Community midwifery model’s effect on availability, utilization and outcomes of maternal and newborn health services in hard-to-reach communities of Busia Kenya: a Quasi-experimental study

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Abstract

Background

Globally, poor women in hard-to-reach areas are least likely to receive healthcare and carry the burden of maternal and neonatal mortality related to complications of childbirth. Midwifery can avert 83% of all maternal & neonatal deaths and stillbirths. This study evaluated the effect of an enhanced community midwifery model (CMM) on skilled attendance during pregnancy and childbirth and maternal and perinatal outcomes against the background of protracted healthcare workers’ strikes in rural Kenya.

Methods

A quasi-experimental (one-group pretest-posttest) designed. Six-months pretest period: December’2016-May’2017. Between Dec’2016-Feb’2017 (period 1) - a doctors’ strike and March-May’2017 (period 2), normal healthcare services resumed. An enhanced CMM (using 10 CMs linked to 6 health facilities) was implemented in the proceeding 5-months posttest period (period 3) – June-October’2017 during the national nurses/midwives’ strike. Differences in performance means for MNH variables of interest between the three periods were computed by ANOVA. Two-groups test of proportions for before and during/after the enhanced CMM computed.

Results

There were differences in mean monthly attendance for community midwifery services for the three periods: 1st ANC (1.8-2.3-9.9, P = 0.0087), 4th ANC (1.4-1.0-7.1, P = 0.0212), skilled births (1.5-1.7-13.1, P < 0.0001). Mean attendance at facility were: 1st ANC (55.7-70.8-4.0), 4th ANC (29.6-38.1-1.2) and skilled births (63.1-87.4-5.6), P ≤ 0.05. No differences in attendance between the doctors’ strike and normalcy period for both CMs and health facilities’ MNH services (P ≥ 0.05). However, significant increases for CMs MNH services during the nurses/midwives strike and significant reductions at the facility level during the same period (P ≤ 0.05). An increase of 68%, 74.5%, 67.8% and 33.3% in the proportion of 1st and 4th ANC, skilled births and PNC conducted by CMs during/after the CMM respectively (P ≤ 0.0001). A double and triple reduction in macerated stillbirths (0.70%-0.36%) and neonatal deaths (0.54%-0.18%) respectively and an increase in babies discharged alive (98.05%-100%) with no change in maternal deaths during/post intervention.

Conclusions

There was improvement in access/utilization of pregnancy and childbirth services from CMs. There is a golden opportunity to integrate the CMs to primary health care system to improve uptake of MNH care services through an enhanced CMM strategy in hard-to-reach communities.

Background

Globally, the latest estimates indicate that 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 respectively (1–3). The risk of a mother dying in a low- and middle-income country is 23 times higher than in a high income country (maternal mortality ratio (MMR) of 254 vs 11 per 100,000 live births) with sub-Saharan Africa having the highest MMR at 534 per 100,000 live births compared to Europe and Central Asia with the lowest MMR at 11 per 100,000 live births (1). An estimated 72 percent of births are now attended by a skilled health personnel (SHP). This however varies according to income group (46 percent in low-income groups and 99 percent in high-income groups) and by geographical area (48 percent in the African region and 99 percent in Europe) (4). Poor women in remote areas are the least likely to receive adequate health care and carry the burden of maternal and neonatal morbidity and mortality related to complications of childbirth (5). This clearly indicates that strategies and policies to address financial risk protection and access to quality essential healthcare services must be adopted to achieve universal health coverage (6). These reflect inequities around the world in access to health services, and highlights the disparities/gaps between countries, but also within countries, and between women with high and low income and those living in rural versus urban areas (7).

Healthcare solutions to prevent or manage these complications are well known. All women need access to antenatal care (ANC) in pregnancy, skilled care during childbirth, and care and support in the weeks after childbirth (7). Countries have now united behind Sustainable Development Goal 3 to reduce the global maternal mortality ratio to less than 70 per 100 000 births, with no country having a maternal mortality rate of more than twice the global average (7). To improve maternal health, barriers that limit access to quality maternal
health services must be identified and addressed at all levels of the health system. As part of the Global Strategy and goal of Ending Preventable Maternal Mortality, World Health Organization (WHO) supports countries through advocacy for more affordable and effective treatments, guidelines and policies towards addressing inequalities in access to and quality of reproductive, maternal, and newborn health care services and ensuring universal health coverage for comprehensive reproductive, maternal, and newborn health care (7). Africa experiences a critical shortage of healthcare providers. The WHO reported that 36 of the 57 countries facing chronic human resource shortages in the health sector are in Sub – Saharan Africa (8) and that only 12.0 per 10,000 of nursing/midwifery personnel are in Africa compared to 80.5 nurses/midwives per 10,000 people in the European region. This shortage of skilled birth attendants is even more severe in rural compared to urban areas (4).

Midwifery, including family planning and interventions for maternal and newborn health, could avert a total of 83 percent of all maternal deaths, stillbirths and neonatal deaths (9). Midwives are skilled health personnel (SHP) providing care during childbirth. WHO, International Federation of Gynecology and Obstetrics (FIGO) and International Confederation of Midwives (ICM) define a SHP as a competent maternal and newborn health (MNH) professional educated, trained and regulated to national and international standards competent to: provide and promote evidence-based, human-rights-based, quality, socio-culturally sensitive and dignified care to women and newborns; facilitate physiological processes during labour and delivery to ensure a clean and positive childbirth experience; and identify and manage or refer women and/or newborns with complications (10). Within an enabling environment (one that provides supportive regulation, policies and infrastructure, communication, referral, logistics, and supplies, inputs that are necessary for a skilled attendant to provide care) (11), midwives can provide 87 percent of the needed essential care for women and newborns, when educated and regulated to international standards (12). To achieve this, midwives must be equitably distributed, accessible by the population and possess the required competencies and motivation to deliver quality care that is appropriate and acceptable to the sociocultural contexts and expectations of the served population (13).

Evidence around the world (especially in Sri Lanka and Pakistan) including Kenya's rural and peri – urban areas has shown that community – based interventions (including community midwives) improve ANC coverage, intrapartum care and reproductive health/family planning, maternal and neonatal health care and outcomes for the poor and disadvantaged women (11, 14–21). World Health Organization specially emphasizes the role of community midwives (CMs) and other community – based interventions in promoting safe motherhood particularly in rural settings with low access to health services (22, 23). However, lack of skills – both clinical and entrepreneurial, and access to funds necessary to develop their practice infrastructure and logistics are major bottlenecks in their operations (11, 20, 21, 24, 25).

Kenya's 2017 MMR is high, estimated at 342 per 100,000 live births way above the global SDG target of less than 70 per 100,000 live births (1, 6). The 2014 national estimates by the Kenya Demographic and Health Survey showed that only 62 percent of births were assisted by a SHP. Worryingly, half of the women residing in rural areas are not attended to by a SHP (26). Delays in reaching health facility account for 42 percent of the maternal deaths as per the first Confidential Enquiry into Maternal Deaths 2017 report. Besides, one in every five maternal deaths had an avoidable community factors identified (27). This underscores the importance of community interventions to improving maternal and perinatal outcomes. Kenya commissioned the community midwifery model in 2006 as an attempt to increase access to skilled attendance at birth. The first implementation guidelines were developed in 2007 and were revised in 2012 to address key policies outlined in the Kenya Health Policy (2012–2030) regarding the provision of essential packages for health, Vision 2030 and the Community Health Strategy (28). The guidelines were revised to standardize the implementation of community midwifery services as a strategy for improving skilled attendance in the provision of maternal and newborn health care at the community level. They highlighted the critical role of the community midwife in the provision of continuum of care during normal pregnancy, childbirth, postpartum period, and in counselling for and providing family planning services as well as newborn care and referral.

Two national industrial strikes by SHP (December 2016 – February 2017 and June – October 2017) crippled the country’s healthcare system and led to many deaths as reported in the Lancet reports (29, 30). During the second strike, Save the Children's 3-year Boresha project from April 2015 – March 2018 with funding from United Kingdom’s Department for International Development (DfID) supported Busia County Department of Health to implement an enhanced community midwifery model (one of the project areas), a community-based intervention whose aim was to create demand, improve access and utilization of skilled antenatal, childbirth and postnatal care services in rural 'hard-to-reach' communities. This was part of a 3-pronged project approach that targeted demand creation in the community for MNH services through the community health strategy; service delivery of MNH services in the health facilities focusing on quality improvement of MNH services through maternal and perinatal deaths surveillance and response; and advocacy to increase government commitment and targeted resources allocation to health. These interventions are essential in reducing preventable maternal and newborn mortalities in communities with low/reduced access to quality maternal and newborn health services. This study evaluated the effect of an enhanced community midwifery model on skilled attendance during pregnancy and childbirth and maternal and newborn health outcomes against the background of a protracted national skilled health personnel’s crisis. The secondary objective was to review the effect of the national doctors and nurses/midwives’ strikes on availability and utilization of MNH services in rural settings of Busia County, Kenya.
Methods

Setting

Busia County has seven sub counties and is predominantly a rural setting. The county’s skilled delivery is 59% (lower than the national average of 62%) meaning that two out of every five women deliver both at home and without a skilled attendance (31). In addition, the county has traditional birth attendants who provided home antenatal and delivery services. During the project, these were reoriented to become birth companions (BCs) and primarily support in health education and referral of pregnant women to the health facilities for skilled antenatal, birth and postnatal care. The four rural hard-to-reach sub counties with poor maternal and newborn health indicators supported were: Teso North, Teso South, Nambale and Samia. In this review, ‘hard-to-reach’ refer to populations who have little regular contact with skilled pregnancy and childbirth services including people living in areas ‘too far’ from the health services. ‘Too far’ not only refers to the physical distance but also logistics and human resource capacity as used in the ‘reaching every district’ strategy in immunization (32).

The Community Midwifery Model (CMM) in Kenya uses skilled out of work or retired licensed healthcare professionals who are resident within a given community and seeks to contribute towards the achievement of SDG 3 (28) and helping to address the three delays that commonly contribute to maternal and perinatal mortality (33, 34). Their primary role is the provision of a continuum of care during normal pregnancy, childbirth, postpartum period, and in counselling for and providing family planning services as well as newborn care and referral. To achieve this, they link with community health volunteers (CHVs), BCs, community health extension workers (CHEWs), local committees, facility staff and county teams as prescribed in the implementation guidelines. In this study, all community midwives had the essential prerequisites for community midwifery services as required in the implementation guidelines for community midwifery services in Kenya (28): retired health professionals (nurse/midwives) with midwifery skills registered with the national regulator Nursing Council of Kenya; had valid practicing licenses (evidence of retention on a professional register with the Nursing Council of Kenya) and lastly, they all had residency within the community they were serving. Their areas/clinics for service provision were verified and supervised by the respective subcounty health management team.

To facilitate their work, Save the Children in collaboration with the Busia County Department of Health supported their training in emergency obstetrics and newborn care (EmONC) to reinforce their essential skills as SHP able to provide nearly all EmONC signal functions, and were provided with necessary logistics (Table 1). Pharmaceuticals (Oxytocin for prevention of postpartum hemorrhage) and non-pharmaceuticals supplies – gloves, syringes and needles, cotton wool and gauze were supplemented and replenished by the link health facilities. Structured monthly and/or appropriate support supervision and mentorship was provided by the project team and the respective subcounty health management team (subcounty nursing officer, subcounty reproductive health coordinator and subcounty community strategy focal person) on quality service delivery.

| 5-days training in emergency obstetrics and newborn care (EmONC) using national EmONC training curriculum |
|--------------------------------------------------------------------------------------------------|
| Antenatal care equipment: weighing scale – adult and infant; fetal scopes                               |
| Intrapartum care equipment: vaginal examination kits; delivery kits, partographs                        |
| Newborn resuscitation equipment – bag and mask/ambubag for ventilation (size 0 and 1) and penguin suction |
| Infection prevention & control decontamination and waste segregation buckets*                             |
| Antepartum, intrapartum and postpartum care job aids/protocols                                           |
| Service delivery registers - mother and child health booklets, antenatal care registers, delivery registers, |
| Referral forms and registers and referral telephone numbers                                               |

* Where sterilizing equipment were not available, link health facilities supported this function as appropriate.

Scope Of Community Midwifery Services

The community midwives provided a range of antenatal, delivery and postnatal care services as recommended by the national guidelines in provision of community midwifery (28) & health services (35) (see Table 2). Importantly, all the childbirth services were conducted at the community midwife’s clinic and in exceptional cases, for instance, insecurity (especially at night), long distances and requests from clients, some were conducted at the community midwives’ homes, as also reported in recent evaluations in the country (36).
Table 2
Services offered by the community midwives

| Period    | Services offered                                                                                                                                 |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Antenatal | dissemination of key messages on danger signs in pregnancy, birth planning and emergency preparedness to support safe pregnancy and delivery of a healthy newborn and early childhood care; monitoring and assessment of pregnancy through focused antenatal care (FANC) model; intermittent preventive treatment for malaria in pregnant women (IPT); tetanus toxoid vaccination; referral for antenatal profile; counseling and testing for HIV among the pregnant women<sup>a</sup> |
| Childbirth| Childbirth care in uncomplicated labour and delivery (Essential Obstetric Care); provision of EmONC signal functions<sup>b</sup>; stabilizing women and/or their newborns who have complications prior to referral; |
| Newborn   | Provision of essential newborn care – warmth, resuscitation, early initiation of breast feeding, nutritional counselling & hygiene |
| Postnatal | Targeted health education/information on danger signs, early detection and treatment of problems, care of breasts, advice on caring for the newborn; immunizations as per the Kenya Expanded Program on Immunization schedule, counseling and testing for HIV among the pregnant and postnatal mothers and provision of family planning counselling and services |
| Family planning | Provision of family planning counselling and methods – pills, injectables, implants and intra-uterine contraceptive devices |

<sup>a</sup> HIV counselling available but testing not available in all the clinics

<sup>b</sup> EmONC signal functions provided include administration of parenteral oxytocics, administration of parenteral antibiotics, administration of parenteral anticonvulsants, manual removal of placenta and newborn resuscitation

Community midwives admitted clients for childbirth services. The period of stay at the CM varied from 1–3 days depending on the condition of the mother. Cases that required further review and care were referred to the link private facility to prevent obstetric complications. It is important to note that there was a minimal user fee for services provided by the CMs. However, no emergency services or delivery services were denied for lack of these fees charged – in line with the universal health coverage policies. Non-monetary items and/or gifts in kind were also a form of payment that was acknowledged by the CMs for the services rendered to the community. In a few occasions however, the services were provided for free depending on the client’s socio-economic capacity. The project supported a reimbursement of KSh. 100 ($1) for BCs for every appropriate referral made with a pregnancy, childbirth or postpartum danger signs. The referral danger signs were: maternal – vaginal bleeding, reduced or no movements of the unborn baby, convulsions, pale, fever, severe headache and severe abdominal pain; neonatal – refusal or poor breastfeeding, infection/fever, convulsions and difficulty breathing.

Design

A quasi-experimental (one-group pretest-posttest) was designed. This design was utilized to determine the effect of a treatment or intervention (an enhanced community midwifery model) on a given sample (hard-to-reach communities/health facilities) against the background of the protracted healthcare workers’ strikes. Besides, the design is characterized by use of a single group of participants (10 community midwives and their link facilities in this study) where all participants are given the same treatments and assessments, therefore, all are in the experimental condition. Secondly, there is a linear ordering that requires the assessment of a dependent variable before and after a treatment is implemented (skilled birth attendance access and utilization for this study) (37). There was no comparison group of facilities that would have selected for a control as community midwives were only established/developed in the project sites making the choice of this one-group pretest-posttest design the best in the case to achieve the intervention effect. The 6-month pretest period used was between Dec 2016 – May 2017 where midwifery services were less disrupted (despite a 3-month doctors’ strike in the first half – December 2016 – Feb 2017 – of this period). Healthcare services resumed in the second half of this period (March – May 2017) in health facilities following the initial 3-month doctor’s strike. The 5-month posttest period used was June – October 2017 after rolling out the enhanced community midwifery model. During the posttest period, all healthcare services were severely disrupted in all health facilities across the country.
The six health facilities in this study were: two comprehensive EmONC (Teso North subcounty hospital and Alupe subcounty hospital) and four basic EmONC (Sio Port subcounty hospital, Nambale subcounty hospital, Amukura health centre and Moding health centre) (Fig. 1).

**Intervention**

A total of 10 available community midwives were enrolled, supported and linked to six high volume health facilities in each of the subcounty. Their distribution was as follows: Samia (1) – linked to Sio Port Subcounty Hospital; Nambale (3) – all linked to Nambale Subcounty Hospital; Teso North (3) – two linked to Teso North Subcounty Hospital and one linked to Moding Health Centre; and Teso South (3) – two linked to Amukura Health Centre and one linked to Alupe Subcounty Hospital.

During the doctors’ strike, maternal and newborn care service delivery (ANC, childbirth and postnatal care) were less affected in health facilities. During the nurses/midwives’ strike, maternal and newborn care services were severely affected across the country. During the nurses/midwives’ strike, a constellation of community midwifery model activities were supported and enhanced to create awareness and demand for community midwifery services: community sensitization by the community health volunteers (CHVs) on danger signs in pregnancy and importance of seeking skilled antenatal, childbirth and postnatal care; linkage of the CMs with the CHVs; reorientation of traditional birth attendants (TBAs) to BCs – initiated during strike period 1; linkage of the CMs and the CHVs with the reoriented BCs. Besides, CMs worked closely with CHEWs and CHVs and recognizing the role of each in the provision of various health services at the community level; data collection and monthly reporting and participation in the subcounty quarterly maternal and perinatal deaths surveillance and response (MPDSR) review meetings. In addition, the project team and the subcounty reproductive health and community health teams conducted support supervision & mentorship of CMs on emergency obstetrics and newborn care skills and community linkage. The CHVs and BCs encouraged and referred pregnant women in their catchment areas to the nearby CM for antenatal, childbirth and postnatal care (Fig. 2).

**Data Collection**

MOH reporting tools were utilized for all the health facility, community midwifery and community health reporting for all the indicators of interest as prescribed by the Ministry of Health.

Data on the numbers of pregnant women seeking antenatal and birth services for both facilities and community midwives were collected using the monthly MOH 711 summary report (Integrated Summary Report: Reproductive & Child Health, Medical and Rehabilitative Services). This is a secondary reporting tool with all the ANC and maternity service delivery data summarized from the primary daily activity reporting registers and is open – access and publicly available on the DHIS2 with login credentials required. This data was verified in the primary MOH tools: ANC register (MOH 405), maternity register (MOH 333) and postpartum care register (MOH 406) by the subcounty reproductive health and the records and information management teams. During the ANC, first and fourth ANC visits were targeted to show the access and utilization of focused ANC services as recommended (38). The maternity register collected data on the skilled births conducted and the postnatal care register collected data on the utilization of postnatal care services for the mothers who had either received delivery services at the CMs and/or had unskilled home births and visited for skilled check – up and/or immunization.

Community health services data – referrals by CHVs for ANC and skilled birth were collected in the prescribed MOH 514 – Community Health Service Delivery Log Book – reporting for all the service delivery data by the CHVs; MOH 515 – Community Health Extension Worker Summary, summarised by the Community Health Extension Worker all the data reported in MOH 514. The data reported in the MOH 514 was verified by the Community Health Extension Worker and the health facility care provider during the CHVs routine monthly data review meetings before eventual transfer into the revised publicly available and open – access MOH 515 summary tool available on DHIS2.

**Variables And Measurements**

Service attendance data for first and fourth ANC, birth and postpartum care by the facilities and CMs for the periods of interest were reviewed. A skilled birth was defined as a birth supported by a skilled health personnel, formerly known as a skilled birth attendant (doctor, midwife, community midwife), defined as an accredited health professional-such as a midwife, doctor or nurse-who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborn babies (10, 39). Postnatal care was defined as care to a woman 2–3 days post-delivery by a skilled health personnel – either in the health facility or by a community midwife.

**Data analysis**
Raw data was extracted from the DHIS2, entered in Microsoft Office Excel 2013, cleaned and exported to STATA version 12 for analysis. Facilities and community midwives were classified into three periods or groups. The three periods of analysis were coded as “1” for the 3-month strike period 1 (doctors’ strike – between December 2016 and February 2017), “2” for the normality 3-month period 2 between March and May 2017 and “3” for the 5-month strike period 3 (nurses/midwives’ strike) between June and October 2017. Performance mean scores of variables of interest (1st ANC attendance, 4th ANC attendance, skilled births and postnatal care) for the three periods were computed. To test the differences between the three periods/groups’ mean scores of variables of interest, a parametric test – one-way analysis (ANOVA) of variance was performed because of their more statistical power than their non-parametric equivalents and therefore more likely to detect significant differences when they truly exist (40). Kruskal-Wallis test, a non-parametric version of one-way-analysis of variance based on ranks which can deal better with small numbers was applied in some cells (41). To determine which periods were different from each other, Tukey post hoc tests were performed for significant (p-value ≤ 0.05) variables at ANOVA. Effect size, P-values and 95% confidence intervals were reported.

To determine the pre and post effect of the community midwifery model, period 1 and period 2 were aggregated to form the pre-community midwifery model intervention period (after the double pretest conducted using ANOVA above) (42). Period 3 represented the post – intervention period after the double pretest period to support the effect of the intervention on MNH attendance and outcomes. Proportions of performance were calculated by comparing the community midwives’ performance to the overall sum of the health facility and community midwives’ skilled birth attendance. Two-groups test of proportions were computed. A p-value of 0.05 and less was considered to indicate significant statistical difference. The level of confidence interval was 95%.

**Results**

**Maternal and newborn health services attendance at the health facility and community midwifery units**

The attendance for 1st & 4th ANC and skilled births at the community midwifery units was high during the nurses/midwives strike in period 3 compared to the previous two periods when nursing/midwifery services were less disrupted in the health facilities despite the doctors’ strike in period 1. Conversely, attendance in the health facilities was lowest in the health facilities during the nurses/midwives’ strike period 3 as compared to the other two periods (Fig. 3).

*data available for 4 facilities; 0 - data unavailable; Source: DHIS2

**Community Maternal And Newborn Health Services**

Community health volunteers continued to provide health education to the community on maternal and newborn health care services in all the three periods. In addition, they referred cases for ANC, skilled births and conducted home visits including counselling mothers on exclusive breastfeeding and identification of newborn danger signs and referral to health facilities for care. Unskilled community births were also reported in the community (Table 3).

| Indicator                                      | Period 1 | Period 2 | Period 3 |
|------------------------------------------------|----------|----------|----------|
| Community health level performance (by Community Health Extension Workers) |          |          |          |
| Referred for ANC                              | 173      | 283      | 321      |
| Referred for birth                            | 129      | 245      | 239      |
| Births                                        | 214      | 410      | 564      |
| Newborns visited within 48hrs after birth     | 176      | 360      | 596      |
| Counselling on EBF                            | 317      | 735      | 1421     |
| Newborns referred with danger signs           | 5        | 6        | 15       |

ANC – antenatal care; EBF – exclusive breastfeeding; *data available for 4 facilities; ** data unavailable; Source: DHIS2
Maternal and newborn health care attendance mean scores at the health facility, community midwifery units and the community level

The overall mean scores for 1st & 4th ANC, skilled births and postnatal care attendance at the health facility level were 43.5 (± 37.5), 23.0 (± 20.3), 52.0 (± 48.2) and 28.9 (± 22.5) respectively with 4th ANC attendance reporting the lowest and skilled births the highest compared with the other services. At the community midwifery units, the overall means for 1st ANC, 4th ANC, skilled births and postnatal care was 4.7 (± 5.6), 3.2 (± 4.5), 5.4 (± 6.3) and 5.4 (± 8.7) respectively. At both the health facility and community midwifery units, there were significant differences between the three periods for 1st ANC, 4th ANC and skilled birth attendance (P ≤ 0.05). For community maternal and newborn health services, the mean scores for clients referred for ANC and skilled births, community births and newborn visitation within 48 hours after birth were higher during period 2 (normalcy period) compared to the other periods even though there were no significant differences between the three periods (Table 4).

### Table 4
Mean scores for maternal and newborn health services at facility, community midwifery and community units

|                              | Total       | Period 1       | Period 2       | Period 3       | ANOVA  | P-value |
|------------------------------|-------------|----------------|----------------|----------------|--------|---------|
| Facility level performance   |             |                |                |                |        |         |
| 1st ANC attendance           | 43.5 (37.5) | 55.7 (21.7)    | 70.8 (36.6)    | 4.0 (4.2)      | 12.05  | 0.0008* |
| 4th ANC attendance           | 23.0 (20.3) | 29.6 (14.0)    | 38.1 (17.7)    | 1.2 (1.5)      | 13.15  | 0.0005* |
| Skilled births               | 52.0 (48.2) | 63.1 (35.0)    | 87.4 (49.0)    | 5.6 (6.6)      | 8.66   | 0.0032* |
| Postnatal care**             | 28.9 (22.5) | 22.1 (12.9)    | 35.8 (29.8)    | **             | 0.2160 |         |
| Community midwives’ performance|            |                |                |                |        |         |
| 1st ANC attendance           | 4.7 (5.6)   | 1.8 (1.2)      | 2.3 (1.5)      | 9.9 (7.3)      | 6.62   | 0.0087* |
| 4th ANC attendance           | 3.2 (4.5)   | 1.4 (1.0)      | 1.0 (0.8)      | 7.1 (6.3)      | 5.04   | 0.0212* |
| Skilled births               | 5.4 (6.3)   | 1.5 (1.3)      | 1.7 (1.5)      | 13.1 (5.2)     | 26.03  | < 0.0001* |
| Postnatal care               | 5.4 (8.7)   | 2.7 (2.4)      | 3.2 (2.9)      | 10.2 (14.1)    | 1.5    | 0.2543  |
| CHEW level performance       |             |                |                |                |        |         |
| Referred for ANC             | 12.0 (10.0) | 9.6 (10.0)     | 15.7 (10.8)    | 10.7 (10.0)    | 0.6    | 0.5598  |
| Referred for birth           | 9.6 (7.5)   | 7.2 (5.8)      | 13.6 (10.0)    | 8.0 (5.5)      | 1.36   | 0.2869  |
| Births (community)           | 17.8 (9.3)  | 11.9 (6.2)     | 22.8 (11.4)    | 18.8 (7.2)     | 2.47   | 0.1179  |
| Newborns visited within 48hrs after birth | 16.5 (9.5) | 9.8 (5.4)    | 20 (10.6)      | 19.9 (8.9)     | 2.79   | 0.0933  |
| Counseled on EBF             | 35.3 (27.3) | 17.6 (13.0)    | 40.8 (30.8)    | 47.4 (29.0)    | 2.24   | 0.1403  |
| Newborns referred with danger signs | 0.4 (0.5) | 0.3 (0.3)    | 0.3 (0.4)      | 0.5 (0.7)      | 0.33   | 0.725   |

SD – standard deviation, ANOVA – Analysis of variance, ANC – antenatal care, EBF – exclusive breastfeeding

*P-value ≤ 0.05 statistically significant; ** data available for 4 facilities for periods 1 and 2 only and t-tests statistics computed
Post hoc analysis maternal and newborn health services at facility and community midwifery units

At both health facility and community midwifery units, there were no significant differences in mean attendance for MNH services between period 1 and period 2 ($P \geq 0.05$). However, there were significant differences in mean scores for MNH services between periods 2 and 3 for 1st ANC, 4th ANC and skilled births ($P \leq 0.05$). At the facility level, there were significant reductions in attendance for 1st ANC, 4th ANC and skilled births from period 1 and period 2 versus period 3, the greatest reduction being for skilled births with 81.8 between period 2 and period 3. At the community midwifery units, there were significant improvements in attendance for 1st ANC, 4th ANC and skilled births from period 1 and period 2 versus period 3, the greatest increase being for skilled births with 11.6 and 11.4 for periods 1 and 2 versus period 3 respectively ($P \leq 0.0001$) (Table 5).
Table 5
Pairwise comparison of means for MNH services between groups/periods

| Indicator           | Groups                  | Mean difference | Std Error | P-value | 95%CI       |
|---------------------|-------------------------|-----------------|-----------|---------|-------------|
| Facility level      |                         |                 |           |         |             |
| 1st ANC attendance  | Period 2 vs Period 1    | 15.1            | 14.3      | 0.553   | -22.0 - 52.2|
|                     | Period 3 vs Period 1    | -51.7           | 14.3      | 0.007*  | -88.8 - 14.6|
|                     | Period 3 vs Period 2    | -66.8           | 14.3      | 0.001*  | -103.9 - 29.7|
| 4th ANC attendance  | Period 2 vs Period 1    | 8.4             | 7.5       | 0.515   | -11.1 - 28.0|
|                     | Period 3 vs Period 1    | -28.4           | 7.5       | 0.005*  | -47.9 - 8.8 |
|                     | Period 3 vs Period 2    | -36.8           | 7.5       | 0.001*  | -56.4 - 17.3|
| Skilled births      | Period 2 vs Period 1    | 24.3            | 20.2      | 0.468   | -28.1 - 76.7|
|                     | Period 3 vs Period 1    | -57.4           | 20.2      | 0.032*  | -109.8 - 5.0|
|                     | Period 3 vs Period 2    | -81.8           | 19.0      | 0.003*  | -134.2 - 29.3|
| Community midwives  |                         |                 |           |         |             |
| 1st ANC attendance  | Period 2 vs Period 1    | 0.4             | 2.5       | 0.983   | -6.1 - 6.9  |
|                     | Period 3 vs Period 1    | 8.1             | 2.5       | 0.014*  | 1.6 - 14.6  |
|                     | Period 3 vs Period 2    | 7.7             | 2.5       | 0.021*  | 1.2 - 14.2  |
| 4th ANC attendance  | Period 2 vs Period 1    | -0.5            | 2.1       | 0.973   | -6.0 - 5.1  |
|                     | Period 3 vs Period 1    | 5.6             | 2.1       | 0.047*  | 0.1 - 11.2  |
|                     | Period 3 vs Period 2    | 6.1             | 2.1       | 0.031*  | 0.5 - 11.7  |
| Skilled births      | Period 2 vs Period 1    | 0.2             | 1.8       | 0.992   | -4.6 - 5.0  |
|                     | Period 3 vs Period 1    | 11.6            | 1.8       | <0.0001*| 6.8 - 16.4 |
|                     | Period 3 vs Period 2    | 11.4            | 1.8       | <0.0001*| 6.6 - 16.2 |

*P-value ≤ 0.05 statistically significant

Effect Of Community Midwifery Model On Mnh Services

Against the background of a national nurses/midwives’ strike, there was a significant improvement in the proportion attendance for all maternal and newborn health services by the community midwives. First and fourth ANC, skilled births and postnatal care attendance increased by 68.0, 74.5, 67.8 and 33.3 percentage points respectively (P ≤ 0.0001) during the intervention of the enhanced community midwifery model (Table 6).
### Table 6
Test of proportions pre and during/post community midwifery model implementation

|                  | Pre - CMM |                  | Post – CMM |                  | Diff | P-value |
|------------------|-----------|------------------|------------|------------------|------|---------|
|                  | HF        | CM               | TOTAL (N)  | Proportion (%)   | HF   | CM      | TOTAL (N)  | Proportion (%) |      |         |
| 1st ANC          | 2278      | 74               | 2352       | 3.1              | 121  | 298     | 419        | 71.1            | 68.0 | < 0.0001*|
| 4th ANC          | 1218      | 55               | 1273       | 4.3              | 57   | 212     | 269        | 78.8            | 74.5 | < 0.0001*|
| Skilled births   | 2707      | 58               | 2765       | 2.1              | 169  | 393     | 562        | 69.9            | 67.8 | < 0.0001*|
| Postnatal care** | 694       | 64               | 758        | 8.4              | 429  | 307     | 736        | 41.7            | 33.3 | < 0.0001*|

CMM = community midwifery model, HF = health facility, CM = community midwives, ANC = antenatal care, diff = difference in proportion (post – pre)

*P-value ≤ 0.05 statistically significant; ** calculated for 4 facility-CM dyads with data

### Maternal And Newborn Health Outcomes

There were significant differences between the three periods for the babies born and discharged alive and the neonatal deaths at the facility (P ≤ 0.05). However, there were no significant differences in the cases of macerated and fresh stillbirths and maternal deaths between the three periods (Table 7).

### Table 7
Kruskal – Wallis/One-way ANOVA test for maternal and newborn outcomes

| Facility outcomes | Total | Period 1 | Period 2 | Period 3 | ANOVA | P-value |
|-------------------|-------|----------|----------|----------|-------|---------|
|                   | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | F-value/X² |       |
| Babies discharged alive | 52.2 (48.3) | 63.8 (35.9) | 87.2 (49.0) | 5.7 (6.6) | 8.49 | 0.0034* |
| Macerated stillbirths | **   | 61.5     | 69       | 40.5     | 3.084 | 0.2139 |
| Fresh stillbirths | **   | 61.5     | 68.5     | 41       | 2.649 | 0.266 |
| Neonatal deaths   | **   | 54       | 82       | 35       | 7.651 | 0.0218*|
| Maternal deaths   | **   | 64       | 54.5     | 52.5     | 0.839 | 0.6574 |

*P-value ≤ 0.05 statistically significant, ** values small and Kruskal-Wallis performed, X² value following Kruskal-Wallis

Following pairwise mean comparison tests, there was a significant reduction in babies discharged alive between period 1 and 2 versus period 3 by 58.1 and 81.4 respectively. Besides, there was a significant reduction in the neonatal deaths between period 2 and period 3 by 0.6 (Table 8).
Effect Of Community Midwifery Model On Mnh Outcomes

Against the national nurses/midwives’ strike, there was a significant increase in the proportion of babies born and discharged alive by the skilled birth attendants from 98.05–100% ($P = 0.0004$). Macerated stillbirths halved from 0.7–0.36% and neonatal deaths reduced three times from 0.54–0.18% even though these differences were not statistically significant. There were no differences in proportions of fresh stillbirths and maternal deaths following the intervention (Table 9).

Table 9

Pre and during/post community midwifery model intervention MNH outcomes

| Pre-CMM intervention | Post-CMM intervention | diff | P-value |
|----------------------|------------------------|------|---------|
| N                    | n                      | Proportion (%) | N | n | Proportion (%) | Proportion (%) | n | Proportion (%) | Proportion (%) |
| Macerated stillbirths$^a$ | 2707 | 19 | 0.70 | 562 | 2 | 0.36 | 0.35 | 0.1751 |
| Fresh stillbirths$^a$ | 2707 | 15 | 0.55 | 562 | 3 | 0.53 | 0.02 | 0.4764 |
| Neonatal deaths$^b$ | 2772 | 15 | 0.54 | 565 | 1 | 0.18 | 0.36 | 0.1267 |
| Maternal deaths$^a$ | 2707 | 3 | 0.11 | 562 | 1 | 0.18 | -0.07 | 0.3394 |
| Babies discharged alive$^b$ | 2772 | 2718 | 98.05 | 565 | 565 | 100 | -1.9 | 0.0004$^*$ |

$^a$ denominator (N) – total births; $^b$ denominator (N) – total live births; $^*P \leq 0.05$ statistically significant

Discussion

This study set out to assess the effect of an enhanced community midwifery model on availability, utilization and outcomes of maternal and newborn health outcomes in rural hard-to-reach settings. Besides, it evaluated the effect of the skilled health personnel's strikes on availability of the MNH services. These are critical features that will help planning and implementation of high-impact interventions in hard-to-reach populations to contribute to a reduction in preventable maternal and perinatal deaths in poor resourced settings.
Findings in this study show that there were no differences on the availability and utilization of ANC attendance (first and fourth), childbirth and postnatal care services during the doctors’ strike and the normalcy period. This can be attributed to the fact that these services are midwife-led in low-resourced countries and essentially most pregnancies and births are uneventful with around 15 percent of all pregnant women likely to develop a potentially life-threatening complication that calls for skilled care, and some require a major obstetrical intervention to survive (43). Secondly, the staffing levels in Kenya in 2018 of 4,000 doctors and 47,000 nurse/midwives being active in the public health sector, translating to only two doctors for every 23 nurse/midwives means that health facilities can provide the minimum basic care by nurse/midwives for the estimated 70–80 percent of pregnant women entering labor that are classified as low risk by the World Health Organization (43, 44). This critical chronic shortage is similar in sub-Saharan Africa (8) and other resource-limited settings, with evidence suggesting that this shortage of skilled birth attendants is even more severe in rural compared to urban areas (4).

Community midwives complemented the existing MNH service delivery systems and their role was very critical especially with the nursing/midwives’ strike. Considering that nurse/midwives are the majority providers of care in pregnancy and childbirth, there absence through a health crisis such as the strikes or where facilities are far apart in rural settings provides an option to consider the available experienced and retired skilled health personnel to bridge the gap in these hard-to-reach communities. Evidence from Nigeria and Ghana in hard-to-reach communities demonstrated that strengthening community engagement and training in handling normal births and referring complications improved ANC coverage and normal births (45, 46).

Reorientation of traditional birth attendants to BCs and community sensitizations by CHVs are key drivers to ensure that communities seek skilled birth attendance during pregnancy and childbirth. Our findings concur with studies conducted in Nigeria and Kenya that emphasizes that CHVs and BCs are key decision influencers and/or decision – makers at the community level in seeking skilled maternal and newborn health services. This is especially in poor rural communities that maintain a strong bias for traditional birth attendant assisted home delivery (21, 47). Local evidence shows that delivery of health messages by CHVs increase knowledge of maternal and newborn care among women in the local community and encourage deliveries under skilled attendance (48). Importantly, the 2017 Kenya confidential enquiry into maternal deaths reports revealed that failure to recognize danger signs (12%) and delay in deciding to refer (11%) were the commonest frequently identified community factors associated with maternal deaths that can be addressed by these special community health workforce (27).

The significant improvements in the proportion of women who accessed skilled ANC and childbirth services from the community midwives during the nurses/midwives’ strike is crucial. Evidence suggests that 16 to 33 percent of all maternal deaths could be prevented by skilled birth attendance in developing countries (49). Further, promoting skilled birth attendance at birth is based on evidence that at least 75 percent of maternal deaths occur from late pregnancy to 48 hours following delivery (50). In Kenya, almost half of the intrapartum fetal deaths occurred in the antenatal and intrapartum period and over half (55.8 percent) of the maternal deaths occurred in the intrapartum and postpartum period (27). Community midwives’ involvement and integration in provision of these critical essential services was timely in averting further complications that would have likely arose from the Thaddeus and Main’s third delay of the 3-delays model (34). With their vast experience, support to the community midwives with regular knowledge and skills updates (through onsite mentorship and supportive supervision) and strengthening community linkages and referral pathways will enhance their capacity at managing or referring of pregnancy and childbirth cases with complications preventing obstetric catastrophes. It is also possible that with their maturity (as they were retired), they were held in high esteem by the community enabling them to seamlessly integrate in the health system.

Strengthening linkages between health facilities and community health interventions is integral to improving access and utilization of critical MNH services. The Kenya Service Provision Assessment Survey (2010) showed that linkage of public health facilities with the communities was poor at only four percent (compared to non – governmental facilities at 30 percent) (51). Given that up to 39 percent of pregnant women deliver at home in Kenya (26), a community midwifery model delivering community maternal and newborn health services is a key link to optimize access and utilization of MNH services (52). However, poor access due to geographical factors (including long distances from health facilities) and limited availability of referral systems for maternity emergencies are the major barriers in the hard-to-reach rural areas (51, 53). In these rural areas, 48 percent of people live more than 5 kilometres away from a health facility and only three percent of the facilities having a linkage with the communities they serve (51). Future programs should focus on increasing facility – community linkages through community health platforms to promote referral systems for maternity emergencies and pregnancy care.

Minimal user fees charged by the community midwives (including acceptance of other non – monetary payment) could be a major determinant of access to and uptake of skilled care in the community. Cost is a key deterrent to access and utilization of skilled pregnancy and childbirth care services especially women in rural areas (22, 54). Recognizing and supporting community midwives to be functional as key providers of care at the community level through provision of supplies, motivation and support supervision will be a key factor in consolidating the gains achieved so far through the free maternity policy effected in 2013 promoting utilization of maternity services in public health facilities (21, 54, 55). This will achieve the desired effect of strengthening the health system in rural poorly resourced settings.
that would cushion the primary consumers of primary health care from the financial constraints as well as achieving the universal health coverage for all populations.

Availability of other services apart from the antenatal and childbirth services could be a key driver for women seeking skilled care from community midwives. These included HIV testing, laboratory and child immunization services. Providing uninterrupted continuum of care is beneficial to the women as they can receive integrated care at one visit (56). This reduces the demands on their expenditure seeking for isolated services. This finding demonstrates that supporting the community health systems to provide the primary comprehensive preventive services will strengthen the level 1 service delivery in hard-to-reach communities (14, 28, 35, 36, 57). Therefore, empowering the community health workforce with the key messages and enabling environment for integrated community maternal and newborn health care is likely to contribute to improved health seeking behaviors in hard-to-reach populations.

Improvements in babies born and discharged alive and reductions in perinatal mortality outcomes from the study (even though not statistically significant) are promising. Increased household newborn visitation within 48hrs after births by CHVs, identification and referral of newborns with danger signs and enhanced health education and sensitization on benefits of exclusive breastfeeding could have contributed to the significant reductions in neonatal deaths. These findings are similar to the systematic review reports from studies conducted in developing countries on the effect of community health intervention packages involving training of community midwives on maternal and perinatal outcomes (58, 59). Within multisectoral interventions, community midwives have contributed to a reduction in maternal mortality ratios in developing countries (60). This focuses the value of integrating maternal and newborn care in community settings through a community midwifery model with a range of interventions, which can be packaged effectively for delivery through a range of community health workers and health promotion groups in hard-to-reach communities.

**Strengths And Weaknesses**

The strengths of this study are that it was conducted in an area that had received community interventions to improve maternal, newborn and child health outcomes and that despite these interventions, community maternal and newborn health linkages and services utilization was still weak in the initial health crisis and the normalcy periods preceding the crisis period 2. Therefore, this study documents how an enhanced community midwifery model can better improve health services utilization in context and inform design of programs to increase use of skilled care during pregnancy and childbirth in hard-to-reach communities. The short interval period of community midwifery model intervention essentially means that the increase in pregnant women seeking antenatal and childbirth care from the CMs is the treatment effect, a key strength of the selected study design and not as a result of the practice effect (61, 62). Besides, inclusion of a pretest period allowed us a comparison by which to assess the effect of the model intervention (62). Consequently, incorporating a ‘double pretest’ – period 1 and period 2 before implementing the intervention (period 3) allowed additional confirmation and support of the effect reported to be due to the model intervention, a key strategy for improving the one group pretest – post-test experimentation (42).

This review relied on data from the DHIS2 which may have weaknesses in completeness, quality and accuracy. The regular supportive supervision on data and reporting by the project and county teams played a crucial role in minimizing these renowned challenges in developing countries. The small number of community midwives in this study entails that our findings should be interpreted considering the small sample size and the rural context. This study did not study the causes of maternal and perinatal mortalities and therefore the reported mortalities cannot be attributed entirely to midwife-related factors.

**Conclusions**

There was a significant reduction in access and utilization of health facility MNH services with the nurses/midwives’ strike compared to the doctors’ strike. A collaborative approach between all the community health influencers – CMs, CHVs and the BCs played a crucial role in awareness and demand creation for utilization of skilled pregnancy and childbirth services in hard-to-reach communities. Community midwives improved skilled birth attendance at a crucial period when the health system was dysfunctional means that they can play a key role in improving skilled birth attendance and maternal and perinatal outcomes in hard-to-reach populations. There is a window of opportunity to integrate community midwives to primary health care system to complement skilled pregnancy and childbirth care in hard-to-reach areas. Devolved health systems should consider supporting the demand and supply sides of the community health models to create an enabling environment to provide skilled maternal and newborn health services in marginalized hard-to-reach communities.

**Recommendations**

This study recommends the following key strategies to improve uptake of skilled pregnancy and childbirth care in communities: (1) Hard-to-reach communities to consider integrating community midwives as part of community health services providers with the formal health
system factoring in incentives, equipping (provision of supplies and equipment) and building the capacity of community health workers for reproductive, maternal, neonatal and child health. (2) Community health workers to play a leading proactive role in creating awareness and educating pregnant women on maternal health and safe birth plans, such as use of the community midwives to facilitate prompt access to midwifery/obstetric care. (3) Counties must invest in community health strengthening initiatives including reorienting TBAs to BCs, empowering and motivating community health volunteers and investing in community transport systems to create demand for and utilization of skilled pregnancy and childbirth attendance in hard-to-reach communities.

**Abbreviations**

ANC – Antenatal care  
BCs – Birth companions  
CHEWs – Community health extension workers  
CHVs – Community health volunteers  
CI – Confidence Interval  
CMM – Community midwifery model  
CMs – Community midwives  
DHIS - District Health Information System  
EmONC – Emergency Obstetrics and Newborn Care  
FANC – Focused antenatal care  
FIGO – International Federation of Gynecology and Obstetrics  
ICM – International Confederation of Midwives  
MOH – Ministry of Health  
MPDSR – Maternal and Perinatal Death Surveillance and Response  
PNC – Postnatal care  
SHP – skilled health personnel  
WHO – World Health Organization

**Declarations**

**Ethics approval and consent to participate**

No institutional review board determination was sought for the study because the Kenya DHIS2 data are publicly available, and the use of program reports in aggregate form was not human subjects’ research (63).

**Consent for publication**

Not applicable

**Availability of data and material**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. The data was extracted from the Kenya Health Information System (KHIS), formerly the District Health Information System 2 (DHIS2), an open source
public access system where all MOH reporting is done and requires registration credentials to access. The link to the databases used is https://hiskenya.org/dhis-web-pivot/

Competing interests

The authors declare that they have no competing interests. The opinions and views expressed in this publication are those of the authors. The information herein does not represent official Save the Children information and does not purport to reflect the opinions, views or positions of the agency.

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Authors’ contributions

DNS: designed the study procedures, provided technical support to the community midwives, conducted data collection, performed data analysis & interpretation and drafted the manuscript; GT and MW participated in the study design and provided the technical support to the community health strategy component implementation and reviewed the initial and final manuscript; TP, DW, JF and EA participated in the design of the intervention, led and supervised the implementation of the intervention at the community and facility level, participated in data reporting and reviewed the manuscript; KS participated in the design of the intervention, provided the overall technical guidance to implementation and reviewed the initial and final manuscript. All authors read and approved the final manuscript.

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Figures

![Figure 1](image)

Figure 1

QGIS distribution of the 8 community midwives’ linked health facilities in Busia County (Authors’ own; generated using QGIS software)
Figure 2

Summary of interventions in the before and during/after intervention periods

- **Pre-intervention period**
  - Dec 2016 - Feb 2017 (Doctors' strike)
  - 1. Mentorship on EmONC skills
  - 2. Supportive supervision
  - 3. CHVs referral of pregnant women for ANC and birth
  - *MNH services less disrupted in the facilities

- **During enhanced intervention period**
  - June - October 2017 (Nurses/midwives’ strike)
  - 1. Orientation of CHVs and ECs on CMs services
  - 2. Sensitization of community by CHVs on CMs
  - 3. Linkage of CMs to CHVs and ECs
  - 4. Community-based referrals by CHVs and ECs
  - 5. Baby outfits for every delivery
  - 6. Mentorship of CMs on EmONC skills
  - 7. Participation in subcounty MFDR reviews
  - 8. Supportive supervision
  - *MNH services severely disrupted in all health facilities

March - May 2017 (normalcy period)
- 1. Mentorship on EmONC skills
- 2. Supportive supervision
- 3. CHVs referral of pregnant women for ANC and birth
- *MNH services functioning normally in health facilities

Figure 3

Attendance for maternal and newborn health services at the health facility and community midwifery units