Original Research Article

Community Healthcare Worker's Social demographic factors and roles Influencing Uptake of Maternal Health Services in Musanze District, Northern Province, Rwanda.

ABSTRACT

Background: Community health workers integrate individuals of their communities to provide preventive, habitual, and emergency maternity healthcare requirements. The aim of this study was to assess Community Health Workers social demographic factors and roles influencing uptake of Maternal Health services in Musanze District, Northern Province, Rwanda**. Methods:** The study design used was analytical cross-sectional study design utilizing both quantitative and qualitative methods. In this study, a simple random sample approach was employed to choose 208 CHWs and 16 CHW's supervisors were interviewed for qualitative data (KII). The statistical tool for social sciences (SPSS) Version 26, was utilized to examine the data. Bivariate analysis with Chi-square test of independence was used to check the relationship between the dependent and independent variables. Ordinal logistic regression was used as the most suitable inferential statistic because the predictor variables and the dependent were ordinal variables. Qualitative data were analyzed by INVIVO version 10. Community health workers 208 participated in the study and all were female**. Results**: This study found that the uptake of maternal health services was regarded as very high. Among those services, deliveries at the Health Facility were at 73.6%, Antenatal care at 65.9%, Family planning at 54.3%, and the rate of Postnatal care was at 45.7%.This study assessed the influence of social demographic factors on uptake of maternal health services, level of education with $p^* < .001$, and working experience $p^* = .005$ were associated with uptake of maternal health services. The study recommends improvement of maternal health services through family planning, health care during pregnancy, post-partum care, with particularly scaling up key motherly health services, regular training and supervision for CHWs. This will help to achieve third goal of SDG 2030 as Good Health and well-being for all People and end up reducing mortality rates in the community unit. The findings of the study will be helpful to Ministry of Health (at District and national level) in taking strategic steps towards reducing mortality rates in the unit and country at large.

Key words: Community health workers 'Sociodemographic factors, roles influencing uptake of maternal health services.

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1. INTRODUCTION

Community health workers play a vital role in working within a community-based team to educate women on the importance of attending antenatal, delivery, and postnatal care with a skilled professional (Population Council ,2012).World Health Organization established a community-based initiative programs and uses community volunteers to provide health care to their people (WHO, 2007; Lauren Crigler, 2014). The roles and activities of community health workers are enormously diverse throughout their history, within and across countries and across programmes. While in some cases CHWs perform a wide range of different tasks that can be preventive, curative and/or developmental, in other cases CHWs are appointed for very specific interventions (WHO, 2007). A community health worker performs one or many duties linked to the delivery of healthcare and received relevant training and supervision (WHO, 2015). Rwanda as a member of these countries, has primarily adopted community health workers and considered their role to achieve the optimum in different health indicators (Bucagu, M., et al., 2012). The criteria for selecting CHWs vary depending on the Ministry of Health in each country; however, the baseline requirements for selecting CHWs through partners in health are that they must be an adult, normally over the age of 18, have reading skills, and be able to adequately read prescription drug packets, fill out simple forms, and take notes all through routine practice sessions (Gatwaza, M. H. 2016). Many programs require a certain level of literacy but in Rwanda, the CHWs must complete primary school and be able to read and write as criteria to be selected as CHWs, and training benefits helped them to make a follow-up of CHWs instructions during pregnancy and after (Beatrice, U. 2016). The sociodemographic variables (Age, Gender, Education, working experience of community health workers all are essential factors to improve the performance of community health where age cohort 40-50 had the highest performance of home visits mothers (Mulingwa; 2014; Marura, H. M. 2015). The health system in the country has recognized the importance of women in obtaining better health in general, as well as maternity and child health in particular, Community health workers in their village area are mothers in this regard and women's continued involvement in the implementation of health initiatives in their communities, particularly in the areas of safe delivery and reproductive health has achieved major improvements on mother's well-being(Condo et al. 2014; Tuyisenge, G., 2019).The study recommends improvement of maternal health services through family planning, health care during pregnancy, post-partum care, with particularly scaling up key motherly health services.This will end up in reducing maternal mortality rate and thereby ensuring the achievement the target of SDGs 2030 and improve the quality of service provided by CHWs.

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2. MATERIALS AND METHODS

2.1. Study design

This was a cross-sectional analytic study with mixed method design including both quantitative and qualitative methods.

2.2. Research area

Research was carried out in Musanze District. The district has 15 Sectors, 68 cells and 432 villages. It has 16 health centers and 432 community in charge of maternal health, Musanze District has a population of 424,572 people and is densely populated of 530, 4 per km^2.

2.3. Study population

The participants in this study were community health workers and their supervisors appointed at health facilities levels in Musanze District

2.4. Determining the sample size

The researcher utilized Slovin's formula to calculate the sample size, that proposes the random sample is obtained by multiplying the average population by the number of people in the sample, a square of the confidence level. This means that

$$n = \frac{N}{1 + (N \cdot e^2)}$$

Where;

n is the sample size

N represents the total population, in this case, total number of CHWs in Musanze District= 432

e indicates the level of confidence (0.05).

$$n = \frac{432}{1 + (432)(0.05^2)} = 207.69230 \approx 208$$

So, the estimated sample size was 208 CHWs then for qualitative data, community health supervisor's all were interviewed in16 Health facilities of Musanze district.

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2.5. Sampling procedures and techniques

A simple random sampling procedure was used to select 208 CHWs and key informant interview was all 16 CHW's supervisors. This number of CHWs was proportionally distributed to 16 health facilities. The table below shows how CHWs were proportionally distribute to 16 Health facilities.

Chart 1: The table below shows the distribution of CHWs to the Health facilities.

Health Center's Name	Number of CHWs per Health facility.	Representative sample proportional to sample size	Rounded Sample size
Kimonyi	13	6.2	6
Musanze	18	8.6	7
Busogo	25	12.03	12
Gataraga	16	7.7	8
Kinigi	23	11.07	11
Kabere	25	12.03	12
Nyange	32	15.4	14
Bisate	29	13.9	14
Karwasa	30	14.4	14
Gasiza	27	13	13
Muhoza	49	23.5	24
Nyakinama	51	24.5	25
Rwaza	32	15.4	15
Gashaki	22	10.5	11
Murandi	18	8.6	9
Shingiro	22	10.5	11
TOTAL=16	**432**	**207.33**	**208**

2.6. Quantitative data collection

In this research a semi-structured questionnaire with open and closed-ended questions was used to collect quantitative data. The questionnaire had two sections, A, B, and Section A captured social demographic characteristics of CHWs. Section B covered the influence of community health workers roles on uptake of maternal health services.To be sure that the instruments are reliable, researcher pre-tested the questionnaires with ten percent of sample; in this case, 21 CHWs were included in pre-testing of the tool in Musanze District.

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2.7. Qualitative data collection

Qualitative data were collected using key informants Interview (KII) with all 16 community health supervisors. The data were collected using a conversation guide with pre-prepared questions, the guide extracted information from the participants. The information was recorded using an audio recorder.

2.8. Quantitative and qualitative Data analysis

The statistical tool for social sciences (SPSS) Version 26 was utilized to analyze quantitative data and dependent variables. Categorical variables were summarized with descriptive statistics for frequencies and percentages. Bivariate analysis with Chi-square test of independence was used to check the relationship between the dependent and independent variables. The variables with a significant relationship with the dependent variable were then modeled with ordinal logistic regression to develop a prediction model. This was done with a 95% confidence interval. Ordinal logistic regression was the most suitable inferential statistic as the dependent variable was ordinal. This statistic established further associations for the variables which were significant in bivariate analysis. Data and results were presented using text, tables, and figures and qualitative data were analysed by NVIVO version 10. Data was recorded using audio recorder, the audios were transcribed to text format for analysis. Transcripts were then uploaded to NVIVO. Similar patterns were identified, and themes were generated.

3. FINDINGS

3.1 Quantitative findings

3.1.1. Uptake of Maternal Health Services.

This study involved 208 CHWs responded to various metrics of the research questionnaire. All the participants were female, 100%. Four indicators were assessed to find out the level of uptake of maternal health services. These were the number of mothers completing antenatal care visits, number of mothers delivering at health care facilities, postnatal care attendance, and rate of Family Planning uptake among mothers.

The variables were assessed to establish whether there was any association with the uptake of maternal health services, these variables were measured using a five-point Likert scale in different ways from strongly disagree to strongly agree and from very low to very high. The chi-square test was applied, and Fishers exact test applied when assumption 4 of chi-square was not

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satisfied and about the internal consistency of these variables had the Cronbach's Alpha value of α = 0.736. When the four items were combined and analyzed, it revealed that more than three quarters(76.4%) of the participants had observed a Very High uptake of maternal health services then 22.1% of them reported High uptake ,and the rest moderate uptake (1.4%).None of the reported Very Low and Low uptake.

Table 1: Association for social demographic characteristics of respondents on Uptake of Maternal Health Services

Social-demographic Factors	Category	Uptake of Maternal Health Services			Chi-square p-value
		Moderate	High	Very High	
Age category of respondents	Between 20 - 30 years	0(0.0%)	1(16.7%)	5(83.3%)	X^2 = 5.135
	Between 31 - 40 years	1(2.3%)	6(14.0%)	36(83.7%)	df =6
	Between 41 - 50 years	2(2.3%)	20(22.7%)	66(75.0%)	*p** =.535
	51 years and above	0(0.0%)	19(26.8%)	52(73.2%)	
Level of Education of respondent	None	0(0.0%)	10(71.4%)	4(28.6%)	X^2 = 27.330
	Primary	3(1.9%)	35(22.4%)	118(75.6%)	df =8
	Ordinary Level	0(0.0%)	0(0.0%)	23(100.0%)	*p** <.001
	Secondary	0(0.0%)	0(0.0%)	5(100.0%)	
	University	0(0.0%)	1(10.0%)	9(90.0%)	
Marital Status of CHWs	Single	0(0.0%)	0(0.0%)	2(100.0%)	X^2 = 7.861
	Married	3(1.8%)	36(21.3%)	130(76.9%)	df =6
	Widowed	0(0.0%)	9(25.0%)	27(75.0%)	*p** =.462
	Divorced	0(0.0%)	1(100.0%)	0(0.0%)	
Occupation/profession of respondents	Farmer	3(1.5%)	46(22.5%)	155(76.0%)	X^2 = 7.842
	Salaried	0(0.0%)	0(0.0%)	1(100.0%)	df =6
	Artisan	0(0.0%)	0(0.0%)	1(100.0%)	*p** =1.000
	None	0(0.0%)	0(0.0%)	2(100.0%)	
Working experience of CHWs	6 months to 3 years	0(0.0%)	9(52.9%)	8(47.1%)	X^2 = 17.312
	Between 4 - 6 years	0(0.0%)	4(50.0%)	4(50.0%)	df =6
	Between 7 - 9 years	1(7.1%)	1(7.1%)	12(85.7%)	*p** = .005
	10 years and Above	2(1.2%)	32(18.9%)	135(79.9%)	

Shows Fisher's Exact Test

The two significant variables were modeled with the ordinal logistic regression analysis to develop a prediction model for the uptake of maternal health services.

3.1.2. The influence of CHW's Social Demographic Factors on Uptake of Maternal Health Services.

3.1.3. Age category and uptake of maternal health services

Results showed that 75.0% of CHWs who were aged between 41-50 years, ranked the uptake of maternal health services as very high, 73.2% who were aged 51 years and above rated the uptake of maternal health services as very high. In this study, uptake of maternal health services is independent of CHWs age. Fisher's exact test showed no relationship between the uptake of maternal health services and age of CHWs with (X^2 = 5.135 df =6 p=0.535).

3.1.4. Education level of CHWs on uptake of maternal health services

The majority of the respondents, 75.6% had completed primary school, rated the uptake of maternal health services as very high. The level of education of CHWs revealed a significant relationship with the uptake of maternal health services with (X^2 = 27.330, df =8 p <.001).

3.1.5. Occupation of CHWs on uptake of maternal health services

More than three quarter, 76.0% of CHWs who were farmers ranked the uptake of maternal health services as very high. Fisher's exact test didn't show any significance association between the occupation of CHWs and the uptake of maternal health services in the community where (X^2 = 28.152 df =6 p*=1.000).

3.1.6. Marital status of respondents on uptake of maternal health services

More than three quarter 76.9% of married CHWs ranked the uptake as very high while 3(1.8%) of them ranked the uptake of maternal health services as moderate. Fisher's exact test of independence showed there was no association between the uptake of maternal health services in the community and the marital status of CHWs (X^2 = 7.861, df =6 p =.462).

3.1.7. Working Experience of CHWs on uptake of maternal health services

The study also sought to know the period through which CHWs had been providing maternal healthcare services. Majority of CHWs 135(79.9%) with working experience of 7 – 9 years ranked the uptake of maternal health services as very high. Fisher's exact test of independence showed a significant relationship between CHWs years of experience and the uptake of maternal health service (X^2 = 17.312 df =6 p = .005). Highly experienced CHWs had a very high performance as compared to less

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experienced ones this could be because they have enough knowledge as they are aware of the challenges and how to counteract them, also they could have attended list of trainings as compared to those who are new in the field.

Table2. Showing Regression model information, goodness -of-Fit and Pseudo R-Square of Sociodemographic characteristic of CHWs and uptake.

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	67.664			
Final	30.537	37.127	7	.000

Link function: Logit.

Goodness-of-Fit

	Chi-Square	Df	Sig.
Pearson	12.586	15	.634
Deviance	8.903	15	.883

Link function: Logit.

Pseudo R-Square

Cox and Snell	.163
Nagelkerke	.234
McFadden	.149

Link function: Logit.

Both CHWs' level of education and their working experience significantly contributed to the prediction model, the logistic regression finding showed that CHWs with a University education led to 15 times increase in the uptake of maternal health services compared with those with no education. Similarly, CHWs with more than 10 years of experience led to 3.6 times increase in the uptake of maternal health services compared with those with 6 months to 3 years of experience.

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Table3. Ordinal logistic regression tables on influence of Social Demographic Factors of CHWs on Uptake of Maternal Health Services.

Parameter Estimates								
							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Uptake_of_Maternal_Health_Services_ Moderate]	-5.571	1.217	20.967	1	.000	-7.955	-3.186
	[Uptake_of_Maternal_Health_Services_ High]	-2.201	1.056	4.349	1	.037	-4.271	-.132
Location	[Education=1]	-2.714	1.190	5.204	1	.023	-5.046	-.382
		Exp(B)= .066						
	[Education=2]	-.838	1.079	.603	1	.437	-2.951	1.276
	[Education=3]	18.418	6219.700	.000	1	.998	-12171.970	12208.807
	[Education=4]	18.719	.000	.	1	.	18.719	18.719
	[Education=5]	0[a]	.	.	0	.	.	.
	[Working experience =1]	-1.285	.542	5.617	1	.018	-2.348	-.222
		Exp(B)= .277						
	[Working experience =2]	-1.301	.733	3.153	1	.076	-2.737	.135
	[Working experience=3]	-.099	.794	.015	1	.901	-1.654	1.457
	[Working experience =4]	0[a]	.	.	0	.	.	.

Link function: Logit.
a. This parameter is set to zero because it is redundant.

3.2. The Influence of Community Health Workers Roles on Uptake of Maternal Health Services.

The results from findings showed that among those who strongly agreed that sending red alert SMS by CHWs towards maternal health services, 157(75.4%) rated the uptake of maternal health services as very high with chi-square test result (X^2 = 17.493 df =6 p* =.006

Majority of respondents ,157(75.4%) confirmed the influence of monthly report submitted by CHWs to the HC, rated the uptake of maternal as very high with (X^2 =13.111 df =4 p* =.008).

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The respondents 176(84.6%) strongly agreed that CHWs' enrolment of girls and ladies of reproductive age has contributed positively to maternal health, rated the uptake of maternal health as very high with (X^2 = 9.788 df =2 *p** =.006).

The participants 150(72.1%) of respondents had very high perception that CHWs' follow-up to the pregnant has improved maternal health, rated the uptake of maternal health as very high with chi-square (X^2 = 39.540 df =2 *p** =.001).

Those who strongly agreed that health education of CHWs to the pregnant women on ANC has improved maternal health were 172(82.6%), rated the uptake of maternal health services as very high, where fisher's exact test was significant with (X^2 = 18.317 df =4 *p** =.001).

Table 4: The influence of CHWs Roles on ANC Uptake among pregnant Mothers

CHWs Roles	Category	Mothers completed ANC visits has increased at the health centre after CHWs started to work in the community			Chi-square p-value
		Average	High	Very High	
Sending red Alert SMS by CHWs for pregnant mothers' emergencies has improved maternal health	Disagree	0(0.0%)	1(100.0%)	0(0.0%)	X^2 = 17.493 df =6 *p** =.006
	Neutral	0(0.0%)	0(0.0%)	2(0.0%)	
	Agree	1(2.1%)	25(52.1%)	22(45.8%)	
	Strongly agree	3(1.9%)	41(26.1%)	113(72.0%)	
The rate of monthly report submitted by CHWs to the health center and contribution toward maternal health services	Moderate	0(0.0%)	0(0.0%)	1(100.0%)	X^2 =13.111 df =4 *p** =.008
	High	2(4.1%)	24(49.0%)	23(46.9%)	
	Very High	2(1.3%)	43(27.2%)	113(71.5%)	
CHWs' enrolment of girls and ladies of reproductive age has contribute positively to maternal health	Agree	2(6.3%)	16(50.0%)	14(43.8%)	X^2 = 9.788 df =2 *p** =.006
	Strongly agree	2(1.1%)	51(29.0%)	123(69.9%)	
CHWs' follow-up to the pregnant has improve maternal health	High	1(1.7%)	38(65.5%)	19(32.8%)	X^2 = 39.540 df =2 *p** <.001
	Very High	3(2.0%)	29(19.3%)	118(78.7%)	
Health education of CHWs to the pregnant women on ANC has improve maternal health	Neutral	0(0.0%)	2(100.0%)	0(0.0%)	X^2 = 18.317 df =4 *p** =.001
	Agree	3(8.8%)	16(47.1%)	15(44.1%)	
	Strongly agree	1(0.6%)	49(28.5%)	122(70.9%)	

*****Shows Fisher's Exact Test

All these variables were then modelled with the ordinal logistic regression analysis to develop a prediction model on uptake of ANC among mothers. The model fitting statistic was significant (X^2 =56.841, *df* =9, *p* <.001), confirming that the model fits all these independent variables.

The Goodness-of-fit statistic was insignificant (X^2 =72.438, *df =57*, *p* =.082), which means that the model has a goodness-of-fit for the fitted data.

Table 5 .Showing the goodness-of-Fit and table showing Pseudo R-Square on ANC Uptake among pregnant mothers.

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	141.344			
Final	84.503	56.841	9	.000

Link function: Logit.

Goodness-of-Fit			
	Chi-Square	Df	Sig.
Pearson	72.438	57	.082
Deviance	44.094	57	.894

Link function: Logit.

Pseudo R-Square	
Cox and Snell	.239
Nagelkerke	.314
McFadden	.191

Link function: Logit.

The model explained 31.4% of the variance in The Wald criterion demonstrates the influence of the five independent variables on the dependent variable. CHWs' follow-up (*p* <.001) and CHWs health education to pregnant women (*p*=.027) significantly contributed to the prediction model. Community health worker's follow-up of pregnant women leads to 5.8 times increase in mothers completing antenatal care visits. Moreover, health education results in 2.7 times increase in the number of mothers completing ANC visits.

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Table 6. Ordinal logistic regression tables on influence of CHWs Roles on ANC Uptake among Mothers

		Parameters Estimate						
							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Mothers completed ANC = 3]	-5.664	.633	79.976	1	.000	-6.905	-4.423
	[Mothers completed ANC = 4]	-1.727	.249	47.968	1	.000	-2.216	-1.238
Location	[Red Alert SMS for pregnant=2]	-3.696	2.335	2.505	1	.113	-8.272	.881
	[Red Alert SMS for pregnant=3]	18.168	.000	.	1	.	18.168	18.168
	[Red Alert SMS for pregnant=4]	-.381	.391	.953	1	.329	-1.147	.384
	[Red Alert SMS for pregnant=5]	0[a]	.	.	0	.	.	.
	[Monthly report submitted=3]	20.359	.000	.	1	.	20.359	20.359
	[Monthly report submitted=4]	-.624	.400	2.430	1	.119	-1.408	.161
	[Monthly report submitted=5]	0[a]	.	.	0	.	.	.
	[Enrolment of girls and ladies=4]	-.322	.455	.501	1	.479	-1.214	.570
	[Enrolment of girls and ladies=5]	0[a]	.	.	0	.	.	.
	[Pregnant women follow up=4]	-1.764	.367	23.150	1	.000	-2.483	-1.045
		Exp(B) =.171						
	[Pregnant women follow up=5]	0[a]	.	.	0	.	.	.
	[Educating pregnant on ANC=3]	-1.838	1.574	1.364	1	.243	-4.924	1.247
	[Educating pregnant on ANC=4]	-.990	.448	4.883	1	.027	-1.868	-.112
		Exp(B) =.372						
	[Educating pregnant on ANC=5]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

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Considering the contribution on uptake of PNC period, the findings showed that post-partum mothers' attendance at the HF has increased at 75.4%. The findings also showed that visiting mothers and giving them health education on uptake maternal health services during ANC up to PNC period has also increased the number post-partum mother's attendance at health facility with X^2 =26.749 df =12 p =.026.

Respondents 84.6% strongly agreed that CHW's enrolment of girls and ladies did not influenced the uptake of maternal health services with X^2 =7.429 df =4 p =.087. CHWs' follow-up with the pregnant mothers up to the post-partum period has improved the uptake of maternal health and increased the number of PNC attendance at HF significantly with X^2 =17.271 df =4 p <.001.

Lastly, 82.6% of respondents strongly agreed with the statement that health education of CHWs to the pregnant women on the importance of doing postnatal care has improved uptake of maternal health services. The result demonstrated that education provided by CHWs to the pregnant women on PNC didn't show any significant association with uptake of maternal health services X^2 =10.842 df =8 p =.324.

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Table 7: Association of CHWs Roles on PNC Uptake among Post-partum Mothers

CHWs Roles	Category	The rate the post-partum mothers' attendance to PNC visit with respect to CHWs visit					Chi-square p-value
		Very Low	Low	Moderate	High	Very High	
Sending red Alert SMS by CHWs for post-partum mothers' emergencies has improved maternal health	Disagree	0(0.0%)	0(0.0%)	0(0.0%)	1(100.0%)	0(0.0%)	X^2 =26.749
	Neutral	0(0.0%)	0(0.0%)	0(0.0%)	1(50.0%)	1(50.0%)	df =12
	Agree	0(0.0%)	2(4.2%)	2(4.2%)	32(66.7%)	12(25.0%)	*p** =.026
	Strongly agree	2(1.3%)	2(1.3%)	3(1.9%)	68(43.3%)	82(52.2%)	
The rate of monthly report submitted by CHWs to the health center and contribution toward maternal health services	Moderate	0(0.0%)	0(0.0%)	0(0.0%)	1(100.0%)	0(0.0%)	X^2 =16.064
	High	0(0.0%)	2(4.1%)	1(2.0%)	31(63.3%)	15(30.6%)	df =8
	Very High	2(1.3%)	2(1.3%)	4(2.5%)	70(44.3%)	80(50.6%)	*p** =.093
CHWs' enrolment of girls and ladies of reproductive age has contribute positively to maternal health	Agree	0(0.0%)	1(3.1%)	2(6.3%)	20(62.5%)	9(28.1%)	X^2 =7.429
	Strongly agree	2(1.1%)	3(1.7%)	3(1.7%)	82(46.6%)	86(48.9%)	df =4 *p** =.087
CHWs' follow-up to the pregnant has improve maternal health	High	0(0.0%)	1(1.7%)	2(3.4%)	41(70.7%)	14(24.1%)	X^2 =17.271
	Very High	2(1.3%)	3(2.0%)	3(2.0%)	61(40.7%)	81(54.0%)	df =4 *p** <.001
Health education of CHWs to the pregnant women on ANC has improve maternal health	Neutral	0(0.0%)	0(0.0%)	0(0.0%)	1(50.0%)	1(50.0%)	X^2 =10.842
	Agree	0(0.0%)	0(0.0%)	2(5.9%)	21(61.8%)	11(32.4%)	df =8
	Strongly agree	2(1.2%)	4(2.3%)	3(1.7%)	80(46.5%)	83(48.3%)	*p** =.324

*****Shows Fisher's Exact Test

These two variables such as sending red alert and follow-up made by CHWs were modelled with the ordinal logistic regression analysis to develop a prediction model on PNC uptake among

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post-partum mothers. The model fitting statistic was significant (X^2 =19.085, *df* =4, *p*=.001), this confirms that the model fits all the two independent variables.

The Goodness-of-fit statistic was insignificant (X^2 =14.499, *df* =16, *p* =.562). This confirms that the model has a goodness-of-fit for the data. The Nagelkerke R-square shows that the modelled variables explain 10.4% of the variance in the PNC uptake among post-partum mothers.

Table 8.Showing the goodness-of-Fit and table showing Pseudo R-Square on PNC Uptake among post -partum mothers

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	67.982			
Final	48.898	19.085	4	.001

Link function: Logit.

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	14.499	16	.562
Deviance	14.844	16	.536

Link function: Logit.

Pseudo R-Square	
Cox and Snell	.088
Nagelkerke	.104
McFadden	.050

Link function: Logit.

The Wald criterion demonstrates that the two independent variables significantly contributed to the prediction model: Sending red Alert SMS by CHWs (*p*=.017) and CHWs' follow-up (*p*=.007). Sending red Alert SMS by CHWs results in 2.3 times increase in PNC uptake among post-partum mothers.

CHW follow-up of pregnant women leads to 2.4 times increase in PNC uptake among post-partum mothers compared.

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Table 9.Ordinal logistic regression tables on influence of CHWs Roles on PNC Uptake among Post-partum Mothers

Parameters Estimate								
							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Q14_Post_Partum_mothers_attendance = 1]	-5.302	.742	51.096	1	.000	-6.756	-3.848
	[Q14_Post_Partum_mothers_attendance = 2]	-4.187	.462	81.952	1	.000	-5.093	-3.280
	[Q14_Post_Partum_mothers_attendance = 3]	-3.553	.368	93.116	1	.000	-4.275	-2.831
	[Q14_Post_Partum_mothers_attendance = 4]	-.263	.175	2.272	1	.132	-.605	.079
Location	[Q12_Red_Alert_Sms_for_gregnant=2]	-1.908	2.105	.822	1	.365	-6.034	2.217
	[Q12_Red_Alert_Sms_for_gregnant=3]	-.196	1.406	.019	1	.889	-2.951	2.559
	[Q12_Red_Alert_Sms_for_gregnant=4]	-.830 Exp(B) = .436	.349	5.669	1	.017	-1.514	-.147
	[Q12_Red_Alert_Sms_for_gregnant=5]	0[a]	.	.	0	.	.	.
	[Q9_Pregnant_women_follow_up=4]	-.885 Exp(B)= .413	.327	7.309	1	.007	-1.526	-.243
	[Q9_Pregnant_women_follow_up=5]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

The researcher also sought to find out the influence of contribution of CHWs on uptake of family planning, the majority, 84.7.0% of respondents strongly agreed that CHWs' enrolment of girls and women of reproductive age on uptake of maternal health services has influenced the rate of mother's uptake towards using FP after receiving health education in the community from CHWs as high 55.1% while 15.3% agreed.

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To examine the influence of CHW's roles on FP uptake was computed, the findings showed that health education of CHWs on FP (X^2 = 25.599 df =6 p <.001), Contribution of CHW on providing FP and uptake of maternal health with (X^2 = 15.290 df =3 p =.001),and CHWs' follow-up to the pregnant women X^2 = 14.044 df =3 p =.001 were statistically associated with uptake of family planning.

Table 10: Association of CHWs roles toward family Planning Uptake

CHWs Roles	Category	The rate of mother's uptake towards using FP after providing health education on FP				Chi-square p-value
		Low	Moderate	High	Very High	
CHWs' enrolment of girls and ladies of reproductive age has contribute positively to maternal health	Agree Strongly agree	0(0.0%) 1(0.6%)	2(6.3%) 4(2.3%)	14(43.8%) 74(42.0%)	16(50.0%) 97(55.1%)	X^2 = 2.480 df =3 p* = .461
Health education of CHWs to the pregnant woman on ANC has improve maternal health	Neutral Agree Strongly agree	0(0.0%) 0(0.0%) 1(0.6%)	1(50.0%) 4(11.8%) 1(0.6%)	0(0.0%) 19(55.9%) 69(40.1%)	1(50.0%) 11(32.4%) 101(58.7%)	X^2 = 25.599 df =6 p* <.001
Contribution of CHWs in providing FP at community level	Agree Strongly agree	0(0.0%) 1(0.6%)	5(10.9%) 1(0.6%)	24(52.2%) 64(39.5%)	17(37.0%) 96(59.3%)	X^2 = 15.290 df =3 p* =.001
CHWs' follow-up to the pregnant has improve maternal health	High Very High	0(0.0%) 1(0.7%)	3(5.2%) 3(2.0%)	35(60.3%) 53(35.3%)	20(34.5%) 93(62.0%)	X^2 = 14.044 df =3 p* =.001

*Shows Fisher's Exact Test

Further analyses were conducted with ordinal logistic regression, the model fitting statistic was less than the alpha value (X^2 =25.435, df =4, p <.001), confirming that the model fits all the modelled independent variables. Additionally, the Goodness-of-fit statistic is greater than the alpha value (X^2 =25.814, df =23, p =.310).

Table 11. Showing the goodness-of-Fit and table showing Pseudo R-Square towards Family planning Uptake.

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Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	80.562			
Final	55.126	25.435	4	.000

Link function: Logit.

Goodness-of-Fit			
	Chi-Square	Df	Sig.
Pearson	25.814	23	.310
Deviance	22.695	23	.479

Link function: Logit.

Pseudo R-Square	
Cox and Snell	.115
Nagelkerke	.143
McFadden	.074

Link function: Logit.

The reference category for the three variables is *'Very High'*, *'Strongly Agree'* and *'Strongly Agree'*, respectively. All the relevant estimates are negative, the findings showed that health education of CHWs on FP (X^2 = 25.599 df =6 p =.001) , contribution of CHW on providing FP and uptake of maternal health with (X^2 = 15.290 df =3 p =.001),and CHWs' follow-up to the pregnant women X^2 = 14.044 df =3 p =.001were statistically associated with uptake of family planning.

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Table 12. Ordinal logistic regression tables on influence ofCHWs Roles toward family Planning Uptake among Mother

		Parameters Estimates						
							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Q15_Health_Education_on_FP = 2]	-6.303	1.053	35.809	1	.000	-8.368	-4.239
	[Q15_Health_Education_on_FP = 3]	-4.252	.455	87.292	1	.000	-5.144	-3.360
	[Q15_Health_Education_on_FP = 4]	-.730	.186	15.317	1	.000	-1.095	-.364
Location	[Q9_Pregnant_women_follow_up=4]	-.821 Exp(B)=.440	.331	6.145	1	.013	-1.469	-.172
	[Q9_Pregnant_women_follow_up=5]	0[a]	.	.	0	.	.	.
	[Q10_Educating_pregnant_on_ANC=3]	-1.611	1.483	1.181	1	.277	-4.517	1.295
	[Q10_Educating_pregnant_on_ANC=4]	-1.051 Exp(B) = .350	.398	6.975	1	.008	-1.830	-.271
	[Q10_Educating_pregnant_on_ANC=5]	0[a]	.	.	0	.	.	.
	[Q20_CHWs_activities_contribute_posively=4]	-.730 Exp(B) = .482	.359	4.126	1	.042	-1.434	-.026
	[Q20_CHWs_activities_contribute_posively=5]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Finally, the researcher examined the influence of Community Health Workers' roles on the rate of deliveries in the healthcare facilities. Preliminary analysis with the fisher's exact test for independence

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confirmed that all the variables had a significant relationship with the rate of deliveries in healthcare facilities. These were: Sending rapid SMS by CHWs X^2 = 34.346 df =6 p <.001, rate of the monthly report submitted by CHWs (X^2 =11.612 df =4 p =.022).

CHWs' enrolment of girls and ladies of reproductive age (X^2 =12.510 df =2 p =.001), CHWs' follow-up to the pregnant (X^2 =22.279 df =2 p <.001), and health education of CHWs to the pregnant women (X^2 =14.886 df =4 p =.004).

These results showed that follow-up made by CHWs for pregnant mothers has influenced the uptake of maternal health services and has increased the number of deliveries. Finally, the majority 82.6% of respondents strongly agreed with the statement that health education of CHWs to the pregnant women on ANC has improved uptake of maternal health services, 16.3% agreed while 0.9% were neutral.

This result showed the influence of CHW's Roles on increasing the number of deliveries at HF. These findings are also supported by the study conducted in Ethiopia (Medhanyie *et al.*, 2012; Ngabo et. al, 2012).

Table13: Association of CHWs Roles on uptake of deliveries at health facilities.

CHWs Roles	**Category**	**CHW's record of pregnant mothers has increased deliveries in a health care facility**			**Chi-square p-value**
		Moderate	**High**	**Very High**	
Sending red Alert SMS by CHWs for pregnant mothers' emergencies has improved maternal health	Disagree	0(0.0%)	1(100.0%)	0(0.0%)	X^2 = 34.346
	Neutral	0(0.0%)	0(0.0%)	2(100.0%)	df =6
	Agree	1(2.1%)	26(54.2%)	21(43.8%)	p* <.001
	Strongly agree	2(1.3%)	25(15.9%)	130(82.8%)	
The rate of monthly report submitted by CHWs to the health center and contribution toward maternal health services	Moderate	0(0.0%)	0(0.0%)	1(100.0%)	X^2 =11.612
	High	1(2.0%)	20(40.8%)	28(57.1%)	df =4
	Very High	2(1.3%)	32(20.3%)	124(78.5%)	p* =.022
CHWs' enrolment of girls and ladies of reproductive age has contribute positively to maternal health	Agree	2(6.3%)	14(43.8%)	16(50.0%)	X^2 =12.510
	Strongly agree	1(0.6%)	38(21.6%)	137(77.8%)	df =2
					p* =.001
CHWs' follow-up to the pregnant has improve maternal health	High	1(1.7%)	28(48.3%)	29(50.0%)	X^2 =22.279
	Very High	2(1.3%)	24(16.0%)	124(82.7%)	df =2
					p* <.001

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Health education of CHWs to the pregnant women on ANC has improve maternal health	Neutral	0(0.0%)	0(0.0%)	2(100.0%)	X^2 =14.886
	Agree	2(5.9%)	15(44.1%)	17(50.0%)	df =4
	Strongly agree	1(0.6%)	37(21.5%)	134(77.9%)	p* =.004

*Shows Fisher's Exact Test

The table 4.16. Shows the ordinal logistic regression analysis to develop a prediction model on the rate of deliveries in health facilities. The model fitting statistic was significant (X^2 =56.500, df =9, p <.001), confirming that the model fits all the five independent variables.

The Goodness-of-fit statistic was insignificant (X^2 =53.479, df =57, p =.608), confirming that the model has a goodness-of-fit for these data.

Table 14. Showing the goodness-of-Fit and table showing Pseudo R-Square on uptake of deliveries at HC.

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	134.900			
Final	78.400	56.500	9	.000

Link function: Logit.

Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	53.479	57	.608
Deviance	43.815	57	.900

Link function: Logit.

Pseudo R-Square	
Cox and Snell	.238
Nagelkerke	.331
McFadden	.214

Link function: Logit.

The Wald criterion demonstrates the influence of the five independent variables on the dependent variable such Sending red Alert SMS by CHWs (p<.001), CHWs' follow-up (p=.004) and CHWs education to pregnant women (p=.026) significantly contributed to the prediction

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model. The odds ratio showed that sending red Alert SMS by CHWs results in 4.3 times increase in the rate of deliveries in healthcare facilities. Additionally, very high CHW follow-up of pregnant women leads to three times increase in the rate of deliveries in healthcare facilities. Health education resulted in 2.8 times increase in the rate of deliveries in healthcare facilities.

Table15.Ordinal logistic regression tables on influence of CHWs Roles on uptake of deliveries at health facilities

Parameters Estimate								
							95% Confidence Interval	
		Estimate	Std. Error	Wald	df	Sig.	Lower Bound	Upper Bound
Threshold	[Q11_Record_of_gregnant_mothers = 3]	-6.165	.734	70.466	1	.000	-7.605	-4.726
	[Q11_Record_of_gregnant_mothers = 4]	-2.263	.292	60.156	1	.000	-2.835	-1.691
Location	[Q12_Red_Alert_Sms_for_gregnant=2]	-4.214	2.335	3.259	1	.071	-8.790	.361
	[Q12_Red_Alert_Sms_for_gregnant=3]	16.822	7177.504	.000	1	.998	-14050.826	14084.471
	[Q12_Red_Alert_Sms_for_gregnant=4]	-1.455 Exp(B) = .233	.399	13.278	1	.000	-2.237	-.672
	[Q12_Red_Alert_Sms_for_gregnant=5]	0[a]	.	.	0	.	.	.
	[Q16_Monthly_report_submitted=3]	18.380	.000	.	1	.	18.380	18.380
	[Q16_Monthly_report_submitted=4]	-.393	.419	.880	1	.348	-1.213	.428
	[Q16_Monthly_report_submitted=5]	0[a]	.	.	0	.	.	.
	[Q8_Enrolment_of_girls_and_ladies=4]	-.755	.477	2.505	1	.113	-1.689	.180
	[Q8_Enrolment_of_girls_and_ladies=5]	0[a]	.	.	0	.	.	.
	[Q9_Pregnant_women_follow_up=4]	-1.108 Exp(B)= .330	.385	8.281	1	.004	-1.862	-.353

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[Q9_Pregnant_women_follow_up=5]	0[a]	.	.	0	.	.	.
[Q10_Educating_pregnant_on_ANC=3]	18.447	6645.014	.000	1	.998	-13005.540	13042.435
[Q10_Educating_pregnant_on_ANC=4]	-1.020 Exp(B)= .361	.459	4.942	1	.026	-1.920	-.121
[Q10_Educating_pregnant_on_ANC=5]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

3.3. Qualitative findings

Qualitative approaches used key informants' interview for 16 CHW's supervisors in 16 health centers of Musanze District, two themes such as Sociodemographic factors of CHWs and influence of Community health workers role on uptake of maternal health services were analyzed and generated.

3.3.1. Influence of sociodemographic factors of CHWs on uptake of maternal health services.

From key informants interview the following sub themes were generated from the theme sociodemographic factors of CHWs and uptake of maternal health services; Age, Education, Occupation, Marital status, working experience.

…… Age and uptake of maternal health, the findings from quantitative data was not the case in qualitative findings ,means that that the oldest CHWs are more trustful in community as reported by CHWs supervisors stated " *CHWs who are more than 40 years old and served for a long period as CHWS are more trustful than those who are still young, this has been identified by the big number of pregnant women who received health care services at the community level, additional to this, a portion of CHWs with age more than 70 years old have a problem of vision, unable to visit all pregnant women, and make follow up in their respective village''* (KII 16).

Findings were also not in agreement with ministry of Health report as the older CHWs were being highly trusted and respected and were likely to increase the uptake of maternal health services in the community (MoH ,2007).

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Education of CHWs and uptake of maternal health services ,this was supported the findings from quantitative where 16 CHWs' supervisors interviewed stated that *"Education and training provided to the CHWs have influenced uptake of maternal health services as the highly educated are more active in training and reporting compared to those with lower education"*(KII 16).

This was same as the findings from a study by (Mulingwa , 2014) ;where the level of education of CHWs had an influence on the uptake of maternal health services as it helps them to make a follow-up of CHWs instructions during pregnancy and after delivery.

Occupation and uptake of maternal health services

…This was not the same findings in qualitative as the CHW's supervisors reported that all of them are formers as stated in interview done *"The majority of people in Rwanda including our CHWs are farmers so they are combining their daily activities with providing health services in their respective villages, this could probably negatively affect provision of maternal health services in the country as our CHWs would spend most of their time in erring their livelihood rather than focusing in providing maternal health services"* (KII 16).

Quantitative findings from this study were not in agreement with the findings from a study conducted in Tanzania on Motivation and satisfaction among community health workers in Morogoro Region where the majority (94%) of respondents relied on farming as the main source of livelihood and this decreases their performance in providing maternal health services as CHWs are working as volunteers and are overwhelmed with responsibilities (Mpembeni, et al, 2015).

Marital status of CHWs and uptake of maternal health services

The findings from the qualitative data were not in agreement with the findings from quantitative data where stated that" married *CHWs are more trustful by mothers in the community than those who are still single in the services"* (KII 16).

Wangalwa et al., (2013) found the same results that uptake of maternal health services was independent to the marital status of CHWs.

But the results were different to the findings from a study conducted on the performance of CHWs in Kenya (Mulingwa, 2014) where there was a significant association between the uptake of maternal health services and the marital status of CHWs and more than half of them were married.

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Working experience and uptake of maternal health service

…… The findings from quantitative was similar to the findings from qualitative as it is reported in an interview with CHW's supervisor that'' E*xperience of CHWs is a more important factor to consider because as well as CHWs are experienced in their work it means the skills also were improved because of training received in different packages comparatively to new CHWs recruited on the services and this has influenced the uptake of maternal health services, the reason given by interviewed supervisors* (KII 16).

Crispin, et al. (2012) did the study on the same in Kenya and found that, as the years of experience of CHWs increases also the uptake of maternal health services also increase, this was confirmed by increased uptake of ANC visit, delivery and uptake of family planning.

3.2.3. Influence of community health workers roles on uptake of Maternal Health Services.

Four indicators were assessed to find out the level of uptake of maternal health services, these were the number of mothers completing ANC visits, number of mothers delivering at health care facilities, PNC attendance, and rate of FP uptake among mothers. These findings are supported by the CHWs Supervisors in the interview conducted to them as it has been stated below.

The results showed that mother who completed ANC visits has increased at the health facility after CHWs started to work in the community. These findings are supported by the study conducted by (Ngabo et. al,2012).

...ANC at health facilities have been increased through the effort of CHWs done in health education and the promotion of visiting mothers in their village. This has influenced positively the changes of some miss understanding for certain mother and escorting pregnant women to deliver at health facility has also increased deliveries at a health facility, visit done by CHWs during the ANC period up to delivery this has decreased maternal and child mortality (KII 16).

In qualitative findings on PNC and uptake of maternal health services, the CHWs supervisors reported that when health education and follow -up are well done ,Postnatal attendances should be improved at health families "*CHWs know pregnant women in the village and mother who have delivered, this record facilitated them to make follow up and encourage mothers to respect*

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the postnatal care period as it has given at health facilities, with partnership and collaboration with CHWs and HF, PNC attendance has increased at health facility (KII 16).

This should be one of the reasons for increase PNC at health facility if health education could be well done in the area, these are supported by Rwanda Ministry of Health (2018).

Through the findings from quantitative and qualitative, we can confirm that as community health works make follow –up and health education to the pregnant mothers in their respective villages; this can improve PNC attendances at health center.

The findings from qualitative on FP were similar to the findings from quantitative where CHWs stated that "*Family planning attendance has increased at health facilities since CHWs started providing services at the community level. Other reasons are that health education is provided on family planning services. Certain mothers are transferred to HF to get the services that are not done by CHWs such as intrauterine devices (IDU), Contraceptive implants, and injectable contraceptives"* (KII 16).

This implies that there is a high rate of contribution of visiting pregnant mothers by CHWs to offer maternal healthcare services and advising them on immediate family planning after delivery, birth spacing, and birth restriction as found in the study by Mwanaisha, (2015) and National Institute of Statistics of Rwanda (NISR) et al., 2015). This was also supported byCHWs supervisors in the interviews.

Discussions

Community health workers 208 were participated in the study and all were female. This study also assessed the influence of social demographic factors on uptake of maternal health services, level of education and working experience were associated with uptake of maternal health services. This was same as the findings from a study by (Mulingwa ,2014) where the level of education of CHWs had an influence on the uptake of maternal health services as it helps them to make a follow-up of CHWs instructions during pregnancy and after delivery.

Crispin, et al. (2012) did the study on the same in Kenya and found that, as the years of experience of CHWs increases also the uptake of maternal health services also increase, this was confirmed by increased uptake of ANC visit, delivery and uptake of family planning. This study found that the uptake of maternal health services was regarded as very high. Among those

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services, deliveries at the Health Facility, antenatal care, Family planning, and postnatal care. The results showed that Sending red Alert SMS by CHWs for pregnant mothers' emergencies by CHWs towards maternal health was increased uptake of maternal health services then CHWs' enrolment of girls and ladies of reproductive were also increased maternal health services. Additional CHWs' follow-up to the pregnant has improved maternal health services.

The results showed that mother who completed Antenatal care visits has increased at the health facility after CHWs started to work in the community.

These findings are supported by the study conducted by Ngabo et.al, 2012. Health education of CHWs to the pregnant women on ANC has improved maternal health services.

This implies that there is a high rate of contribution of visiting pregnant mothers by CHWs to offer maternal healthcare services and advising them on immediate family planning after delivery, birth spacing, and birth restriction as found in the study by Mwanaisha

Conclusion

The study found that the uptake of maternal health services in Musanze District was 76.4%. The two significant variables of socio demographic factor such us education and working experience were modeled with the ordinal logistic regression analysis to develop a prediction model for the uptake of maternal health services.

Recommendations

1. The researcher recommends that there is a need to improve the level of education of CHWs Through the selection criteria.
2. The Ministry of Health recommends recruiting married CHWs in charge of maternal health care in selection criteria.
3. The study recommends improvement of maternal health services through family planning, health care during pregnancy, post-partum care, with particular hard work to scaling up key motherly health services

4. The CHWs who are more than 70 years of age should replace or retire because many of them have vision challenges and they are not able to carry out their activities as expected.

This will help to achieve third goals of SDG 2030 as Good Health and well-being for all People and end up reducing mortality rates in the community unit.

Ethical Approval and Consent:

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The MKU Institutional Research Ethics and Review Committee (IREC) provided ethical approval for this study. The permission to perform the research was sought from Musanze district after presenting an official authorization letter from MKU. Following receiving written permission, the investigator went to the health facilities to consent the participants to participate. The participation was voluntary, and confidentiality was assured to the participants by excluding any information that can directly identify the participants.

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