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Factors Associated with Uptake of Immunizations for Vaccine-Preventable Childhood Diseases in a Peri-Urban Settlement; A Case Study of Nansana Municipality, Uganda

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Abstract

Immunization uptake for childhood vaccine-preventable diseases remains low in urban areas of Uganda, leading to repeated outbreaks of diseases like measles, despite easy communication and accessibility to services. The objectives of this study were to establish immunization coverage and to identify the factors that affect the uptake of immunization among the children aged 10 – 23 months in Nansana Municipality, Wakiso District, Uganda. This was a cross-sectional mixed methods study, utilizing both qualitative and quantitative approaches. Assessment of immunization uptake was carried out on 344 parents/guardians of children aged 10–23 months, using simple random sampling on pre-tested structured questionnaires. Data was analyzed using SPSS 20.0 software. Additionally, 2 focus group discussions with parents and key informant interviews with immunization focal persons were also conducted. Immunization coverage was found to be 90.4% for BCG, 89.3% for Penta1, 80.7% for Penta2, 72.5% for Penta3 and 73.9% for measles1. Availability of vaccines (AOR= 33, 95% CI, 1.44 – 792, p=0.03), accessibility to immunization services (AOR = 32, 95% CI, 2.0 – 513, p=0.01) and communication between the parents and health workers about the return dates (AOR = 0.03, 95% CI, 0.01 – 0.83, p=0.03), were the factors that were independently associated with immunization uptake. The coverage rates were higher than the national average, with the health care service-related factors identified as being critical for improving immunization uptake. There is a need for improved vaccine supply and communication about immunization services, which should be designed considering the local context in collaboration with slum-dwelling communities.

Keywords: *Childhood, Immunization, Uptake, Urban.*

Introduction

Worldwide, the Vaccine-Preventable Diseases (VPDs) burden has remained high, and the immunization coverage rates have plateaued for the last decade, with an estimated 19.7 million children under 1 year not receiving the basic vaccines in 2019 [1]. Childhood immunizations are protective measures against infectious diseases [2], and is one of the most cost-effective health investments, with proven strategies that make it accessible to even the most hard-to-reach and vulnerable populations [3]. Consequently, the VPDs, continue to be an important public health problem in developing countries [4], making immunization a reliable child survival strategy that prevents more than 2.5 million child deaths each year globally. Approximately 10 million under-five deaths occur in low-income countries annually, most of which are from VPDs [5]. Therefore, childhood immunization is a key intervention towards attaining Sustainable Development Goal (SDG) number 3 that aims to reduce under-five mortality to less than 25/1000 live births by 2030 [6].

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Despite the registered global progress in ensuring the provision of childhood vaccinations, difficulties still exist, especially on how to reach the most vulnerable, poorest, disadvantaged childhood populations in remote and slum communities, especially within sub-Saharan Africa. In 2020 17.1 million infants did not receive an initial dose of DTP vaccine, pointing to a lack of access to immunization and other health services, and an additional 5.6 million are partially vaccinated [1]. The Global Vaccine Action Plan (GVAP) was the global immunization strategy of the "Decade of vaccines" (2011–2020). As such, this would boost and propel the reach of every child (REC)/ reach every district (RED) concept that was introduced to ensure that all children receive their vaccination at all levels [4].

Earlier studies and systematic reviews conducted across the globe pointed out low education level of parents/caretakers, cultural/religious beliefs, age of caretakers, transport difficulties, long distance to health facilities, a difficult geographical terrain, accessibility to health facilities, refugee status, mobility of populations, negative messaging/anti-vaccine sentiments, social, economic status and attitudes of the parents/caretakers [7-10]. In addition to that, the resurgence of outbreaks of vaccine-preventable diseases (VPDs), including measles, has prompted renewed attention on how vaccine misinformation and hesitancy can lead to the spread of infections and negatively impact public health [10].

Although childhood immunizations are free in Uganda and many strategies like radio talk shows are done in a bid to change socio-cultural, religious beliefs and attitudes towards immunization, as well as mass campaigns, static and outreach programmes to improve immunization coverage, there is little success [5, 11, 12], yet only 55% of children aged 12–23 months are fully vaccinated with coverage being relatively higher in urban areas (61%) than rural areas (50%), [12]. The immunization agenda sets out seven priority areas and four core principles in a world where everyone, everywhere, at every age, fully benefits from vaccines for good health and well-being [13].

Nansana Municipality is located in the Wakiso District of Central Uganda, in close proximity to Kampala City. It has a population of 532,800 people, with urban and peri-urban settlements. The municipality has persistently performed poorly with low routine immunization coverage and continues to frequently report outbreaks of vaccine-preventable diseases, especially measles. In the financial year 2018/19, the Municipality reported 41% and 42% coverage of Penta 3 and Measles vaccinations, respectively [14], which were far below the district performance at 82% and 87%, respectively [14] and the national target of >90% and 95% respectively [12].

Most of the studies on immunization uptake in Uganda have been conducted in rural areas [7, 15] while that of Babirye, [16] on factors affecting immunization behavior in Kampala employed only qualitative data. In response to this, this current study explored the factors influencing immunization uptake in an urban setting like Nansana Municipality. The results of this study add to existing knowledge, and guide policymakers to improve immunization programs in Uganda urban areas and sub-Saharan Africa, and also to provide useful information for further research on these issues.

Materials and Methods

This was a cross-sectional mixed methods study using both quantitative and qualitative data collection methods, which was conducted between June and August 2021 in Nansana Municipality. The area with the majority of small business is made up of four administrative divisions, namely, Nansana, Nabweru, Gombe, and Busukuma, and 29 parishes. It has 54 health facilities, with only 39% (21/54) of the health facilities have EPI services, while some of the remaining health facilities are used as outreach posts for EPI

services [17]. The assessment of the factors associated with childhood immunization uptake was carried out using researcher-administered questionnaires of 344 parents/guardians of children aged 10 - 23 months, focus group discussions with parents/guardians, and key informants' interviews of EPI providers/ focal points. The sample size was estimated using the World Health Organization's (WHO) 30 cluster sampling technique for cluster survey design [18] for Expanded Program on Immunizations (EPI). Each parish was considered as a cluster, except for Nansana, where one very densely populated parish was divided into 2 parishes, to make a total of 5 parishes.

The study employed simple random sampling strategies to identify respondents for the interviews. However, probability proportionate to size (PPS) was used for allocating the household according to the population of the divisions of Nansana Municipality, ranging from an average of 5 participants per parish/cluster in Busukuma Division to 27 in Nansana Division, as shown in Table 1. A total of 2 focus group discussions from 2 randomly selected villages were conducted for parents/guardians of children <24 months, on addition to 7 key informant interviews including the District Health Officer, District EPI focal person, Municipal EPI focal person, and 4 other EPI focal persons from randomly selected health facilities offering EPI. Each Focus group had 8 participants (socially distanced, following the COVID-19 protocols to avoid it transmission), with each session taking 45 to 60 minutes.

Participant Consent and Ethical Approvals

Ethical approval was obtained from Mbarara University of Science and Technology, Research and Ethics Committee (MUST -REC, REF MUST-2021-68), and the Uganda National Council for Science and Technology (UNCST -REF HS1507ES). The clearance for conducting the research study in Nansana Municipality was sought and granted from Wakiso District Health Officer's office and the Nansana Municipal Council Town Clerk's office. All the participants were subjected to informed consent.

Table 1. Sample size and distribution among divisions and parishes/clusters

Division	Number of Households	Number of Parishes/Clusters	Average Number of Participants per Cluster	Sample Size
Nansana	52,725	5	27	134
Nabweru	38,775	6	17	100
Gombe	28,667	11	7	72
Busukuma	14,444	8	5	38
Municipality	**133,200**	**30**	**11**	**344**

Data Collection, Management, and Analysis

Before data collection, the research instruments were pre-tested through the pilot study to determine suitability and appropriateness to ensure clarity and relevancy of data collection instruments. Data was collected by trained research assistants under the guidance of the principal investigator. Data was collected, cleaned, edited, and entered in SPSS version 20. Descriptive statistics were expressed as means/medians, frequencies, and percentages, whereas inferential statistics were analyzed using the Chi-square (χ^2) technique, where bivariate analysis was conducted to examine the association between the socio-demographics of parents, the health care system factors, and immunization uptake. Crude Odds Ratios (COR) and corresponding 95%

Confidence Intervals (CI) were reported. Significant variables (with a p-value <0.05) from the bivariate analysis were included in the models, the multivariate logistic regression to determine variables independently immunization uptake. Adjusted Odds Ratios (AOR) with corresponding 95% CI were reported, and significance levels of p-value < 0.05 were used for hypothesis testing.

Qualitative data from the focus group discussions and key informant interviews were captured as stated from the focus groups and key informants, transcribed and uploaded into the qualitative analysis software MAXQDA version 12. Data was analyzed following the six steps of the thematic approach developed by Braun and Clarke [19]. These were interpreted thematically, woven, and added in the discussion together with the quantitatively interpreted data for the overall conclusion of the study findings according to the objectives of the study. The data from the quantitative and qualitative analysis were triangulated. Data and information collected during the course of the study has been safely stored.

Results

The study successfully enrolled and analyzed 344 parents/guardians with children 10-23 months. From the 344 children surveyed, majority 51.7% (178/344) were female, 60% (206/344) of birth order 2nd to 4th, with mean and medians age of 16 months and 15 months respectively, where more than half (52.0%) were below 18 months, as shown in Table 2.

Table 2. Socio Demographic Characteristics of the Children

Variable	Frequency (n = 344)	Percent
Age of the child category		
<18 months	179	52.0
>18 -23 months	165	48.0
Birth order of the child		
First (1)	94	27.3
2nd – 4th order	206	59.9
5th or more	44	13.8
Gender of the child		
Male	166	48.3
Female	178	51.7

As regards to the socio demographic characteristics of parents/guardians enrolled, the majority, 86% (296/344), were female, biological parents of the children 95.6% (329/344), aged at or below 45 years 96.5% (332/344); most of them Catholics or Protestants (32.0% vs. 24.1%); and married or cohabiting 86% (296/344). Other parents/guardians' characteristics are as shown in Table 3.

Table 3. Socio Demographic Characteristics of Parents/Guardians

Variable	Frequency (n = 344)	Percent (%)
Age of parent/guardian category (Years)		
<25 years	140	40.7
26 – 45 years	192	55.8
>45 years	12	3.5
Relationship with the child		
Parent	329	95.6

Other	15	4.4
Gender of the parent/guardian		
Male	48	14
Female	296	86
Education level		
Never been to school	7	2.0
Primary (P1 – p7)	90	26.2
Secondary (S1 – S6)	190	55.2
Post-secondary (certificates, diplomas)	57	16.6
Marital status		
Never married	25	7.3
Married/cohabiting	296	86
Divorced/separated	19	5.5
Widowed	4	1.2
Religion		
Catholic	110	32.0
Protestant (Anglican)	83	24.1
Muslim	80	23.3
Seventh Day Adventist (SDA)	25	7.3
Pentecostal	42	12.2
Other	4	1.2
Occupation		
Civil servant	13	3.9
NGO/private	19	5.6
Businessman/woman	136	39.5
Casual laborer	55	15.9
House wife	94	27.3
Unemployed	27	7.8
Monthly Household Income		
< 58 USD	65	18.9
59 USD – 143 USD	207	60.2
>144 USD	72	20.9
Belief in vaccine protecting against diseases		
Yes	279	81.1
No	65	18.9
Knowledge of children immunized diseases		
Yes	275	79.9
No	69	20.1

As shown in Table 4, from the 344 parents/guardians who participated in the study, the majority, 71.2% (245/344), viewed the health workers attitude positively, were within 5kilometer distance from the health facility offering EPI 91.6% (315/344), had awareness about the availability of immunization services 90.7% (312/344), noted the availability of vaccines 83.5% (287/344) and could easily access immunization services 88.7% (305/344). Other health care system characteristics are described in Table 4.

Table 4. Health care system characteristics related to childhood immunizations

Variable	Frequency (n = 344)	Percent (%)
Attitude of health workers		
Positive (Friendly)	245	71.2
Negative (Rude)	99	28.8
Distance from the health facility		
<2 kilometers	206	59.9
3 – 5 kilometers	109	31.7
>5 kilometers	29	8.4
Awareness of availability of immunization services		
Yes	312	90.7
No	32	9.3
Availability of all vaccine antigens		
Always available	287	83.5
Sometimes not all available	50	14.5
Most times not any available	7	2.0
Easy access to immunization services		
Yes	305	88.7
No	39	11.3
Skipping services due to poor timing of the clinic		
Yes	108	31.4
No	236	68.6
Waiting time		
< 3 hours	111	32.3
4 – 5 hours	190	55.2
>6 hours	43	12.5
Return dates information emphasis		
Always	258	75.0
Sometimes	78	22.7
Never	8	2.3
Reminders for return dates		
Yes	101	29.3
No	243	70.7
Side effects experience		
Yes	223	64.9
No	121	35.1
Provision of adequate information about immunization		
Yes	201	58.4
No	143	41.6

The study results revealed immunization coverage rates for the municipality to be 90.4% for BCG, 89.3% for Penta1, 80.7% for Penta2, 72.5% for Penta3, 73.9% for measles 1 and 43.8% for measles 2.

Socio-Demographic Factors Associated with Childhood Immunization Uptake

Table 5 shows the socio-demographic and health care delivery factors associated with immunization uptake. Of the socio-demographic characteristics of the respondents, only the parent's belief in vaccine importance was found to be associated with immunization uptake. The other socio-demographic variables such as the age of the parent/guardian/child, gender of the parent/guardian/child, birth order of the child, relationship to the child, nature of the occupation, marital status, religion, monthly income, and knowledge of childhood immunized diseases, were not associated with of immunization uptake. Parents who believed in vaccines protecting their children from the vaccine-preventable diseases were about two (2) times more likely to take their children for immunization and consequently take all required vaccines (COR= 1.9, 95% confidence interval, CI: 1.2 – 5.2**),** compared to those who did not believe in vaccine importance.

Table 5. Association between the socio-demographic and health care system factors and uptake of childhood immunizations in a bivariate analysis

Factor	**Response**	**Fully Vaccinated at 9 Months**		**COR (95% CI)**	**p-value**
		Yes	**No**		
		Freq (%)	**Freq (%)**		
Socio demographic factors					
Belief in vaccine importance	Yes	125 (80.1%)	31 (19.9%)	1.9(1.2 – 5.2)	0.02*
Health Care System factors					
Attitude of health workers	Friendly	113 (79.0%)	30 (21.0%)	4.4(1.4 – 13.9)	0.01*
Distance from the health facility	< 2 km	109 (79.0%)	29 (21.0%)	3.6(1.3 – 10.4)	0.02*
Availability of all vaccine/antigens	Always	130 (77.8%)	37 (22.2%)	5.8(1.3– 25.6)	0.019*
Easy accessibility to services	Yes	139 (76.4%)	43 (23.6%)	63(12.54– 318.9)	0.000**
Timing of immunization clinic	Poor	31 (47.7%)	34 (52.3%)	0.1(0.01 – 0.3)	0.000**
Return dates emphasis	Always	125 (93.3%)	9 (6.7%)	19.5(4.4 – 87.2)	0.000**
Reminders for return dates	Yes	96 (82.1%)	21 (17.9%)	5.7(1.4 – 22.8)	0.02*
Side effects or reactions	Yes	51 (59.3%)	35 (40.7%)	4.9(1.3 – 24.1)	0.01*
Adequate information provision	Yes	132 (84.6%)	24 (15.4%)	8.2(2.2 – 31.2)	0.01*

Health Care System Factors Associated with Childhood Immunization Uptake

There was a significant association (**p-value <0.05**) between some health service delivery-related factors to the parent's uptake of their children's immunization. Health workers attitude (COR=4.4, 95% CI: 1.4 - 13.9), distance from the health facility (COR = 3.6, 95% CI: 1.3 - 10.4), availability of all vaccines (COR= 5.8, 95% CI: 1.3 - 25.6), , accessibility to immunization services (COR= 63, 95% CI: 12.5 – 318.9), timing of the immunization clinic (COR= 0.1, 95% CI: 0.01 – 0.3), return dates emphasis (COR= 19.5, 95% CI: 4.4 – 87.2), reminder for return dates (COR= 5.7, 95% CI: 2.4 – 22.8), side effects to vaccinations (4.9, 95% CI: 1.3 -24.1), and information provision on immunization (COR=8.2, 95% CI: 2.2 – 31.2), were all significantly associated with childhood immunization uptake, see Table 5. However, Other factors like awareness of immunization services and waiting time were not significantly associated with immunization uptake.

Independent Factors Associated with Childhood Immunization Uptake

In the final logistic regression model, the availability of vaccines, accessibility to immunization services, and return dates emphasis were found to be independently significantly associated with the childhood immunization uptake, as results are presented in Table 6.

Table 6. Multivariable logistic regression showing the association between socio demographic and health service-related factors, and immunization uptake

Factor	Response	AOR (CI; 95%)	p- value
Belief in vaccine importance	Yes	3.30(0.62 – 17.64)	0.16
Attitude of health workers	Friendly	0.98(0.06 – 16.57)	0.99
Distance from health facility	<2km	0.32(0.02 – 6.14)	0.45
Availability of all vaccines	Always	33.8(1.44 – 792) *	0.03*
Easy accessibility to services	Yes	32.4(2.0 – 513) *	0.01*
Poor timing of immunization clinic	Yes	1.20(0.21 – 6.78)	0.83
Return dates emphasis	Never	0.03(0.01 – 0.83) *	0.03*
Reminders for return dates	Yes	0.40(0.01 – 12.24)	0.60
Had Side effects or reactions	Yes	0.06(0.01 – 4.43)	0.43
Adequate information	Yes	2.66(0.15 – 46.16)	0.50

Parents who always got the scheduled vaccine antigens when they had taken their children for immunization were 34 times more likely to take up immunization for their children and therefore complete the immunization schedule compared to those who missed any scheduled vaccine antigen (adjusted OR=33.8, 95%CI: 1.4 - 792, *p*=0.03), while those who had easy accessibility to getting their children vaccinated were also equally 32 times more likely to fully immunize their children (aOR= 32.4, 95% CI: 2.0 -513, *p*=0.01). However, the parents who were never emphasized on the return dates and its importance were also 33 less likely to take the opportunity to get their children immunized and accept the immunization services (aOR= 0.03, 95% CI: 0.01 – 0.83, p=0.03).

Key findings from the focus groups and key informant interviews

About 86% of the key informants were female, with a median working experience of 7.5 (4–15) years. Respondents were interviewed on the overall performance of immunization in Nansana Municipality. The number of children who are vaccinated on weekly average ranges from 30 to 150 depending on the location and level of the health facility. All the health centers conduct outreaches, 3 -5 of them per month. Most health facilities conduct a weekly static immunization session despite the guidelines of daily immunization services by the Uganda National Expanded Programme on Immunization.

"We carry out immunizations on Wednesday for static and Thursday for outreach sessions. In a week, we immunize between 130–150 babies before COVID-19, though now we receive 80- 100 babies. We do outreach to ease access to immunization services because we serve 5 parishes/wards there some places which are far from the facility, so we realized the mothers used to miss out on immunization because they can't move up to the facility because of the long-distance".

EPI focal person, at a HC II.

Stock-outs of vaccines had been minimized, though could still be experienced when the Flight in Time (FIT), a pilot project for vaccine supplies, was operational until last year. However, they now have time to time shortages of vaccines, especially at H/C IIs and HC IIIs, leading to some hindrances to immunization

service delivery. The stock-outs were frequent occurrences, as argued by respondents from the facilities.

"Vaccines are supplied from the district stores. The Vaccine supply has been adequate when the FIT was supplying, and now, we have experienced some stock-outs of different antigens. However, the *stock-outs can be for a week or 2 and not more than a month".*

Municipal EPI focal person, EPI focal persons.

The main side effects from vaccinations were fever, injection site swelling, skin rash, abscesses, convulsions, and cough.

"They usually report pain and fever. The injections are very painful. We see children who get an abscess. We had also received around 2 cases who got swelling at the injection site when we gave pneumococcal vaccine" HC III EPI focal person.

Discussion

The findings show that the major factors associated with childhood immunization in this urban context were availability of vaccines, access to immunization services, and the return dates emphasis by health workers to parents/guardians of the children. The findings were more of health care system/service delivery-related factors than socio-demographics of parents and children.

Availability of vaccines is very important for effective vaccine acceptance and utilization by parents. Low vaccination coverage in children is largely a result on the shortage of vaccines supplies by healthcare providers to parents when they take their children for immunization. Consistent studies conducted elsewhere agreed that vaccine availability at the health facility level greatly impacted on immunization uptake [20-22]. Studies done in Uganda showed that the shortage of vaccines and the challenges in transportation them negatively on immunization uptake [7, 15, 16]. Other studies done in Ethiopia and Nigeria indicated that vaccine shortages at the health facility level and difficulties of transporting vaccines were commonly reported to significantly hinder immunization services [2, 23] Thus, improving vaccine availability to health facilities is critical in increasing vaccines acceptance, utilization, and coverage. In the current study, the variation in the availability of particular vaccine antigens might have impacted the results. However, information on which vaccines antigens were more in shortage was not collected and is an area for further investigation.

Equally important to acceptance of immunization and uptake is the easy access to immunization services by parents. Poor arrangement and coordination of immunization sessions at the health center level were identified as a barrier to immunization uptake by parents [21, 24]. This would result in delays and a long waiting time leading to frustration of the parents and resulting in defaulting the immunization schedules and incomplete immunization. As noted in some earlier studies, parents' difficulty in accessing immunization services could be because of a shortage of staff, therefore hindering required optimum childhood immunization coverage [7, 26, 27].

Also, worthy to note is that good communication leads to understanding and building of trust between two parties. Friendly interaction between the health workers and parents when communicating return dates for scheduled immunization results in immunization acceptance and uptake. This leads to the completion of the vaccination schedule [7, 22]. On the other hand, the effects of poor communications have been linked to poor uptake of immunization services by parents for their children, despite the vaccines being protective [21, 26]. Well-informed parents are likely to accept immunization for their children, understand the importance of honoring the return dates and completing the immunization schedule.

The immunization coverage rates for different antigens reported here are high when compared to the municipal and district and

national average rates reported in the health management information system (HMIS) at the time of the study [14]. The lower district figures could be due to the reporting system failing to capture the child immunization information in a number of instances. For example, parents tend to shift from one immunization center to another without notifying the original immunization center. This happens when vaccines become unavailable at a given center, parents move to another area looking for a job, or any other circumstances. The original immunization center then records these children as defaulters (partially vaccinated) and thus is reflected in the district figures. Therefore, availability of vaccines, accessing them to the parents, and maintaining close communication between the parents and health workers is a function of the health care system, which also encompasses the health workers as a provider, whose attitude should be friendly to the service receiver. Studies done in Uganda, Cameroon and Nigeria indicated that providers' hostility and rude attitudes to mothers is a major barrier with immunization uptake [20, 28, 29].

Though some studies found associations between distance and immunization outcomes, distance from health facilities was also not independently associated with immunization acceptance and uptake in this study, just as health worker's attitudes, reminders for return dates, side effects of vaccines, and information provision. This is probably because at least 90% of the parents in this study were with a 5-kilometer distance from the health providing immunization services. Yet, according to Tefera's study [25], families whose home was at least an hour from the vaccination site were less likely to be fully vaccinated than families whose home was between 30 and 59 min away. Reportedly, the longer the distance from the vaccination site, the lower the chances of vaccination by day 7 (of life) of a child [30]. In contrast, the densely populated area with slums in Nansana and Nabweru divisions, where parents move from job to job looking for survival, makes it difficult to effectively provide immunization services.

Some parents hold reservations towards immunization acceptance and uptake due to the side effects of vaccines to their children. The associated side effects of vaccines [16, 23]. Others express a total distrust of immunization programs and vaccine [15]. Thus, health education programs targeting the parents are critical in increasing vaccines acceptance, utilization, and coverage, which in effect also improves communication as it was also cited during focus group discussions and key informant interviews. In a study conducted by Mekonnen [31], it was noted that parents sometimes forgot the appointment date for the next immunization visit of their children, which greatly impacts on immunization uptake, and that when reminders are sent on time to parents about routine immunization schedules positively impacted on immunization uptake, [32].

Parents not being knowledgeable of immunization, the most frequently and consistently reported factor associated with childhood immunization was not found to be associated with childhood immunization in this urban context, as was with age, sex, education, occupation, marital status, and monthly income [2, 7, 15, 32, 33], in contrast to the findings of a review of studies conducted in Uganda and elsewhere. However, as reported by Wiysonge [34], the low parental knowledge of immunization and/or lack of access to information about childhood immunization could be an important contributor to the high burden of unimmunized children in sub-Saharan Africa and that parents with low education and low socioeconomic status attainment tend to show more uncertainty towards immunization, [7, 25, 35].

The findings in this current study were more of health care system/service delivery-related factors than socio-demographics of parents, contrary to the systematic review findings of

Bangura [36]. The effects of misinformation about childhood immunization on social, mass, and community communications media and how they affect immunization uptake and completion of the immunization schedule have not been explored by this study and therefore recommended for further research.

Study limitations

Conclusion

The immunization coverage rates were higher than the municipal, district, and national averages, with the health care service-related factors identified as being critical for improving immunization uptake. There is a need for improved vaccine supply and communication about immunization services, which should be designed considering the local context in collaboration with slum-dwelling communities.

Although the study was confined to one municipality, this study area is typical of other urban settings in terms of health infrastructure and in Uganda. The study findings are therefore comparable across similar settings. We also note that this was a cross-sectional study, and therefore, we cannot define the temporal relationship between the independent variables and outcome. The direction of causality can therefore only be regarded as suggestive. The data collected on a number of independent variables were based on self-reports that are likely to be subject to social desirability bias. As a result, there is a limit to which such responses can be considered accurate by foreknowledge of what, in the view of the respondent, would be a suitable response. However, the current findings do carry implications for health service managers, decision-makers, and health care providers in their consideration of designing and implementing immunization services.

Appendices

Abbreviations

AOR: Adjusted Odds Ratio; COR: Crude Odds Ratio; CI: confidence interval; FGD: Focus Group Discussion; IA2030: Immunization Agenda 2030; SPSS: Statistical Package for Social Sciences; UNICEF: United Nations International Children Emergency Fund and WHO: World Health Organization.

Availability of data and materials

All data supporting our findings are contained in the paper. There are no restrictions to data sources. However, details of the full data may be accessed through Amos Kijjambu.

Competing interests

The authors declare that there are no competing interests.

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References

[1] World Health Organization, 2021 "World Health Statistics," World Health Organization, Geneva, Switzerland, https://creativecommons.org/licenses/by-nc-sa/3.0/igo.

[2] Tadesse, H., Deribew, A and Woldie, M, 2009 "Predictors of defaulting from completion of child immunization in south Ethiopia, A case-control study," *BMC Public Health*, 9, 4–9, https://doi:10.1186/1471-2458-9-150.3 World Health Organization, 2009 "World Health Statistics," WHO Library Cataloguing-in-Publication Data Geneva, World Health Organization, Geneva, Switzerland.

[3] Wolfson et al., 2008 "Estimating the costs of achieving the WHO – UNICEF Global Immunization Vision and Strategy, 2006 – 2015,", https://doi:10.2471/BLT.07.045096.

[4] Rutherford, M. E., Mulholland, K and Hill, P. C, 2010 "How access to health care relates to under-five mortality in sub-Saharan Africa: systematic review," Trop. Med. Int. Heal., 15(5), 508–519, https://doi:10.1111/j.1365-3156.2010.02497.x.

[5] World Health Organization, 2018 "World health statistics 2018: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization," Geneva, https://creativecommons.org/licenses/by-nc-sa/3.0/igo.

[6] Malande et al., 2019 "Barriers to effective uptake and provision of immunization in a rural district in Uganda," *PLoS One*, 14 (2), p. e0212270, https://doi.org/10.1371/journal.pone.0212270.

[7] Uddin, M. J., Saha, N. C., Islam, Z., Khan, I. A., Quaiyum, M. A, and Koehlmoos, T. P, 2012 "Improving low coverage of child immunization in rural hard-to-reach areas of Bangladesh: findings from a project using multiple interventions," Vaccine, 30 (2),168–179, https://doi.org/10.1016/j.vaccine.2011.11.030.

[8] Bbaale, E, 2013 "Factors influencing childhood immunization in Uganda," J. Health. Popul. Nutr., vol. 31, no. 1, p. 118, 2013 doi:10.3329/jhpn.v31i1.14756.

[9] Olson, O, and Berry, C, 2020 "Addressing Parental Vaccine Hesitancy towards Childhood Vaccines in the United States: A Systematic Literature Review of Communication Interventions and Strategies," Vaccine, https://doi.10.3390/vaccines8040590.

[10] Ameen, M, and Mustafi, A, 2013 "Factors Influencing Childhood Immunizations in Bangaladesh," *International Journal of Mathematics and Statistics Studies*, vol. 1, no. 3, pp. 55–65, https://www.ea-journals.org.

[11] .Ministry of Health, "Health Annual health Sector Performance Report," 2019. Ministry of Health: Kampala, Uganda.

[12] O'Brien, K., Lindstrand, O. A, and Nandy, R 2021 "The Immunization Agenda 2030: a vision of global impact, reaching all, grounded in the realities of a changing world,". http://dx.doi.org/10.2139/ssrn.3830709.

[13] Wakiso District Local Government, HMIS Report 2019 "*Wakiso District Health Records*" District Health Officer, Wakiso, Uganda.

[14] Tugumisirize, M. E & Tumwine J, 2002 "Missed opportunities and caretaker constraints to childhood vaccination in rural areas of Uganda," East Afr. Med. J., 79(7), DOI: 10.4314/eamj.v79i7.8837.

[15] Babirye, J. N., Rutebemberwa, E., Kiguli, J., Wamani, H and F. Nuwaha, 2011 "More support for mothers: a qualitative study on factors affecting immunization behaviour in Kampala, Uganda," *BMC Public Health*, pp. 1–11: 723. https://doi.org/10.1186/1471-2458-11-723.

[16] Nansana Municipal Council, HMIS Report 2019 "*Nansana Municipality Health Records*" Municipal Health Office, Nansana, Uganda.

[17] World Health Organization, "World Health Organization Vaccination Coverage Cluster Surveys: Reference Manual," Geneva, 2015.

[18] Braun, V, 2014 "What can 'thematic analysis' offer health and well-being researchers?" *Int J Qualitative Stud Health Well-being*, 1, 9–10, http://dx.doi.org/10.3402/qhw.v9.26152.

[19] Nolna, S. K., Bonono, C. R., Moncher, M. N., Bindé, T., Nolna, D and Zogo, P. O, 2018 "Factors influencing the performance of routine immunization in urban areas: A comparative case study of two cities in Cameroon: Douala and

Yaounde," Vaccine, 36 (49), 7549–7555, https://doi.org/10.1016/j.vaccine.2018.10.048.
[20] Tadesse et al., 2017 "Factors and misperceptions of routine childhood immunization service uptake in Ethiopia: findings from a nationwide qualitative study," Pan Afr. Med. J., 28 (1), http://www.panafrican-med-journal.com/content/article/28/290/full/.
[21] Zewdie, A., Letebo, M and Mekonnen, T, 2016 "Reasons for defaulting from childhood immunization program: a qualitative study from Hadiya zone, Southern Ethiopia," *BMC Public Health*, 16(1), 1–9, https://doi.org/10.1186/s12889-016-3904-1.
[22] Babalola, S, 2011 "Maternal reasons for non-immunization and partial immunization in northern Nigeria," *J. Paediatr. Child Health*, 47(5), 276–281. https://doi.org/10.1111/j.1440-1754.2010.01956.x.
[23] Tefera, Y. H., Getachew, K., Assefa, T., Ababu, Y., Simireta, T., Zewdie Birhanu, Z, 2017 "Factors and misperceptions of routine childhood immunization service uptake in Ethiopia: findings from a nationwide qualitative study," 8688, 1–9, https://doi:10.11604/pamj.2017.28.290.14133.
[24] Tefera, Y. A., Wagner, A. L., and Boulton, M. L, 2018 "Predictors and Barriers to Full Vaccination among Children in Ethiopia," Vaccines, 6(22)1–11, https://doi.org/10.3390/vaccines6020022.
[25] Mthiyane et al., 2019 "Factors associated with missed and delayed DTP3 vaccination in children aged 12-59 months in two communities in South Africa, 2012-2013," *South African Med. J.*, 109 (8), 562–569, https://doi.org/10.7196/SAMJ.2019.v109i8.13244.
[26] Obasohan, P. E., Mustapha, M. A., Makada, A., and Obasohan, D. N, 2018 "Evaluating the reasons for partial and non-immunization of children in Wushishi local government area, niger state, Nigeria: methodological comparison," *Afr. J. Reprod. Health*, 22 (4), 113–122, 22:113: https://doi.org/10.29063/ajrh2018/v22i4.12.
[27] Ambe, J. P., Omotara, B. A., and Baba, M.M, 2001 "Perceptions, beliefs and practices of mothers in sub-urban and rural areas towards measles and measles vaccination in Northern Nigeria," Trop. Doct., 31(2), 89–90, https://doi.org/10.1177%2F004947550103100211.
[28] Braka, R. F. L., Asiimwe, D., Soud, F., Makumbi, I and Gust, D, 2012 "A Qualitative Analysis of Vaccine Safety Perceptions and Concerns Among Caretakers in Uganda," *Matern. Child Heal. J.*, 16, 1045–1052, https://doi.org/10.1007/s10995-011-0826-5.
[29] Miyahara et al., 2016 "Barriers to timely administration of birth dose vaccines in The Gambia, West Africa," Vaccine, 34 (29) 3335–3341, https://doi.org/10.1016/j.vaccine.2016.05.017.
[30] Mekonnen, A. G., Bayleyegn, A. D., and Ayele, E. T, 2019 "Immunization coverage of 12–23 months old children and its associated factors in Minjar-Shenkora district, Ethiopia: a community-based study," *BMC Pediatr.*, 19(1):198. https://doi.org/10.1186/s12887-019-1575-7.
[31] Akwataghibe, N.N., Ogunsola, E. A., Broerse, J. E.W., Popoola, O. A., Agbo, A. I and Dieleman, M. A, 2019 "Exploring factors influencing immunization utilization in Nigeria—a mixed-methods study," *Front. Public Health.*, 7, 392, https://doi.org/10. 3389/fpubh.2019.00392.
[32] Ntenda, P. A. M, 2019 "Factors associated with non-and under-vaccination among children aged 12–23 months in Malawi. A multinomial analysis of the population-based sample," *Pediatr. Neonatol.*, vol. 60, no. 6, pp. 623–633 19;60(6):623 –33, https://doi.org/10.1016/j.pedneo.2019.03.005.
[33] Wiysonge, C. S., Uthman, O. A., Ndumbe, P.M., and G. D. Hussey, G. D, 2012 "Individual and contextual factors associated with low childhood immunisation coverage in Sub-Saharan Africa: A multilevel analysis," *PLoS One*, vol. 7, 5 e37905. https://doi.org/10.1371/journal.pone.0037905.
[34] Kiptoo, E., 2015 "Factors Influencing Low Immunization Coverage Among Children Between 12 - 23 Months in East Pokot, Baringo Country, Kenya," *Int. Journal of. Vaccines.*, vol. 1, no. 2 https://doi.org/10.15406/ijvv.2015.01.00012.
[35] Bangura, J. B., Xiao, S., Qiu, Ouyang, D. F., and Chen, L, 2020 "Barriers to childhood immunization in sub-Saharan Africa: A systematic review," *BMC Public Health*, 20:1108, doi: https://doi.org/10.1186/s12889-020-09169-4.