Original Research Article

Community Health Workers' social demographic factors and roles influencing uptake of Maternal Health ~~services~~ Services in Musanze District, Northern Province, Rwanda.

ABSTRACT

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 thisstudy, 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. 208 CHWs 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 HF were at 73.6%, ANC at 65.9%, PF at 54.3%, and the rate of PNC 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, Role influencing uptake of maternal health services.

Comment [MSA1]: Capitalization should be consistent in each word

Comment [MSA2]: Sentence should be started with word.

Comment [MSA3]: Abbreviation should be avoided in abstract

Comment [MSA4]: Role or roles? It is used as "roles" in the title.

1. INTRODUCTION

Community Health workers (CHWs) play an essential role in the community that guarantees key health services are available and accessible to the community members. 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). CHWs performs one or many duties linked to the delivery of healthcare and received relevant training and supervision (WHO,2015). Community health workers are unpaid household workers who make home visits to mothers during pregnancy up to labor and delivery (Haines, Sanders, Lehmann, Rowe, &Law, 2007). Several health organizations around the world use CHWs for primary health care.Rwanda as a member of these countries, has primarily adopted community health workers and considered their role to achieve the optimum in different health indicatorsBucagu, 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 sessionsBeatrice, U. (2016).According to MoH,2007a CHW has to be mature enough to be allowed to provide maternal health services, the CHWs who have more experience in services are more respected and trustfully in the community than those who are still young. In the study conducted on the performance of CHWs in Kenya on marital status has demonstrated that ~~CHWs~~majority of CHWs were married with (76.9%)(Mpembeni et al, 2015). 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 afterGatwaza, M. H. (2016).The sociodemographic variables ~~(~~such as Age, ~~gender~~Gender, Education, ~~working~~ Working experience of ~~community health workers~~CHWs~~all~~ are essential factors while studying how the communities are motivated to uptake the services provided by these CHWs, behavior change toward uptake of CHWs activities; especially young age group, under 30, while age cohort 40-50 had the highest performance of home visits(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, MH-CHWs 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 healthhas 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

Comment [MSA5]: It is suggested to modify with clear sentence construction. Justification should be proposed why this study is intended to conduct such as research gap.

Comment [MSA6]: Citation format is being different from others. Referencing style should be consistent for the whole manuscript.

Comment [MSA7]: Citation style

Comment [MSA8]: Sentence construction is not clear.

Comment [MSA9]: Citation style

Comment [MSA10]: This sentence is not clear for reader.

Comment [MSA11]: Citation style

Comment [MSA12]: Abbreviation should not be used at first time

ensuring the achievement the target of ~~NDGs~~ MDGs 2030 and improve the quality of service provided by CHWs.

2. MATERIALS AND METHODS

2.1. Study design

This was a cross-sectional analytic study with mixed method design ~~utilized~~ including bothquantitative and qualitative methods ~~because it examined the exposure and outcome at a time.~~

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

2.5. Sampling procedures and techniques

Comment [MSA13]: Number of participants for qualitative study is needed to describe. Are all supervisors selected in a health facility? If only one supervisor is selected , criteria of selection is also needed to mention if there is more than one supervisor.

A simple random sampling procedure was used to select 208 CHWs. 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.

Comment [MSA14]: Is there any pre-testing for data collection?
Is it face to face interview or delivering self-administered questionnaries?

2.7. Qualitative data collection

Qualitative data were collected using key informants Interview (KII) with 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. 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 ~~q~~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.

Comment [MSA15]: Working definition of variables should be included especially for dependent variable.
It is not clear whether uptake of maternal health services is defined. Because table 2 shows the uptake of patients according to the CHWs services.

How to categorize this outcome variable? Is there any reference for categorization?

Roles of CHWs is also needed to be defined.

3. FINDINGS

3.1 Quantitative findings

Comment [MSA16]: Logistic regression tables should be added in addition to the texts for clear presentation.
There are so many association tables and so it will be better to describe only finding of significant association in a combined table including all outcomes.

Comment [MSA17]: Firstly, uptake of maternal health services should be presented by mean of figure.

3.1.1. Influence of CHW's Social Demographic Factors on Uptake of Maternal Health Services

This study involved 208 CHWs responded to various metrics of the research questionnaire. All the participants were female, 100%.

3.1.2. 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. Chi-

square test showed no relationship between the uptake of maternal health services and age of CHWs withp^*=0.535).

3.1.3. 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)

3.1.4. Occupation of CHWs

More than three quarter,76.0%of CHWs who were farmers ranked the uptake of maternal health services as very high. Chi square 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).

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

More than three quarter76.9% of married CHWs ranked the uptake as very high while 3(1.8%) of them ranked the uptake of maternal health services as moderate. The Chi-square 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).

3.1.6. 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. Chi-square 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).

The two significant variables were modeled with the ordinal logistic regression analysis to develop a prediction model for the uptake of maternal health services. From the findings, the Nagelkerke R-square showed that the model explains that 23.4% of the variance in the uptake of maternal health services was due to these variables. 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

Comment [MSA18]: Font size is not consistent.

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.

Table 1: Chi-square table 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%)	

Comment [MSA19]: These tables included many zero cells for each independent variable. Do the authors check the expected frequency for eligibility to use Chi-square test? If it is not eligible, Fisher's exact test is recommended.

Comment [MSA20]: Title should not be included the name of statistical test. It is better to title as "Association of sociodemographic characteristics on uptake of maternal health services"

3.2. Uptake of Maternal Health Services per Indicator

The researcher sought to find out the individual contribution of the assessed variable to the uptake of maternal health services, the findings showed that 73.6% of participants responded that the deliveries in health care facilities had the most improvement after CHWs started to work in the community. 65.9% of the CHWs who participated in this study responded that there was a very high increase of mothers completing ANC visits. More than half of the CHWs, 54.3%

Comment [MSA21]: Why do authors divide the independent variables as indicator and roles?
This make some confusion for reader.

Comment [MSA22]: The start of sentence should be word in place of number.

responded that there was a very high uptake of mothers towards using FP after providing health education. Moreover, 45.7% responded that there was a very high increase in the rate of post-partum mothers' attendance to PNC visits with respect to CHWs' visits.

Table 2. Frequency table showing the uptake of Maternal Health Services per Indicator

Variable	**Category**	**Frequency (N208)**	**Percentage (%)**
Mothers completed ANC visits has increased at the health center after CHWs started to work in the community	Average	4	1.9
	High	67	32.2
	Very high	137	65.9
CHW's record of pregnant mothers has increased deliveries in a health care facility	Moderate	3	1.4
	High	52	25.0
	Very high	153	73.6
The rate of post-partum mothers' attendance to PNC visits with respect to CHWs visit	Very low	2	1.0
	Low	4	1.9
	Moderate	5	2.4
	High	102	49.0
	Very High	95	45.7
The rate of mother's uptake towards using FP after providing health education on FP	Low	1	.5
	Moderate	6	2.9
	High	88	42.3
	Very high	113	54.3

Comment [MSA23]: It is important to mention how to categorize.

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

The results from findings showed that among those who ~~those~~ 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 chi-square test result with (X^2 =13.111 df =4 p* =.008).

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 highwith chi-square (X^2 = 9.788 df =2 p* =.006).

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 chi-square test was significant with (X^2 = 18.317 df =4 p* =.001). 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). 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 education to pregnant women (p=.027) significantly contributed to the prediction model. Very high CHW follow-up of pregnant women leads to 5.8 times increase in mothers completing ANC visits. Moreover, CHWs' strong acceptance of the positive contribution of education results in 2.7 times increase in the number of mothers completing ANC visits.

Comment [MSA24]: Should not start with numbering.

Comment [MSA25]: Should not start with numbering.

Table 3: Chi-square showing 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%)	
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%)	

Comment [MSA26]: It is necessary to check eligibility to use Chi-square test.

Comment [MSA27]: It is necessary to check eligibility to use Chi-square test.

Comment [MSA28]: It is necessary to check eligibility to use Chi-square test.

Comment [MSA29]: It is better to mention as "Health Education".

Comment [MSA30]: It is necessary to check eligibility to use Chi-square test.

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.

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 HFsignificantly 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 ANC didn't show any significant association with uptake of maternal health servicesX^2 =10.842 df =8 *p** =.324

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 post-partum mothers. The model fitting statistic was significant (X^2 =19.085, *df* =4, *p**=.001). 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 while CHW follow-up of pregnant women leads to 2.4 times increase in PNC uptake among post-partum mothers compared.

Comment [MSA31]: Should not start with numbering.

Comment [MSA32]: PNC?

Table 4:Chi-square table showing the Influence of CHWs Roles on PNC Uptake among Post-partum Mothers

Comment [MSA33]: It is necessary to check eligibility to use Chi-square test.
Title should be changed without mentioning the statistical test.

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 =26.74
	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 =16.06
	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
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

Comment [MSA34]: It is necessary to check eligibility to use Chi-square test.

Comment [MSA35]: It is necessary to check eligibility to use Chi-square test.

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.

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* =.001were statistically associated with uptake of family planning.

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).This shows that follow-up of pregnant mothers and health education positively contributed to increased uptake of family planning services. The odds ratio From the Exp(B) value generated from the parameter estimates,follow-up of pregnant mothers resulted in 2.3 times increase in the uptake of family planning services among women. CHWs contribute positively on providing FP results in 2.1 times increase. Furthermore, health education had 2.9 times increase in family planning uptake.

Table 5:Chi-square test on the influence of CHWs roles toward family Planning Uptake

Comment [MSA36]: It is necessary to check eligibility to use Chi-square test.
Title should be changed without mentioning the statistical test.

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
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

Finally, the researcher examined the influence of Community Health Workers' roles on the rate of deliveries in the healthcare facilities.Preliminary analysis with the chi-square test for independence 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). 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). The odds ratio shows Sending red Alert SMS by CHWs resulted in 4.3 times increase in

the rate of deliveries in healthcare facilities. Health education results in 2.8 times increase in the rate of deliveries in healthcare facilities.

Table 6:Chi-square test showing the influence of CHWs Roles on uptake of deliveries at health facilities.

Comment [MSA37]: It is necessary to check eligibility to use Chi-square test.
Title should be changed without mentioning the statistical test.

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
					df =2
	Strongly agree	1(0.6%)	38(21.6%)	137(77.8%)	*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
					df =2
	Very High	2(1.3%)	24(16.0%)	124(82.7%)	*p** =.001
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
					df =4
	Agree	2(5.9%)	15(44.1%)	17(50.0%)	*p** =.004
	Strongly agree	1(0.6%)	37(21.5%)	134(77.9%)	

3.3.Qualitative findings

Comment [MSA38]: Authors are suggested to explore their point of view based on the quotations of participants because there is only mentioning of quotations in this section.

Qualitative approaches used key informants' interview on CHW's supervisors, 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.

Comment [MSA39]: It is necessary to take care of font size for consistency.

……Age and uptake of maternal health services , the qualitative findings as from interview with CHWs supervisor; *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 9).

…….. Level of education and uptake of maternal health services, Interviews with CHWs' supervisor 16 stated that *"Education of 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).

…….. Occupation of CHWs and uptake of maternal health services *"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 10).

……About 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; married *CHWs are more trustful by mothers in the community than those who are still single in the services* (KII 16).

…… The same was also reported in an interview with CHWs 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).

3.2.3. Influence of community health workers roleson 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.

…….. *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).

……..**PNC**, *CHWs know pregnant women in the village and mothers who have delivered, this record facilitated them to make follow up and encourage mothers to respect 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).

……..**PF**, f*amily 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).

4.Discussions

The purpose of conducting this research was to assess the influence of CHWs on the uptake of maternal health services in the Musanze district. 208 CHWs participated in the study and all were female. This study found that the uptake of maternal health services was regarded as very high. Among those services, deliveries at the HF were at 73.6%, ANC at 65.9%, PF at 54.3%, and the rate of PNC was at 45.7%.The results showed that Sending red Alert SMS by CHWs for pregnant mothers' emergenciesby CHWs towards maternal health serviceswith chi-square test

Comment [MSA40]: Quotations are represented only for the supervisor 16. Therefore the quotation of other supervisors should be explored.

Comment [MSA41]: This section should be revised overall because authors just mention the findings again instead of giving discussion points.

Comment [MSA42]: Should not be numbering at the start of sentence.

result (X^2 = 17.493 df =6 p* =.006).CHWs' enrolment of girls and ladies of reproductive were significant with (X^2 = 9.788 df =2 p* =.006). CHWs' follow-up to the pregnant has improved maternal health services with chi-square (X^2 = 39.540 df =2 p* =.001).Health education of CHWs to the pregnant women on ANC has improved maternal health where chi-square test was significant with (X^2 = 18.317 df =4 p* =.001).The findings showed that health education of CHWs on FPwere statistically significant with (X^2 = 25.599 df =6 p* =.001).This study also 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.

Conclusion

The study found that the uptake of maternal health services in Musanze District was 76.4%, while deliveries at HF, ANC, PF, and PNC were 73.6%, 65.9%, 54.3%, and 45.7% respectively. The study examined the influence of social demographic factors on uptake of maternal health services and results showed that there was a significant association between the level of education of CHWs and uptake of maternal health services and working experience of CHWs.

Comment [MSA43]: It is not necessary to mention again.

Comment [MSA44]: To describe the influence of sociodemographic factors and roles of CHWs on uptake of maternal health services, the results of logistic regression should be pointed out.

Comment [MSA45]: It should be based on the significant research findings.
It is better to link withthe findings of both quantitative and qualitative study portions.

Recommendations

1.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

2. 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 Consideration

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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