Contribution of community health workers in the prevention of disease caused by malnutrition in Rwanda

Roger Muremyi (✉ muremyiroger@yahoo.fr)

Research

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Abstract

Background Malnutrition affects physical growth, morbidity, mortality, cognitive development, reproduction, and physical work capacity, and it consequently impacts on human performance, health and survival. It is underlying factor in many diseases for both children and adults, and is particularly prevalent in developing countries, where it affects one out of every 3 preschool-age children. A well-nourished child is one whose weight and height measurements compare very well with standard normal distribution of heights and weights of healthy children of the same age and sex. Factors that contribute to malnutrition are many and varied.

Objective The objective of the present study is to evaluate the contribution of community health workers in the prevention of diseases caused by malnutrition in Rwanda. Factors included: community health workers, place of residence (urban, rural), sex of child, marital status, antenatal care, breastfeeding, wealth index and education level.

Methodology: We used data from NISR(DHS2014.2015) collected on child that covered 1137 Households. The results show that the level of wasting, stunting, and underweight in children under five years of age was 51.89%, 58.4% and 36.24% respectively.

Findings: Malnutrition was significantly ($p < 0.01$) higher among boys than among girls. The prevalence of wasting and stunting decreased significantly by community health workers and antenatal care. The higher the level of parent's education, the lower the level of child underweight observed. Breastfeeding was found to reduce the occurrence of underweight among children.

Conclusion The study findings imply that efforts for redressing child under nutrition in Rwanda should focus on factors associated with development outcomes such as, community health worker's improvements, parent's education, and the creation of employment or economic engagements that do not comprise important child care practices such as breastfeeding and antenatal care.

1. Introduction

Over the last three centuries following the 1978 Alma Ata Declaration on Primary Health Care (PHC), community health workers (CHWs) have been encouraged to become component of the health structures of many emerging nations. CHW programs were implemented in many of these nations in a top-down manner with comparatively restricted capability construction and scheduling. instead of being the leading edge of changed strategy to health care, CHWs often wound up becoming a badly resourced and undervalued expansion of the current health service- "just another couple of finger"(MINISTRY OF HEALTH, 2013).

Worldwide, CHWs are used as a strategy to address the shortage of health workers, and render certain basic health services to their communities (e.g. USA, China, Brazil, and South Africa)(Rwanda Governance Board, 2017). Depending on the specific needs of countries and communities, CHWs' profiles

vary in terms of activities, scope; training among others. According to WHO (World Health Organization) definition of CHWs is that they should be: “members of the communities where they work; selected by the communities; answerable to the communities for their activities; supported by the health system but not necessarily a part of its organization; and, have shorter training than professional workers (Rwanda Governance Board, 2017).

The Rwanda CHW Program was established in 1995 after Genocide, aiming at increasing uptake of essential maternal and child clinical services through education of pregnant women, promotion of healthy behaviors, and follow-up and linkages to health services. An estimated 45,000 CHWs operating at the village level provide the first line of health service delivery. There are three CHWs in each village: a male-female CHW pair providing basic care and integrated community case management (CCM) of childhood illness, and a CHW in charge of maternal health, called an ASM (Agent de Santé Maternelle). There are four main objectives of the program (1) strengthen the capacity of decentralized structures to allow community health service delivery; (2) strengthen the participation of community members in community health activities; (3) strengthen CHW motivation through CPBF to improve health service delivery; and (4) strengthen coordination of community health services at the central district, health center, and community levels. The program has since grown to include an integrated service package that includes malnutrition screening, treatment of TB patient of DOT, prevention of NCDs, community-based provision of contraceptives, and promotion of healthy behaviors and practices including hygiene, sanitation, and family gardens (Lauren Crigler, 2014).

From 2005, after the decentralization policy was introduced countrywide, there was sustained capacity building of the CHWs through training and supply of materials. By 2011, the number of CHWs had grown to 60,000. In May 2012, the Ministry of Health and Ministry of Local Government decided to remove the CHWs in –charge of Social Affairs in all the Villages. The number of community health workers was therefore reduced from 60,000 to approximately 45,000. Each village is meant to have 3 CHWs. The range of services offered at community level by CHWs has evolved over time and so has its underlying policy, plans and implementation strategies (Luigi D’Aquino, 2016).

Based on experience of the community initiatives for the past several years, the Government of Rwanda through the Ministry of Health consolidated the most promising strategies in the 2008 National Community Health Policy. In each village (Umudugudu), the binomes (pairs of CHW) are trained in ICCM and they are responsible for administering appropriate first aid as quickly as possible and refer severe cases to health facilities. The training is accompanied by supportive supervision to strengthen their knowledge and skills to provide quality services to their communities. It is for this purpose that this training manual was developed. The ICCM is a strategy that ensures comprehensive and continuous care to under 5 years’ sick child focusing on the most common diseases: malaria, diarrhea, pneumonia and malnutrition. These interventions are curative, preventive and promote with participation of families and communities. This program comprises also growth monitoring and the promotion of child development.

Community Health Workers (CHWs) play an important role that complements the health care provided by health center workers(Dr. BINAGWAHO Agnes, 2014).

According to World Health Organization(WHO), Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'undernutrition'- which include stunting (low height for age), wasting (low weight for height), underweight (low weight for age), and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is overweight, obesity and diet-related non communicable diseases (such as heart disease, stroke diabetes and cancer).

The term malnutrition generally refers both to under nutrition and over nutrition, many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations. Inadequate diet and diseases, in turn, are closely linked to the general standard of living, the environmental conditions, and whether a population is able to meet its basic needs such as food, housing and health care. Malnutrition is thus a health outcome as well as the risk factor for diseases and exacerbated malnutrition, and it can increase the risk both morbidity and mortality(Monika Blössner & Mercedes de Onis, 2005).

Malnutrition continues to be a major public health problem throughout the developing world, particularly in southern Asia and sub-Saharan Africa. The high prevalence of bacterial and parasitic diseases in developing countries contributes greatly to malnutrition there. Similarly, malnutrition increases one's susceptibility to and severity of infections, and is thus a major component of illness and death from disease. Malnutrition is consequently the most important risk factor for the burden of disease in developing countries. It is the direct cause of about 300000 deaths per year and indirectly responsible for about half of all deaths in young children. The risk of death is directly correlated with the degree of malnutrition(Olaf Müller & Michael Krawinkel, 2005).

Malnutrition, with its two constituents of protein-energy malnutrition and micronutrient deficiencies, continues to be a major health burden in developing countries. However, it is globally the most important risk factor for illness and death, with hundreds of millions of pregnant women and young children particularly affected(Olaf Müller & Michael Krawinkel, 2005).Over three million deaths occur from protein-

energy malnutrition (PEM) in children under five worldwide annually. The burden of malnutrition in the developing world accounts for a large majority of these deaths, where one in four children under five are underweight. In Rwanda, an estimated 38% of children under five suffer from chronic malnutrition(MINISTRY OF HEALTH, 2018). The substantial burden of infectious disease contributes to the high rate of malnutrition among children, leading to negative effects on growth, as well as increased vulnerability to future occurrences of infection(Dr. Agnes Binagwaho et al., 2011). Improved nutrition can reduce child morbidity and mortality related to infectious disease, as adequately nourished children are more likely to fight and recover from an infection, and that is why Rwanda as the country which want to achieve MDGs has developed some of strategic policies to keep fighting against this problem of malnutrition in under five years children, the community health workers program has played an important role in expanding coverage of basic services, especially community based FP services and treatment of childhood malnutrition reduction.

According to RDHS (Rwanda Demographic Health Survey) data, it shows that there has been a vast improvement in the nutritional status of children: between 2005 and 2010, the percentage of children who were underweight declined from 18% to 11% and the percentage of children who were stunted declined from 51% to 44%. And also between 2010 and 2015 the underweight has declined from 11% to 8.8%, while stunted declined from 44% to 38%. Though there is an improvement but the percentage is still high (NISR,2015).

However, in Rwanda there are community health workers, Rwanda is still having problem of malnutrition diseases. One of the biggest problem is stunting where the statistics shows that there is a big rate number of 38% are stunted.

This analysis uses the most recent DHS data from NISR (National Institute of statistics of Rwanda) to understand how the nutritional status of children varies with the educational achievement of mothers in the country. The main purpose of this paper is to evaluate how the community health workers is contributing in the prevention of diseases caused by malnutrition. Specifically, to identify diseases caused by malnutrition, to find out the challenges faced by community health workers, to examine the contribution of community health workers in the prevention of diseases caused by malnutrition in Rwanda, to suggest some possible solutions to overcome malnutrition. These will help the policy makers to get true and reliable information on malnutrition in Rwanda.

2. Literature Review

The program of CHW Program was established in 1995, having an aim of increasing uptake of essential maternal and child clinical services through maternal education who is pregnant, promotion of health behaviors and follow up and linkages to health services. An estimated 45000 CHWs operating at the level of village: male-female CHWs pair providing basic and integrated community cases management of childhood illness a CHWs in charge of maternal health called an ASM(Rwanda Ministry of Health., 2018). Moreover, the core of level 1 health service provision rest on the key household practices. In this view CHWs who were described as gate keeper of health in community were found to be effective in dialoging with the households on actions for health since they shared a common situation and experience. In all the district visited, the CHWs had been selected by the community using the MOH guidelines with a strong emphasis on the willingness and ability to work as volunteers(Ministry of health, 2007).

Basing on the community strategy (Ministry of health, 2007), Community health workers are expected to be, mature, respected and responsible members of the community the community choose men or women by the community to provide basic health care.

Community health workers are coming from the village in which they live. They are between ages 20 and 50 they must know write and to read. They must volunteer willing and they are considered to be honest, trustworthy and reliable(Rwanda Ministry of Health., 2018). They to be selected by the members of village. On the last Saturday of the month (Umudugudu, or community service day) the villagers and volunteers are gathered together and voting “with their feet” in a literal sense. The process has been described as one that includes community members lining up the person they support. The individual with high number of community members is recruited.

Binomes are trained in community based IMCI in each of the villages (umudugudu) by preparing them as first responders to a number of common childhood illness, including diarrhea, malaria and pneumonia. The CHWs are also trained on when and how to refer the installation to serious instance. IMC refresher training is given by a supporting supervisory model which the supervisor performs training to enhance the understanding and abilities of the CHWs in offering quality case management services in their communities(Rwanda Ministry of Health., 2011).

Another example of program specific training is the ten day training for community based provision of FP service(Rwanda Ministry of Health., 2011a). A total of 3061 CHWs in three districts have received their training, which uses participatory methods, having CHWs brainstorm ideas and practice exercises such as role plays and perform a rapid diagnosis tests for malaria(Rwanda Ministry of Health., 2011a).

3. Findings From Other Researchers On Community Health Workers

Freddy Perez et al. (2009) made a study on the role of health community health workers in improving child health program in Mali using a community based cross-sectional survey that was undertaken using multi-stage cluster sampling of wards and village. The data was collected using questionnaires among 401 child caregivers and registers of 72 CHWs. their findings showed that, among 401 households supposed to receive a visit by a CHWs, 219 had received at least one visit in the last three months before

the survey, through the results mother is the most important caregiver (97%), high percentage being illiterate. Caregivers treat fever and diarrhea with the correct regimen in 40% and 11% of cases respectively. Comparative analysis between households with and without CHWs visits showed a positive influence of CHWs on family health practice like: knowledge on the management of child fever, non-utilization of antibiotics in home treatment of diarrhea, presence and bed net, all these have been statistically significant. A total of 27(38%) CHWs had not received supervision at all against 45(63%) who followed the regularly each month during the last six month, therefore they concluded saying that continuous training, transport means, adequate supervision and motivation of CHWs through the introduction of financial incentives and remuneration are among key factors to improve the CHWs work in rural communities(Freddy Perez, Hamady Ba, Sayed G Dastagire¹, & Mathias Altmann, 2009).

Bryenne and Eilish McAuliffe (2013) investigated on effect of community health workers delivering preventive interventions for maternal and child health in low and middle income countries. They worked on the evidence for policy and practical information and coordinating centre's (EPPI-Centre) guidelines and systematic searching of the database occurred between June 8-11th, 2012: CINAHL, Embase, ovid Nursing Database, PubMed, Scopus, Web Science and POPLINE. Their study characteristics of included studies were extracted using a data sheet and peer tested quality assessment. A narrative synthesis of included studies was compiled with articles being coded descriptively to synthesize and draw conclusion. A total of 10281 studies were initially identified and through the screening process a total of 17 articles detailing 19 studies were included in review. With cross-sectional studies five preventive intervention categories like malaria prevention, health education, breastfeeding promotion, essential newborn care and psychological support. Therefore, all these categories showed the evidence for effectiveness of community health worker. They concluded that community health workers were shown to provide a range of preventive interventions for maternal and child health in low-and middle-income countries(Bryenne Gilmore & Eilish McAuliffe, 2013).

Zaeem and Assad Hafeez (2009) made a study on knowledge and communication needs assessment of community health workers in developing country. They focused on group discussions which were held with health workers and their supervisors belonging to all the four province of the country and the Azad Jammu & Kashmir region. Self-response questionnaire was also used to obtain information on questions regarding their continued education. About four fifths of the respondents described their communication skills as moderately sufficient and wanted improvement. Knowledge on emerging health issues was insufficient and the respondents showed willingness to participate in their continued education. Media campaigns were successful in building the image of health workers as a credible source of health information. They concluded saying that a continued process should be insured to provide opportunities to health workers to update their knowledge sharpen communication skills and bring credibility to their personal as health educators(Zaeem Haq & Assad Hafeez, 2009).

Andy Haines, et al., (2007) made a study on achieving child survival goals: potential contribution of community health workers, they find that there is renewed interest in the potential contribution of community health workers to child survival. Community health workers play a big role in undertaking

different tasks like case management of childhood illnesses and delivery of preventive interventions including immunization, promotion of healthy through case management of childhood illness these interventions of community. Though, community health workers are not a panacea for weak health systems and will need task to be focused, training, supervision, and the active involvement of the communities in which the work. They also announced that the introduction of large scale programs for community health workers needs evaluation to look on the impact on child survival and effectiveness cost(Andy Haines, et al., 2007).

4. Conceptual Framework

This part summarizes how dependent variable is influenced by explanatory variables. the researcher has based also on socio-demographic variables (access to information, wealth, health facility, place of residence, place, child, sex, household size)

Independent variable		Dependent variables
Community health worker	Socio-demographic factors	Child nutrition status
↪ Community health workers facility	↪ Access to information	↪ Stunting
	↪ Wealth workers	↪ Wasting
	↪ Health facility	↪ Underweight
	↪ Place of residence	
	↪ Province	
	↪ Child sex	
	↪ Household size	
Source: researchers own 'construct		

5. Data And Methods

5. Data and Methods

This study extracted necessary information from Rwanda Demographic Health Survey (RDHS) 2014-15, which was conducted through a joint effort of the National Institute of Statistics of Rwanda (NISR). Under this chapter the researcher present and define the variables as well as the methods that will be used to analyze the data. For achieving the objective of the study, multivariate regression model will be used to analyze the relationship between community health workers and malnutrition reduction and how the community health workers contribute to reduce malnutrition in Rwanda. Define the methodology as the set of methods and principles that are used when studying a particular kind of work. A method

composes all intellectual process an orderly system or arrangements that enable a researcher to reach an aspect of knowledge by using various techniques (Bailey, Kenneth D, 1978).

5.1 Data description

The RDHS is a standardized and nationally representative survey that, inter alia, collects detailed level information on housing and household characteristics, maternal and child health, gender, domestic violence, family planning, nutrition, knowledge, and behaviors related to malaria and HIV/AIDS. For the 2014-15 RDHS, the fieldwork took place from July 7 to September 6 2014 and data editing were complete on April 26, 2015. Data cleaning and finalization were completed on May 15, 2015.

5.2 Target population, data filtering

The RDHS is standardized and nationally representative survey that collects detailed level information on housing and household's characteristics, maternal and child health, gender, domestic violence, family planning, nutrition, knowledge and behaviors related to malaria and HIV/AIDS. For the 2014-15 RDHS, the field work took place from July 7 to September 6 2014 and data editing were complete on April 26, 2015. The sample size is 1137, though it was used the total household was 3615 before data cleaning. Then some cases were dropped during data cleaning we remain with 1137 cases.

The study targeted on all families who have children malnutrition problem in their families. The research will focus on those children; the data set contains more variables and observations as it will be presented in conceptual framework. For the researcher was filtered the variables and observations that are relevant to the recent study design.

5.3 Methods of analysis and model specification

5.3.1 Methods of analysis

The researcher used two types of methodology namely: Descriptive statistics (frequency statistics and bivariate analysis) and multivariate analysis, which will have used to identify the direction of effect for each independent variable.

5.3.2 Descriptive statistics

The descriptive statistics for variables is important for summarizing the characteristics of respondents. Bivariate analysis using chi-square test will be used to identify the relationship between the community health workers and diseases caused by malnutrition diseases. Chi-square formula is shown below:

$$Chi - square(X^2) = \frac{(O - E)^2}{E}$$

5.3.3 Multivariate analysis

Multivariable binary logistic regression analysis extends the technique of multiple regression analysis to research situation in which the outcome variable is categorical (Dayton 1992). Generally, logistics is well suited for describing and testing the hypothesis about relationship between a categorical outcome variable and more predictors. In order to obtain a more comprehensive picture of the contribution of the community health workers on malnutrition disease, we will consider several interlinked aspects running through from sickness and socio demographic factors treatment and prevention to finally health outcomes. When sick then all these be linked on malnutrition disease.

The logistic regression analysis will be used to assess contribution of CHWs on Malnutrition disease and other factors that influence malnutrition disease and was reported as odds ratio (OR) with 95% confidence interval (CI). The univariate logistic regression was performed using one variable in the model at a time in order to find the association between age at death and each independent variable. Then, multivariate logistic regression will be performed using all the independent variables at a time. The fitness of the final logistic model was tested using Hosmer and Lemeshow goodness of fit test.

Logistic regression analysis studies the association between a categorical dependent variable and a set of independent (explanatory) variables. The name logistic regression is used when the dependent variable has only two values, such as 0 and 1 or yes and No. The name multinomial logistic regression is usually reserved for the case when the dependent variable has three or more unique.

The binary logistic regression model is shown like:

$$\log(P) = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

The model is used because the outcomes were dichotomous (binary) outcomes or binary.

Where P is the probability of the event of interest b_i are the parameters of logistic model, X_n is the independent variables and $\logit(P)$ is the outcome or dependent variable.

The social demographic characteristics include the mother's age, educational attainment, marital status and antenatal care. Concerning the household characteristics, we control for the sex of the household head, the number of household members and the living children, the household's wealth index, as well as, the place of residence. In order to account for geographic differences, we do include dummy variable for each of the 4 provinces in the estimations.

6. Results Of The Analysis

This section contains the presentation, analysis and the discussion of the findings of the study. These are presented according to the main research questions raised to guide the study conducted by NISR on RDHS 2014.2015. First part of this chapter included the background information of the respondents. Second part focused on the main findings of the study about the contribution of community health workers in the prevention of the diseases caused by malnutrition.

6.1 Respondents Characteristics

This section dealt with the information collected on female population respondents in Rwanda. The characteristics of respondents discussed mainly include sex of respondents, female age group at first birth, place of residence, women marital status, place of residence and their highest education attainment.

6.2 Univariate analysis

This part presents the description of child characteristics: health workers care, wealth index, mother education level, place of residence, province, antenatal care, age, sex, breast feeding, for the purpose of ascertaining the percentage and frequency distributions.

Diseases caused by malnutrition and child characteristics

Stunting	Freq.	Percent
Non-stunted	473	41.60
stunted	664	58.40
Total	1,137	100.00

wasting

Non-wasted	547	48.11
wasted	590	51.89
Total	1,137	100.00

weight

non_		
underweight	725	63.76
underweight	412	36.24
Total	1,137	100.00

Health workers

no	338	29.73
yes	799	70.27
Total	1,137	100.00

Education level

<hr/>		
Noeducation	114	10.03
primary	798	70.18
secondary	170	14.95
higher	55	4.84
<hr/>		
Total	1,137	100.00

wealth index

<hr/>		
poor	428	37.64
middle	200	17.59
rich	509	44.77
<hr/>		
Total	1,137	100.00

Breastfeeding

<hr/>		
no	142	12.49
yes	995	87.51
<hr/>		
Total	1,137	100.00

Marital |

status |

<hr/>		
single	38	3.34
married	1,078	94.81
widowed	1	0.09

divorced	20	1.76
<hr/>		
<hr/>		
Total	1,137	100.00
<hr/>		
sex of		
<hr/>		
child		
<hr/>		
<hr/>		
female	591	51.98
<hr/>		
male	546	48.02
<hr/>		
<hr/>		
Total	1,137	100.00
<hr/>		
Antenatal		
<hr/>		
care		
<hr/>		
<hr/>		
no	1,026	90.24
<hr/>		
yes	111	9.76
<hr/>		
<hr/>		
Total	1,137	100.00

Source: DHS2014-15

According to all total respondent 58% had the problem stunting 51.89% were wasted and 36. 24% of the total population were under-weight. The majority met the health worker (70.27%) while other 29.63% did not. And most of them had primary level education with 70.18% followed by with those in secondary level with 14.95%, 44.77% are rich and 37.64% are poor. Here high number of children have had a breastfeeding while low number did not, 87.51% and 1.49% respectively. According to respondent's marital status, most of them were married with 94.81% of the whole surveyed population and 51.98% were female and 49.02% were male. Above 90% did not get antenatal care

6.3 Bivariate

This section presents the results of bivariate analysis on diseases caused by malnutrition. As earlier mentioned, it establishes the strength of association between diseases caused by malnutrition and each explanatory variables by using cross tabulations and chi-square statistics. Tables below show the details of death patterns by each of the selected independent variables.

Factors that influence stunting

stunting status			p value
province	total non-stunt (%)	stunted (%)	
<hr/>			
kigali city	168 104(61.90)	64(38.10)	0.000
south	301 108(35.88)	193(64.12)	
west	239 84(35.15)	155(64.85)	
north	164 54(32.93)	110(67.07)	
east	265 123(46.42)	142(53.58)	

Health |

workers			p value
no	yes		
<hr/>			
no 338	79(23.37)	259(76.63)	0.000
yes 799	394(49.31)	405(50.69)	
<hr/>			

type of |

place of |

residence |

rural	836	295(35.29)	541(64.71)	
urban	301	178(59.14)	123(40.86)	0.000

education |

level |

Noeducation	114	30(26.32)	84(73.68)	
primary	798	308(38.60)	490(61.40)	
secondary	170	96(56.47)	74(43.53)	
higher	55	39(70.91)	16(29.09)	0.000

wealth |

index |

poor	428	134(31.31)	294(68.69)	
middle	200	62(31.00)	138(69.00)	
rich	509	277(54.42)	232(45.58)	0.000

breastfeeding |

no	142	104(73.24)	38(26.76)	
yes	995	369(37.09)	626(62.91)	0.000

Marital |

status |

single	38	16(42.11)	22(57.89)	
--------	----	-----------	-----------	--

married	1,078	448(41.56)	630(58.44)		
widowed	1	1(100.00)	0(0.00)		
divorced	20	8(40.00)	12(60.00)		0.699

sex of |

child |

female	591	262(44.33)	329(55.67)		
male	546	211(38.64)	335(61.36)		0.052

Antenatal |

care |

no	1026	381(37.13)	645(62.87)		
yes	111	92 (82.88)	19(17.12)		0.000

Source: RDHS2014-15

The results of bivariate analysis are shown in the table above. And it shows that, province, health worker, place of residence, breastfeeding, wealth index and antenatal care are statistically significant because their p-value are less than **0.05** (p value <0.05). Means that the all mentioned variables have an influence on stunting status.

Basing on findings indicated in table above, it shows that the problem of stunting among Rwandan children is still high. According the surveyed household distributed by province north, west and south provinces are at high level of stunting with 67.07%, 64.85% and 64.07% respectively and the province which has the small number of stunting is Kigali with 38.1% of the total population. Among the total surveyed children 76.63% of the total children who didn't get help from health workers were stunted while 50.69% of the total children who met with health worker were also stunted.

From our findings it is indicated that large number of children who were stunted, their mother had low educational level, for those with no education 73.68% were stunted while with those of primary level 61.4% also were stunted. As the level of education increase number of children with stunting decreases. And large number stunting was from rural distributed children with 64.71% while urban is 40.86%. And male children are more likely to meet stunting problem compared to female. Also 62.87% of the total children who didn't get antenatal care were stunted while for those who did, only 17.12% were stunted.

Factors that influence wasting

wasting status			
province Total	non-waste (%)	wasted (%)	P value
<hr/>			
kigali city 168	100(59.52)	68(40.48)	0.000
south 301	146(48.50)	155(51.50)	
west 239	90(37.66)	149(62.34)	
north 164	76(46.34)	88(53.66)	
east 265	135(50.94)	130(49.06)	
<hr/>			
Health			
workers			
<hr/>			
no 338	143(42.31)	195(57.69)	0.000
yes 799	404(50.56)	395(49.44)	
<hr/>			
place of			
residence			
<hr/>			
rural 836	360(43.06)	476(56.94)	

urban | 301 187(62.13) 114(37.87) 0.000

education |

level |

no education | 114 40(35.09) 74(64.91)

primary | 798 370(46.37) 428(53.63)

secondary | 170 99(58.24) 71(41.76)

higher | 55 38(69.09) 17(30.91) 0.000

wealth |

index |

poor | 428 162(37.85) 266(62.15)

middle | 200 88(44.00) 112(56.00)

rich | 509 297(58.35) 212(41.65) 0.000

breastfeeding

no | 142 85(59.86) 57(40.14)

yes | 995 462(46.43) 533(53.57) 0.003

Marital |

status |

single 38	17(44.74)	21(55.26)	
married 1,078	523(48.52)	555(51.48)	
widowed 1	0 (0.00)	1(100.00)	
divorced 20	7(35.00)	13(65.00)	0.467
<hr/>			
sex of			
child			
<hr/>			
	female	591	307(51.95) 284(48.05)
Male	546	240(43.96)	306(56.04) 0.007
<hr/>			
<hr/>			
Antenatal care			
<hr/>			
no 1,026	470(45.81)	556(54.19)	
yes 111	77(69.37)	34(30.63)	0.000

source: RDHS 2014-15

The results of bivariate analysis are shown in the table above. And it shows that, province, health worker, place of residence, breastfeeding, wealth index and antenatal care are statistically significant because their p-value are less than **0.05** (p value <0.05) except maternal marital status. Means that the all mentioned variables have an influence on wasting status.

Among the total children who didn't get facility from the health workers 57.69% were wasted while 49.44% only were wasted for those who got facility from health workers which means that health workers have a role in reducing the number of wasted children. The result shows that western province is heading other province in having high number of children leaving with the problem of wasting, with 62.34% of the total surveyed children are wasted and is followed by north province which has 62.34% and the province which has low number of wasted children is Kigali city with 40.48%.

For maternal educational level, the results indicated that children whose mothers has high level of education are more likely not to have this problem of wasting. For those with no education wasting was 64.91% while for those in higher education wasting was at 30.91 % as shown in the table. And higher number of wasting children was in rural areas, with 56.94% of the total surveyed children.

Factors that influence underweight

Underweight status				
Province	Total	non-underweight(%)	underweight(%)	P-value
<hr/>				
kigali city	168	105(62.50)	63(37.50)	0.027
south	301	207(68.77)	94(31.23)	
west	239	135(56.49)	104(43.51)	
north	164	113(68.90)	51(31.10)	
east	265	165(62.26)	100(37.74)	

Health |

workers			
<hr/>			
no	338	219(64.79)	119(35.21)
yes	799	506(63.33)	293(36.67)
<hr/>			

type of |

place of |

residence |

<hr/>			
rural	836	522(62.44)	314(37.56)
urban	301	203(67.44)	98(32.56)
			0.122
<hr/>			

education|

level|

no education	114	78(68.42)	36(31.58)	
primary	798	507(63.53)	291(36.47)	
secondary	170	102(60.00)	68(40.00)	
higher	55	38(69.09)	17(30.91)	0.422

wealth |

index |

poor	428	272(63.55)	156(36.45)	
middle	200	123(61.50)	77(38.50)	
rich	509	330(64.83)	179(35.17)	0.703

breastfeeding

no	142	84(59.15)	58(40.85)	
yes	995	641(64.42)	354(35.58)	0.222

Marital |

status |

single	38	23(60.53)	15(39.47)	
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married 1078	688(63.82)	390(36.18)	
widowed 1	0(0.00)	1(100.00)	
divorced 20	14(70.00)	6(30.00)	0.518

sex of |

child |

female 591	374(63.28)	217(36.72)	
male 546	351(64.29)	195(35.71)	0.725

Antenatal |

care |

no 1026	656(63.94)	370(36.06)	
yes 111	69(62.16)	42(37.84)	0.712

SOURCE: RDHS 2014-15

The results of bivariate analysis are shown in the table above. And it shows that, all factors are statistically insignificant except province because their p-values are less than 0.05(p value <0.05). Means that the all mentioned variables have no influence on underweight status.

Here the province which is at higher number of underweight, western province and followed by east, and Kigali city with 43.51%, 37.74% and 37.50%. and the majority were male (56.04%).

6.4 Multivariate analysis

Binary logit parameter estimates of model 1

Stunting status	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
<hr/>						
Health worker	-1.217217	.1636756	-7.44	0.000	-1.538016	-.8964191
province	-.0568698	.0511028	-1.11	0.266	-.1570294	.0432898
place residence	-.571168	.1838945	-3.11	0.002	-.9315946	-.2107414
education level	-.3417421	.1208649	-2.83	0.005	-.5786329	-.1048513
wealth index	-.277401	.0861079	-3.22	0.001	-.4461695	-.1086326
breast feeding	1.178479	.219007	5.38	0.000	.7492327	1.607724
antenatal care	-1.59828	.2778857	-5.75	0.000	-2.142926	-1.053634
_cons	1.626605	.3673184	4.43	0.000	.9066738	2.346536

LR chi2(9) = 250.08 Prob > chi2 = 0.0000 Pseudo R2= 0.1620 Log likelihood = -646.94952

The model is:

$\log(p) = 1.626605 - 1.217217 \text{ health worker} - 0.0568698 \text{ province} - 0.571168 \text{ place residence} - 0.3417421 \text{ education level} - 0.277401 \text{ wealth index} + 1.178479 \text{ breast feeding} - 1.59828 \text{ antenatal care}.$

The likelihood of the model is the probability that you would observe the dichotomous (actually multichotomous) outcomes of the sample, given the coefficient estimates. The logit algorithms maximize the logarithm of this likelihood, and since the probabilities is between 0 and 1, then the log likelihood is always negative. Our maximum log likelihood of obtaining outcomes of health insurance coverage from the sample is -646.94952 and the test chi-square is 250.08.

As the calculated chi-square statistics is highly significant at 5%, then the null hypothesis that the constrained model is correct is rejected. This means that the probability in the upper tail beyond the calculated statistic is smaller than the significance level chosen for test. Hence our explanatory variables are important covariates to the model.

According to the finding shown in the table above all factors are statistically significant except province which is not because the p-value (0.266) is greater than 0.05.

Holding other factors constant, factors constant health worker reduces the odds of stunting status by 1.21 percent which indicate that health workers have a large contribution in reducing this disease caused by malnutrition after antenatal care which has 1.6.

Other factors like distribution by province also reduce the stunting status by 0.056 ceteric purbus, and place of residence has a contribution in reducing stunting status by 0.57. When holding other factor constant level of education reduce the odds of stunting status by 0.34 while breast feeding increase the odds by 1.17 here is also another factor called wealth index which reduces the odds of stunting status by 0.277 when other factors are hold constant.

Binary logit parameter estimates of model 2

wasting	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
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Health worker 	-.3689097	.1396012	-2.64	0.008	-.642523	-.0952964
province 	-.0440565	.046641	-0.94	0.345	-.1354712	.0473582
place residence 	-.4262017	.1686871	-2.53	0.012	-.7568224	-.0955811
education level 	-.1954709	.108764	-1.80	0.072	-.4086444	.0177026
wealth index 	-.2587137	.0792108	-3.27	0.001	-.4139641	-.1034633
breast feeding 	.2289394	.1946632	1.18	0.240	-.1525935	.6104723
child sex 	.3073024	.1234634	2.49	0.013	.0653185	.5492863
antenatal care 	-.6047335	.229367	-2.64	0.008	-1.054285	-.1551824
_cons 	.9052192	.3919809	2.31	0.021	.1369506	1.673488

LR chi2(8)= 82.22 Prob > chi2=0.0000 Pseudo R2=0.0522 Log likelihood = -746.18373

Source DHS2014-15

The model is:

log(p)= .9052192-.3689097**Health worker**-.0440565 **province**-.4262017**place residence**-.1954709**education level**-.2587137**wealth index**+.2289394**breast feeding**+.3073024**child sex**-.6047335**antenatal care**

The likelihood of the model is the probability that you would observe the dichotomous (actually multichotomous) outcomes of the sample, given the coefficient estimates. The logit algorithms maximize the logarithm of this likelihood, and since the probabilities is between 0 and 1, then the log likelihood is always negative. Our maximum log likelihood of obtaining outcomes of health insurance coverage from the sample is -746.18373 and the test chi-square is 82.22.

As the calculated chi-square statistics is highly significant at 5%, then the null hypothesis that the constrained model is correct is rejected. This means that the probability in the upper tail beyond the

calculated statistic is smaller than the significance level chosen for test. Hence our explanatory variables are important covariates to the model.

According to the finding shown in the table above all factors are statistically significant except province, level of education and breast feeding which are not because the p-value is greater than 0.05.

Holding other factors constant, factors constant health worker reduces the odds of stunting status by 0.36 which indicate that health workers have a large contribution in reducing this disease caused by malnutrition after antenatal care which has 0.90 when other factors remains constant.

Holding other factors constant, place of residence has a contribution in reducing the odds of wasting status by 0.42, here is also another factor called wealth index which reduces the odds of wasting status by 0.26 when other factors are hold constant. Ceteric paribus also sex of child has a contribution 0.30 in increasing odds of wasting status.

Binary logit parameter estimates of model 3

Underweight	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
province	.0204013	.0444034	0.46	0.646	-.0666278 .1074305
_cons	-.6274855	.1492666	-4.20	0.000	-.9200427 -.3349283

Source DHS2014-15

Model is $\log(p) = -.6274855 + .0204013 \text{ province}$

And because the p value of province is greater than 0.05 hence it is not statistically significant.

7. Discussion Of Results

As expected the social economic factors like, health workers, maternal education, breast feeding, wealth, health care (antenatal care) index have influence on child stunting similar to the world health organization in 2018. Also in 2010 the world health organization find that poor schooling has an influence on child stunting and wasting which is the same as our findings.

Wealth index and breast feeding have an expected sign and they are statistically significant. The findings show that breastfeeding reduce child stunting status. The result is similar to Rwanda ministry of health 2013 and 2018.

Community health workers and breast feeding are statistically significant and according to the results both community health workers and breastfeeding have an influence on the child reduction of stunting and wasting which has been also investigated by USAID 2016 in Haiti.

Community health workers contribute a larger role in improving children health, and according to the result of Freddy Perez et al. (2009) in Mali also find that these CHWs have large role which is looks the same as findings of Brynne and Eilish McAuliffe (2013).

Andy Haines, et al. (2007) find that there is renewed interest in the potential contribution of community health workers to child survival, which is similar to our result that CHWs contributes to child health.

7. Conclusion and Recommendation

From the result, we found that community health workers have positive influence on malnutrition disease since we reject null hypothesis and confirm that community health workers have influence in the reduction of malnutrition disease in Rwanda. But there are other factors that make the malnutrition still high, this is rural areas where their education still low because most people has almost complete primary only or have no education where we found that as the level of education increase the number of children with stunting decrease and also the results indicates that children whose mothers has high level of education are more not to have problem of malnutrition.

Other factors that contribute to malnutrition disease in Rwanda are place of residence where we found that the big number of children who are not malnourished are from rural areas, wealth index where the poorest family still have the problem according the result indicate that wealth index have a big role in the reduction of malnutrition. Those that are contribute to malnutrition level in RWANDA.

Basing on the findings, the community health workers has great impact to reduce malnutrition disease in Rwanda. That is why I recommend the local people who are the main concern and implementers of government policies, this will be helpful to fight against malnutrition in different areas and also the improvement of nutrition.

I recommend again community health workers to participate in different trainings provided by the government or Ministry of Health, because they will find some advices related to health and it will help them again to manage some different case of this problem. The real assets government has, is its

citizens. This is where the welfare of the population comes from and with the positive leadership. The government does not force people to join the strategies but if it is a beneficial one, everyone comes to enjoy it. Citizens especially women should work hard and awareness understanding of government strategies for a support to avoid malnutrition in their families.

Abbreviations

AIDS

Acquired Immune Deficiency Syndrome

ASM

Agent de Santé Maternelle

CBN

Community Based Nutrition

CCM

Community Case Management

CHC

Center for Health Care

CHEW

Community Health Extension workers

CHW

Community Health Worker

FP

Family Planning

MDGs

Millennium Development Goals

MOH

Ministry of Health

NCDs

Non Communicable Diseases

NGOs

Non-Governmental Organizations

NISR

National Institute of Statistics of Rwanda

PEM

Protein Energy Malnutrition

PHC

Primary Health Care

RBC

Rwanda Biomédical Center

RDHS

Rwanda Demographic Health Survey

RGB

Rwanda Governance Board

TB

Tuberculosis

UNICEF

United Nation International Children Emergency Funds

WHO

World Health Organization

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