

# Factors Contributing to the Acceptability of Second Dose of Measles Vaccine among Children in Livingstone District, Zambia

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**How to cite this paper:** Nchimunya, M., Chanda, D. and Musenge, E. (2023) Factors Contributing to the Acceptability of Second Dose of Measles Vaccine among Children in Livingstone District, Zambia. *Open Journal of Pediatrics*, 13, 220-234.  
<https://doi.org/10.4236/ojped.2023.132028>

**Received:** February 1, 2023

**Accepted:** March 17, 2023

**Published:** March 20, 2023

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## Abstract

**Introduction:** Measles is a viral disease that is a major public health problem in both developed and developing countries. It is a contagious disease resulting from infection with the measles virus and is still responsible for more than 100,000 deaths per year. Although vaccination is one of the most successful and cost-effective public health interventions to reduce mortality and morbidity, approximately 1.4 million children worldwide die from vaccine-preventable diseases each year. In Zambia, MCV2 was 66% below WHO recommended target of 95%. This study therefore assessed the acceptability of second dose measles vaccination services among caretakers/mothers with children less than two years of age in Livingstone, Zambia. **Methods:** The study used analytical cross-sectional study design. A logistic regression analysis was performed to identify factors associated with acceptability of the second dose of measles vaccine. A semi structured questionnaire was administered to collect data on socio demographic characteristics and factors related to acceptability of the second dose of measles vaccine. SPSS version 26.0 was used for descriptive and inferential analysis at 5% level of significance. **Results:** There was no statistically significant difference in acceptability of the second dose of measles vaccine by gender, marital status, type of employment, income level, socio-cultural and traditional beliefs, and education level. However, there was a statistically significant difference in acceptability of the second dose of measles vaccine by knowledge level of second dose of measles vaccine. A Chi square test result indicated that second dose acceptability was higher with less children than that of respondents with many children ( $\chi^2(5) = 15.3, p < 0.009$ ) and knowledge levels ( $\chi^2(2) = 14.8, p < 0.001$ ). Changes in knowledge level from medium to high reduced the odds of second dose measles vaccine acceptability. Furthermore, this study showed that acceptance of the second

measles vaccination increased from mothers/caretakers with low knowledge (3.6%) to medium knowledge (13.3%) and finally high knowledge (83.1%). **Conclusion:** Tailored messaging to increase knowledge among mothers and caregivers on the importance of the second dose of measles vaccine is critical in improving acceptability. Therefore, the researchers recommend that the health providers should continue to raise awareness associated with the low acceptability of the second dose of measles vaccine and improve on child preventable diseases such as measles.

## Keywords

Measles, Second Dose, Acceptability, Caretakers

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## 1. Introduction

Measles is a viral disease that remains a major Public Health problem in both developed and developing countries. It is a contagious disease resulting from infection with the measles virus and is still responsible for more than 100,000 deaths per year, compared to more than 2 million deaths per year before the introduction and widespread use of the measles vaccine [1]. Measles caused 134,200 deaths worldwide in 2015, mostly among children under the age of five [2]. Most of these deaths occurred in sub-Saharan Africa (SSA).

WHO [3] reported that in 2018 many regions were hit with large measles outbreaks that caused many deaths. Based on current trends of measles vaccination coverage and incidence, the World Health Organization Strategic Advisory Group of Experts on Immunizations (SAGE) concluded that measles elimination is greatly under threat, and the disease resurged in a number of countries that had earlier achieved, or were close to achieving elimination status. It is for this reason that many countries around the world are still experiencing measles outbreaks [2].

Despite the influence of Expanded Programme for Immunization (EPI), second dose of measles vaccine coverage is low in the United States of America and England. CDC [4] reported that in 2012, only 23% of the under-five children were found to have received second dose of measles vaccine during the time of assessment in the United States of America.

Similarly, in developing countries, there is still an enormous toll of measles deaths and disability despite considerable efforts and increasing immunization coverage. Empirical evidence from a number of countries suggests that a two-dose measles vaccination programme, by improving individual protection and herd immunity can make a major contribution to measles control and elimination of local circulation of the disease [5].

In September 2018, Zambia launched a National Immunization Campaign using a combined measles and rubella vaccine targeting all children between the ages of 9 months and 15 years.

The routine childhood immunization schedule in Zambia recommends administration of Measles Containing vaccine one (MCV1) at 9 months and MCV2 at 18 months. In 2015, the Zambian MCV1 and (MCV2) coverage estimates were 90% and 47%, respectively. High coverage with two doses of Measles Containing Vaccine (MCV) serves as the foundation required to ensure high population immunity against measles [6]. Measles vaccination coverage must reach and remain at or exceeding 95% with each of the two doses of MCV for countries yet to introduce Rubella-Containing Vaccine (RCV), Measles and Rubella (MR) or MMR vaccines at the District and National levels [3].

In sub-Saharan Africa, countries are still facing low acceptability of second dose measles vaccine with the average coverage rate of 60% as reported by WHO [3]. Indeed, from this report it is worth noting that, countries in Sub-Saharan Africa have low acceptability of second dose measles vaccine. On the other hand, the WHO [7] reported that in South Africa and Botswana the acceptability of the second measles vaccine has been shown to be high, with South Africa having an 85% second measles vaccine acceptance rate and Botswana at 84%. Therefore, despite the low acceptability of second dose measles vaccine in other sub-Saharan Africa, two countries such as Botswana and South Africa had high rates of second dose measles vaccine acceptability.

Zambia conducted a measles and rubella (MR) vaccination campaign for children aged 9 months to less than 15 years in 2016 [8]. The campaign marked the first rollout of a rubella vaccine in Zambia. To assess the effect of the campaign, the estimate of MR sero-prevalence was compared to pre- and post-campaign sero scans in Southern Province, Zambia. Measles sero-prevalence increased from 77.8% to 96.4% in children under 15 years of age [8].

According to records from Livingstone District, from 2016 to 2020, Livingstone District HMIS Report [9] revealed that MCV2 acceptability averaged only 43%. The low coverage puts the district at higher risk of measles outbreaks. This report of the low acceptance of second dose of measles over the past five years attracted the researcher's attention. The study sought to determine factors contributing to the acceptability of the second dose measles vaccine in three Health Centers in Livingstone District namely: Maramba, Libuyu and Mahatma Gandhi. Findings from this research will be used to improve second dose measles acceptability and consequently contribute to the elimination of measles in Zambia.

## **2. Materials and Methods**

### **2.1. Study Design and Participants**

This was Analytical cross-sectional study design. A quantitative approach was used to quantify factors contributing to the low acceptability of the second dose measles vaccine through numerical data. The research design collected data from a group of subjects at only one point in time [10].

The study population comprised of all mothers, caregivers who lived with children under the age of two, all adolescents with children who had received the

first dose of measles and lived in the service area of three health centers within the past six months and whose guardians agreed to provide informed consent were eligible to participate. The sample size was 124. It was determined using Pfeifer's formula. The formula was adopted because it ensured that the sample provided inferences about the population being studied. The three Health Center catchment areas were purposively selected based on the acceptability of second dose of measles background information available. Study participants, who in this case were mothers and caregivers, were selected at each health center using a simple random sampling technique. Actual selection at each health center was done by counting the population of caregivers during the child vaccination session. Small papers were prepared according to the number of participants. A Tick, YES equal to the number of sample size required was made and then participants were asked to select one from the closed box.

## **2.2. Instrument**

A semi-structured questionnaire was used to collect data related to the variables to be measured. Section one of the questionnaires captured unique characteristics of individual respondents. The questions in sections II, III and IV were carefully constructed to answer the main research questions as they relate to specific variables. The questionnaire was translated into Tonga which is the commonly used language and another one in English to ensure accurate wording of the questions. A review of documents or records was conducted to ensure that the records match what respondents were answering.

The research instrument was checked for validity by at least two subject matter experts. The content validity was ensured by taking suggestions from experts, advisers and lectures that looked at its relevancy, clarity and consistence to the study. After, the questionnaire was amended according to the suggestions and the corrections according to respondents' answers. Reliability was upheld by using the same instrument to collect data from the respondents and clarifications were done so that they did not misunderstand the questions. To achieve this, a test re-test analysis was employed during the pilot study. A pilot study was conducted at Boma clinic because the facility has similar characteristics as those involved in the main study. Data was collected using face-to-face interviews

## **2.3. Statistical Analysis**

The data collected from questionnaires were checked for completeness, readability, correctness and consistency. Questions (closed) were coded and entered into an Excel spreadsheet, which was imported into SPSS version 26 software for analysis. Participant's demographic variables were presented using cross tabulations, frequency tables and bar charts. The chi-square and binary logistic regression were performed to test for associations and effects respectively between the dependent variable and the independent variables at 0.05 significance level.

## 2.4. Ethical Consideration

The study was approved by the University of Zambia Biomedical Research Ethics Committee (REF UNZA-2737/2022) and the National Health Research Authority in Lusaka, Zambia.

## 3. Results

### 3.1. Association between Acceptability of Second Dose Measles Vaccine and Socio-Demographic Characteristics in Livingstone District

**Table 1** shows acceptability of second dose measles vaccine as cross-tabulated with socio-demographic characteristics, knowledge, attitude and socio-cultural beliefs.

**Table 1.** Association between acceptability of second dose measles vaccine and demographic characteristics in Livingstone District (n = 124).

Characteristic	Category	Acceptability of second measles dose		Chi-square value	p-value
		Yes, n (%)	No, n (%)		
Age (years)	<24	20 (24.1)	11 (26.8)	5.372	0.498
	25 - 29	28 (33.7)	11 (26.8)		
	30 - 34	23 (27.7)	9 (22.0)		
	≥3 ≥ 35	12 (14.5)	10 (24.4)		
Gender	Male	2 (2.4)	1(2.4)	0.00	0.992
	Female	81(97.6)	40 (97.6)		
Marital Status	Single	28 (33.7)	17 (41.5)	4.421	0.219
	Married	47 (56.6)	24 (58.5)		
	Divorced	2 (2.4)	0 (0)		
	Separated	6 (7.2)	0 (0)		
Number of children	≤4 children	78 (28.9)	36 (31.7)	15.327	<b>0.009*</b>
	>4 children	5 (6.0)	5 (12.2)		
Type of employment	Not employed	22 (26.5)	4 (9.8)	4.677	0.096
	Informal	52 (62.7)	32 (78)		
	Formal	9 (10.8)	5 (12.2)		
Income level (ZMW)	Low (<2000)	72 (86.7)	33 (80.3)	0.953	0.621
	Medium (2000 - 10,000)	9 (10.8)	7 (17.1)		
	High (>10,000)	2 (2.4)	2 (2.4)		

There was no statistically significant difference in acceptability of the second dose of measles vaccine by Age;  $p = 0.489$ , gender;  $p = 0.992$ , marital status;  $p = 0.219$ , type of employment;  $p = 0.096$  and income level;  $p = 0.621$ . However, there was a statistically significant difference in acceptability of the second dose of measles vaccine by number of children;  $p = 0.009$ .

### 3.2. Association between Acceptability of Second Dose Measles Vaccine and Knowledge, Education Levels, Attitude and Socio-Cultural Beliefs in Livingstone District

**Table 2** shows that there was no statistically significant difference in acceptability of the second dose of measles vaccine by socio-cultural and traditional beliefs;  $p = 0.313$ , attitude;  $p = 0.992$  and education level;  $p = 0.81$ . However, there was a statistically significant difference in acceptability of the second dose of measles vaccine by knowledge level of second dose of measles vaccine;  $p = 0.001$ .

### 3.3. Acceptability of Second Dose of Measles

This section presents findings on the acceptability of the second dose of measles vaccine among mothers/caregivers responsible for the care of under-two children as shown in **Table 3** below.

**Table 3** shows that out of the 124 respondents enrolled in this study, 83 (66.9%) reported having taken their children for the second dose measles vaccine while 41 (33.1%) respondents did not take their children for the second dosage. Among those who took their children for the second dose measles vaccine,

**Table 2.** Association between acceptability of second dose measles vaccine and knowledge, education levels, attitude and socio-cultural beliefs in Livingstone District (n = 124).

Characteristic	Category	Acceptability of second measles dose		Chi-square value	p-value
		Yes, n (%)	No, n (%)		
Socio-cultural & traditional beliefs	Positive	60 (72.3)	26 (63.4)	1.017	0.313
	Negative	23 (27.7)	15 (36.6)		
Attitude towards 2 <sup>nd</sup> dose of measles	Positive	58 (69.9)	29 (70.7)	0.922	
	Negative	25 (30.1)	12 (29.3)		
Education level	Low	50 (60.2)	27 (65.9)	0.421	0.81
	Medium	20 (24.1)	9 (22)		
	High	13 (15.7)	5 (12.2)		
Knowledge level	Low	3 (3.6)	7 (17.1)	14.844	0.001*
	Medium	11 (13.3)	13 (31.7)		
	High	69 (83.1)	21 (51.2)		

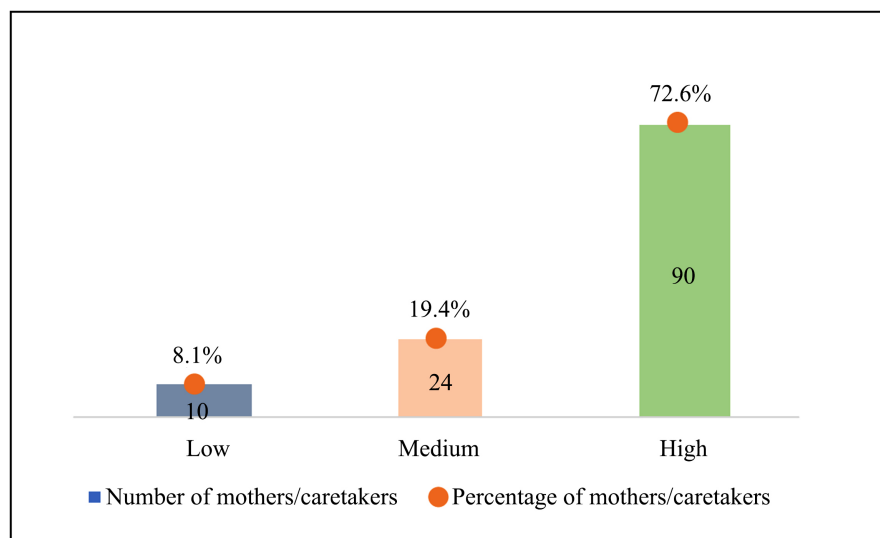
**Table 3.** Acceptability of second dose of measles among respondents (n = 124).

Characteristic	Frequency (n)	Percentage (%)
<b>Took the child for the second dose measles vaccine</b>		
Yes	83	66.9
No	41	33.1
<b>Month children taken for second dose measles vaccine</b>		
Under 18 months	8	9.6
At 18 months	52	62.7
More than 18 months	20	24.1
Do not know	3	3.6

majority (62.7%) indicated taking their children for the second dose at 18 months, 24.1% took after 18 months, 9.6% took their child before 18 months, and 3.6% of the respondents did not know the exact age they took their children for the second dose.

### 3.4. Knowledge Levels of Second Dose of Measles among Caretakers

**Figure 1** below shows knowledge levels of second dose of measles among mothers/caretakers.

**Figure 1.** Knowledge levels of second dose of measles among mothers/caretakers (n = 124).

Most mothers/caretakers (90; 72.6%) exhibited high knowledge levels of the second dose of measles with 24 (19.4%) and 10 (8.1%) exhibiting medium and low knowledge levels respectively.

### 3.5. Educational Levels of Mothers/Caretakers

Figure 2 shows the education level attainment of mothers/caregivers responsible for the children.

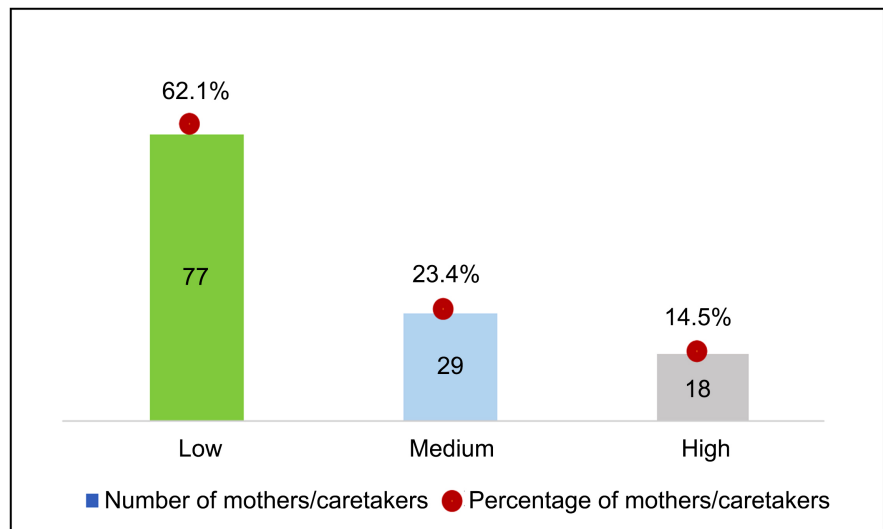


Figure 2. Educational levels of mothers/caretaker (n = 124).

Most of the mothers/caretakers had low education; 77 (62.1%), with 29 (23.4%) having medium education while the least were those with high education 18 (14.5%).

### 3.6. Socio-Cultural and Traditional Beliefs

Figure 3 shows the socio-cultural and traditional beliefs of mothers/caregivers responsible for the children.

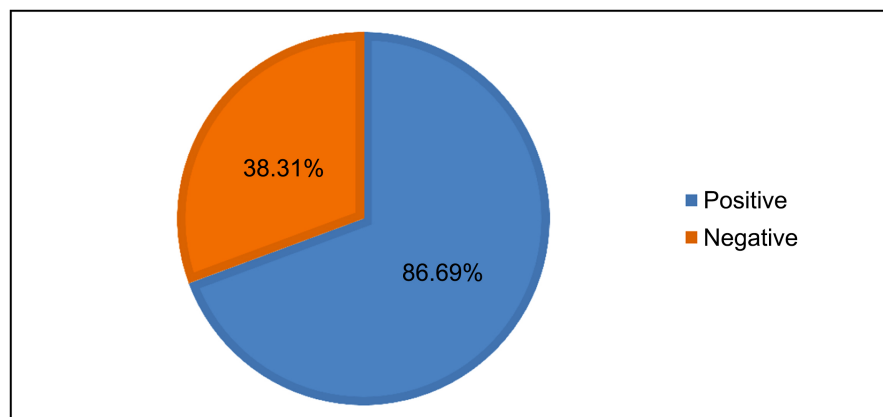


Figure 3. Socio-cultural and traditional beliefs (n = 124).

Most mothers/caretakers had positive socio-cultural and traditional beliefs (86; 69%) towards second measles vaccination with the rest 38 (31%) having negative socio-cultural and traditional beliefs.



#### 4. Discussion

The findings of the present study indicated that most respondents were female (mothers/caretakers) (97.6%) with males representing 2.4% of respondents (fathers/caretakers). The majority age bracket for the mothers/caretakers between 25 - 29 years of age with the least  $\geq 45$  years. A study conducted with 200 respondents on childhood immunization acceptability and related factors in children aged 12 - 23 months in rural Gambia reported that most respondents, accounting for 53%, in age distribution was between 26 and 35 years old. All respondents (100%) were female [11]. The age group in this study extends beyond that reported in this study. In addition, the 100% female respondents reported in the study contradict the results of this study. However, results similar to this study were reported in a study that focused on evaluating immunization coverage and associated factors in children aged 12 - 23 months in Techiman Municipality, Ghana in 2016. Most respondents (mothers/caretakers) were aged between 25 and 29 years of age (37.5%) out of 600 respondents [12]. Similarly, a study conducted in Georgia reported that the majority of the respondents were between the ages of 26 - 30 years.

This study reported that most mothers/caretakers were married (57.3%), with the majority being informally employed (67.7%), 21% unemployed and 11% formally employed. This contrasts with the results reported by [13] in a study on mothers' knowledge and attitudes to vaccination of children in Georgia, which reported 77.7% unemployed and 22.3% employed.

This study showed that majority who showed acceptability towards the second dose of measles vaccine were those in informal employment (62.7%) compared to those in formal employment (10.8%) and the unemployed (26.5%). However, contrary to this study, [13] reported that mothers who were unemployed (70%) demonstrated more acceptability by ensuring completion of all childhood vaccinations. Respondents with low education (60.2%) showed more acceptability compared to those with medium (24.1%) and high (15.7%) education. The findings are contrary to those reported by [13] where it was reported that those with higher education level (86.7%) completed all childhood vaccinations for their children showing high acceptability.

The average knowledge level of this study showed that majority of respondents had a high knowledge of; how many doses of measles vaccine a child is supposed to receive, benefits of routine vaccination to prevent infectious diseases and complications, when children should be vaccinated from birth, when the first and second doses of measles vaccine should be administered to a child and when children are considered fully immunized. The findings of this study are similar to those reported in a study conducted in Saudi Arabia by [14], where it was reported that 72.0% of the mothers who participated in a multistage sampling study had an overall good knowledge regarding child vaccination. On the other hand, a study conducted in Georgia that included 60 mothers and used frequencies and percentages for statistical analysis of the collected data reported

that most mothers (65%) did not know the reason for vaccinations, but they knew when the right age for vaccination was and when it was needed, while 59 percent believed vaccination was not harmful [13].

Respondents were stratified by age and their acceptability of the second dose of measles vaccine for each age group. A Chi square test result of 5.372 yielding a p-value of 0.372 at 5% level of significance indicated that there was no significant difference in the acceptability of second dose measles between age groups of the respondents.

According to the findings from this study, age was not a predictor of the acceptability of MCV2 in Livingstone, Zambia. The findings from this study were not consistent with findings from a study on maternal determinants of immunization status of children of ages 12 - 23 months in urban slums of Varanasi [15] India. Current study findings were also inconsistent with another study on the factors affecting acceptance of complete immunization coverage of children under 5 years in rural Bangladesh [16]. Both studies indicated that maternal age was one of the most important factors influencing complete immunization. The study in rural Bangladesh, in addition [15] found that children of middle age mothers are more likely to be fully immunized than their counterparts of older mothers. This may be due to mothers' accumulated knowledge of the modern Health care system and memory of repeated messages on the importance of immunization services over time. Younger parents/caregivers may not have the same sense of responsibility as their older counterparts, or younger parents/caregivers may rely on their older family members for decision-making or approval [16].

Gender of the household head was not a significant predictor of the acceptability of the second dose of measles vaccine in Livingstone, Zambia. In this study, acceptability was 97.6% and 2.4% among females and males respectively. However, a Chi square test result of 0.000 yielding a p value of 0.992 at 5% level of significance indicated no significant difference between the male and female respondents.

Hence, the gender of the head of the household was not significant to acceptability of the second dose of measles. The conclusion could be that, in view of the prevailing culture of men being the heads of the household in Southern Zambia, the women may be more likely to value immunization than the men possibly because of the fact that women are the primary caregivers of children starting from antenatal all through their vaccines eligibility period which includes the first 18 months in which the child must receive the second dose measles vaccine.

This study showed an increase in second dose acceptance among single (33.7%) to married (56.6%) respondents, and among separated (2.4%) and divorced (7.2%). Although acceptance of the second dose of measles fluctuated among the different marital statuses of respondents, the relationship was not statistically significant, with a chi-square test yielding a p-value of 0.219, which is greater than 0.05, indicating that there was no association between mother/caretakers'

marital status and acceptability of the second dose of vaccine. The results indicated that the null hypothesis could not be rejected as there was insufficient evidence to demonstrate that there was an association between maternal/caretakers' marital status and second dose acceptance.

The study results in this study contrast with the results of a study in Japan which found an association between a single parent family and childhood under vaccination [17]. In addition, in contrast to this study, a study in the US reported an association between maternal marital status, being unmarried and delayed childhood vaccination [18]. However, some studies found no association between marital status and up-to-date childhood vaccinations [19].

The study revealed that there was a higher acceptability of MCV2 among mothers/caregivers in informal employment (62.7%) than those in formal (10.8%) and non-employment (26.5%). Although the study showed that the respondents in informal employment were more likely to take their children for the second dose of measles vaccine, there was no association between respondents' occupational status and acceptance of the second dose of measles vaccination ( $p = 0.096$  which is greater than 0.05). In contrast to this result, a study conducted in Cyprus shows an association ( $p = 0.035$ ) between employment status and caretakers' reluctance to take their children for vaccinations [20].

The analysis showed that a greater proportion of respondents with 3 or less children reported having taken their children for second dose measles vaccine compared to respondents with 4 or more children. A Chi square test result indicated that second dose acceptability was higher with less children than that of respondents with many children ( $\chi^2(5) = 15.327$ ,  $p < 0.009$ ) at 5% level of significance. This implies that there was an association between the number of children (3 or less) a caretaker had and their acceptance of the second dose of the measles vaccine. Similar to this study, [21] reports that parents with more children might have a lot of responsibilities which limit their ability to allocate time and subsequently distract their adherence.

Additionally, parents are not always aware of the importance of the "second dose", especially if a mother feels that "a child is going strong at the age of 18 months" (*i.e.*, the time of the second dose of measles vaccine). Some of these findings are supported by studies from Malawi, Ethiopia, Kenya, and Tanzania, where parents are most likely to be hesitant and miss the opportunity to vaccinate with the second dose of measles vaccine when they have a larger sized family [22].

Knowing and understanding the use of vaccines most likely influences a person's attitude and beliefs towards vaccination. This study showed that acceptance of the second dose of measles vaccination increased from mothers/caretakers with low knowledge (3.6%) to medium knowledge (13.3%) and finally high knowledge (83.1%). The study found that the level of knowledge was statistically significant using a chi-square test with a p-value of 0.001 and concluded that there was an association between knowledge level of the mothers/caretakers and their

acceptance of the second dose of the measles vaccine. Similarly, a study in Malaysia assessing knowledge and attitude among postnatal mothers towards childhood vaccination revealed that mother's knowledge was an important component for childhood immunization with a  $p < 0.05$  [23].

This study found no significant association ( $p = 0.81$ ) between educational level and mother/caretaker acceptance of the second dose of measles vaccine. Therefore, the null hypothesis could not be rejected and the conclusion was that there was insufficient evidence to prove that there is an association between caretakers' educational level and their acceptance of the second dose of measles vaccine. Similar findings to this study were reported on factors related to parents' adherence to childhood immunization, where they found no significant association between vaccination completion of children and educational attainment of mothers/caretakers [21].

In contrast to this study, [24] reported in a cross-sectional survey of 239 households in Uganda that educational status was significantly associated with completion of polio and measles plans. Similarly, a study by [25] found that caretaker's education levels had a positive influence on access to childhood vaccination. Another study by [26] comparing parental education to second measles vaccination also reported that educational level was related to vaccination completion and that higher education levels may decrease concerns surrounding vaccines since those with higher education are more likely to have better access to information and also have learned more about health as a whole.

Sociocultural and traditional beliefs and acceptability of the second dose measles vaccine showed higher acceptability (72.3%) among those who had positive attitudes about the second dose than those who had negative attitudes (27.7%). Despite this, there was no significant association ( $p = 0.313$ ) between sociocultural and traditional beliefs and second-dose measles vaccine acceptability in this study. Therefore, the null hypothesis could not be rejected and it can be concluded that there was insufficient evidence to prove that there is an association between sociocultural and traditional beliefs among mothers/caretakers and their acceptance of the second dose of measles vaccine. This finding was supported by [27], who found no sufficient evidence to prove that there was an association between the observation of traditional beliefs among caretakers and their uptake of immunization.

In contrast to this study, [28] conducted a regional-level cross-sectional study whose purpose was to examine the cultural and socioeconomic factors between parents/caretakers and the completion or non-completion of routine vaccination schedules. Results showed a statistically significant association between cultural and socioeconomic status and completion of immunization schedules. Supporting this finding was another study by [29], which aimed to examine mothers' attitudes towards vaccinating their children in Nigeria and reported that the mother's cultural orientation at birth correlates positively with the mother's attitude linked to vaccination.

## Study Limitations

The study was conducted at selected facilities in the Livingstone district; therefore, generalization of the findings should be done with caution because of contextual differences.

## 5. Conclusion

The Livingstone District Health Office (HMIS Reports 2020) revealed that the acceptability of MCV2 coverage averaged at 43%. This is below the WHO recommended coverage of 95%. The results of this study revealed that acceptability of the second dose measles vaccine is at 66.7% compared to 43% recorded by Livingstone District Health Office. High knowledge levels and smaller number of children were found to be significant factors associated with acceptability of the second dose measles vaccine. Therefore, the researchers recommend that the health providers should continue to raise awareness associated with the low acceptability of the second dose of measles vaccine and improve on child preventable diseases such as measles.

## Acknowledgements

I wish to express my special thanks to my Dr. Chanda and Mr. Musenge for encouraging and correcting my work. I also thank all the lecturers in the department of Public Health Nursing, for imparting so much knowledge in me during the course of the program. I also thank all study area Health Facility Sister in Charges who made this study possible. The statistical input from Mr. Kaala was very helpful and appreciated.

## Funding

The study received no funding from any organization or persons.

## Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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