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Effect of A Community Health Worker led Intervention on Skilled Birth Care in Rural Mwingi West Sub-County, Kenya: A Quasi Experimental Study

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Abstract

Despite strong evidence that skilled birth care (SBC) significantly reduces maternal deaths, one in four babies worldwide are delivered without SBC. This has kept maternal mortality rates (MMR) high in sub-Saharan Africa and Kenya in particular. Kenya adopted Community Health Strategy (CHS) with the aim of improving community health services. The aim of this study was to evaluate the effect of CHS on SBC in Mwingi west sub-county, Kenya. A quasi experimental study design was conducted with 1 pretest and 2 post-test household surveys done in intervention and control sites. Sample size in each survey was 422 households. Women with a child aged 9-12 months were main respondents. Binary logistic regression analysis was used to estimate the odds of SBC utilization before and after the intervention In intervention site; SBC utilization significantly improved by 12.9% (57.9% vs. 70.5%) and women in end term survey were 1.6 times (Adj. OR=1.556, P<0.0001; 95%CI: 1.295-1.868) more likely to deliver under SBC compared to baseline. Compared to control, the proportion of women delivering under SBC in intervention site increased by 8.6%. To improve maternal and child health outcomes in Kenya, implementation of CHS should be fast tracked in all counties. *(Afr J Reprod Health 2018; 22[3]: 59-70).*

Keywords: Community Health Strategy, Community Health Workers, Skilled Birth Care, Maternal and Child Health

Résumé

Malgré des preuves solides que les soins de naissance qualifiés (SNQ) réduisent de manière significative les décès maternels, un bébé sur quatre dans le monde est livré sans SNQ. Cela a maintenu les taux de mortalité maternelle (TMM) élevés en Afrique subsaharienne et au Kenya en particulier. Le Kenya a adopté une stratégie de santé communautaire (SSC) dans le but d'améliorer les services de santé communautaires. L'objectif de cette étude était d'évaluer l'effet du SSC sur les SNQ dans le sous-comté de Mwingi l'Ouest, au Kenya. Un plan d'étude quasi expérimental a été réalisé avec 1 pré-test et 2 enquêtes post-test sur les ménages effectuées dans des sites d'intervention et de contrôle. La taille de l'échantillon dans chaque enquête était de 422 ménages. Les femmes ayant un enfant âgé de 9 à 12 mois étaient les principales personnes interrogées. Une analyse de régression logistique binaire a été utilisée pour estimer les chances d'utilisation du SNQ avant et après l'intervention sur le site d'intervention. L'utilisation des SNQ s'est nettement améliorée de 12,9% (57,9% contre 70,5%) et les femmes en fin de traitement étaient 1,6 fois plus nombreuses (Adj. OR = 1,556, P <0,0001; IC à 95%: 1,295-1,868) à la ligne de base. Comparativement au groupe témoin, la proportion de femmes accouchant sous le SNQ dans le site d'intervention a augmenté de 8,6%. Pour améliorer les résultats en matière de santé maternelle et infantile au Kenya, la mise en œuvre de la SSC devrait être accélérée dans tous les comtés. *(Afr J Reprod Health 2018; 22[3]: 59-70).*

Mots-clés: stratégie de santé communautaire, agents de santé communautaires, soins à la naissance, santé maternelle et infantile

Introduction

Maternal survival has significantly improved since the adoption of Millennium Development Goals (MDGs). Globally, maternal mortality ratio dropped by 44% between 1990 and 2015[1]. Despite this progress, every day hundreds of women die during pregnancy or from childbirth-related complications. Most of these deaths are in the developing regions, where MMR is about 14 times higher than in the developed regions[1]. By 2015, developing countries accounted for approximately 99% of global maternal deaths with sub-Saharan Africa alone accounting for roughly 66% followed by Southern Asia [2]. In Kenya, MMR is high (510 per 100 000 live births)[2]. Skilled birth care (SBC) is one of the proven health interventions which can help reduce MMR by preventing and managing pregnancy and child birth related complications[1].

SBC is defined as "the process by which a woman is provided with adequate care during labor, delivery, and early postpartum period by a skilled attendant operating within an environment capable of providing care for normal deliveries as well as appropriate emergency obstetric care" while the term skilled birth attendants refers exclusively to accredited health professionals such as midwifes, doctors or nurses who have been educated and trained to proficiency in the skills needed to manage normal pregnancies, childbirth, and the immediate postnatal period.[3,4] By end of 2014, more than 71% of deliveries were conducted under SBC globally[1]. This was a tremendous progress compared to 59 per cent observed in 1990[1]. This progress however was not without inequalities. Literature reveals that regions with low SBC prevalence had the highest MMR. In sub-Saharan Africa and southern Asia Countries for example, the prevalence of women delivering under SBC was reported as 52% (lowest globally)[1]. Consequently, sub-Saharan Africa and Southern Asian regions have the highest MMR in the world with sub-Saharan Africa alone accounting for roughly 66% of maternal deaths globally (MMR 546 per 100 000 live births) followed by Southern Asia (176 per 100 000 live births)[2]. On the other hand, countries with high prevalence of SBC deliveries were reported to have low MMR. Regionally, proportion of women delivering under SBC in Latin American and Caribbean countries, Caucasus and Central Asia, and eastern Asian countries is 92%, 96% and 100% respectively[1]. Consequently, these regions had a low MMR with Latin America and Caribbean countries having a MMR of 67 deaths per 100,000 live births, Caucasus and central Asia had 33 per 100, 000 live births, and eastern Asia had 27 per 100, 000 live births[2].

Despite strong evidence that SBC significantly reduces maternal deaths, one in four babies worldwide are delivered without SBC[1]. In Kenya proportion of women who delivered under SBC improved markedly from 43% in the 2008/09 Kenya Demographic and Health Survey (KDHS) to 61% in the 2014 KDHS[5]. Despite this improvement, proportion of women delivering under SBC is still low in many parts of the Country. Nineteen out of the 47 Counties in Kenya have less than half of women delivering without SBC[5]. In Tana river county, that proportion is 31%, Wajir County -18%, Marsabit County -25%, Turkana County -23%, West Pokot County -25%, Samburu County -24%, Trans Nzoia County -41% and in Kitui County where Mwingi West sub-county is located, the proportion of women delivering without SBC is low at 45%[5].

Studies have shown that different countries have embraced different interventions to help increase number of women delivering under SBC. In Bangladesh, an integrated maternal health care intervention focused on deployment of Community based Skilled Birth Attendants increased SBC significantly among rural women[6]. In Nigeria, evaluation of a community based intervention initiated to address transport as a barrier in accessing SBC was found to improve access to SBC among women in rural areas[7]. In Pakistan, evaluation of Community Health Worker (CHW) led intervention which promoted SBC among other Maternal and Child Health (MCH) services revealed that the intervention increased number of women delivering under SBC[8]. Rwanda is one of the countries which reduced MMR by three quarters, between 1990 and 2015 and achieved Millennium Development Goal (MDG) target (5A)[9]. This achievement is attributed to a number of interventions which include CHW led interventions[9]. Though Kenya did not meet MDG number 5, the country has embraced several interventions to meet MDGs. Evaluation of a Traditional Birth Attendant (TBA) led campaign in eastern part of Kenya established that the TBA led intervention was effective in increasing delivery under SBC[10]. Another study conducted to establish effectiveness of a CHW led health education on SBC in three rural locations in Kenya established that the campaign was effective in increasing SBC in intervention sites[11].

In 2006, Kenya adopted a CHW led Primary Health Care intervention popularly referred to as the Community Health Strategy (CHS) with the aim of improving health service delivery at the community level[12]. In Mwingi West sub-county, CHS was initiated in 2011 by the Ministry of Public Health and Sanitation (MoPHS) in partnership with African Medical and Research Foundation (AMREF)-Kenya[13]. Since inception of CHS in Mwingi west Sub County, no evaluation has been conducted to establish the effect of the intervention on SBC. This coupled with the low uptake of SBC among women in the sub-county (45%)[5] justified the need to carry out this assessment. The aim of this study was to evaluate the effect of CHS on utilization of SBC in Mwingi west Sub County.

Methods

The research design

This was a quasi-experiment study in which 1 pre-test and 2 post-test time series household surveys were conducted in both intervention and control sites. Data was collected at 3-time points; a baseline survey was used to collect baseline data in both intervention and control sites. First post intervention (midterm evaluation) survey data was collected in both intervention and control sites nine months after implementation of the CHS in intervention site. Second post intervention (end-term) survey data was collected in both intervention and control sites 18 months after implementation of the CHS in intervention site. Women of reproductive age with a child aged 9-12 months were main respondents. Each survey enrolled different participants.

Study area

This was an experimental study with intervention and control site. Intervention site was Mwingi west sub-county and control site was Mwingi North sub-county. Both sub counties are in Kitui County. Mwingi west sub-county has a total population of 111,346 people[14]. Mwingi North sub county has a total population of 150,179 people[14]. Intervention and control sites have similar climatic and ecological characteristics, poor infrastructure and are located in a rural arid and semi-arid area[15].

The CHS intervention

CHS is a CHW led[12] Primary Health Care (PHC) intervention in which CHWs play a leading role in providing PHC services. Among PHC services provided is MCH education and promotion. CHWs promoted SBC by identifying newly expectant women in the Community and educating them on importance of delivering under SBC among other MCH issues. CHWs then linked these mothers to local health centers to ensure they received essential MCH services including delivery under SBC.

Inclusion and exclusion criteria

In both intervention and control sites women with a child aged 9-12 months and who gave verbal or written informed consent were included in the study. Women excluded in the study are those with a child aged 9-12 months and did not give consent, and those with a child outside the age limit of 9-12 months.

Sample size determination

Reference[16] provides Fisher's formula for calculating representative sample size of a population with more than 10,000 participants. After employing this formula, a representative sample size of 384 households was established. Thirty-eight households (10 percent of 384 households) were added into this sample to cater for non-response. A total sample size of 422 households was determined.

Sampling procedure

Purposive and simple random sampling methods were employed. Purposive sampling was used to identify intervention and control sites. Mwingi west Sub County was purposively selected as intervention site since the CHS program was to be implemented in the sub county. Mwingi north sub county was also purposively sampled as the control site because the intervention was not under implementation in the sub county, and the sub county borders Mwingi West sub county[15].

Simple random sampling was first used to assign villages into three clusters of data collection sites in each of the two sites (intervention and control sites). The three clusters identified in intervention and control sites were randomly assigned for baseline, midterm and end-term surveys as follows: In intervention site, Mwambui, Ikuusya and Thonoa villages of Waita Division/Ward were grouped in 1 cluster and randomly assigned for baseline survey, Wikithuki, Kairungu, and Kyethani villages of Kyethani Division/Ward were also in 1 cluster and randomly assigned for midterm survey, and Mbondoni and Kavuvwani villages of Kiomo Division/Ward were also in 1 cluster and randomly assigned for end-term survey. In control site, Kamuwongo, Ngaie, and Kimangao villages of Kyuso Division/Ward were grouped in 1 cluster and randomly assigned for baseline survey, Kimela, Mitamisyi, and Ikime villages of Ngomeni Division/Ward were also in 1 cluster and randomly assigned to midterm survey and Mutanda, Kyandali, and Kakuyu villages of Mumoni Division/Ward were in 1 cluster and randomly assigned for end-term survey.

The second step was to apply simple random sampling in identifying the study participants in both intervention and control sites. To accomplish this, the first thing was to develop a sampling frame for each of the three clusters in the intervention and the control sites respectively. House-Holds (HHs) included in the sampling frame were only those with child/children aged between 9-12 months as indicated in the inclusion criteria. In intervention site, sampling frames were developed using household registers which were developed during creation of CUs. The household registers had socio-demographic data of all community members in each CU. Community meetings (barazas) were conducted to help identify the households with mothers of a child/children aged 9-12 months who had been selected in the household register. In the control site, community meetings facilitated by village elders and local chiefs were used in identification of households with mothers of a child or children aged between 9-12 months. Sampling frames were developed shortly before commencement of each survey. At baseline survey, midterm survey and end-term surveys sampling frames were developed in March/April 2012, February/March 2013, and March/April 2014 respectively.

In intervention site, sampling frames were developed as indicated in the following; Mwambui, -482 HHs, Ikuusya-389 HHs and Thonoa-372HHs, (Total-1243 for baseline survey cluster), Wikithuki-302 HHs, Kairungu-383 HHs, Kyethani-242 HHs (total-927 for midterm survey cluster)), and Mbondoni -491HHs, Kavuvwani - 616 HHs (total-1107 for end-term survey cluster)). In control site, sampling frames were developed as indicated in the following; Kamuwongo -337 HHs Ngaie-311HHs, Kimangao-323HHs (total 971 for baseline survey cluster), Kimela-313HHs, Mitamisyi, -317 HHs, Ikime-402 HHs (total 1032 HHs for midterm survey cluster)) and Mutanda-343 HHs, Kyandali -502 HHs, Kakuyu -363 HHs (total 1208 for end-term survey cluster).

A formula was used to calculate the proportion of representative sample size in each sub-location/village in a cluster as shown in the following;

Formula: **Np=C/D x n**

Where;

Np= Proportion of sample size of a given Sub-location/Village

C= total number of HHs in a Sub-location/village with a mother of a child /children aged 9-12 months

D= total number of HHs with a child aged 9-12 months in each data collection cluster (data collection site)

Table 1: Sampling Frames and Proportional Sample size in Intervention and Control Sites in Mwingi West and Mwingi North Sub-Counties, Kenya

	Intervention Site Mwingi West Sub County Waita Ward/cluster 1			**Control Site Mwingi North Sub County Kyuso Ward/cluster 1**		
Baseline Survey (March 2012 - June 2012)	**Village/ Sub-location**	**No. of HHs with child (9-12 *mths*)**	**Sample size (Np)**	**Village/ Sub-location**	**No. of HHs with child (9-12 *mths*)**	**Sample size (Np)**
	Mwambui	482	164	*Kamuwongo*	337	146
	Ikuusya	389	132	*Ngaie*	311	135
	Thonoa	372	126	*Kimangao*	323	141
	Total	**1243**	**422**	**Total**	**971**	**422**
Midterm survey	**Kyethani Ward/cluster 2**			**Ngomeni Ward/cluster 2**		
(March 2013- June 1013).	**Village/ Sub-location**	**No. of HHs with child (9-12 *mths*)**	**Sample size (Np)**	**Village/ Sub-location**	**No. of HHs with child (9-12 *mths*)**	**Sample size (Np)**
	Wikithuki	302	137	*Kimela*	313	128
	Kairungu	383	175	*Mitamisyi,*	317	130
	Kyethani	242	110	*Ikime*	402	164
	Total	**927**	**422**	**Total**	**1032**	**422**
End-term Survey	**Kiomo Ward/cluster 3**			**Mumoni ward/cluster 3**		
(March 2014-June 2014)	**Village/ Sub-location**	**No. of HHs with child (9-12 *mths*)**	**Sample size (Np)**	**Village/ Sub-location**	**No. of HHs with child (9-12 *mths*)**	**Sample size (Np)**
	Mbondoni	491	187	*Mutanda*	343	120
	Kavuvwani	616	235	*Kyandali*	502	175
				Kakuyu	363	127
	Total	**1107**	**422**	**Total**	1208	**422**

Using SPSS, a sample size of 422 households was drawn from each sampling frame.

n = desired sample size (calculated as (422 HHs)
Example: representative sample size for Mwambui village was calculated as follows;
Np=C/D x n where C=482, D=1243, and n=422, Np was calculated to be 164

Table 1 indicates a summary of the number of HHs in each sampling frame per sub location/village and the proportion of households sampled in each of the sampling frames in both intervention and control sites.

Data collection process

A pre-intervention survey was conducted to collect baseline data in both intervention and control sites. In the intervention site, baseline data were collected from a total 416 households while in the control site baseline data were also collected from a total of 411 households. This exercise took place from March 2012 to June 2012. Baseline survey was followed by two post intervention surveys in both intervention and control sites. Data for first post intervention survey (mid-term survey) were conducted at least 9 months after implementation of the CHS in Mwingi west Sub County (from May 2013 to June 2013). In the intervention site data were collected in 413 households while in the control site data were also collected from 413 households. The second post intervention survey took place after at least18 months after implementation of the CHS (from March 2014 to June 2014). In this survey, data collection in intervention site was done from 417 households and in the control site data was collected from 420 households**.**

Variables in the study

The independent variable in the study is the intervention-CHS, while the dependent variable was utilization of SBC.

Study validity and reliability

A pilot study was conducted at Nzeluni in Mwingi west sub-county before the main study. Data were collected in a randomly selected sample of 45 households (slightly above 10 per cent of the sample size) in three villages in Nzeluni sub location. Upon testing the data for reliability, the coefficient of internal consistency (Cronbach's *alpha*) was 0.864. This value was within the recommended range of 0.70-0.95[17] and therefore we were assured that the questionnaire was reliable. Internal validity of the study was ensured by applying a sound methodology while external validity was ensured by use of a representative sample size.

Data analysis

To estimate net effect of CHS intervention on SBC, Difference-in-Differences (DiD) model was used to compare the net changes in SBC proportions over 18 months implementation time between intervention and control groups as proposed by Memon *et al*[8] and, White and Sabarwal[18]. Z score tests were used to determine if proportions of women delivering under SBC before and after the intervention were significantly different. Binary logistic regression was used to control for potential confounders (socio-demographic characteristics) and establish the probability of a mother to deliver under SBC within the intervention and control sites over the 18 months of CHS intervention. SPSS version 20 was employed in this analysis.

Results

Socio demographic characteristics of study population

Utilization of SBC among women in intervention and control sites

At baseline, the proportion of women who delivered under SBC in intervention and control site was 57.9% and 46.5% respectively. At midterm survey; proportion of women delivering under SBC in intervention site increased by 8.7% (from 57.9 to 66.6%) while in control site, proportion of women delivering under SBC increased by 2.7% (from 46.5 to 49.2%). In end term survey; proportion of women delivering under SBC increased by 12.6% from (57.9 at baseline to 70.5%). While in control site, the proportion of women who delivered under SBC increased by 4% compared to baseline (from 46.5% to 50.5%). These results are summarized in Table 3.

Difference in Differences proportion and Z score tests measuring change in SBC Uptake

Baseline survey indicated that proportions of women who delivered under SBC in intervention (57.9%) and control (46.5%) sites were significantly different (Z= 3.2991, P<0.05).

In intervention site; proportion of women who delivered under SBC at midterm survey (66.6%) was significantly different from proportion of women who delivered under SBC at baseline survey (57.9%) (Z= 2.5697, P<0.05). A comparison between proportion of women who delivered under SBC at end term survey (70.5%) in intervention site to the same proportion at base line survey (57.9%) also revealed a significant difference (Z= 3.7846, P< 0.001).

In the control site; no significant difference was observed in the proportions of women who delivered under SBC by comparing baseline SBC proportion (46.5%) with midterm SBC proportion (49.2%) (Z= 0.7702; P>0.05). Similarly, no significant difference was observed by comparing baseline SBC proportion (46.5%) DID Proportion with end-term SBC proportion (50.5%) in the same site (Z= 1.1547; P>0.05).

In intervention site, proportion of women who delivered under SBC increased significantly by 8.7% and 12.6% at midterm survey and end term survey respectively compared to baseline. In control site, no significant increase was observed between baseline SBC utilization and end term SBC utilization in control site. The Difference in Differences (DID) was calculated by first, finding the difference between end-term survey SBC prevalence and baseline SBC prevalence in intervention site; which is 12.6%. Second step was to find the difference between end term SBC prevalence and baseline SBC prevalence in control site; which is 4%. Third step was to find the difference between the two differences (i.e. 12.6% - 4%), DID = 8.6%. These results are summarized in Table 4.

Table 2: Social demographic characteristics of women in Mwingi West and Mwingi North Sub-Countries, Kenya

Age		**Mwingi West**		**Mwingi North**		**Mwingi. West**		**Mwingi North**		**Mwingi West**		**Mwingi North**	
		F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
	16-20 years	8	1.9	12	2.9	14	3.4	18	4.4	29	7.0	20	4.8
	21-25 years	35	8.4	63	15.3	61	14.8	59	14.3	64	15.3	76	18.1
	26-30 years	106	25.5	134	32.6	141	34.1	127	30.8	112	26.9	117	27.9
	31-35 years	149	35.8	139	33.8	126	30.5	143	34.6	132	31.7	138	32.9
	36-40 years	113	27.2	57	13.9	69	16.7	59	14.3	80	19.2	63	15.0
	41-45 years	5	1.2	6	1.5	2	0.5	7	1.7	0	0	6	1.4
	Total	**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**
Parity		**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
	1 Child	20	4.8	23	5.6	25	6.1	22	5.3	13	3.1	30	7.1
	2 children	19	4.6	22	5.4	28	6.8	15	3.6	26	6.2	13	3.1
	3 children	60	14.4	58	14.1	74	17.9	64	15.5	65	15.6	67	16.0
	4 children	105	25.2	124	30.2	93	22.5	93	22.5	122	29.3	89	21.2
	5 children	93	22.4	89	21.7	95	23.0	113	27.4	99	23.7	100	23.8
	6 children	63	15.1	74	18.0	66	16.0	82	19.9	65	15.6	88	21.0
	6 and above	56	13.5	21	5.1	32	7.7	24	5.8	27	6.5	33	7.9
	Total	**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**
Education		**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Level	No education	33	7.9	12	2.9	25	6.1	16	3.9	27	6.5	8	1.9
	Primary level	141	33.9	86	20.9	127	30.8	108	26.2	102	24.5	124	29.5
	Secondary level	149	35.8	228	55.5	167	40.4	187	45.3	208	49.9	167	39.8
	College/University	93	22.4	85	20.7	94	22.8	102	24.7	80	19.2	121	28.8
	Total	**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**
Occupation		**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
	Not working	8	1.9	10	2.4	13	3.1	15	3.6	34	8.2	15	3.6
	Peasant Farmer	206	49.5	233	56.7	225	54.5	247	59.8	226	54.2	230	54.8
	Business	105	25.2	117	28.5	91	22.0	92	22.3	99	23.7	108	25.7
	employment	97	23.3	51	12.4	84	20.3	59	14.3	58	13.9	67	16.0
	Total	**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**
Marital		**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Status	Single	21	5.0	31	7.5	30	7.3	44	10.7	40	9.6	34	8.1
	Married	306	73.6	350	85.2	299	72.4	328	79.4	311	74.6	337	80.2
	Windowed	24	5.8	12	2.9	16	3.9	15	3.6	18	4.3	18	4.3
	Separated/ Divorced	65	15.6	18	4.4	68	16.5	26	6.3	48	11.5	31	7.4
	Total	**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**
Monthly		**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Income	**≤2500**	118	28.4	219	53.3	153	37.0	221	53.5	161	38.6	242	57.6
	2501 - 5000	129	31.0	109	26.5	122	29.5	94	22.8	133	31.9	86	20.5
	5001 - 7500	45	10.8	32	7.8	53	12.8	29	7.0	47	11.3	22	5.2
	7501 - 10000	66	15.9	12	2.9	14	3.4	18	4.4	15	3.6	19	4.5
	> 10000	58	13.9	39	9.5	71	17.2	51	12.3	61	14.6	51	12.1
	Total	**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**

Odds of utilizing SBC among women before and after intervention

Initial comparison of intervention and control sites at baseline survey using binary logistic regression indicated that women in intervention site were 1.6 times more likely to deliver under SBC compared to control (crude Odds Ratio (OR)= 1.586, P<0.05: 95%CI=1.205-2.088). However, after controlling for socio-demographic characteristics which include maternal age, parity, level of education, marital status and average household income, the adjusted OR indicated no significant difference in the odds of mothers who delivered under SBC

Table 3: Utilization of SBC among Women in intervention and control sites in Mwingi West Sub-County, Kenya

Survey	Intervention site				Control Site			
	SBC		Non -SBC		SBC		Non-SBC	
	Frq.	**%**	**Frq.**	**%**	**Frq.**	**%**	**Frq.**	**%**
Baseline	241	**57.9**	175	42.1	191	**46.5**	220	53.5
Midterm (9months)	275	**66.6**	138	33.4	203	**49.2**	210	50.8
End-Term (18 months)	294	**70.5**	123	29.5	212	**50.5**	208	49.5

Table 4: Z score tests measuring change in SBC proportions in Mwingi West Mwingi North sub-counties

Site	Baseline	Mid-term (9 months)	End term (18 months)	Midterm-Baseline	End term-Baseline
Intervention	241/416 (57.9%)	275/413 (66.6%)	294/417 (70.5%)	**Z= 2.5697 P=0.01016***	**Z= 3.7846 P= 0.00016***
Control	191/411 (46.5%)	203/413 (49.2%)	212/420 (50.5%)	**Z= 0.7702 P= 0.4413**	**Z= 1.1547 P= 0.25014**
Int-Ctr	**Z= 3.2991 P= 0.00096***	**Z= 5.0736 P=0.00***	**Z= 5.925 P=0.00***	**DID** (%) = (70.5-57.9) - (50.5-46.5) = **8.6%**	

Table 5: Initial Comparability of Odds of at SBC Utilization Baseline

Baseline Survey	Crude vs. *Adj.*	Sig.	OR	95% CI
Intervention Vs. Control	Crude OR	0.001*	1.586	1.205 -2.088
	Adjusted OR	0.970	0.993	0.681 -1.448

Table 6: Odds of Utilizing SBC among Women in Intervention and Control Sites

Site	Survey	Crude Vs. Adj. OR	Sig	OR	95%CI
Intervention site	**Midterm vs. Baseline**	Crude OR	**0.010***	**1.447**	**1.091-1.919**
		Adjusted OR	**0.005***	**1.681**	**1.168-2.419**
	End term Vs. Baseline	Crude OR	**0.0001***	**1.321**	**1.144-1.525**
		Adjusted OR	**0.0001***	**1.556**	**1.295-1.868**
Control Site	**Midterm vs. Baseline**	Crude OR	0.441	1.113	0.847-1.464
		Adjusted OR	0.386	1.154	0.835-1.594
	End term Vs. Baseline	Crude OR	0.249	1.083	0.945-1.241
		Adjusted OR	0.255	1.097	0.936-1.285

between intervention and control site at baseline survey (Adj. OR=0.993, P>0.05, 95%CI: 0.681 - 1.448). These results are summarized in Table 5.

In the intervention site; a binary logistic regression comparing odds of women who delivered under SBC revealed a significant difference between; baseline survey and midterm survey, and between baseline survey and end term survey. Women in the midterm survey were found to be 1.4 times and 1.7 times more likely to deliver under SBC compared to women at baseline survey in the crude and adjusted ORs respectively [(crude OR=1.447, P<0.05; 95% CI: 1.091-1.919), Adj. OR=1.681, P<0.05; 95%CI: 1.168-2.419)]. A comparison between baseline survey and end-term survey in intervention site indicated that women in the end term survey were 1.3 times more likely to deliver under SBC compared to women at baseline survey (crude OR=1.321, P<0.0001; 95% CI: 1.144-1.525). After adjusting for social demographic characteristics women in end term survey were found to be **1.6** times more likely to deliver under SBC compared to women at baseline (Adj. OR=1.556, P<0.0001; 95%CI: 1.295-1.868).

In the control site; no significant difference in the odds of women who delivered under SBC was observed between baseline survey and midterm survey [(crude OR=1.113, P>0.05; 95% CI: 0.847-1.464), Adj. OR=1.154, P>0.05; 95%CI: 0.835-1.594)]. A comparison between baseline survey and end-term survey also revealed no significant difference in the odds of women who delivered under SBC between the two groups [(crude OR=1.083, P>0.05; 95% CI: 0.945-1.241), Adj. OR=1.097, P>0.05; 95%CI: 0.936-1.285)]. These results are summarized in Table 6.

Discussion

Prevalence of women who delivered under SBC at baseline was 57.9% and 46.5% in intervention and control site respectively**.** Z score tests found in Table 3 indicate that the 2 proportions are significantly different. This could be the result of confounders mostly coming from the difference in socio-demographic characteristics of the two populations. This is confirmed by a binary logistic regression analysis which indicated that after controlling for socio-demographic characteristics as potential confounders, there was no significant difference in the odds of women who delivered under SBC in intervention site compared to control site at baseline. This therefore suggests that the two SBC proportions could be equal if not for the influence of the difference in socio-demographic characteristics in the two populations. This therefore suggests that intervention and control site SBC proportions at baseline are in the same range with the 45.6% SBC prevalence reported for Kitui county (which hosts both intervention and control sites) by the KDHS 2014[5].

Regarding the effect of CHS on SBC in intervention site, proportion of women who delivered under SBC increased significantly by 8.7% (from 57.9% at baseline survey to 66.6% at midterm survey). This was supported by a binary regression analysis conducted to compare probability of SBC utilization in midterm survey and baseline survey. Adjusted ORs indicated that, women at midterm survey were 1.7 times more likely to deliver under SBC compared to women at baseline survey. The highest significant increase in SBC utilization in intervention site was however observed at end term survey. SBC utilization increased by 12.6% (from 57.9% at baseline to 70.5% at end-term survey). Adjusted ORs indicated that women at end term survey were 1.6 times more likely to deliver under SBC compared to women at baseline survey.

In control site, no significant difference was observed between base line SBC proportion and midterm survey SBC proportion. A comparison between end term and baseline survey SBC proportions yielded a marginal 4% increment in SBC utilization which was not significant. Adjusted ORs indicated no significant difference in odds of SBC utilization between these groups. These observations lead to one conclusion, that the observed increase in proportion of women delivering under SBC in intervention site, and the observed increase in the odds of women delivering under SBC in end term survey compared to baseline survey in intervention site is the result of the effect of CHS. Health education and counseling program and follow up of expectant women by CHWs in intervention site was effective in increasing the number of women delivering under SBC in intervention site compared to control site. The net effect as shown by the DID indicates that over the 18 months of implementation of CHS, proportion of women utilizing SBC in intervention site increased by 8.6%.

It is important to note that though national implementation of free maternity services in Kenya was implemented on 1st June, 2013[22] , free maternity services seemed to have had little or no impact on the proportion of women who delivered under SBC in both intervention and control sites. This is based on observation that no significant change was observed between midterm and end term survey in the control site. However, it is also important to note that end term survey data was collected in both intervention and control sites in less than one year (from March 2014 to June 2014) after implementation of free maternity services in Kenya and this perhaps was not enough time for the free maternity service to have a positive impact in the community.

These results are supported by several studies. A study conducted in the remote mountainous district of Gilgit, Northern Pakistan to evaluate the effect of a CHW led health promotion program established that the intervention significantly increased SBC in intervention site 18 months after it was implemented[8]. Rwanda is one of the African countries that achieved MDG goal target 5A- to reduce MMR by three quarters between 1990 and

2015[9]. A reviewed of 12 studies conducted in Rwanda revealed that, the country has a network of 45,011 CHWs[9]. Each village in Rwanda has at least 3 CHWs including two general CHWs (a female and a male), responsible for community health education, nutrition, and HIV prevention. Besides these 2 CHWs, each village has a CHW, known as 'Mobilizer for Maternal Health'-a female responsible for carrying out community–based interventions specifically focusing on MCH[9]. These CHWs play a critical role in linking expectant women in the communities with health facilities[9]. This in turn improved SBC and significantly reduced MMR by 78% (from 1300/100,000 live births in 1990 to 290/100,000 live births in 2015)[9].

Another study which reviewed evidence from CHW led interventions in Rwanda, Afghanistan, Nigeria, and Nepal indicates that CHWs demonstrated that they were effective in delivery of MCH related community-based primary healthcare interventions[23]. In Kenya, several studies have confirmed that CHWs are effective in promoting SBC. A CHW led health education program in some parts of rural Kenya was found to be effective in increasing deliveries under SBC [11]. Two other similar studies conducted to assess effectiveness of CHS in health outcomes in parts of western Kenya , Nyanza, Garissa and Busia indicate that CHS was effective in promoting SBC[21,24].

Study Limitations

The study had several important limitations; the most important of these was selection of intervention and control sites. Since implementation of the CHS was a MoPHS and AMREF-Kenya project which was designed to be implemented in Mwingi West sub county, it was not feasible to randomly assign the CHS intervention to community members in Mwingi west sub county. This is the reason why a non-randomized pre-test and post-test experimental study design was deemed appropriate. Though this method has been employed in other similar studies[8,11,19-21], evidence from this design is weaker compared to a randomized controlled trial. Secondly, researchers were also not able to account for possibility of other programs that could influence MCH outcomes of interest in the intervention site. However, there was an attempt to reduce the effect of confounding factors through; treating socio-demographic characteristics of both intervention and control sites as potential confounders and having them controlled in the binary logistic regression model used in data analysis, by matching the control to the intervention sites by geographical location, and infrastructural characteristics, and by removing the difference in the outcome between intervention and control groups at the baseline by applying DID model as proposed by reference[18].

Ethical Considerations

Ethical clearance for this study was provided by the National Council of Science and Technology (NCST) of the Government of Kenya (GoK).

Conclusion and Recommendation

CHS increased SBC utilization in intervention site by 12.9%. Women in end-term survey of the intervention site were 1.6 times more likely to deliver under SBC compared to women at baseline survey in the same site. In the 18 months CHS was implemented in Mwingi West sub-county, the intervention increased SBC utilization by 8.6% compared to control. To increase the number of women in Kenya delivering under SBC, government need to fast-track implementation of CHS in all sub counties. This will decrease MMR in Kenya and improve MCH outcomes which in turn will help Kenya meet the health-related Sustainable Development Goals by 2030.

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Competing Interests

The authors hereby declare that there was no competing interest in this study.

Contribution of Authors

JMN conceived the idea and developed the manuscript. JOO analyzed the data, JHO and ROO supervised the entire study and read the work for intellectual input. AJK read the manuscript for intellectual input.

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