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Determinants of Effective Child Immunization Delivery: A Study of Community Health Units in Informal Settlements in Nairobi County, Kenya

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Abstract

The effectiveness of Community Health Units (CHU) in delivering child immunization services is a critical component of public health in urban informal settlements. In Nairobi County, CHU are tasked with ensuring that all children receive necessary immunizations. However, the effectiveness of these units is influenced by several factors, including the Accountability System and Human Resource Management practices. Despite the implementation of CHU, a significant proportion of children in these informal settlements remain unimmunized. Previous studies have not sufficiently explored how the clarity of accountability systems and adherence to human resource practices impact the effectiveness of CHU in delivering child immunization services. This gap necessitates an in-depth examination to enhance the performance of CHU in such vulnerable populations. We aimed to examine the influence of the accountability system and Human Resource Management practices on the effectiveness of CHU in delivering child immunization services in urban informal settlements in Nairobi County, Kenya. The study adopted a cross-sectional descriptive design, utilizing an interpretivist research philosophy to explore the depth of the relationship between the independent variables (Accountability System and Human Resource Management) and the dependent variable (effectiveness of CHU delivery of child immunization services). A sample of 354 Community Health Workers was selected from 449 fully functional CHU in the informal settlements using stratified simple random sampling. Data was collected via a structured questionnaire and analyzed using descriptive statistics and binary logistic regression to determine the relationship

between variables using SPSS version 26. The findings revealed that a clear accountability system significantly increased the effectiveness of CHU in delivering child immunization services, with an odds ratio of 0.140. Similarly, adherence to standard human resource practices significantly improved CHU performance, with an odds ratio of 0.207. The logistic regression model indicated that 43.1% of the variance in CHU effectiveness could be explained by the independent variables. The results underscored the importance of clear communication channels, community involvement in monitoring and evaluation, and consistent support supervision as vital elements in enhancing CHU performance. We conclude that strengthening accountability systems and adhering to standard human resource practices are essential for improving the delivery of child immunization services by CHU in informal settlements. These results imply that policymakers and health administrators should prioritize these factors to achieve full immunization coverage and improve public health outcomes in underserved urban areas.

Keywords

Community Health Units, Child Immunization, Accountability System, Human Resource Management, Informal Settlements

1. Introduction

Health systems are inherently complex, composed of various interdependent building blocks that need to be viewed holistically to understand their dynamic interactions and synergies (Puchalski et al., 2016). Some of critical aspects of the health systems are Human Resource Management and Accountability, which involve processes for monitoring, analyzing, and enhancing the performance of individuals and institutions (Health Policy Project, 2014). Within the framework of health systems, service delivery is essential, as it ensures the provision of effective, safe, and quality health interventions to those in need, with minimal wastage of resources (WHO, 2015). In Kenya, the delivery of essential health services at the community level is facilitated through Community Health Units (CHU). These units' form part of the formal health system, delivering services via the Community Health Workforce (CHWF), a key component in the delivery of child health interventions, including immunization (KMOH, 2020). Immunization, in particular, serves as a gateway for providing other vital health services (WHO, 2015).

The effectiveness of CHU in delivering child immunization services has been linked to the competence of CHWF in assessment and referral skills, as well as adherence to standard procedures. For instance, Bartos et al. (2019) found that CHWF attached to maternal and child health programs was effective in referring pregnant women and children under six months to health facilities, using standard referral forms. All referred clients were confirmed to have accessed the required services. Similarly, Rowe et al. (2017) demonstrated that adherence to

guidelines by CHWFs improved their performance.

The Accountability System can be measured using indicators such as communication channels, referral systems, community support, and monitoring and evaluation. Past studies have highlighted the importance of clear communication channels between CHWF, the health system, and the community (Kok et al., 2015). In Mozambique, improved accountability and performance were attributed to better coordination and communication (Simon et al., 2019). However, challenges such as perceived inferiority among CHWF due to lack of recognition and support have negatively impacted their performance (Bartos et al., 2019).

Human Resource Management within CHU, guided by indicators such as selection, recruitment, work clarity, supervision, and training, also significantly influences performance (Cairncross et al., 2012; Crispin et al., 2012; Bartos et al., 2019; Smith et al., 2013). Studies have shown that CHWF who are carefully selected and trained perform better and feel more motivated. For example, in Ghana, CHWF selected by the community felt a sense of duty and pride, which improved their performance (Cairncross et al., 2012). Conversely, in India, CHWF who are not accepted by the community due to being selected by health facility staff experienced lower performance (Shankar et al., 2009). Additionally, training has been directly linked to improved performance, with trained CHWF better able to carry out assessments and prescribe basic treatments (Smith et al., 2013).

This study addresses the significant challenge of low full immunization coverage in informal settlements in Nairobi, which stands at 55%—one of the lowest in Kenya (UNICEF, 2018; Soura et al., 2015). With 56% of urban population living in informal settlements and Nairobi hosting some of the largest informal settlements in Africa, the implications of such low coverage are substantial (Debabrata, 2018). Despite the introduction of the Community Strategy in 2006, a considerable number (about 45%) of children in these areas still do not receive full immunization coverage (UNICEF, 2018; Soura et al., 2015). Given the complexity of health systems, a systems thinking approach is necessary to understand how the Accountability System and Human Resource Management practices influence CHU delivery of child immunization services in the informal settlements. This approach allows for a more productive and efficient way of operating within the multifaceted realities of these settings. Previous studies on CHU have largely focused on public health perspectives (Marchal et al., 2023), under-scoring the need for a systems thinking approach to address these challenges more effectively. The primary objective of this study is to examine the influence of the Accountability System and Human Resource Management practices on the delivery of child immunization services by Community Health Units in urban informal settlements in Nairobi.

2. Material and Methods

This study utilized an interpretivist research philosophy, selected due to the small sample size and the need to deeply explore the relationship between the

Accountability System, Human Resource Management practices and the delivery of child immunization services by Community Health Units in Nairobi's urban informal settlements. A cross-sectional descriptive research design was employed to investigate practices, situations, and perspectives within the selected CHUs. The study focused on 449 fully functional CHUs located in Nairobi County's informal settlements (KMOH, 2020). The sample was drawn from approximately 4490 Community Health Workers (CHWs) associated with the 449 CHUs, with around 10 CHWs also known as Community Health Promoters (CHP) per CHU. Stratified simple random sampling was used to ensure proportional representation across the strata. The Cochran formula (Ahamad & Halim, 2017) was applied to determine a sample size of 354 respondents, which was then proportionally distributed among the CHUs. Data was collected through a structured questionnaire (source: author, 2022) designed to capture detailed information on the Accountability System, Human Resource Management practices and the CHUs' delivery of child immunization services. The questionnaire underwent validity and reliability testing to ensure it measured the intended elements consistently. Data analysis was conducted using both descriptive and inferential statistics. Descriptive statistics, including percentages, frequencies, and cross-tabulations, provided a general overview of the data. Inferential statistics, particularly binary logistic regression, were used to examine the relationship between the Accountability System, Human Resource Management practices and the effectiveness of CHUs in delivering child immunization services. The logistic regression model estimated the probability of effective service delivery (coded as 1) versus ineffective delivery (coded as 0), with Accountability System and Human Resource Management practices as key predictors.

$$\text{Logit}\left(\pi_k\right) = n = \gamma k \tag{2}$$

where: $\text{Logit}\left(\pi_k\right)$ is the probability of CHU service delivery being effective symbolized (π), if effective CHU delivery of child immunization service probability is p, then probability of CHU service delivery not being effective is $1-p$. Thus on one hand $\text{Logit}\left(\pi_k\right) = \log p / \log\left(1-p\right)$, was the ratio of the logarithm of effective CHU delivery of child immunization service probability versus the logarithm of ineffective CHU delivery of child immunization service which depends on Accountability System and Human Resource Management practices (k), on the other hand the odds of CHU service delivery not being effective was $\text{Logit}\left(1-\pi_k\right)$.

The results are presented using tables and pie charts to provide a clear visual representation of the findings. Additionally, narrative interpretations were provided to contextualize the data and explain the significance of the results within the framework of the study's objectives.

Ethical considerations included: proper entry into the Nairobi County health department by getting written authorization documents from National Commission for Science and Technology; Nairobi Metropolitan Services Medical Officer

of Health (MOH), Kenya Methodist University (KeMU), Science and Ethics Review Committee; Informed written consent from the respondents; participants treated with respect, data handled with confidentiality, participants given the freedom to participate or withdraw from the study if so wish.

3. Results & Discussion

CHU performance in this study is the ability to effectively deliver immunization services to all children in need of immunization. The study gives the result of established existing relationship between Accountability System; Human Resource Management Practice and Community Health Units' Delivery of Child Immunization Services in Nairobi's informal settlements.

3.1. Response Rate

Data was collected from 354 respondents which was 100% response rate.

Table 1. Cronbach's alpha reliability statistics.

	Cronbach's Alpha	Number of Items	Conclusion
Accountability	0.789	31	Scale reliable
Human resource management	0.814	48	Scale reliable
CHU immunization service delivery	0.647	6	Scale reliable

Source: Research data (2023).

According to Table 1, Cronbach's Alpha for the 3 variables is >0.647, this shows that the questionnaire had required internal consistency. A reliability test of Cronbach's Alpha more than 0.5 is considered to be acceptable.

Table 2. Demographic information.

Demographic characteristic		Frequency	percentage
Age	18 - 35	146	41.2
	36 years & >	208	58.8
Gender	Male	75	21.2
	Female	279	78.8
Marital Status	Married	200	56.5
	Single	154	43.5
Education level	Secondary	263	74.3
	Primary	91	25.7
Monthly income of more than Ksh.10,000	6 - 12 months a year	105	29.9
	1 - 5 months a year	163	46
	Never	86	24.4

Source: Research data (2023).

As per Table 2, demographic information highlighted characteristics which were deemed necessary to determine that the respondents were a representative sample.

Majority 208 (58.8%) of the respondents were 36 &above years of age while minority 146 (41.2%) were 18 - 35 years. Most of the respondents 279 (78.8%) were female, while minority 75 (21.2%) male respondents. Higher number of respondents were married at 200 (56.6%) while a lower number 154 (43.5%) were single.

Most of the respondents had attained secondary education 263 (74.3%) while least number 91 (25.7%) had primary level of education. Majority of the respondents 105 (29.9%) earned a monthly income of more than Ksh.10,000 6-12 times in a year, while minority 86 (24.3%) never earned income of more than Ksh 10,000.

3.2. Independent Variable: Accountability System

Table 3. Analysis of the effect of accountability system on perceptions of CHU child immunization delivery in healthcare.

Statement	Agree	%	Disagree	%
Communication channel is clear	214	60.5	140	39.5
Referral system is in place and clear	302	85.3	52	14.7
Community actively participates in CHP activities	296	83.6	58	16.4
Community actively monitors and evaluate the CHP	109	30.8	245	69.2

Source: Research data (2023).

In Table 3, majority (60.5%) of respondents agreed that communication structure was clear. These finding implied that firstly, a significant number 39.5% of CHP struggle with lack of clear communication within and without the CHU which greatly affects the proper coordination of immunization activities thus greatly impacting on performance negatively. In agreement Kok et al. (2015) revealed the significance of having proper communication between the CHWF and other actors in the health system and community. Communication channel was clear and had made coordination and access to job aid and child healthcare services proficient.

Secondly, 85.3% of respondents agreed that referral system was clear, this implied that referral system was generally clear and tracking of referred children from the community to health-care services and back was much better. In agreement (Teela et al., 2019) revealed that as CHWF and healthcare workers working in the maternal and child healthcare department coordination improved in Myanmar, the quality of care too improved.

Thirdly, 83.6% of respondents agreed to have received community support which inferred that community should be encouraged to embrace CHP work in order to have 100 % full coverage of immunization of children in the community. Study by Amare (2011) revealed that community support given to CHWF increased

their motivation and thus increased their performance.

Fourthly, 69.2% disagreed that community actively participated in the monitoring and evaluation of CHU activities this implied that there was low understanding of monitoring and evaluation in the community. In support a study by Alfven et al. (2012) in Uganda revealed that community gave CHWF feedback for their performance and this influenced their performance positively.

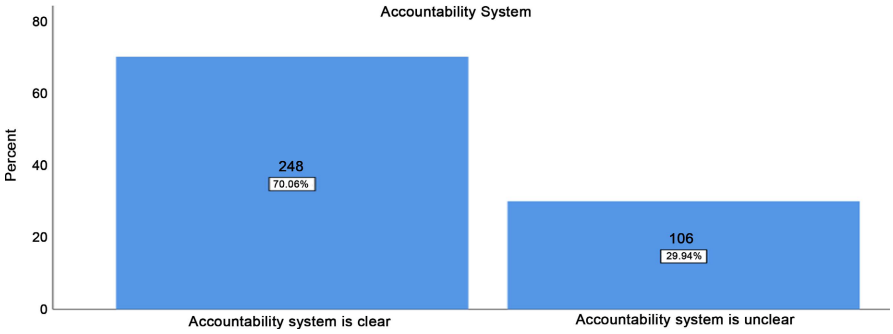

Figure 1. Accountability system. Source: Research data (2023).

Figure 1 above shows that a majority of the respondents 70.06% felt that Accountability system was clear in the Community Health Units. A study revealed that CHWF reported an improvement in the accountability to the primary healthcare system and to the community and this was attributed to the improvement in the coordination and communication practices (Simon et al., 2019).

3.3. Independent Variables: Human Resource Management Practices

Table 4. Analysis of the effect of human resource management on perceptions of CHU child immunization delivery in healthcare.

Statements	Agree	%	Disagree	%
Selected by the community	288	81.4	66	18.6
Years of experience have made me gained more skills and confidence	109	30.8	245	69.2
There is clear understanding of roles and targets	268	75.7	86	24.3
Support supervision is timely received by CHP	228	64.4	126	35.6
Received training on Under-five children's Immunization	311	87.9	43	12.1

Source: Research data (2023).

Firstly as stated in Table 4. Majority 288 (81.4%) CHP selected by the community, worked and lived in the same community. This implied that majority of the CHP understood the community challenges around immunization. In agreement a study carried out among CHWF in Ghana showed that as a result of community

selecting them, the CHWF had sense of responsibility and pride which in turn motivated their performance (Cairncross et al., 2012).

Secondly, majority 254 (69.2%) of CHP felt that years of experience did not make any difference in their work. This implied that years of experience had no effect on skill nor confidence needed to serve as CHP. In contrast a study revealed that years one has worked as CHWF has effect on their performance as it is shown in their ability to appropriately use job aids, deliver good quality of care and empower clients (Crispin et al., 2012).

Thirdly, majority 268 (75.7%) CHP agreed that they understood their roles and targets. This inferred that clarity of roles should be made at the point of selection, to ensure improved delivery of children immunization services. This finding concurs with the study conducted in Malawi which revealed that due to lack of understanding of their role CHWF ended up taking role that were not theirs, thus doing basic treatment for adults yet CHWF were working in child healthcare services program (Callaghan-Koru et al., 2012).

Fourthly, most of 228 (64.4%) of CHP agreed that Support supervision was received timely. This implied that a structured way of giving supportive supervision should be put in place, CHP in this study agreed that support supervision had helped them to minimize errors in their work. In agreement a study done in Ghana CHWF reported that if they were supervised they would feel motivated and would do well in their work (Hill et al., 2018).

Fifthly, majority 311 (87.9%) CHP had been trained on under-five years' immunization. This implied that the CHU were doing well in terms of equipping the CHP with knowledge on immunization. According to Smith et al. (2013) training has direct effect of performance, the CHWF who received training were able to carry on their roles better that those who did not receive.

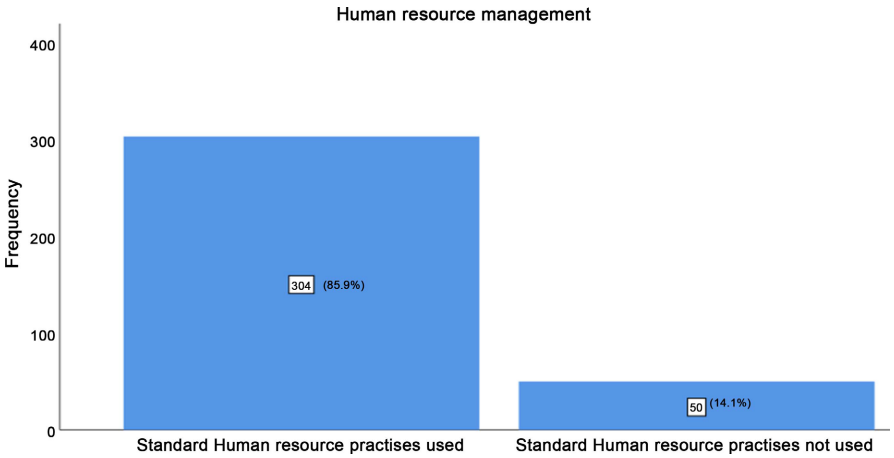

Figure 2. Human resource management. Source: Research data (2023).

Figure 2 above shows that a majority of the respondents 85.9% felt that standards Human Resource Management practices were used. Human Resource Management practices within CHU significantly influence performance (Cairncross et

al., 2012; Crispin et al., 2012; Bartos et al., 2019; Smith et al., 2013). Studies have also shown that CHWF who are carefully selected, trained, and receive support supervision performed better and felt more motivated. For example, in Ghana, CHWF selected by the community felt a sense of duty and pride, which improved their performance (Cairncross et al., 2012).

3.4. Dependent Variable: Community Health Units Immunization Service Delivery

In this section the study sought to determine the degree to which the respondents agreed with statements on effectiveness in CHU delivery of child immunization service.

Table 5. CHU delivery of child Immunization service.

Statement	Agree		Disagree	
	F	%	F	%
I find satisfaction in my work as a Community Health Promotor	321	90.7	33	9.3
Iam able to identify children who have defaulted immunization and give appropriate health education with confidence	347	98	7	2
I refer appropriately more than one children in need and defaulters of immunization services monthly	332	93.8	22	6.2
Job aid I use—Register	303	85.6	51	14.4
Job aid I use—procedure manual/guideline	271	76.6	83	23.4
Job aid I use—(Algorithms) flowcharts/checklist	194	54.8	160	45.2

Source: Research data (2023).

In line with **Table 5** above most of the respondents agreed that: they found satisfaction in their work; were competent in assessment and referral skill; and used job aids (registers, procedure manuals and algorithms) in their work. The study conducted by (Bartos et al., 2019) in their study revealed that CHWF showed their effectiveness in the referral of the pregnant and under 6 month children to the health facility with a standard referral form and all the referred clients were confirm to have accessed the services in the health facility. These findings concurs with studies conducted by (Dambisya & Matinhure, 2012) which stated that for improved performance there is need for proper standards and guidelines; and adherence to these standards and guidelines showed improvement in the CHWF performance.

Community Health Units Performance

This section sought to establish the general status of CHU performance in the delivery of child immunization services in Nairobi County informal settlements.

According to **Figure 3**, highest 252 (71.2%) number of the CHP showed effectiveness while (102) 28.81% showed ineffectiveness in the delivery of child

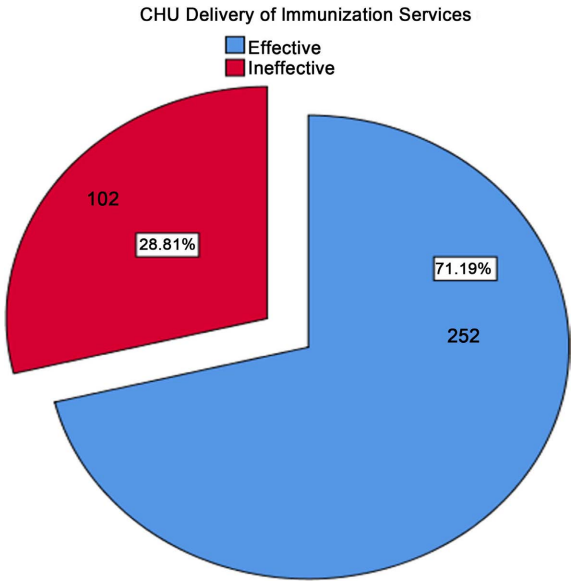

Figure 3. CHU immunization service delivery. Source: research data (2023).

immunization services. This implied that CHP follow the laid down procedures and competently assessed, referred and follow-up children for immunization services appropriately in the CHU.

3.5. Correlation and Regression Analysis

Table 6. Correlation between independent and dependent variable.

Statement	effectiveness	%	ineffectiveness	%	Chi-square	Pearson correlation
Accountability system is clear	211	59.6	37	10.5	77.951[a] (*Chi-value*)	(0.469**) correlation
Accountability system is unclear	41	11.6	65	18.3	0.000 p-value {Sig. (2-tailed)}	0.000 p-value {Sig. (2-tailed)}
Standard Human Resource management practices used	231	91.7	73	71.6	24.181[a] (*Chi-value*)	(0.261**) correlation
Standard Human resource Management practices not used	21	8.3	29	28.4	0.000 p-value {Sig. (2-tailed)}	0.000 p-value {Sig. (2-tailed)}

Source: Research data (2023).

In Table 6. Clear accountability system had significant effect, *p*-value = 0.0001 {Sig. (2-tailed)} on the view that CHU child immunization service delivery was effective. The use of Standard Human Resource management practices had significant effect, *p*-value = 0.0001 {Sig. (2-tailed)} on the view that CHU child immunization service delivery was effective.

3.5.1. The Logistic Model Fitted to the Data

Chi-square Test: This was done to determine whether there was any relationship

between independent variable and dependent variable. Table 7 below illustrates the result from omnibus

Table 7. Omnibus test of model coefficients.

	Chi-square	df	p-value
Step	126.81	4.0	0.0000
Block	126.81	4.0	0.0000
Model	126.81	4.0	0.0000

Source: Research data (2023).

Table 7 demonstrates the impact of the projection ability of the model when all the independent variables are considered as one block. The p-value = 0.000 was smaller than 0.05 which indicated that the model had significant projection ability.

Table 8. Model summary.

Step	−2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	298.326a	0.301	0.431

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than 0.001.

Table 8 above displays Cox & Snell R^2 and Nagelkerke R^2 that aid in computation of the variation. The explicated disparity ranges from 30.1% and 43.1% depending on the reference readings which are Cox & Snell R^2 or Nagelkerke R^2 values. This study used Nagelkerke R^2 to explicate the disparity on the dependent variable as explicated by the independent variable in the model, hence 43.1% CHU effectiveness in the delivery of child immunization services was explicated by the model.

Table 9. Classification table.

	Observed		Predicted		
			CHU delivery of immunization services		Percentage correct
			Effectiveness	Ineffectiveness	
Step 1	CHU delivery of immunization services	Effectiveness	222	30	88.1
		Ineffectiveness	45	57	55.9
	Overall Percentage				78.8

a. Predicted probability is 0.500.

Binary logistics regression is used to predict events occurring and not occurring. Binary logistics regression in this study was used to predict effectiveness and ineffectiveness of CHU. Classification value in Table 9 is 78.8% which shows that

the model is good in the classification of the outcomes.

3.5.2. Logistics Regression Coefficients and Exponential Coefficients Relationship between Accountability System, Human Resource Management and Effectiveness of CHU Delivery of Child Immunization Service Delivery

The strength of the relationship between independent and dependent variables was established by doing binary logistic regression analysis under the entry method.

Table 10. Regression coefficients and logistic odds.

Variable	B	S.E.	Wald	df	*p*-value	Exp (B)	(95% C.I. for EXP(B)	
Accountability System								
Accountability system is unclear (RC)						1.000		
Accountability system is clear	−1.967	0.3	42.893	1	0.000	0.140	0.078	0.252
Human Resource Management practices								
Standard Human resource practices not used (RC)						1.000		
Standard Human resource practices used	−1.574	0.394	16.000	1	0.000	0.207	0.096	0.603
Constant	2.309	0.433	28.470	1	0.000	10.065		

a. Variable(s) entered on step 1: Accountability System and Human resource Management).

In line with Table 10, the findings revealed that firstly, β = −1.967, Wald = 42.893, df = 1 which is associated with a *p*-value of 0.000 and Odds ratio = 0.140 for the Accountability factors. The outcomes revealed that a clear Accountability system significantly influenced the probability of effectiveness of CHU delivery of child immunization services because the *p* value = 0.000 is less than 0.05 which was the picked level of significance. Moreover, having a clear Accountability system significantly "increased" the odds for effectiveness of CHU delivery of child immunization services by a factor of 0.140 since the Exp (B) associated with the Accountability system is 0.140. Exp (B) = 0.140 suggest that unclear Accountability System in the CHU negatively affected the effectiveness of CHU delivery of child immunization services by CHU hence reduced the chances of effectiveness of CHU delivery of child immunization services by (1 − 0.140 = 0.860) which is 14% significant reduction in the odds for effectiveness of CHU delivery of child immunization services. Secondly, β = −1.574, Wald = 16.000, df = 1 which is associated with a p-value of 0.000 and Odds ratio = 0.207 for the Human Resource Management practices. The outcomes revealed that Standard Human Resource Management practices significantly influenced the probability of effectiveness of CHU delivery of child immunization services because the p value = 0.000 is less than 0.05 which was the picked level of significance. Additionally, Standard

Health Resource Management practices significantly "increased" the odds for effectiveness of CHU delivery of child immunization services by a factor of 0.207 since the Exp (B) associated with the Human Resource Management is 0.207. Exp (B) = 0.207 suggest that when Standard Human Resource practices are not upheld in the CHU it negatively affected the effectiveness of CHU delivery of child immunization services by CHU hence reduced the chances of effectiveness of CHU delivery of child immunization services by (1 − 0.207= 0.793) which is 21% significant reduction in the odds for effectiveness of CHU delivery of child immunization services. According to (Dambisya & Matinhure, 2012) study, the findings stated that for improved performance there is need for proper standards and guidelines; and adherence to these standards and guidelines. Therefore, a clear Accountability System and upholding standard Human Resource Management practices were perceived as improving coordination and execution of child immunization activities across all CHU and the health facilities which ensured timely access to immunization services by children according to schedule.

4. Study Limitations

The limitations in this study included smaller sample size due to financial and time constraints; and data collected could be biased due to wanting to please or withhold important data from the researcher.

5. Conclusion

The study concluded that having a clear Accountability System in place and upholding standard Human Resource management practices promote effectiveness of CHU delivery of child immunization services.

Communication channels and monitoring and evaluation system were found as a crucial part of accountability between the community, formal health system and CHU delivery of child immunization services in Nairobi county urban informal settlement, hence must be strengthened in order to enjoy the full benefit of a clear accountability system.

The study also concluded that having unclear Accountability System over a clear accountability system reduces the chances of better performance by CHU in the delivery of child immunization services in the informal settlement in Nairobi County.

6. Recommendation

1) Communication channel in the CHU should be strengthened to improve the accountability level among CHWF.

2) Community and formal health system should be empowered to monitor and evaluate the activities of CHU in a structured way.

3) Support supervision should be enhanced as it revealed to help in minimizing work/task related errors and boosts confidence in service delivery.

Author Contribution Statement

LC, WT and JM conceptualized and designed the study. LC acquired and analysed the data. All authors interpreted the results. LC drafted the initial manuscript. All authors reviewed and approved the final manuscript for submission.

Availability of Data Statement

Data will be available on request.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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