


Predictors of Adherence to Routine Immunization Schedule Among Caretakers of Children Aged 10 to 18 Months in Lira City, Uganda

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Abstract

Background. Although the majority of nations have routine immunization programs in place as a public health strategy, more than 1.5 million children under the age of 5 die yearly worldwide due to inadequate vaccination coverage. This study investigated the predictors of adherence to routine immunization schedules in Lira city. **Methods.** This was a cross-sectional study among 420 caretakers of children aged 10 to 18 months. Bivariate and multiple regression analyses were conducted to assess the predictors of adherence to the full immunization schedule. A P -value $> .05$ was considered statistically significant at 95% CI. **Results.** The study result indicated that the majority, 237 (56.4%) of caretakers were aged 25 to 34 years, 205 (48.8%) had attained primary level education, and 284 (67.6%) were married. The results showed that 365 (87.0%) had their children fully immunized. The predictors of adherence to full immunization schedule were knowledge on when to start vaccination (AOR:5.65; 95% CI:1.82-17.55; $P=.003$), maternal outcome expectations (AOR:3.45; 95% CI:1.16-10.29; $P=.03$) and maternal knowledge (AOR:2.15; 95% CI:1.18-3.90; $P=.01$). **Conclusion.** The study findings show that 9 in 10 of the caregivers adhered to the immunization schedule. The significant predictors of adherence to full immunization were flexible clinical hours, maternal outcome expectations and maternal knowledge. Based on the conclusions we recommend that government and service providers be flexible in clinic hours and continue health education to women of childbearing age at an early stage, especially during antenatal care visits, delivery and the postnatal period on childhood vaccination to maintain adherence to the routine immunization schedule.

Keywords

caretakers, children, adherence, immunization schedule

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Background

Although the majority of nations have routine immunization programs in place as a public health strategy, more than 1.5 million children under the age of 5 die every year worldwide.¹ This is caused by insufficient vaccination coverage and could be avoided if routine immunization schedules were followed as prescribed.² Africa's Sub-Saharan region is where the majority of these fatalities occur.³ When vaccination rates are low, populations are more susceptible to the outbreak of diseases that can be prevented.¹ Each vaccination is timed for a certain biological window when the child's immune system will be able to react most rapidly and effectively to protect the

child from the infectious disease it is meant to prevent.¹ A highly secure sign of immunization status and the protection of the population against infectious diseases is adherence to routine vaccination schedules.⁴

Most of the available literature on caregiver adherence to routine immunization is from high-income countries. In a survey of European states, caregivers revealed a significant lack of confidence concerning immunization.⁵

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Other factors influencing routine adherence to routine immunization among caregivers were employment level, economic status, vaccinations-related knowledge, family size,⁶ forgetting appointments, the efficacy of the vaccines,⁷ and poor access to healthcare facilities.⁸ These studies may not, however, be generalizable to low-resource countries like Uganda. There is, therefore, a need to understand the factors that predict caregiver adherence to routine immunization to tailor health interventions that deal with these factors, improve the chances of adherence to routine immunization and prevent the spread of infectious diseases.

Uganda, has a mandatory national immunization program, with laws that encourage immunization and at the same time criminalize the intentional failure of caregivers to take their children for immunization. Further, the Ugandan government through UNEPI and other partners is providing funding to support routine immunization. However, only 55% of children aged 12 to 23 months had received all the basic vaccinations and 49% received the vaccination by the appropriate age of 12 months in 2018.⁹ In 2020, a report in Lango sub-region in northern Uganda indicated low vaccination coverage (close to 50% of children immunized which is lower than the national average of 55%).¹⁰ In the same year, a study in Lira showed that 49%, 3%, and 48.7% of children had received a pentavalent and measles-containing vaccine respectively by 1 year which was lower than the national target of 90%.¹¹ However, there is scarce information on the predictors of adherence to routine immunization schedules among caretakers in Lira city, thus the present study.

Materials and Methods

Research Design

This study adopted a community-based cross-sectional study design using a quantitative research approach to data collection. Data were collected between April and May 2022.

Study Settings

The study was conducted in Lira City in Northern Uganda. Lira city is located in Lango sub-region in Northern Uganda. Lira City is approximately 337 km (209 mi), by road, North of Kampala, the capital and largest city in Uganda. This area is preferred because 53% of the children were not fully immunized in the 2020/21 financial year.

Sample Size and Sampling Procedure

The sample size was calculated using a Kish Leslie (1965) formula with the assumption of a 55% prevalence

of children who received all basic vaccination (UDHS 2016), thus $P=.55$, Z value corresponding to 95% CI ($Z=1.96$) and the margin of error (e) was 0.05. We provided a 10% allowance for non-response and obtained a total sample size of 420 caretakers. A total of 420 respondents were randomly sampled from the 49 wards in Lira city, a caretaker was included per household. The study population included caretakers of children aged 10 to 18 months who were residents of Lira city.

Data Collection Instruments

The study administered a questionnaire to collect data from eligible caretakers. The study questionnaire captured individual, socio-cultural and health system factors conceptualized as predicting adherence to the routine immunization schedule. The questionnaire was developed by the researcher and guided by reviewed literature. The questionnaire had 3 sections covering individual, socio-cultural and health system factors conceptualized to influence adherence to the immunization schedule. The individual variables included items on age, education, marital status, fear of side effects and others. Secondly, health system variables were distance to facility, health education, flexible clinical hours, maternal outcome expectations, the information provided on a number of visits, health workers' attitudes and maternal knowledge. The instrument was pretested using 42 participants which are 10% of the study sample in the maternal and child health clinic. The pre-test results were used to improve the tools for validity and reliability.

Data Collection Procedure

The data collection was carried out between April and May 2022. The eligibility criteria required caretakers of children aged 10 to 18 months. After the approval of the research protocol was granted, eligible participants were identified, informed about the purpose of the study, the right to voluntary withdraws if appropriate, and asked to participate after signing the written consent forms. Three research assistants were trained for data collection. The research assistants moved from house to house guided by Local Council chairpersons to administer one questionnaire to one caretaker per household in 45 to 60 minutes. In circumstances where the study participant was not available or busy, a neighboring household which met the criteria was used as a replacement.

Statistical Analysis

At the end of each interview, every questionnaire was checked for completeness and correctness checking out missing and out-of-range before entry into the excel

Table 1. Caregiver Social Demographic and Individual Factors Associated with Adherence to Immunization Schedule (n = 420).

Variable	Frequency (%)	Fully immunized		P-value
Immunization status	420 (100%)	No = 55 (13.0%)	Yes = 365 (87.0%)	
Age of caretaker				.46
18-24	139 (33.1)	22 (15.8)	117 (84.2)	
25-34	237 (56.4)	26 (11.0)	211 (89.0)	
35-44	42 (10.0)	7 (16.7)	35 (83.3)	
45-49	2 (0.5)	0 (0.0)	2 (100.0)	
Education level of caretaker				.55
Primary	205 (48.8)	31 (15.1)	174 (84.9)	
Secondary	124 (29.5)	14 (11.3)	110 (88.7)	
Tertiary	59 (14.0)	5 (8.5)	54 (91.5)	
Vocational training	32 (7.7)	5 (17.9)	27 (82.1)	
Marital status of caretaker				.60
Single	49 (11.7)	5 (10.2)	44 (89.8)	
Cohabiting	71 (16.9)	12 (16.9)	59 (83.1)	
Married	284 (67.6)	35 (12.3)	249 (87.7)	
Divorced	16 (3.8)	3 (21.4)	13 (78.6)	
Knowledge on when to start vaccination				.003*
Anytime	12 (2.9)	6 (50.0)	6 (50.0)	
Immediately after	402 (95.7)	49 (12.2)	353 (87.8)	
1 month after	6 (1.4)	0 (0.0)	6 (100.0)	
Knowledge of a number of visits				.03*
3 times	9 (2.1)	1 (11.1)	8 (88.9)	
4 times	42 (10.0)	7 (16.7)	35 (83.3)	
5 times	261 (62.2)	26 (10.0)	235 (90.0)	
I don't know	81 (19.3)	19 (23.5)	62 (76.5)	
Others	27 (6.4)	2 (7.4)	25 (92.6)	
Fear of side effects				.03*
Yes	131 (31.2)	24 (18.3)	107 (81.7)	
No	289 (68.8)	31 (10.7)	258 (89.3)	

*Statistically significant variable at $P < .05$.

worksheet and exported to STATA version 15 for analysis. Descriptive data were summarized using frequency tables. Binary and multivariable logistic regression analyses were used to determine potential predictors of adherence to the routine immunization schedule. The effects of the independent variables were expressed as odds ratio (OR) and associated 95% confidence interval (CI). The outcome variable of the study was full immunization by 1 year transformed into a dichotomous variable.

Ethical Approval Considerations

This study was approved by the Institutional Review Board (GUREC-2021-106). Study participants were recruited based on written informed consent. Clearance for data collection in the community was sought and granted by the Principal Medical Officer, and local leaders from the 2 divisions of Lira City East and City West. Confidentiality was maintained throughout the entire

study period. Each participant was given a unique respondent's number and had the right to withdraw from the study at any time. The filled data collection tools were filed in box files and kept under lock and key. The data was stored in a flash disk with backup and protected by a password to ensure no access to external persons.

Results

Caregiver Social Demographic Characteristics

A total of 420 study participants were included in this study. The majority, 237 (56.4%) of the respondents were aged between 25 and 34 years, 205 (48.8%) had a primary level of education, 143 (34.1%) were self-employed, 43.3% were Anglican and 284 (67.6%) were married as shown in Table 1. The result in Table 1 indicates that a significant number of the respondents, 365 (87.0%) had their children fully immunized and was associated with knowledge on when to start vaccination

Table 2. Socio-Cultural Factors Associated with Adherence to Immunization Schedules Among Caretakers of Children (n = 420).

Variable	Frequency (%)	Fully immunized		P-value
Immunization status		55 (13)	365 (87%)	
Head of household				.32
Guardian	14 (3.3)	3 (21.4)	11 (78.6)	
Mother	55 (13.1)	5 (9.1)	50 (90.9)	
Father	343 (81.6)	45 (13.1)	298 (86.9)	
Others	8 (2.0)	2 (25.0)	6 (75.0)	
Number of children in the household				.15
1-3	328 (78.1)	44 (13.4)	284 (86.6)	
4-6	87 (20.7)	9 (10.3)	78 (89.7)	
7-10	5 (1.2)	2 (40.0)	3 (60.0)	
Partner support				.15
Regular	328 (66.9)	44 (13.4)	284 (86.6)	
Irregular	87 (14.8)	9 (10.3)	78 (89.7)	
No support	5 (18.3)	2 (40.0)	3 (60.0)	
Reminders from elected community leaders				.03*
No	129 (30.7)	24 (18.6)	105 (81.4)	
Yes	291 (69.3)	31 (10.7)	260 (89.3)	

*Statistically significant variables at $P < .05$.

($P = .003$), knowledge about a number of visits to complete a child's vaccination ($P = .03$) and lack of fear of side effect of vaccines ($P = .03$).

Socio-cultural factors associated with adherence to the routine immunization schedule. A bivariate analysis was conducted to show the association between the socio-cultural factors and full vaccination (Table 2). The study result revealed that reminders from elected community leaders were associated with full immunization $P = .03$.

Health system factors associated with adherence to immunization schedules among caretakers of (n = 420). Bivariate analysis in Table 3 shows that flexible clinical hours ($P = .003$), health education ($P = .003$), maternal outcome expectations ($P = .003$), caretakers' knowledge of the number of visits ($P = .03$) and maternal knowledge ($P = .004$) were associated with full immunization $P = .03$.

Predictors of adherence to routine immunization schedule among caretakers of children. Multivariate regression findings in Table 4 showed that the predictors of adherence to full immunization schedule were flexible clinical hours (AOR:5.65; 95% CI:1.82-17.55; $P = .003$), maternal outcome expectations (AOR:3.45; 95% CI:1.16-10.29; $P = .03$) and maternal knowledge (AOR:2.15; 95% CI:1.18-3.90; $P = .01$).

Discussion

This study set out to assess the predictors of adherence to routine immunization schedules among caretakers of

children aged 10 to 18 months in Lira city. Our findings show that 365 (87.0%) of the caregivers adhered to the immunization schedule. This result may be attributed to received information on vaccination and the majority of caretakers, 350 (83.3%) observed in this study. This finding is favorably consistent with 93% in Rwanda¹² However, this study's result of 87% full vaccination is higher than the 47% pooled prevalence from a systematic review and meta-analysis conducted in Ethiopia¹³ and 75.6% from a study conducted in Sinana district, Southeast Ethiopia.¹⁴ Additionally, it was higher than the results of studies done in Jigjiga district (36.6%),¹⁵ and Mecha district (49.3%).¹⁶ This could be attributed to variation in the study design, sample size and sampling procedure, timing, differences in access to vaccination services or geographical differences.

Our study showed that flexibility in clinic hours was a predictor of adherence to the routine immunization schedule. The results of the present study revealed that caretakers who believed that clinics had flexible hours were 5 times more likely to observe routine immunization schedules compared with their counterparts. This seems to be a good strategy for improving adherence to routine immunization schedules especially if there were flexible immunization hours. This finding is in tandem with the study conducted in India.¹⁷ Thus, as Uganda is trying to achieve universal health coverage, the initiatives for scaling up coverage in immunization programs should be optimally used for the expansion of health interventions.

Caretakers who knew the benefits of childhood immunization were 3 times more likely to adhere to the

Table 3. Health System Factors Associated with Adherence to Immunization Schedules Among Caretakers of (n=420).

Variable	Frequency (%)	Fully immunized		P-value
Immunization status		55 (13)	365 (87%)	
Distance to immunization post				.65
<5 km	350 (83.3)	47 (13.4)	303 (86.6)	
>5 km	70 (16.4)	8 (11.4)	62 (88.6)	
Flexible clinical hours				.003*
No	18 (4.3)	6 (50.0)	12 (50.0)	
Yes	402 (95.7)	49 (12.2)	353 (87.8)	
Health education				.003*
No	49 (11.7)	13 (26.5)	36 (73.5)	
Yes	371 (88.3)	42 (11.3)	329 (88.7)	
Maternal outcome expectations				.003*
No	16 (3.8)	6 (37.5)	10 (62.5)	
Yes	404 (96.2)	49 (12.1)	355 (87.9)	
Information provided on a number of visits				.03*
No	131 (31.2)	24 (18.2)	107 (81.8)	
Yes	289 (68.8)	31 (10.7)	258 (89.3)	
Health workers attitude				.10
Welcoming	355 (84.5)	41 (11.6)	314 (88.4)	
Lazy	27 (6.4)	7 (25.9)	20 (74.1)	
Welcoming	25 (6.0)	5 (20.0)	20 (80.0)	
Negative	13 (3.1)	2 (15.4)	11 (84.6)	
Vaccine stock out				.79
No	268 (63.8)	36 (13.4)	232 (86.6)	
Yes	152 (36.2)	19 (12.5)	133 (87.5)	
Maternal knowledge				.004*
No	176 (41.9)	33 (18.8)	143 (81.2)	
Yes	244 (58.1)	22 (9.0)	222 (91.0)	

*Statistically significant variable at $P < .05$.**Table 4.** Predictors of Adherence to Routine Immunization Schedule Among Caretakers of Children (n=420).

Variable	COR (95% CI)	AOR (95% CI)	P-value
Sex of child			
Male	1.00	1.00	
Female	0.63 (0.35-1.11)	0.57 (0.31-1.05)	.07
Flexible clinical hours			
No	1.00	1.00	
Yes	7.20 (2.24-23.22)	5.65 (1.82-17.55)	.003***
Number of children in the household			
1-3	1.00	1.00	
4-6	1.34 (0.63-2.87)	1.43 (0.64-3.21)	.39
7-10	0.23 (0.04-1.43)	0.21 (0.04-1.26)	.09
Maternal outcome expectations			
No	1.00	1.00	
Yes	4.35 (1.51-12.49)	3.45 (1.16-10.29)	.03**
Maternal knowledge			
No	1.00	1.00	
Yes	2.33 (1.31-4.15)	2.15 (1.18-3.90)	.01**

Abbreviations: 1.00, Reference category; COR, crude odds ratio; AOR, adjusted odds ratio.

*Statistically significant variable at $P < .05$, ** $P < .05$, *** $P < .01$.

immunization schedule compared with their counterparts. This means that the more knowledge caregivers acquire concerning the benefits of child immunization and the adverse effects of not immunizing a child, the higher the chances of increasing their confidence toward childhood immunization uptake. Expecting to be protected after receiving childhood vaccinations has a big impact on childhood vaccination rates.¹⁸ This finding is in line with those of a previous systematic review that sought to identify variables associated with immunization coverage.²

Having good maternal knowledge of child immunization is a predictor of adhering to the immunization schedule. caretakers with good knowledge of childhood immunization were found to be 2 times more likely to adhere to immunization schedules compared to their counterparts who had poor maternal knowledge. Caretakers with knowledge of immunization schedules may know the time for childhood immunization uptake. They may also, know the benefits of timely immunization uptake for the children under their care. Consistent with our results, a study in Ethiopia showed that caretakers who had maternal knowledge were 3 times more likely to have their children immunized compared with their counterparts.¹⁹ This result is also consistent with the systematic review conducted in Africa.²

Limitations

The findings of this study provide evidence on the relationship between individual, socio-cultural, and health system factors and full immunization for children in the urban and peri-urban populations in Lira City. However, it was a cross-sectional study and may not establish causality between associations. Also, the results may not be generalizable due to geographical limitations.

Conclusion

The study findings show that 9 in 10 of the caregivers adhered to the immunization schedule. the significant predictors of adherence to full immunization were flexible clinical hours, maternal outcome expectations and maternal knowledge. Based on the conclusions we recommend that government and service providers be flexible in clinic hours and continue health education to women of childbearing age at an early stage, especially during antenatal care visits, delivery, and the postnatal period on childhood vaccination to maintain adherence to the routine immunization schedule.

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Authors' Contribution

JA, was involved in the conceptualization, study design, the data collection, data analysis, and presentation. AK and CKN supervised the work, screening, and validity. All authors were involved in the writing, review and finalization of the manuscript. All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit it to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical Clearance

Egerton University Institutional review board approval (EG-2022-178)

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Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

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