1.0			
Uasin Gishu	9.5	4.6	19.5	<0.0001*
Kilifi	4.0	2.1	7.7	<0.0001*
Vihiga	0.9	0.5	1.8	0.871
Taita Taveta	1.9	1.1	3.5	0.032*
Interval Period				
2014 (year 5) (Ref)	1.0			
2015 (year 4)	1.4	0.7	2.8	0.392
2016 (year 3)	1.0	0.5	2.1	0.973
2017 (year 2)	1.4	0.7	2.8	0.321
2019 (year 1)	4.2	2.1	8.4	<0.0001*

*P<0.05 statistically significant, AOR – adjusted odds ratio, CI – confidence interval

Discussion

The purpose of this study was to identify the determinants of staff retention after EmOC training in Kenya. The findings will be useful to improve the availability and performance of all the EmOC signal functions and improve the quality of maternal and newborn health services and outcomes at health facilities.

Overall, our findings demonstrate that although practices on staff deployment and transfers varied across counties, overall retention of EmOC trained SHP in maternity departments was low (36%) in the five counties. Nurse/midwives had the highest odds of being retained in the maternity departments five years after the EmOC training compared to clinical officers and doctors. Besides, only SHP trained within the last year had a higher chance of retention in maternity departments compared with those trained 2 – 5 years ago.

For a return on investment, in-service trained SHP can demonstrate greatest impact in performance and health outcomes by utilising the acquired knowledge and skills when retained in related departments/wards/units where they can apply the skills. High levels of attrition - defined broadly as exits from the workforce, which may be due to emigration, voluntary exits (e.g. to other sectors of employment), illness, death or retirement – lead to a large loss of public resources spent on in-service training of a health worker (26). To plan effectively for the future, more focus needs to be dedicated to the issue of workforce retention and attrition following in-service training.

Midwives educated and regulated to international standards and working in well-equipped enabling environments are able to provide the full scope of interventions needed when they are fully integrated into a well-functioning health system within a multidisciplinary team to ensure availability of quality MNH and referral services when required for pregnancy and childbirth complications and emergencies (27, 28). Following the skilled health personnel definition by WHO and others, it is critical for trained competent integrated teams working within an enabling environment to be available in maternity departments for pregnancy and childbirth services (29). Our study shows that midwives are better retained compared to other cadres. While retention of nurse/midwives can be improved, retention of all the team is essential.

Redeployments and staff movements or rotations may be inevitable due to shortages and inequitable distribution in these low resourced settings and so a system to ensure that those available are trained to maintain competency is required.

The overall average staff transfer rate of 43% compares with the overall annual attrition rate of between 3 and 44% from a rapid review of attrition rates of health workers from the workforce in different regions and settings by Lopes and colleagues (30). This high transfer rate is not beneficial as the investments made for in-service training a SHP in key skills relevant to improving practice and outcomes in a distinct department is likely not to result in the desired impact. As a result, there is need for harmonised local practices and interventions including local staff deployment policies and guidelines at county and facility level to ensure that trained SHP with key skills are retained in departments they can utilise their competencies for improved health outcomes.

Our study showed that a significant proportion of doctors were pursuing further education compared to the other cadres. This could pose short to medium term challenges to the health facilities but represents a good long term investment in pursuing specialist training especially in these low resourced and inequitably distributed human resources for health settings (31, 32). Evidence has also shown that attrition contributes to increased workload and worse working conditions for the remaining workforce, which in turn contributes to lower quality of care and worse health outcomes (33). This calls for a robust capacity building approach to strengthen the skills of the remaining SHP serving in the health facilities at any given time to allow for a seamless transition when personnel leave for specialist training. This may include a mandatory and periodic EmOC training, including as part of induction of new members of the maternity care team, mentoring of all staff in order to maintain good quality of care.

Our study had strengths and limitations. To the best of our knowledge, this is the first study in Kenya to identify the determinants of in-service staff retention in maternity departments after EmOC training. These findings have triggered a review of human resource management practices including maintaining a skills training database at the health facilities, sub-counties and counties included in this study for future planning for deployment, capacity building and transfers/rotations based on specific skillset for greatest impact on quality of care. Our study did not examine annual trends in retention/transfers and whether the transfers are to relevant departments where healthcare workers can demonstrate the greatest impact either intra-facility, intra-county or inter-facility and intercounty. As time goes by after training, more staff moving either within or between health facilities or departments is not surprising – whether due to personal, higher education, logistical reasons or career advancement/promotion. However, our study did not establish who decides the movement of the trained staff – whether by staff choice or by authorities.

Our findings have implications for practice and policy. For a return on investments and impact, counties and health facilities should strengthen capacity building and retention strategies of all skilled health personnel with EmOC skills in maternal and newborn health. Health managers should develop and implement local strategies, policies and protocols for staff deployment/transfers/replacement and retention based on key competencies by SHP and maintain a skills training database as well as provide an enabling working environment and motivation for SHP to apply the acquired competencies to prevent unnecessary attrition as well as preventing occupational stress (34-37). Further research is needed to examine the annual trends in SHP transfers and retention in relevant departments. In addition, future research should investigate the SHP transfer or retention and their impact on availability of EmOC services and maternal and newborn health outcomes in the respective health facilities and counties.

Conclusion

Retention of EmOC trained SHP in the relevant maternity departments where they can demonstrate the greatest impact was low at 36 percent. Two out of five (42.5%) EmOC trained SHP were transferred to other health facilities post-training. SHP were more likely to be retained during the first year after training compared to the subsequent years and varied from county to county. County policies and guidelines on SHP deployment and transfers/retention should be strengthened to optimise the benefits of EmOC training. Future studies to examine the effect of staff transfers or retention on the maternal and newborn health practices and outcomes in the health facilities as well as whether the staff movement is by choice or by the authorities are needed.

Abbreviations

ANC – Antenatal care

AOR – adjusted odds ratio

BEmONC – basic emergency obstetrics and newborn care

CEmONC – comprehensive emergency obstetrics and newborn care

CI – Confidence Interval

EmONC – Emergency Obstetrics and Newborn Care

EOC – Emergency obstetrics care

LSTM – Liverpool School of Tropical Medicine

MiH – Making it Happen

MNH – maternal and newborn health

MOH – Ministry of Health

SDG – Sustainable development goal

SHP – Skilled health personnel

WHO – World Health Organization

Declarations

Ethical approval and consent to participate

Secondary data was used. No institutional research and ethics review was sought. All data from the training database used was deidentified before analysis and this was part of the monitoring of implementation to strengthen capacity of the workforce through in-service EmOC training interventions, and all SHP consented/registered to participation in the trainings. Data was accessed from the internal LSTM maintained training database in Kenya and no administrative permissions were required to access the raw data.

Consent for publication

Not applicable (as our manuscript does not contain any personal information, or data in any form (including any individual details, images or videos)).

Availability of data and material

The datasets used and/or analysed during the study are available from the corresponding author on reasonable request.

Competing interest

The authors declare that they have no competing interests.

Funding

None

Authors' contributions

DS and CA conceptualized the idea and designed the study. DS performed data extraction, cleaning, analysis and interpretation of the results, drafted the primary manuscript, reviewed and prepared it for publication. CA, HA, ET and IB interpreted the results and substantively reviewed the manuscript for publication. IN, OM, ME, SG, FI and LN participated in the design of the study procedures, data collection and reviewed the drafts and final manuscript. All the authors read and approved the final manuscript.

Acknowledgement

This paper has been developed under the Reducing Maternal and Newborn Deaths programme funded by the UK Government as part of efforts to improve access and utilisation of all the EmOC signal functions for quality maternal and newborn health services at health facilities and better maternal and perinatal outcomes in Kenya. We specially acknowledge the collaboration and support provided by Gladys Etemesi (Kilifi County Reproductive Health Coordinator), Margaret Chuya (Taita Taveta County Reproductive Health Coordinator), Veronica Musiega (Vihiga County Reproductive Health Coordinator) and Carolyne Chemoiywo (Uasin Gishu County Reproductive Health Coordinator) and the respective counties' health departments through the reproductive health offices using the cost-shared model of health financing to

improve the quality of MNH services. Lastly, the authors would like to acknowledge the special logistical support provided by the LSTM team in Kenya – Veneranda Kamanu, Roselyne Githinji, David Ndakalu, Esther Wekesa, Eunice Ngundo and Pamela Godia during the data collection.

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Figures

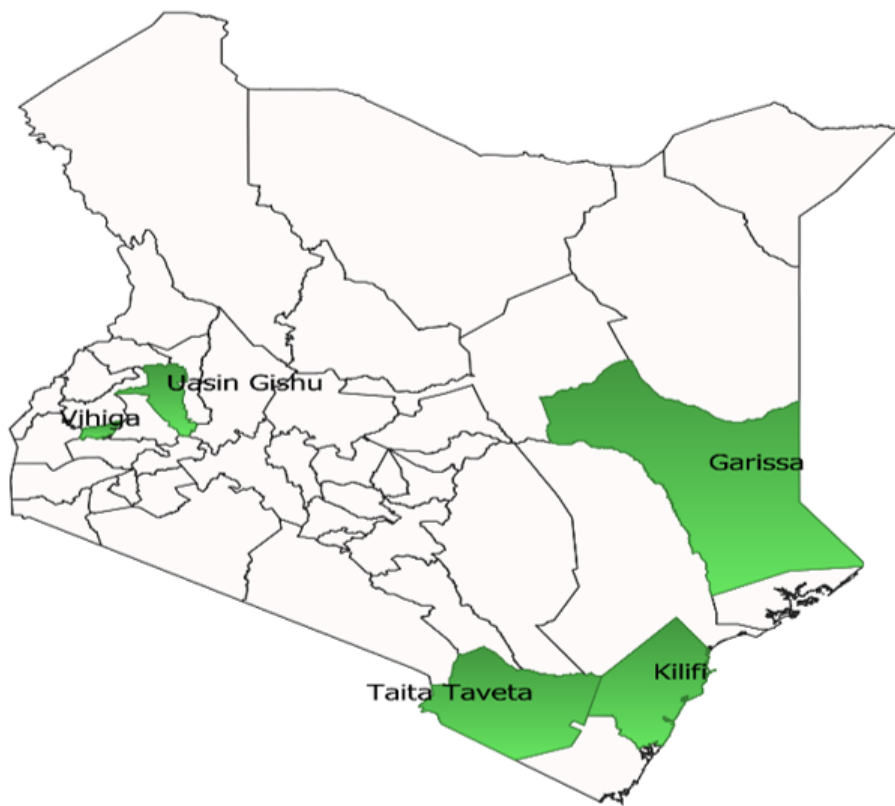


Figure 1

Five counties supported by LSTM included in the study