

**YELLOW FEVER VACCINE HESITANCY AMONG PARENTS AND CAREGIVERS
OF CHILDREN BELOW FIVE YEARS IN KYETUME PARISH, MUKONO
DISTRICT, UGANDA**

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Abstract

Background: Despite a safe and effective vaccine being available, yellow fever remains a reoccurring public health threat, with vaccine hesitancy hindering achievement of full vaccination benefits.

Objective: This study aimed to assess prevalence and some of the key factors for yellow fever vaccine hesitancy among parents and caregivers of children under five in Kyetume, Mukono District, Uganda.

Methods: A cross-sectional quantitative study was conducted among 309 parents and caregivers of children under five years. Data was collected using structured questionnaires and analyzed using SPSS version 26. Descriptive statistics were used to summarize the socio-demographic characteristics of parents and caregivers and the prevalence of yellow fever vaccine hesitancy among them. Independent T-tests were used to compare means between groups where appropriate. Bivariate analysis using Chi-square tests and multivariable binary logistic regression were used to explore associations between yellow fever vaccine hesitancy and socio-demographic, awareness levels, and other access related factors.

Results: Prevalence of yellow fever vaccine hesitancy among parents and caregivers was at 47.9% (nearly half). Whereas bivariate analysis showed associations with social-demographic, knowledge, and access factors, multivariable logistic regression identified vaccine availability in the community (AOR = 0.302, 95% CI: 0.120 - 0.760, $p = 0.011$), fewer barriers to access (AOR = 0.821, 95% CI: 0.747 - 0.902, $p < 0.001$) and frequency of vaccines in the community (AOR = 0.855, 95% CI: 0.781 - 0.937, $p < 0.001$) as the independent predictors of reduced vaccine hesitancy.

Conclusion: From the findings, urgent efforts are needed to reduce barriers to vaccine access and to ensure available, consistent, and frequent supply of vaccines within communities, to address vaccine hesitancy.

Keywords: Yellow fever, vaccine hesitancy, vaccines, parents and caregivers, Kyetume, Mukono.

Declaration

I, BAKIZA EDWIN hereby declare that this is my original work, is not plagiarised and has not been submitted to any other institution for any award.

Bakiza Edwin _____ 

Date _____10th June 2026_____

Approval

This is to certify that this research titled “Yellow fever vaccine hesitancy among parents and caregivers of children below five years in Kyetume Parish, Mukono - Uganda”, has been done under my supervision and is now ready for submission.

Signature 

Date 29/06/2026

Dr. Agnes Ssali (PhD)

Supervisor

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Glossary of terms

Vaccine hesitancy	In this study and as defined, this was the delay in acceptance or refusal of vaccines despite the availability of these vaccines and vaccination services.
Hesitant & non-hesitant	Caregivers of children who had received the yellow fever vaccine according to the child's vaccination card were classified as <u>non-hesitant</u> . Caregivers of children who had missed, or not received (delayed) the yellow fever vaccine at the time of data collection were classified as <u>vaccine hesitant</u> based on the hesitancy definition above.
Parents and caregivers	Biological parents, guardians, grandparents, or other individuals who were responsible for the care and health related decision making for the target age group (9-59 months).

Table of Acronyms

AEG	Absolute Equity Group
DHO	District Health Office
DV	Dependent Variable
EYE	Eliminate Yellow fever Epidemics
FPC	Finite Population correction
HBM	Health Belief Model
IV	Independent Variable
LC	Local Council
MoH	Ministry of Health
MV	Moderating Variable
PACV	Parent Attitudes about Childhood Vaccines
PPS	Probability Proportional to Size
REC	Research Ethics Committee
SMS	Short Message Service
SPSS	Statistical Package for the Social Science
SSA	Sub-Saharan Africa
UBOS	Uganda Bureau of Statistics
UNCST	Uganda National Council for Science and Technology
UCU	Uganda Christian University
UNIPH	Uganda National Institute of Public Health
VH	Vaccine Hesitancy
VHTs	Village Health Teams
WHO	World Health Organisation
YF	Yellow Fever

CHAPTER 1: GENERAL INTRODUCTION

This chapter presents the background, problem statement, purpose, objectives, research questions, scope, justification, and significance of the study, as well as the conceptual framework.

1.1 Background

Endemic to Africa and South America, yellow fever is an acute arbovirus disease caused by the yellow fever virus of the flaviviridae family that affects humans and nonhuman primates as the main vertebrate hosts (Oyono et al., 2022). It is transmitted by the bite of infected mosquitoes of the species *Aedes* spp. and *Haemagogus* spp. (Moussallem et al., 2019).

Yellow fever is responsible for over 78,000 deaths every year with a possibility of the actual mortality rate being higher given that it presents non-specific symptoms which could give room for misdiagnosis and under-reporting (Garske et al., 2014). It has *three types*; one being the urban cycle where the *Aedes aegypti* mosquitoes are known to be responsible for transmission among hosts (Ingelbeen et al., 2018), the zoonotic cycle known to be facilitated by several mosquito vectors, including the *Aedes africanus*, (Gaythorpe et al., 2019), and the sylvan-to-urban spillover known to be influenced by changes in land use and landscape (Monath & Vasconcelos, 2015).

Over 47 countries (34 from African and 13 from South America) are endemic to yellow fever with an estimated 90% infections occurring on the African continent (Porudominsky & Gotuzzo, 2018). Uganda is one of the countries and since its very first outbreak in 1941, other outbreaks continue to occur (Wamala et al., 2012).

With no specific viral treatment, vaccination remains the most efficient means of managing yellow fever. However, this is greatly limited by vaccine hesitancy which remains a challenge in achieving vaccination benefits (Gaythorpe et al., 2021; Lane et al., 2018).

Defined as the delay in the acceptance or the blunt refusal of vaccines despite them being available, vaccine hesitancy is a growing trend in global health and one of the top ten threats to global health alongside climate change (Marti et al., 2017; World Health Organisation, 2019).

As is the case with other vaccines, reaching a broad vaccination coverage for yellow fever is still a challenge for public health (Lopes, Souza, et al., 2023). Yellow fever vaccination is primarily delivered through three programmes namely routine childhood immunization targeting infants aged around 9 months in at-risk regions, periodically conducted mass preventive and outbreak response campaigns that target a broader age range and vaccination of people travelling to high-risk areas (Shearer et al., 2017).

Following the comprehensive global strategy to eliminate yellow fever epidemics (EYE) by 2026, the Ministry of Health (MoH), Uganda launched and carried out the first phase yellow fever mass vaccination in June 2023 vaccinating 9,421,530 people out of the target 13.3 million reaching a 70% coverage. In 2024, with a target of vaccinating 14 million people, MoH, Uganda launched the second phase nationwide yellow fever vaccination campaign which ran in April 2024 targeting people between the ages of 9 months and 60 years (MoH, 2024). The results from this campaign were not published by the time of this study

With a safe and effective vaccine since 1937, yellow fever continues to re-emerge as a public health threat in endemic regions such as Uganda (Baba & Ikusemoran, 2017). Implementing vaccine campaigns has been shown to be associated with an 86% reduction in the risk of yellow fever outbreaks (Jean et al., 2021).

However, vaccine hesitancy remains a problem affecting the full achievements of vaccine benefits across the globe, Uganda inclusive (Lane et al., 2018).

This study aimed to assess prevalence and some of the key factors for yellow fever vaccine hesitancy among parents and caregivers of children under five in Mukono District, Uganda.

1.2 Problem statement

Despite the proven achievements of vaccinations in protecting public health, vaccine uptake in Uganda has remained low with several factors contributing to this being unknown (Kabagenyi et al., 2022). Following the introduction of yellow fever vaccine in the routine immunization schedule, in 2022 the national coverage remained low at 29% posing a risk of low population immunity and possibility of outbreaks (Makerere University School of Public Health et al., 2024). Subsequent mass vaccination campaigns have failed to bridge the gap. The campaign conducted in June 2023 achieved a 70% nationwide coverage slightly below the 80% needed to maintain immunity and avoid outbreaks (Juan-Giner & Hombach, 2024).

The same sub target can be noted at district level. According to the district health office the 2024 yellow fever mass vaccination campaign achieved a 72.4% coverage among children below 5 years (12 - 59 months) which is lower than the 80% coverage needed for herd immunity (District Health Office Mukono, 2024; Makerere University School of Public Health et al., 2024).

Because Uganda's yellow fever control strategy heavily relies on surveillance, case management, and vaccination (Mensah et al., 2024), low coverage leaves communities vulnerable. Given that children below 5 are highly vulnerable to vaccine preventable diseases (Frenkel, 2020), and recent outbreaks of yellow fever in the neighboring districts of Wakiso and Buikwe (Byaruhanga et al., 2023), Mukono district faces a heightened risk of a localized outbreak. This calls for an urgent need to assess the prevalence and some of the factors for yellow fever vaccine hesitancy particularly among parents and caregivers of children under 5 in the district.

1.3 Purpose of the study

The primary objective of this study was to assess the prevalence and some of the key factors for yellow fever vaccine hesitancy among parents and caregivers of children under 5 years in Kyetume Parish, Mukono - Uganda.

1.4 Objectives of the study

- 1) To determine the prevalence of yellow fever vaccine hesitancy among parents and caregivers of children below 5 in Kyetume, Mukono district.
- 2) To assess the knowledge levels of parents and caregivers of children below 5 years of age regarding yellow fever vaccination in Kyetume, Mukono district.
- 3) To examine the attitudes of parents and caregivers towards yellow fever vaccination among children below 5 years in Kyetume, Mukono district.
- 4) To assess accessibility to yellow fever vaccination services among parents and caregivers of children under 5 years old in Kyetume, Mukono district.

1.5 Research questions

1. What is the prevalence of yellow fever vaccine hesitancy among parents and caregivers of children below 5 years in Kyetume, Mukono district?
2. What are the knowledge levels of parents and caregivers of children below 5 years regarding yellow fever vaccination in Kyetume, Mukono district?
3. What are the attitudes of parents and caregivers towards yellow fever vaccination among children below 5 years in Kyetume, Mukono district?
4. What is the level of accessibility to yellow fever vaccination services among parents of children below 5 in Kyetume, Mukono, district?

1.6 Scope of the study

The study was conducted among parents and caregivers of children between 9 and 59 months in Kyetume Parish, Mukono district in Uganda.

1.7 Significance of the study

Yellow fever is a serious viral illness with potentially fatal consequences, particularly in young children (Nwaiwu et al., 2021) and despite the availability of an efficacious vaccine (intervention), vaccine hesitancy remains a significant challenge to immunization efforts in many parts of the world, including Uganda (Lane et al., 2018). This study was significant in several ways.

First, by assessing the knowledge levels of parents and caregivers regarding yellow fever vaccination, the study aimed at identifying knowledge gaps that may influence vaccination decisions. The findings could inform the development of targeted health education and risk communication strategies aimed at improving awareness and timely acceptance of yellow fever vaccination.

Second, the study examined accessibility related factors associated with yellow fever vaccine hesitancy among parents and caregivers of children below five years in Kyetume Parish, Mukono district in Uganda. Understanding these factors provides evidence that can guide efforts to improve or maintain the availability, accessibility, and consistence of vaccination services in communities.

The findings provide valuable information for policymakers, public health practitioners, and immunization program managers in designing and implementing context specific interventions to reduce vaccine hesitancy.

In addition, the study contributes to the existing body of knowledge on yellow fever vaccine hesitancy in Uganda. The findings may serve as a reference for future studies in similar settings and support broader regional and global efforts aimed at improving childhood immunization coverage and preventing future yellow fever outbreaks.

Ultimately, the study provides evidence on some of the factors associated with yellow fever vaccine hesitancy among parents and caregivers in Kyetume Parish, Mukono district. Such

evidence can support informed decision making and contribute to strategies that promote timely vaccination.

By understanding the knowledge levels among parents and caregivers regarding yellow fever vaccination, the study could help magnify the gaps (if any) and inform future communication programs.

1.8 Conceptual framework

The framework was derived from the Health Belief Model (HBM), an effective tool for identifying facilitators and barriers to health behaviors (Zartaloudi, 2022). Developed by social psychologists in the U.S. Public Health Service in the 1950s, the model is based on the idea that an individual's decision to engage in or not engage in a health-related action, such as child vaccination is influenced by their perceptions of susceptibility, severity, benefits, and barriers to a given health threat. The model also considers triggers to action and self-efficacy (Champion & Skinner, 2008).

Using this model, we assumed that parents would most likely vaccinate their children if they believed they were at risk of contracting yellow fever (perceived susceptibility), if they saw yellow fever as a serious or life-threatening disease (perceived severity), if they trusted vaccination to effectively prevent yellow fever (perceived benefits), if they felt that the barriers to vaccination were manageable (perceived barriers), or if they were motivated by peers, media, reminders (cues to action), and if they were confident in their ability to ensure their children receive the vaccine (self-efficacy).

We also assumed that parents and caregivers who perceived their children to be at low risk of contracting yellow fever, regarded the disease as less serious, doubted the effectiveness of vaccination, experienced significant barriers to accessing vaccination services, lacked motivating cues to action, or had low confidence in their ability to obtain vaccination for their children would most likely be hesitant to have their children vaccinated.

Based on these two assumptions, the outcome variable in this study was categorized as parents and caregivers who were **hesitant** and those who were **non-hesitant** to yellow fever vaccination, as shown in the conceptual framework below.

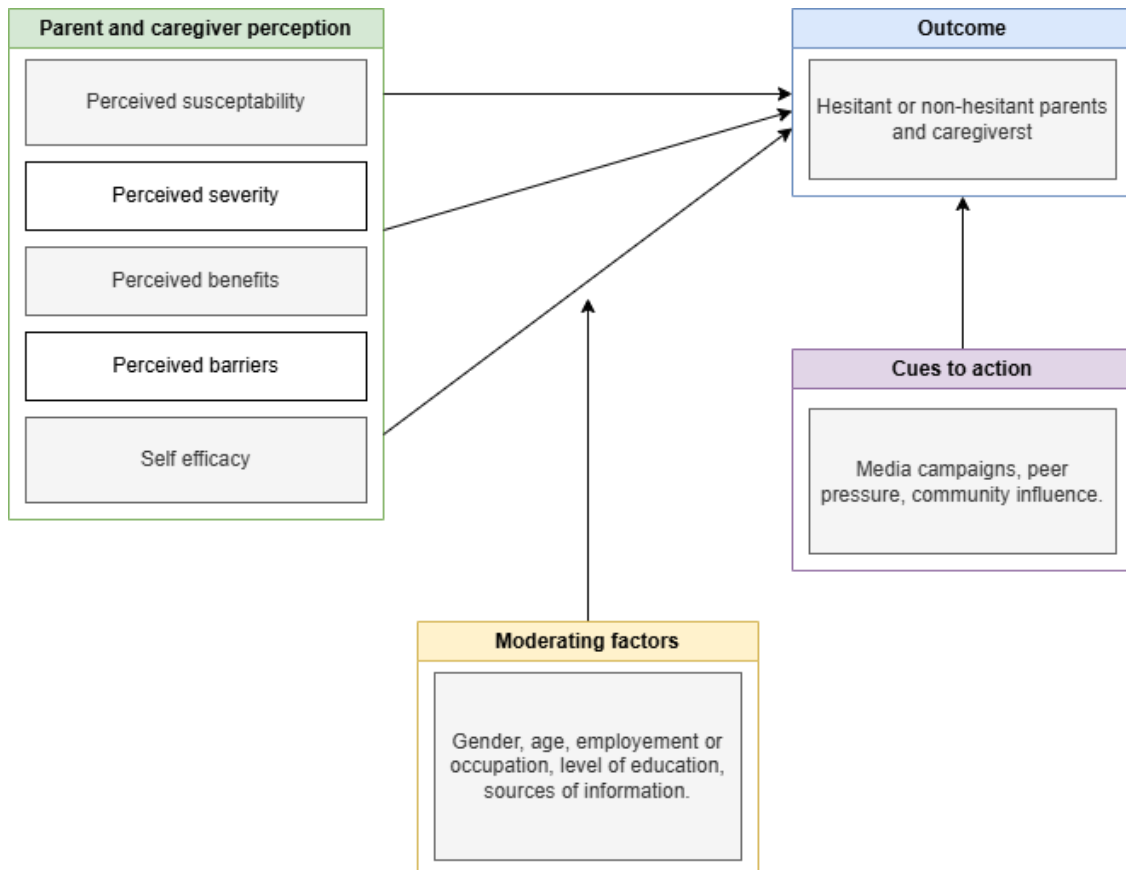


Figure 1: Conceptual framework

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature for the study. Literature was sourced from several sources such as online libraries like BioMed Central, PLOS one, PubMed, and other peer reviewed journals in line with the study objectives.

2.2 Prevalence of yellow fever vaccine hesitancy.

Yellow fever vaccine hesitancy continues to pose a significant threat to vaccination programs in Africa, potentially eroding decades of progress (Cooper et al., 2018). This calls for more studies to assess the factors behind this behavior.

Some of the factors commonly pointed out as contributing to hesitancy include lack of information, safety concerns of the vaccines, and fear of adverse events after vaccination (Lopes, Souza, et al., 2023). This study aims to verify some of these and pose possible solutions.

In relation to the above, in Uganda, community sources are known to play a very crucial role in disseminating vaccine related information, but politicization and mistrust can hinder acceptance at community level (Huebl et al., 2024), calling for more studies to uncover some of the factors behind yellow fever vaccine hesitancy.

Research gaps still exist in the nature and some of the causes of vaccine hesitancy particularly in Africa and with limited evidence-based interventions and validated measurement tools (S. Cooper et al., 2018). More studies need be conducted to establish the nature and some of the other factors causing yellow fever vaccine hesitancy among parents and caregivers of children under 5.

To address some vaccine hesitancy challenges, improving health education through trusted community members has always been recommended together with providing accurate

information about vaccine safety and adverse events (Huebl et al., 2024; Lopes, de Souza, et al., 2023). This study therefore aimed at assessing the effectiveness of some of the measures if at all they are in place to support in developing effective public health strategies to mitigate vaccine hesitancy.

2.3 Knowledge of parents towards vaccines

Vaccination is among the most cost-effective available public health interventions with an estimate of having averted at least 37 million deaths between 2000 and 2019 (Lindstrand et al., 2021). The responsibility to vaccinate children below 5 years entirely depends on their parents and caregivers, implying that their knowledge and attitudes towards vaccines plays a very crucial role in this regard.

Despite the provisions of free health care and readily available vaccines, a significant proportion of children do not receive their childhood vaccinations across the globe, and the situation intensifies in developing countries (Hadjipanayis et al., 2020). This points out the importance of studying parental or caregivers' knowledge and its influence on vaccine hesitancy.

Parental hesitancy to vaccines has been known to be a major barrier to childhood vaccination (Fadl et al., 2024). Roughly one in every five parents is hesitant towards routine childhood immunization in the 12 Sub-Saharan Africa (SSA) countries (at 21.2%). Parents who have good knowledge and awareness of vaccines have been known to be less hesitant to vaccines (Voo et al., 2021).

Low levels of education, negative beliefs and negative attitudes often from lack of information about the benefits of vaccination have closely been related to significant impacts on the uptake of yellow fever vaccination (Koivogui et al., 2017). Studies like these important to compare education levels and their contribution to vaccine hesitancy.

Vaccine hesitancy is an individual behavior, but it can also be a result of broader societal influences and should always be looked at in the historical, political and socio-cultural context in which vaccination takes place (Dubé et al., 2014). This makes such a community study important in pointing out some of the factors behind vaccine hesitancy in local communities.

Parental concerns, such as inadequate knowledge of immunization schedules, anxieties regarding side effects, and perceived contraindications, have been known to frequently contribute to vaccine hesitancy (Bangura et al., 2020). This study aims to study this further and raise some conclusions on some of the factors for vaccine hesitancy.

A study conducted in Uganda on perceptions of mass immunization revealed that parents were hesitant to vaccinate their children against yellow fever primarily due to concerns about potential vaccine side effects and the association of the yellow vaccination cards with the ruling political party's yellow color, a clear example of how knowledge could contribute to yellow fever vaccine hesitancy in our communities (Huebl et al., 2024).

Given that high immunization coverage is crucial for countries to maximize the protective benefits of vaccines (Brewer et al., 2017), more research needs to be done on some of the factors that could hinder coverage and uptake of vaccines.

2.4 Attitudes of parents towards vaccines

Negative experiences within the healthcare system, and general distrust towards the government has been known to establish perfect milieu for vaccine-hesitancy attitudes across Africa (Ackah et al., 2022). This calls for more studies on attitudes of parents and caregivers of children below particularly 5 at community level.

Some recent studies have explored attitudes towards yellow fever vaccination in Africa, particularly in Uganda and Ghana, highlighting that in Uganda, vulnerable groups relied mostly on community sources for vaccine related information, but point out that lack of

knowledge and political related factors continue to lead to mistrust among these groups (Huebl et al., 2024).

In another study on parents of kindergarten children (aged between 1-5 years), attitudes were measured using the Parent Attitudes about Childhood Vaccines (PACV) survey. The results revealed that vaccine refusing or delaying parents were mainly those who thought that infant vaccinations were primarily an economic business of the pharmaceutical companies than the prevention of diseases (Bianco et al., 2019).

Another study in Ghana found that most nomadic communities had very poor knowledge of yellow fever symptoms and this could eventually affect their attitudes towards vaccination (Inusah et al., 2023). Research has consistently pointed to the crucial role of maternal knowledge and positive attitudes in driving childhood vaccination rates (Vonasek et al., 2016), which is key in our yellow fever study given that parents must decide for their children who are under 5 years of age.

2.5 Access and availability of vaccines

Vaccination continues to save countless lives worldwide; however, there are still gaps in accessibility and acceptability of vaccines and is still observed locally and globally (Kalantari et al., 2022), calling for more studies to study these gaps in communities.

Many factors such as policies, systems, health services, access, and social and political influences have been known to affect childhood vaccination (Shapiro et al., 2021), calling for more studies to point out the magnitude of these factors and address them.

Availability and accessibility of healthcare services and vaccines is an important determinant of vaccination uptake among parents of children below 5 years because even in cases where there is a plentiful supply of vaccines, accessibility could still be a barrier to increasing vaccine coverage there by delaying vaccination (Kennedy, 2020).

A study on child vaccination in sub-Saharan Africa by Bobo et al. (2022) noted that a substantial number of children failed to receive and benefit from recommended vaccines due to poor access among other causes depicting how such barriers to access and availability of healthcare services could significantly impact vaccination uptake and cause hesitancy.

According to Dowhaniuk (2021), transport related barriers were noted to pose significant challenges to health care access among the poor in Uganda with vulnerable Ugandans (those least likely to afford transport expenses) experiencing the highest exorbitant travel costs and longest distances to health centers, a possible barrier to vaccination. Studies like this one would clarify this at a peri-urban level.

Parents could struggle to access vaccines because of the costs and opportunity costs of getting vaccinated, as well as the timing and location of appointments (World Health Organisation, 2019), a common problem in low- and middle-income countries. This has also been noted as a problem in high-income countries, but it is particularly a problem among poorer communities (Royal Society for Public Health, 2019).

In a study by Ssebagereka et al. (2024) it was noted that less than a third of all children under 24 months in Uganda were fully immunized, pointing out inequity in full vaccination status, with the under-privileged populations being the most affected as depicted by the high AEG (Absolute Equity Group) estimate.

Immunization being among the most cost-effective public health interventions (Lindstrand et al., 2021), the study calls for more research on examining the current levels of access and availability of healthcare services in relation to YF vaccine in Kyetume, Mukono.

Achieving optimal vaccine accessibility in Africa, particularly in Uganda, is contingent on understanding a multifaceted landscape of the determinants and research has consistently pointed to the crucial role of maternal knowledge and positive attitudes in driving childhood vaccination rates (Vonasek et al., 2016).

Significant barriers that could lead to delayed vaccination or hesitancy persist, encompassing fundamental issues such as lack of information, geographic distance to health services, financial constraints, and pervasive distrust in vaccines (Bangura et al., 2020).

The 5As framework of (Access, Affordability, Awareness, Acceptance, and Activation) provides a valuable lens through which to categorize some of the varied determinants of vaccination and guide strategic interventions (Thomson et al., 2016). Beyond individual decision-making, a social-ecological perspective reveals that vaccine demand is deeply embedded within complex social structures, including familial and community relationships, interactions with healthcare systems, and broader societal norms (Bell et al., 2022). Effective strategies for improving vaccine accessibility in Africa must therefore extend beyond individual-level interventions to encompass broader family and community-focused approaches. Challenges within the health sector, such as human resource shortages, inadequate infrastructure for vaccine storage and supply, can further impede progress there by delaying vaccination (Bangura et al., 2020).

Social networks, political dynamics, and the intricate interactions between vaccine access, supply, and demand collectively shape parental perceptions and practices (Mavundza et al., 2023). Consequently, enhancing health facility accessibility and designing context-specific interventions is paramount for improving vaccination coverage there by reducing hesitancy (Bangura et al., 2020).

In conclusion, the reviewed literature highlighted a complex interplay of factors influencing vaccine hesitancy, including knowledge levels, attitudes, access to health services and vaccines. While several studies provided valuable insights into these determinants across different contexts, there remained a gap in context specific evidence, particularly in local communities such as Kyetume, Mukono, in Uganda. This underscored the need for localized research to better understand the prevalence, and some of the factors for vaccine hesitancy

in a local community. The study sought to build on this, to contribute to evidence-based strategies for improving public health interventions.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter includes the study design that was used, area of study, population, sampling method and size, variables and indicators, procedure for data collection and analysis, quality control and ethical considerations.

3.2 Research design

A quantitative approach was employed for this study. A cross-sectional descriptive design was used to measure the prevalence of vaccine hesitancy among parents and caregivers, levels of knowledge, and attitude of parents and caregivers as well as the confidence levels in the effectiveness of yellow fever vaccines among parents and caregivers of children under 5 years of age in Kyetume Parish Mukono district, Uganda. Descriptive designs aim to provide estimates on traits such as people's attitudes, knowledge or health behavior (Kesmodel, 2018). The study also examined the availability and accessibility to healthcare and vaccine related services. A questionnaire was developed to assess the levels of knowledge, attitudes, and practices of parents, parent's confidence levels in vaccines as well as access or availability of vaccines and healthcare facilities and this was administered to a sample of the target population. The questionnaire included questions on current vaccination status of children, knowledge on yellow fever vaccine, attitudes towards vaccines (yellow fever in particular), and accessibility to vaccines.

3.3 Area of study

The study was conducted in Kyetume, a parish in Nakisunga sub county located in Mukono district in Uganda. It had a total population of 5,416 people and 1,583 households (Uganda Bureau of Statistics, 2014) which was the focus for the study. It should be noted that by the time of data collection, the 2014 data was the most recent data that was available to the

public. The 2024 census had just been conducted, but data specifically up to sub county level was not yet available.

Kyetume Parish was purposively selected as an ideal sample for the study in Mukono district because it had the least number of illiterates above 18 years of age at 8.3% according to the 2014 census data (Uganda Bureau of Statistics, 2014). This aligned closely with the objectives of the study. The parish comprised of five villages namely, Bukasa, Kazinga, Kyetume, Lufunve and Ntale-Kyeyo.

3.4 Study period

Data was collected in February 2025 among parents and caregivers of children aged between 9-59 months in Kyetume Parish, Mukono District.

3.5 Sources of information

The main source of information for the study was the parents and caregivers of children under 5 years old residing in Kyetume Parish, Mukono district in central Uganda. Parents were asked to provide a copy of the immunization card to confirm the vaccination status of the children and additional data from the recent yellow fever mass vaccination such as the coverage by parish was obtained from the district health offices in Mukono.

3.6 Population of the study

The study population involved households of parents and caregivers of children below 5 years old residing in Kyetume, Mukono district in central Uganda. This is because parents and caregivers are solely responsible for making decisions regarding yellow vaccination among other vaccinations for their children.

3.7 Sampling determination and sampling

A sample is a subset of the population, selected to be a representation of the larger population (Acharya et al., 2013). For this study, the sample size of the study was 309

households in Kyetume Parish determined using the Kish and Lisle (1965) (Kish, 1965) method of sample size determination as follows:

$$n = \frac{Z^2 * P (1 - P)}{d^2}$$

Where

n - the initial sample size required

Z - the Z-score for confidence level (which is 1.96 for a desired 95% confidence level).

P - the estimated proportion of households with the characteristic of interest (0.5, being the most conservative estimate).

d - the margin of error (0.05).

$$= 0.9604/0.0025$$

n = 384.16 (being the initial sample size)

Because the target population was finite and fell below 10,000, we applied the Standard Finite Population correction (FPC) to adjust the sample size downward and avoid oversampling (Jordan, 2013).

$$n = \frac{N * C}{N + C}$$

Where n - is the adjusted sample size

N - the target sample size

C - initial sample size obtained from the Kish and Leslie formula

$$n = \frac{1583 * 348.16}{1583 + 348.16}$$

= 309 households (as our adjusted sample size).

As noted in the study area section above (3.3), the baseline figure (N = 1,583) represented the total number of households within Kyetume Parish, Mukono district (Uganda Bureau of

Statistics, 2014). While a newer national census had been conducted in mid-2024, fully disaggregated, parish, village, and sub county level data were not yet officially published or accessible to the public at the time of the study. This made 2014 the most recent, reliable, and official data source available. From a statistical standpoint, the FPC is highly robust against moderate population fluctuations in communities like Kyetume Parish. Even if the local population had grown say by 30% over the past 10 years (say from 1,583 to 2,058), the FPC formula would only shift the required sample size from 309 to 324 (Jordan, 2013). Because this minor shift does not compromise the statistical power or the 5% precision of our study, the sample size of 309 remained adequate to meet the study objectives.

For sampling, systematic sampling was employed. With this, the initial household was selected randomly and then every k th household was selected thereafter (Acharya et al., 2013). The k th household (interval) was calculated by dividing the total number of households (N) by the required number of households (n) thus the formula ($k=N/n$). In this case we used $1583/309$ giving us 5 (five) as our interval.

For each household selected, the available parent or caregiver was interviewed only if they had at least one child aged between 9 and 59 months. The questionnaire was designed to capture information on all children between 9 and 59 months residing in the selected household, including their yellow fever vaccination status, and any challenges faced particularly for those that had not been vaccinated at the time of data collection.

For households where the parent or caregiver declined to participate or was unavailable at the time of the visit, these were classified as non-response. These were replaced with the next eligible household using the same sampling procedure to maintain the representativeness of the sample. Participation was entirely voluntary, and no attempts were made to compel respondents to take part in the study. Data collection continued until the predetermined sample size of 309 respondents was attained. This ensured that the study

achieved the required sample size while adhering to ethical principles of voluntary participation and informed consent.

The sample distribution across the five villages in the parish was determined using probability proportional to size (PPS) approach. This is a standard and effective approach for ensuring the representativeness of a sample, particularly when the primary sampling units (villages in this case) are of unequal sizes (Skinner, 2016). This approach was used with the help of village health teams (VHTs) and local leaders (LC1) in establishing the relative village sizes and number households.

3.8 Variables and indicators

Table 1: Variables and indicators

Variable	Type	Indicator
Yellow fever vaccine hesitancy among parents and caregivers.	Dependent variable	▪ Hesitant ▪ Non-hesitant
Social-demographic variables	Moderating variable	▪ Age of parent/caregiver ▪ Gender of parent/caregiver ▪ Education level of parent/caregiver ▪ Occupation of parent/caregiver ▪ Number of children under 5 years
Knowledge variables	Independent variable	▪ Knowledge of the existence of yellow fever as a disease ▪ Understanding the symptoms and complications of yellow fever ▪ Awareness of yellow fever transmission ▪ Knowledge of prevention methods, including vaccination
Attitudinal variables	Independent variable	▪ Beliefs in the importance of vaccination for preventing yellow fever ▪ Perception of vaccination ▪ Concerns on potential vaccine side effects or long-term risks
Behavioral variables	Independent variable	▪ Vaccination status of the child ▪ Specific reasons for refusing or delaying vaccinating children

Accessibility variables	Independent variable	▪ Ease of accessing vaccination services (at a health facility or outreach programs/mass vaccination) ▪ Availability of yellow fever vaccines in the community
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3.9 Measurement levels

Table 2: Measurement levels

Nominal	Ordinal	Ratio
▪ Gender of parent/caregiver ▪ Occupation of parent/caregiver ▪ Vaccination status of child or children (binary outcome - yes or no)	▪ Age of parent/caregiver. ▪ Education level of parent/caregiver ▪ Attitude of parent/caregiver towards vaccination ▪ Confidence levels in vaccines (low, moderate, high), ▪ Knowledge of parent/caregiver regarding yellow fever ▪ Accessibility to vaccines/healthcare services or the recent mass vaccination centers	▪ Number of children under 5

3.9.1 Procedures of data collection

Research assistants (five in total) were recruited and trained on the study objectives, ethical considerations, and administration of the questionnaire to ensure consistency during data collection. The questionnaire was developed in English and was not formally translated into the local language. However, all research assistants were fluent in both English and Luganda (the local language commonly spoken in the study area) and they were trained on how to convey the questions consistently during interviews. The questionnaire was pre-tested on a small sample of 10 parents outside the study area to ensure clarity, relevance, and reliability of the questions. With the help of local community leaders and village health teams (VHTs),

face-to-face interviews were conducted with the selected respondents in their homes and business premises.

3.9.2 Data collection instruments

A structured questionnaire was used for data collection. The questionnaires were well numbered for easy tracking, and they comprised questions on demographic information of the respondents, vaccination status of their children, their knowledge, attitudes, practices, and confidence in vaccine safety, as well as their accessibility to vaccination services.

3.9.3 Quality control

To ensure the quality, consistency, and accuracy of the data collected, several control measures were implemented.

Research assistants received comprehensive training on the study objectives, ethical considerations, interview techniques, and administration of the questionnaire to ensure uniformity in data collection procedures.

The questionnaire was pre-tested among 10 parents and caregivers outside the study area to assess its clarity, relevance, and comprehensibility. Feedback from the pre-test was used to refine the tool before the commencement of the main study.

The principal investigator closely supervised and actively participated in the data collection process to ensure adherence to the study protocol and to provide immediate guidance and support to the research assistants whenever necessary.

Completed questionnaires were reviewed on a daily basis by the principal investigator for completeness, consistency, and accuracy. Any identified errors, omissions, or inconsistencies were addressed promptly to minimize data quality issues.

3.9.4 Data processing & analysis

The data collected was organized, sorted, coded (as shown in the table below) and entered in statistical software package SPSS version 26 for analysis.

Table 3: Data coding

Variable	Coding
Outcome variable	
Yellow fever vaccine hesitancy among parents and caregivers.	Non hesitant - 0, Hesitant - 1
Demographic variables	
Gender of parent/caregiver	Male - 1, female - 2
Age of parent/caregiver	Categorical
Education level of parent/caregiver	No education -1, Primary - 2, Secondary - 3, University - 4, Post University - 5
Occupation of parent/caregiver	Unemployed or stay at home -1, Farmer - 2, Businessperson or trader - 3, Formal employment - 4
Number of children under 5 years	Continuous
Behavioral variables	
Vaccination status per child (Is Child/children vaccinated?)	Yes - 1, No - 2
Reasons for no vaccination or delayed vaccination per child (for those that had a “No - 2” in the previous question).	Lack of knowledge about yellow fever vaccination -1 Concerns about vaccine safety - 2 Vaccines not available - 3 Religious or cultural beliefs - 4 Child was sick at the time of vaccination - 5 Lack of time to take child(ren) for vaccination - 6 Child(ren) not at home at the time - 7 Distance to health facility - 8
Awareness variables	
Awareness of the existence of yellow fever as a disease (Is the parent aware?)	Yes - 1, No - 2
How would you rate your knowledge of yellow fever symptoms and complications?	High - 1, Moderate - 2, Low - 3, None - 4
Awareness of how yellow fever is transmitted (is the parent aware?)	Yes - 1, No - 2

Does the parent know that vaccination can prevent yellow fever?	Yes - 1, No - 2
Sources of information and vaccine related information.	Healthcare workers - 1 Family and friends - 2 Media (such as TV, radio, newspapers) - 3 Social media - 4 Other: Specify _____
Attitudinal variables	
How important does the parent perceive yellow fever vaccination is for preventing the disease?	Very Important - 1, Somewhat important - 2, Not important - 3, None - 4
Does the parent have concerns about potential side effects or long-term risks of the vaccine?	Yes - 1, No - 2
If yes (above), to what extent are these concerns?	Very concerned - 1, Moderately concerned - 2, Slightly concerned - 3, Not concerned - 4
How confident is the parent in the safety and effectiveness of the yellow fever?	Very confident - 1, Somewhat confident - 2, Not confident - 3, None/not sure - 4
How strongly does the parent agree with the statement: "Vaccinating children against yellow fever is beneficial?"	Strongly agrees - 1, Agrees - 2, Neutral - 3, Disagrees, strongly disagrees - 4
How much does the parent trust the advice of healthcare workers regarding yellow fever vaccination?	Completely - 1, Somewhat - 2, Do not trust - 3, Not sure - 4
Accessibility variables	
How easy is it for the parent to access vaccination services?	Very easy - 1, Easy - 2, Difficult - 3, Very difficult - 4
Are yellow fever vaccines available in the community?	Yes - 1, No - 2
What is the main barrier to accessing vaccines in the community?	Distance - 1, Lack of supplies - 2, Cost of vaccines - 3, Other: specify _____
How frequent are vaccines offered in the community?	Always - 1, Sometimes - 2, Rarely - 3, Never - 4

Yellow fever vaccine hesitancy (the outcome variable) was operationally defined using the child's vaccination status, in line with the World Health Organization (WHO) definition of

vaccine hesitancy as both the delay in acceptance or refusal of vaccination despite availability of services (World Health Organisation, 2019). This study was timed following both a massive national yellow fever vaccination campaign and the sustained integration of the vaccine into the routine childhood immunization schedule in 2022. Because of this, non-vaccination was utilized as a behavioral proxy for vaccine hesitancy. For children who had not received the vaccine at the time of data collection, their parents and caregivers were classified as hesitant, while those whose children had received the vaccine were classified as non-hesitant.

3.9.5 Identification and handling of missing data

Data cleaning revealed some missing values in variables such as reasons for no vaccination and the vaccination status for children 2, 3 and 4. These were from a skipping pattern in the questionnaire for example, a parent who only had one child would not respond to questions for child two and three or a parent who had their child or children vaccinated would not have to respond to reasons for delayed or no vaccination for the same child or children. Consequently, these missing values were systematically re-coded as 'Not Applicable' (N/A), ensuring a comprehensive dataset for analysis.

Descriptive analysis was used to identify and describe trends and variation in the population. This was to help answer the who, what, where, when, and to what extent questions in the study (Loeb et al., 2017). It was used to summarize and present basic features of the data collected to provide an overview of the population. Under this, frequencies, percentages, and means for the variables such as knowledge levels, attitudes, practices and access to vaccines were calculated and presented to identify patterns and trends.

Bivariate analysis was used to explore how the dependent variable depends on or is explained by the independent variables in the study (Bertani et al., 2018). This was to help in exploring the relationship between two variables at a time to assess potential correlations for example the relationship between vaccine knowledge and yellow fever vaccine hesitancy

or the relationship between parent's attitudes and yellow fever vaccine hesitancy. Chi-square tests were used to examine the association between two categorical variables for example the relationship between gender and yellow fever vaccine hesitancy and t-tests on the other hand used to examine differences between means such as the average number of children below 5 between hesitant and non-hesitant parents or caregivers (Waller, 2012).

Multivariable analysis which involved the use of statistical techniques such as the binary logistic regression was used to assess how various factors such as knowledge, attitudes, access to vaccines, and confidence in vaccines jointly predict yellow fever vaccine hesitancy. This was to help in identifying the most significant factors for yellow fever vaccine hesitancy among parents and caregivers of children below 5 years of age. Only variables that showed statistically significant associations ($p < 0.05$) in the bivariate analysis were included in the multivariable logistic regression.

3.10 Ethical consideration

The study was conducted in line with the Uganda National Council for Science and Technology (UNCST) national guidelines for research involving humans as research participants (Uganda National Council for Science and Technology (UNCST), 2014).

The protocol was reviewed and approved by the University Research Ethics Committee (REC) under approval number: UG-REC-026. A clearance letter dated 11th November 2024 is attached (appendix 2). Official permission at village level was requested and granted by the local council leadership in all the five (five) villages before collecting data.

Before interviews, participants were informed about the study's purpose, procedures, and their right to withdraw at any time. A written and signed informed consent form was then obtained from all participants. All data collected was kept confidential and solely used for research purposes.

3.11 Dissemination of study results

The findings will be disseminated to relevant stakeholders such as the District Health Office (DHO) in Mukono and in the villages where data was collected. The study findings have already been disseminated through both oral and poster presentations at scientific conferences held in Kampala, Entebbe (Uganda Virus Research Institute), and Stellenbosch, South Africa. These presentations have provided opportunities to share the research findings with researchers, public health practitioners, and other key stakeholders.

In addition, a manuscript based on the study findings has been drafted and is currently under review. Following this review, it will be submitted to a peer-reviewed journal for consideration for publication.

At the community level, dissemination of the findings is planned for next year, subject to the availability of resources. It will involve sharing the results with community members to promote knowledge translation and support evidence informed interventions.

CHAPTER 4: DATA ANALYSIS, PRESENTATION, AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter presents the study findings. These are organized in line with the study objectives and presented using frequency tables, percentages, means and figures highlighting key findings. The impact of missing data handling, and reliability testing is also highlighted.

4.2 Data cleaning and preparation

Before analysis, missing values were identified in some variables such as reasons for delayed or no vaccination and the vaccination status for children 2, 3, and 4. These were not random but a result of the questionnaire's skipping patterns. For instance, parents with only one child wouldn't answer questions pertaining to two or three children. To ensure a complete dataset for analysis, this was systematically re-coded as 'Not Applicable' (N/A).

4.2.1 Reliability testing

Reliability analysis was conducted using Cronbach's Alpha to assess internal consistency of the questionnaire constructs used in the study (Vaske et al., 2017). The vaccination status items demonstrated low to moderate internal consistency ($\alpha = 0.531$, 3 items), indicating limited but acceptable reliability in measuring vaccination patterns among households. The attitude items showed good internal consistency ($\alpha = 0.713$, 3 items), suggesting that the items consistently measured parental attitudes towards vaccination.

The knowledge scale demonstrated acceptable internal consistency ($\alpha = 0.697$, 8 items), indicating moderate reliability of the items assessing parental knowledge and awareness of yellow fever and vaccination. For the accessibility construct, the initial reliability was poor ($\alpha = -0.197$, 6 items), indicating inconsistency among the items. After removing one of the items 'sources of information', the reliability improved to an acceptable level ($\alpha = 0.789$, 5 items), indicating a stable and internally consistent measure of accessibility related factors.

Overall, the results indicated that most of the constructs had acceptable to good internal consistency, supporting the reliability of the data used for further statistical analysis.

4.3 Descriptive results

4.3.1 Socio-demographic characteristics of parents by vaccine hesitancy in Kyetume, Mukono district

A total of 309 parents and caregivers were interviewed and the table below summarizes their key social-demographic variables by yellow fever vaccine hesitancy. These were grouped as gender, age, education levels, and occupation.

The table (4) presents the distribution of socio-demographic characteristics by yellow fever vaccine hesitancy status. Place of residence (village) showed a statistically significant association with vaccine hesitancy ($p < 0.001$), while gender, age, education level, and occupation were not significantly associated ($p > 0.05$), implying that place of residence may have played a role in influencing yellow fever vaccine hesitancy. All socio-demographic variables were subsequently considered for multivariable logistic regression analysis.

Table 4: Social-demographic characteristics of parents by vaccine hesitancy (N=309)

	Hesitant	Non hesitant	Total	P-value
Village				0.001
Lufunve	54 (64.3%)	30 (35.7%)	84 (100%)	
Kyetume	17 (33.3%)	34 (66.7%)	51 (100%)	
Ntale	38 (56.7%)	29 (43.3%)	67 (100%)	
Bukasa	18 (36.7%)	31 (63.3%)	49 (100%)	
Kazinga	21 (36.2%)	37 (63.8%)	58 (100%)	
Gender				0.113
Male	9 (33.3%)	18 (66.7%)	27 (100%)	
Female	139 (49.3%)	143 (50.7%)	282 (100%)	
Age				0.471
18-24	36 (56.3%)	28 (43.7%)	64 (100%)	
25-34	65 (45.1%)	79 (54.9%)	144 (100%)	
35-44	32 (48.5%)	34 (51.5%)	66 (100%)	

45-54	5 (33.3%)	10 (66.7%)	15 (100%)
55 & above	10 (50%)	10 (50%)	20 (100%)
Education level			0.130
No formal education	12 (63.2%)	7 (36.8%)	19 (100%)
Primary education	42 (55.3%)	34(44.7%)	76 (100%)
Secondary education	77 (45.6%)	92 (54.4%)	169 (100%)
Tertiary education (Tertiary & University)	17 (11.5%)	28 (17.4)	45 (100%)
Occupation			0.061
Unemployed or stay at home parents	60 (55.6%)	48 (44.4%)	108 (100%)
Farmer	20 (51.3%)	19 (48.7%)	39 (100%)
Business or trader	58 (43.6%)	75 (56.4%)	133 (100%)
Formal employment	8 (29.6%)	19 (70.4%)	27 (100%)
Student	0 (0.0%)	1 (100%)	1 (100%)
Casual laborer	2 (100%)	0 (0.0%)	2 (100%)

Majority of parents and caregivers were female of whom 139 (49.3%) were hesitant and 143 (50.7%) were non hesitant. Majority (144) were the aged between of 25-34 years with 65 (45.1%) hesitant and 79 (54.9%) non hesitant to the yellow fever vaccine. Most respondents (169) had a secondary education followed by tertiary (45). Over 133 were engaged in business or trading 58 (43.6%) were hesitant and 75 (56.4%) were not hesitant to yellow fever vaccination. Regarding the total number of children under 5, 183 (59.5%) of parents had one child under five years, and 100 (32.0%) had two children under five making these two the majority.

4.3.2 Objective 1: Prevalence of yellow fever vaccine hesitancy among parents and caregivers of children below 5 in Kyetume, Mukono district

Vaccine hesitancy was assessed using the delayed or refusal to vaccinate child 1 as the primary reference point. Parents with more than one child who had only vaccinated one leaving the others unvaccinated were classified as hesitant, based on the reasons they gave for non-vaccination. Conversely, parents who had one unvaccinated child but had vaccinated the others were categorized as non-hesitant, also considering the reasons given.

This variable, being the main outcome (dependent variable), was measured as a binary indicator: parents who delayed or were reluctant to vaccinate their children were grouped as hesitant, while those who vaccinated their children were considered non-hesitant. A total number of 148 parents (47.9%) were classified as hesitant, while 161 parents (52.1%) were classified as non-hesitant, as illustrated in the figure below.

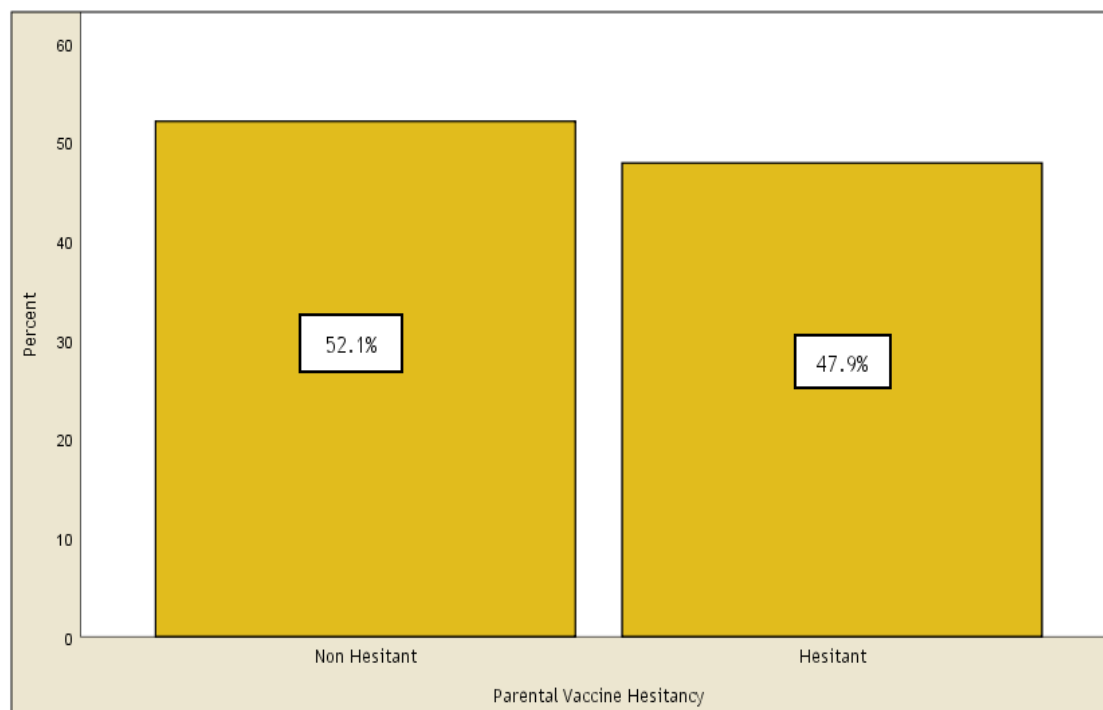


Figure 2: Prevalence of vaccine hesitancy among parents and caregivers

Reasons for delayed vaccination or hesitancy for children one and two are summarized in the table below. They included lack of knowledge about yellow fever vaccination, unavailability of vaccines within communities, limited time to take children for vaccination, child being ill at the time of vaccination, children not being at home when vaccination was offered, and concerns about vaccine safety and religious and cultural beliefs to a smaller extent.

Table 5: Reasons for delayed vaccination for child 1 and 2

Child 1 *one	Frequency	Percent	Child 2 *two	Frequency	Percent
Lack of knowledge	120	80.5	Lack of knowledge	46	65.7

Concerns about vaccine safety or side effects	8	5.4	Concerns about vaccine safety or side effects	4	5.7
Vaccine not available	12	8.1	Vaccine not available	13	18.6
Religious or cultural concerns	1	0.7	Religious or cultural concerns	1	1.4
Child was sick at the time of vaccination	3	2.0	Lack of time	2	2.9
Lack of time	4	2.7	Child not at home	2	2.9
Child not at home	1	0.7	Was underage at the last vaccination	2	2.9
Total hesitant	149	100	Total hesitant	70	100
N/A	160		N/A	239	

4.3.3 Objective 2: Knowledge levels of parents and caregivers of children below 5 years on yellow fever vaccination in Kyetume, Mukono district

To address this objective, parents were asked about their awareness of yellow fever as a disease. The majority (88%) reported being aware, while 12% had no knowledge or had never heard of it. Additionally, parents' knowledge of yellow fever symptoms and complications was assessed using a Likert scale. This scale is composed of four or more Likert-type responses that were later combined into a single composite score or variable during the data analysis to provide a quantitative measure (Boone Jr et al., 2012). Responses were categorized into two groups: 'good knowledge' (combining high and moderate responses) and 'poor knowledge' (combining low and none). Based on this classification, 37.5% of parents demonstrated good knowledge, while 62.5% had poor knowledge, as presented below.

Table 6: Knowledge levels and vaccine hesitancy

Knowledge of YF symptoms and Complications	Frequency	Percent	Non hesitant	hesitant	P-value
Good	116	37.5	41.6%	33.1%	0.123
Poor	193	62.5	58.4%	66.9%	
Total	309	100.0	100%	100%	

Parents were also asked whether they knew how yellow fever is transmitted. Only 7.8% demonstrated awareness of its mode of transmission, while the vast majority (92.2%) had

no knowledge of how the disease spreads. When asked if they knew that vaccination could prevent yellow fever, 86.1% responded affirmatively, 10.7% were unaware, and 3.2% were uncertain. Additionally, parents were asked to indicate their sources of information on yellow fever. Family and friends as well as healthcare workers was the most commonly referred source of information among both the hesitant and non-hesitant groups as summarized in the table below.

Table 7: Sources of information

Sources of information	Frequency	Percent	Non hesitant	hesitant	P-value
Health care workers	47	15.2	18%	12.2%	0.001
Family & friends	61	19.7	13%	27%	
Media	27	8.7	6.2%	11.5%	
None	18	5.8	1.9%	10.1%	
Health care workers, family & friends, media	6	1.9	3.1%	0.7%	
Health care workers & family & friends	30	9.7	8.1%	11.5%	
Family & friends, Media & Clubs at school	2	0.6	1.2%	0.0%	
Family & friends and Media	38	12.3	15.5%	8.8%	
Health care workers and Media	63	20.4	27.3%	12.8%	
Family & friends and social media	1	0.3	0.0%	0.7%	
Health care workers, Media, social media	1	0.3	0.0%	0.7%	
Family & friends and school	1	0.3	0.6%	0.0%	
School	9	2.9	4.3%	1.4%	
Media & social media	2	0.6	0.0%	0.7%	
Healthcare workers & social media	1	0.3	0.0%	0.7%	
Healthcare workers & School	1	0.3	0.0%	0.7%	
Personal experience	1	0.3	0.6%	0.0%	
Total	309	100.0	100%	100%	

4.3.4 Objective 3: Attitudes of parents towards yellow fever vaccines and healthcare services in Kyetume, Mukono district

Regarding parental attitudes, respondents were asked how important they perceived yellow fever vaccination in preventing the disease. A significant majority (70.9%) indicated that it was very important, suggesting that most parents recognized and valued the role of

vaccination in yellow fever prevention. When asked about vaccine-related concerns, 23.9% reported having concerns, while the majority (76.1%) expressed no concerns. Among those with concerns, most reported them as moderate. Additionally, parents generally expressed positive attitudes toward the safety of the vaccine and demonstrated trust in healthcare workers, as summarized in the table below.

Table 8: Confidence in vaccine safety

	Frequency	Percent	Non hesitant	Hesitant	P-value
Confidence in vaccine safety					
Very confident	155	50.2	57.8%	41.9%	0.001
Somewhat confident	136	44.0	40.4%	48%	
Not confident	17	5.5	1.2%	10.1%	
Not sure	1	0.3	0.6%	0.0%	
Total	309	100.0	100%	100%	
Trust in healthcare workers					
Completely trust	212	68.6	76.4%	60.1%	0.006
Somewhat trust	89	28.8	22.4%	35.8%	
Do not trust	8	2.6	1.2%	4.1%	
Total	309	100.0	100%	100%	

As shown in the bar graph below, parents were asked about their level of agreement with the statement ‘vaccinating children against yellow fever is beneficial’ and most of the parents (87.7%) agreed with the statement further showing a positive attitude to vaccination. Responses from 5 scale Likert scale of strongly agree, agree, neutral, disagree and strongly disagree were grouped into 3 (i.e. 1 - Agree, 2 - Neutral and 3 - Disagree). This approach is supported by previous research, which suggests that collapsing categories can be appropriate when options are underutilized and it does not significantly compromise psychometric integrity (Colvin et al., 2020).

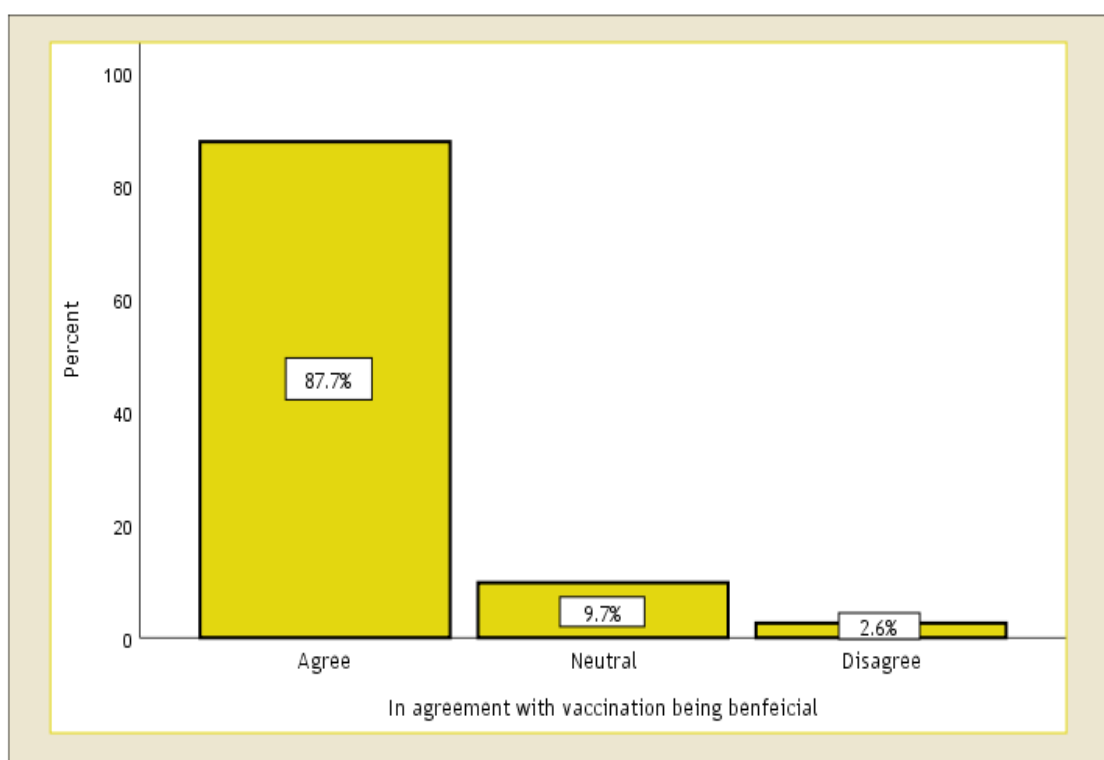


Figure 3: Parental responses on vaccinating children against yellow fever being beneficial.

4.3.5 Objective 4: Accessibility to vaccines among parents and caregivers of children under 5 in Kyetume, Mukono district

For this objective, we looked at how easy it was for parents to access vaccination services and a majority 50.8% found it easy while 45.3% found it difficult. A majority parents 50.2 % reported that vaccines were available in their community while a 46% said they were not available with a 3.9% of parents and caregivers unsure. For those that said there were no vaccines in the community, we probed further to find out the challenges they faced, and the responses are summarized in the table below.

The distribution of barriers differed significantly by vaccine hesitancy status ($p < 0.001$), with a higher proportion of hesitant parents reporting lack of vaccine supply and lack of awareness of vaccine availability compared to non-hesitant parents. Conversely, a larger proportion of non-hesitant respondents reported no barriers to accessing vaccination services. These findings suggest that structural and informational barriers to vaccine access may contribute to vaccine hesitancy among parents and caregivers.

Table 9: Barriers to vaccine access

	Frequency	Percent	Non hesitant	Hesitant	P-value
Distance to health facility	20	6.5	5.6%	7.4%	0.001
Lack of vaccine supply	92	29.8	20.5%	39.9%	
Cost of vaccination	9	2.9	2.5%	3.4%	
Not aware of the availability of vaccine	33	10.7	3.7%	18.2%	
Distance to health facility & lack of vaccine supply	1	0.3	0.6%	0.0%	
Cultural & religious beliefs	1	0.3	0.0%	0.7%	
None	153	49.5	67.1%	30.4%	
Total	309	100.0	100%	100%	

We further probed about the frequency of yellow fever vaccines in the community. A majority 35.92% reported that vaccines were available sometimes, 24.60% said rarely, 24.27% said not at all, 12.30% said always available and 2.91% were not sure as shown in figure 4 below.

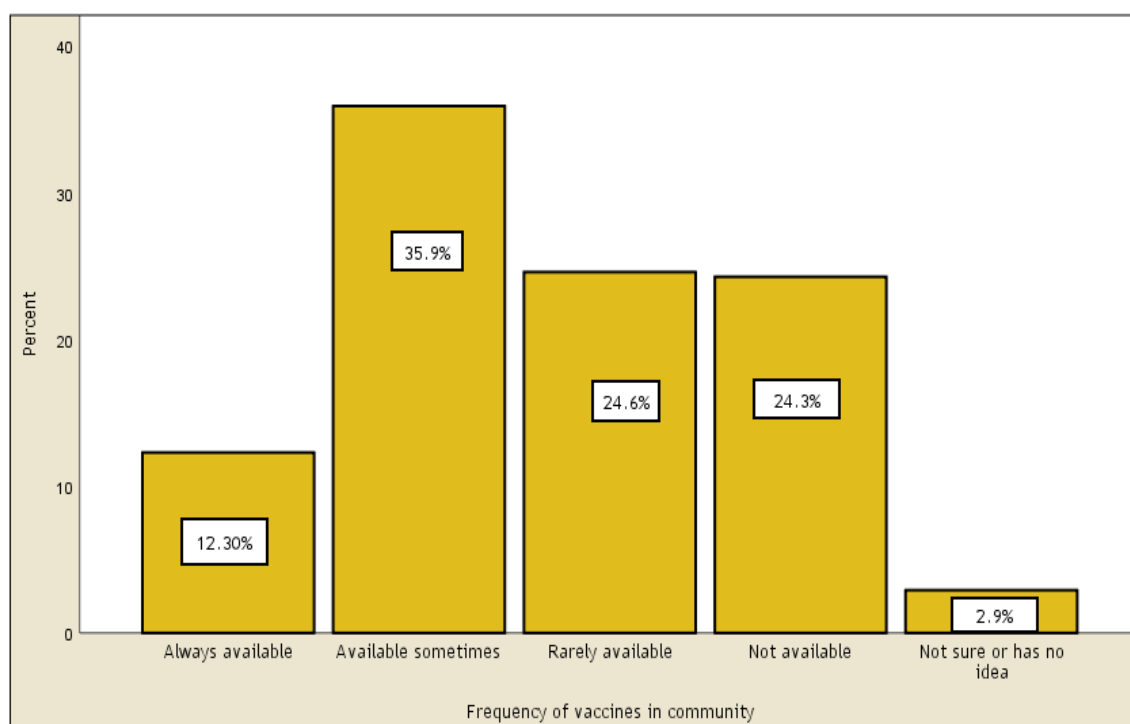


Figure 4: Frequency of vaccines in community.

4.4 Exploratory data analysis

The number of children under five years was the only continuous variable included in the study. Normality assessment using the Shapiro-Wilk test indicated that the variable was not normally distributed ($p < 0.05$). Consequently, the Mann-Whitney U test was used to compare the distribution of the variable between vaccine hesitant and non-hesitant parents. The analysis showed no statistically significant difference between the two groups (Mann-Whitney U = 11,781, $p = 0.846$) indicating that the distribution of the number of young children did not differ meaningfully between the two groups.

4.5 Bivariate analysis (chi-square test) of factors associated with yellow fever vaccine hesitancy

The table below presents the results of the chi-square (bivariate) analysis examining factors associated with yellow fever vaccine hesitancy. The findings indicate that several variables across socio-demographic characteristics, knowledge and awareness, attitudes, and access to vaccines were significantly associated with vaccine hesitancy.

Table 10: Chi-square results for categorical variables

	X2	df	P-Value
Demographics			
Village	21.086	4	0.001
Gender	2.514	1	0.113
Age	3.548	4	0.471
Education	5.641	3	0.130
Occupation	10.565	5	0.061
Knowledge & awareness levels			
Awareness of the existence	8.431	1	0.004
Knowledge of symptoms & complications	2.534	3	0.469
Aware of transmission	3.658	1	0.056
Knows vaccine can prevent it	12.482	2	0.002
Sources of information	47.532	16	0.000
Parent's attitudes			
How important is vaccination in preventing yellow fever	23.468	3	0.001
Do you have concerns about the side effects of yellow fever vaccine	3.945	1	0.047
What's the extent of concerns	7.444	3	0.059

How confident are you in the effectiveness of yellow fever vaccines?	16.889	3	0.001
Do you agree that vaccinating children against yellow fever is beneficial?	9.113	4	0.058
Do you have trust in the healthcare workers	10.171	2	0.006
Access to vaccines			
How easy is it to access vaccines	35.009	4	0.001
Are vaccines available in your community	39.755	2	0.001
Main barrier to accessing vaccines	48.503	6	0.001
How frequent are vaccines available?	54.617	4	0.001

Chi-square tests were conducted to examine the relationship between vaccine hesitancy and demographic characteristics of parents. For the values tested, only the village of residence showed a statistically significant association with vaccine hesitancy ($\chi^2 = 21.086$, $df = 4$, $p < 0.001$), suggesting that the village where a parent or caregiver stayed could have had an influence on their decision to have their child vaccinated against yellow fever. Other demographic factors like gender ($p = 0.113$), age ($p = 0.471$), education level ($p = 0.130$), and occupation ($p = 0.061$), did not show statistically significant associations with vaccine hesitancy. Occupation on the other hand was close but remained statistically non-significant at the 0.05 level.

Under knowledge and awareness levels, multiple indicators showed that parents who were aware of the existence of yellow fever were significantly less likely to be hesitant ($\chi^2 = 8.431$, $df = 1$, $p = 0.004$). Similarly, those knowledgeable about vaccination being able to prevent yellow fever were strongly associated with reduced hesitancy ($\chi^2 = 12.482$, $df = 2$, $p = 0.002$). However, other components like awareness of transmission ($p = 0.056$), and parental understanding of yellow fever symptoms and complications ($p = 0.469$) were not statistically significant. Sources of information showed a highly significant association ($\chi^2 = 47.532$, $df = 16$, $p < 0.001$), suggesting that where parents receive their information plays a key role in influencing their vaccine-related decisions.

Parental attitudes toward yellow fever vaccination was explored through several attitude-related variables. The perceived importance of the yellow fever vaccine was significantly

associated with vaccine hesitancy ($\chi^2 = 23.468$, $df = 3$, $p < 0.001$), and concerns about potential side effects ($\chi^2 = 3.945$, $df = 1$, $p = 0.047$). Additionally, those with higher confidence in vaccine effectiveness ($\chi^2 = 16.889$, $df = 3$, $p < 0.001$) and those with greater trust in healthcare workers ($\chi^2 = 10.171$, $df = 2$, $p = 0.006$) were less likely to exhibit yellow fever vaccine hesitancy. The extent of vaccine concerns ($p = 0.059$) and agreement that vaccinating children is beneficial ($p = 0.058$) were marginally above the 0.05 significance level, indicating possible trends that may warrant further investigation.

All access-related variables demonstrated strong associations with vaccine hesitancy. Ease of accessing vaccines ($\chi^2 = 35.009$, $df = 4$, $p < 0.001$), and availability of vaccines in the community ($\chi^2 = 39.755$, $df = 2$, $p < 0.001$) were significantly associated with reduced hesitancy. Likewise, reported barriers to vaccine access ($\chi^2 = 48.503$, $df = 6$, $p < 0.001$) and the frequency of vaccine availability ($\chi^2 = 54.617$, $df = 4$, $p < 0.001$) were strongly related to yellow fever vaccine hesitancy. The findings highlight the critical importance of consistent and convenient access to vaccination services in reducing vaccine hesitancy among parents and caregivers.

In summary, bivariate analysis was used to identify several factors that had a statistically significant association with yellow fever vaccine hesitancy. These were further considered for multivariate analysis.

4.6 Multivariable analysis of factors associated with vaccine hesitancy

To identify independent predictors of parental vaccine hesitancy, a binary logistic regression was used. Analysis included variables that showed statistically significant associations ($p < 0.05$) in bivariate analysis above as well as all the social-demographic factors. The dependent variable: vaccine hesitancy was coded as a binary outcome (1 = Hesitant, 0 = non-hesitant) and the output provided regression coefficients (B), significance levels (p-values), odds ratios (Exp-B), and 95% confidence intervals (CI).

The variables assessed include socio-demographic characteristics, knowledge and awareness of yellow fever, parental attitudes towards vaccination, and access-related factors.

From the results and as shown in the table below, three variables were statistically significant predictors of vaccine hesitancy at the $p < 0.05$ level and these included the following:

Availability of vaccines in the community ($p = 0.011$). This variable had a negative coefficient ($B = -1.198$), indicating that participants who reported better availability of vaccines were significantly less likely to be hesitant. The odds ratio ($\text{Exp}(B) = 0.302$) suggests that improved availability was associated with a 70% reduction in the odds of vaccine hesitancy.

Barriers to vaccine access ($p < .001$). This variable was also significantly associated with vaccine hesitancy. With a coefficient of $B = -0.198$ and an odds ratio of 0.821, the results suggest that for every unit increase in perceived barriers (e.g., distance, cost, or time constraints), the odds of hesitancy increased by approximately 17.9%.

Frequency of vaccine availability in the community ($p = 0.009$). Multivariable logistic regression revealed that frequency of vaccine availability in the community was a statistically significant predictor of vaccine hesitancy ($B = -0.156$, $SE = 0.046$, $Wald = 11.401$, $p < 0.001$). The odds ratio ($\text{Exp}(B)$) was 0.855 with a 95% confidence interval of 0.781 to 0.937. This indicates that as the frequency of vaccine availability increased, the likelihood of vaccine hesitancy significantly decreased. Specifically, individuals in communities with more frequent vaccine availability were approximately 14.5% less likely to be hesitant compared to those in areas with fewer opportunities.

Non-significant predictors that did not reach statistical significance ($p > .05$) included the village of residence, parental awareness of yellow fever, knowledge of vaccine prevention, sources of information, importance of yellow fever vaccination, concerns about vaccines, confidence in vaccine safety, trust in healthcare workers, and general access to vaccines.

The binary logistic regression model was statistically significant, as indicated by the Omnibus Test of Model Coefficients ($\chi^2 = 60.938$, $df = 12$, $p < 0.001$). This suggests that the model with predictors was a significant improvement over the null model with no predictors. The -2 Log Likelihood value was 367.427, and the model explained approximately 17.9% of the variance in vaccine hesitancy based on the Cox & Snell R^2 , and 23.9% using the Nagelkerke R^2 , indicating modest but meaningful explanatory power. Model fit was further supported by the Hosmer and Lemeshow goodness-of-fit test, which was not statistically significant ($\chi^2 = 9.221$, $df = 8$, $p = 0.324$), suggesting that the model fitted the observed data well. In terms of predictive performance, the model correctly classified 67.6% of hesitant parents (sensitivity) and 73.9% of non-hesitant parents (specificity), indicating a balanced ability to distinguish between the two groups.

Table 11: Binary logistic regression for factors for vaccine hesitancy

	B (coefficient)	Sig. (p-value)	AOR	95%(CI)
Age	-0.129	0.197	0.879	(0.722, 1.069)
Gender	0.121	0.354	1.128	(0.874, 1.456)
Village	-0.109	0.236	0.897	(0.749, 1.074)
Parental awareness of yellow fever	0.358	0.405	1.430	(0.616, 3.320)
Knowledge of Vaccine prevention of yellow fever	0.089	0.788	1.093	(0.570, 2.097)
Sources of information	-0.014	0.637	0.986	(0.928, 1.047)
Knows the importance of yellow fever vaccination	0.296	0.373	1.345	(0.701, 2.582)
Has concerns on vaccines	0.154	0.607	1.167	(0.648, 2.101)
Confidence in vaccine safety	0.311	0.260	1.365	(0.795, 2.343)
Trusts healthcare workers	0.130	0.684	1.139	(0.609, 2.131)
Access to vaccines	0.057	0.779	1.058	(0.712, 1.573)
Availability of vaccines in community	-1.198	0.011	0.302	(0.120, 0.760)
Barrier to vaccine Access	-0.198	0.000	0.821	(.747, 0.902)
Frequency of vaccines in community	0.156	0.001	0.855	(0.781 - 0.937)

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

This chapter discusses the findings as presented in chapter four. Analysis explored knowledge levels, parents' attitudes, accessibility to vaccines, and the prevalence of vaccine hesitancy among parents and caregivers of children under five in Kyetume Parish, Mukono District.

5.2 Prevalence of yellow fever vaccine hesitancy among parents and caregivers of children under 5

A significant proportion of parents and caregivers 148 (47.9%), nearly half of the sample exhibited yellow fever vaccine hesitancy. Main reasons for hesitancy were lack of knowledge about yellow fever vaccination and inconsistent vaccine availability within the community. These findings align with earlier research by Facciola et al (2019) which pointed out insufficient knowledge and negative perceptions as key factors behind parental decisions to vaccinate children. Despite relatively high levels of general awareness, results suggest that misinformation may still play a substantial role in shaping vaccination behaviors.

5.3 Knowledge levels of parents and caregivers of children under 5

The study revealed that 37.5% of parents and caregivers had good knowledge about the disease and its vaccine. Although awareness of the disease and understanding that vaccines can prevent it were high, knowledge of symptoms and transmission was generally low. These findings are consistent with a study in South Omo area, Southern Ethiopia (Legesse et al., 2018), where 36.1% of respondents were found to be knowledgeable about yellow fever. This suggests that simply being aware of vaccines doesn't guarantee a thorough understanding of vaccines, potentially influencing vaccination choices.

5.4 Attitudes of parents and caregivers of children under 5 towards yellow fever vaccines

Parental attitudes showed a mix of confidence and concern. About 70.9% of respondents believed the vaccine was important, 76.1% reported having no concerns, 50.2% expressed high confidence in vaccine safety, and 68.6% reported trusting healthcare workers. The findings are consistent with a study in Ghana where 80% of household heads surveyed had positive attitudes to yellow fever vaccination (Inusah et al., 2023). While these findings indicate generally positive attitudes, a significant proportion of respondents still reported concerns and mistrust. These results align with an online survey Kassi et al. (2022) where several participants expressed low trust in medical vaccines. This stresses the need for more specific interventions to boost public confidence and resolve persistent uncertainties surrounding vaccine safety and effectiveness.

5.5 Access to yellow fever vaccines among parents and caregivers of children under 5

Access to vaccination services continues to be a significant hurdle. In this study, nearly a third of respondents (31.7%) reported difficulty accessing vaccines, while a much smaller proportion (22.7%) found it very easy. This suggests that factors like the distance to vaccination sites, limited vaccine availability, and infrequent community outreach likely contribute to these difficulties. Our regression analysis further supports this, indicating that barriers to vaccine access and the frequency of vaccine availability in the community are strong predictors of yellow fever vaccine hesitancy. This aligns with research by Bedford et al. (2018) who observed that low vaccination rates are often a result of access related issues than outright refusal. Increased frequency of vaccine availability was associated with reduced vaccine hesitancy among parents and caregivers of children under 5. Parents and caregivers in communities where vaccines were more regularly available were 14.5% less likely to exhibit hesitancy suggesting that consistent and visible vaccination opportunities may build public confidence and reduce yellow fever vaccine hesitancy.

5.6 Summary of predictors of vaccine hesitancy

Multivariable logistic regression confirmed that barriers to access, vaccine availability in the community, and frequency of vaccine availability (mass campaigns) were the strongest independent predictors of yellow fever vaccine hesitancy. Other variables did not significantly predict yellow fever vaccine hesitancy in the adjusted model. These findings emphasize the importance of addressing practical and contextual barriers over entirely focusing on knowledge based interventions.

CHAPTER 6: LIMITATIONS, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the key limitations, conclusion and provides recommendations based on the findings.

6.2 Limitations

This study had some limitations that should be considered when interpreting findings. These are explained below.

The study used a purely quantitative cross sectional design which restricted a deeper contextual understanding of the lived experiences, perceptions, and decision making processes of parents and caregivers regarding yellow fever vaccine hesitancy.

Yellow fever vaccine was recently introduced into Uganda's routine childhood immunization schedule in 2022. With this, the observed vaccine hesitancy among parents and caregivers is likely to reflect early implementation dynamics, particularly among children born before the introduction of the vaccine into the routine schedule and those who may have missed the recent mass vaccination campaign.

The sample size determination and sampling relied on population estimates derived from the 2014 national census. Although a more recent national census was conducted in 2024, detailed disaggregated data up to parish and sub-county levels was not yet publicly available at the time of this study. Changes in population dynamics such as growth and migration over time may have introduced slight deviations from current population realities, potentially affecting representativeness.

There is a possibility of misclassification bias in defining vaccine hesitancy. In this study, all parents and caregivers of children aged nine months and above who had not received the yellow fever vaccine at the time of data collection were classified as 'hesitant,' as long as

their children were 9 months of age. This was regardless of whether non-vaccination resulted from refusal or delay.

Recall bias may have affected the accuracy of responses, particularly among parents and caregivers who were unable to present vaccination cards, requiring reliance on self-reported vaccination history. Although research assistants were trained and administered the questionnaire in both English and Luganda where necessary, self-reporting may still have introduced minor inaccuracies due to imperfect recall or social desirability bias.

As noted, some of the factors were significant in the bivariate analysis but non-significant in the multivariate analysis and these included village of residence, parental awareness of yellow fever, knowledge levels, sources of information, concerns about vaccines, confidence in vaccine safety, trust in healthcare workers. There is need to study these further given that have some level of association with yellow fever vaccine hesitancy.

Lastly, the study was conducted in a single parish within the district, which limits the generalizability of the findings to other settings. Vaccine hesitancy patterns may vary across parishes due to differences in access to health services, infrastructure, and socio-cultural factors.

6.3 Conclusions

6.3.1 Prevalence of yellow fever vaccine hesitancy among parents and caregivers of children under 5.

Yellow fever vaccine hesitancy stood at 47.9%, indicating that nearly half of the surveyed parents exhibited delay or reluctance in vaccinating their children. The key self-reported reasons included lack of knowledge on yellow fever vaccinations, and limited vaccine availability in communities among others. This calls for more vaccine accessibility at community level through channels such as increased and consistent number of immunization days in the villages, disseminating more vaccination related information and material

through trusted sources such as radios, TVs, cultural and religious leaders among others to address some of the knowledge gaps.

6.3.2 Knowledge and awareness

The study found that while awareness of yellow fever was relatively high, knowledge about symptoms, complications, and transmission was limited. Only 37.5% of respondents demonstrated good knowledge. Although most parents knew that vaccination could prevent yellow fever, this knowledge did not independently predict yellow fever vaccine hesitancy, suggesting that awareness alone is not sufficient to reduce vaccine hesitancy.

6.3.3 Attitudes toward vaccination

Parental attitudes were generally positive, with the majority recognizing the importance of vaccination and expressing confidence in vaccine safety and trust in healthcare workers. However, a significant portion of the population still had doubts and concerns, which could contribute to yellow fever vaccine hesitancy. These attitudinal gaps underline the need for more personalized, trust-building communication from community and all relevant health authorities.

6.3.4 Access and structural barriers

Access related issues were the most significant predictors of yellow fever vaccine hesitancy in our parish of study. Logistic regression revealed that barriers to vaccine access, inconsistent availability, and frequency of vaccines in the community significantly influenced parents' decisions to vaccinate their children. Increasing the number of consistent vaccination points in the communities and the frequent use of mobile or outreach immunization services can help reduce access barriers in the villages.

6.4 Contribution of the study

The study made some contributions by providing information on the prevalence and some of the key factors for yellow fever vaccine hesitancy among parents and caregivers of children under 5, in a parish in Mukono district central Uganda.

6.5 Recommendations

6.5.1 Strengthen community-based access to vaccines

Increase the availability and regularity of yellow fever vaccines within local communities through outreach services. This can be ensured by the government's Ministry of Health (MoH) in line with the district health office and other relevant stakeholders.

6.5.2 Enhance targeted health education

Ensure that vaccine related messages are simplified, culturally relevant to build and improve awareness of the disease, its symptoms, vaccine benefits, and risks of non-vaccination. At grass root level, these messages can be passed on through short messaging services (SMS) and the village health teams (VHTs) since they are trusted and they reach the most people in their communities. Communities should be involved in the design of these messages (co-design).

6.5.3 Address community mistrust in vaccines

Evaluate the design and communication of frequent vaccination campaigns to ensure they are engaging, transparent, and not overwhelming. This can be done through incorporating feedback from the community to improve clarity and encouraging co-design interventions with beneficiary communities so that they easily adopt and own the strategies.

6.5.4 Invest in monitoring and evaluation

Establish a feedback system to track real time parental concerns and attitudes. This can be through the village health teams or health facilities where concerns are forwarded to the district health office and the ministry of health for further review. Such a system would direct policy makers on how best to adjust strategies to reduce hesitancy in communities.

6.6 Suggestions for further research

Future studies should employ qualitative methods to explore deeper into some of the cultural beliefs, fears, and misconceptions surrounding yellow fever vaccine hesitancy (factors that may not be fully captured through quantitative design).

Given the nature of information, particularly through media and other informal networks in the communities, further research is needed to assess how these channels influence individual perception and decision-making regarding childhood vaccination.

To enhance generalizability and uncover regional variations, similar studies should be conducted in other yellow fever endemic regions, districts and countries, allowing for comparative analysis of trends and determinants of vaccine hesitancy.

Given that the yellow fever vaccine was introduced into the routine immunization schedule in 2022, in Uganda, the observed high prevalence of vaccine hesitancy may largely be a reflection of parents and caregivers of children born before 2022. Further studies are therefore needed to explore and model vaccine hesitancy across different birth cohorts (both pre and post introduction of the vaccine into the routine schedule) to better understand how timing of vaccine introduction influences yellow fever vaccine hesitancy among parents and caregivers of under 5s.

Investigating the process, extent and impact of community engagement in the design, development, and delivery (co-design) of immunization or vaccine campaigns could shed more light on its potential to reduce vaccine hesitancy.

Additional research is needed to explore individual level barriers to vaccination including social economic factors, health literacy, or trust in health systems that may not have been fully addressed in the study.

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Appendix 1: Research work plan

Activities	Period in Months				
	May to September 2024	October 2024	November to December 2024	January to February 2025	March to June 2025
Proposal writing & approval					
Questionnaire Design					
Pre-test of tools					
Data collection and analysis					
Draft report writing, & Final submission to the university					

Appendix 2: Budget estimate

Item	Total cost (UGX)	Justification
Transport & logistics for data collection	4,200,000	7 Research Assistants collecting the data in 5 days (minimum of 9 households each).
Stationery (printing, photocopying of questionnaires).	300,000	Printing & photocopying of questionnaires, and proposal for submission.
Internet & airtime	200,000	Airtime & internet - monthly bundles.
Data analysis	1,000,000	Support with data analysis
Contingency	300,000	
<u>Total</u>	<u>6,000,000</u>	

Appendix 3: Questionnaire



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STUDY QUESTIONNAIRE.

Study Title: Yellow fever vaccine hesitancy; A study among parents & caregivers of children below 5 years of age.

Study No: _____ (Should match with the one on the consent form).

Research Assistant Name: _____ **Signature:** _____

Village: _____

Date: _____

Consent signed & dated: ☐ Yes ☐ No (tick one).

A: Demographic Information.

1. Gender of parent/caregiver.

☐ Male

☐ Female

2. Age of parent/caregiver.

☐ 18-24 years ☐ 25-34 years ☐ 35-44 years ☐ 45-54 years ☐ 55 years and above

3. Education level of parent/caregiver.

☐ No formal education ☐ Primary education ☐ Secondary education ☐ Tertiary education
(College/University)

4. Occupation of parent/caregiver.

☐ Unemployed/stay at home ☐ Farmer ☐ Business/Trader ☐ Formal employment

5. Number of children under 5 years.

☐ 1

☐ 2

☐ 3

☐ 4 or more

B: Vaccination status (per child).

For each child, please provide the following information.

Child 1

6. Has this child been vaccinated against yellow fever?

☐ Yes

☐ No

7. If NO, what is the reason for not vaccinating? (Main reason).

☐ Lack of
knowledge about
yellow fever

☐ Concerns about
vaccine safety or
side effects

☐ Vaccine not
available

☐ Religious
or cultural
beliefs

☐ Other (please
specify below)

Child 2

8. Has this child been vaccinated against yellow fever?

☐ Yes

☐ No

9. If NO, what is the reason for not vaccinating? (Select the main reason).

☐ Lack of
knowledge about
yellow fever

☐ Concerns about
vaccine safety or
side effects

☐ Vaccine not
available

☐ Religious or
cultural beliefs

☐ Other (please
specify below)

Child 3

10. Has this child been vaccinated against yellow fever?

☐ Yes

☐ No

11. If NO, what is the reason for not vaccinating? (Select the main reason).

☐ Lack of knowledge about yellow fever
☐ Concerns about vaccine safety or side effects
☐ Vaccine not available
☐ Religious or cultural beliefs
☐ Other (please specify below)

Child 4

12. Has this child been vaccinated against yellow fever?

☐ Yes

☐ No

13. If NO, what is the reason for not vaccinating? (Select the main reason).

☐ Lack of knowledge about yellow fever
☐ Concerns about vaccine safety or side effects
☐ Vaccine not available
☐ Religious or cultural beliefs
☐ Other (please specify below)

C: Knowledge and Awareness.

14. Are you aware of the existence of yellow fever as a disease?

☐ Yes

☐ No

15. How would you rate your knowledge of yellow fever symptoms and complications?

☐ High

☐ Moderate

☐ Low

☐ None

16. Are you aware of how yellow fever is transmitted?

☐ Yes

☐ No

17. Do you know that vaccination can prevent yellow fever?

☐ Yes

☐ No

18. From which source(s) did you learn about yellow fever and vaccination? (select more than one)

☐ Healthcare
workers

☐ Family/friends

☐ Media (TV,
radio,
newspapers)

☐ Social media

☐ Other (please
specify below)

D: Attitudes and Perceptions.

19. How important do you think yellow fever vaccination is for preventing the disease?

☐ Very important

☐ Somewhat important

☐ Not important

20. Do you have concerns about the side effects or risks of the yellow fever vaccine?

☐ Yes

☐ No

21. If YES, to what extent are you concerned?

☐ Very concerned

☐ Moderately concerned

☐ Slightly concerned

☐ Not concerned

22. How confident are you in the safety and effectiveness of the yellow fever vaccine?

☐ Very confident

☐ Somewhat confident

☐ Not confident

23. How strongly do you agree with the statement: "Vaccinating children against yellow fever is beneficial?"

☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

24. How much do you trust the advice of healthcare workers regarding yellow fever vaccination?

☐ Completely trust ☐ Somewhat trust ☐ Do not trust

E: Access to vaccination services.

25. How easy is it for you to access yellow fever vaccination services in your community?

☐ Very easy ☐ Easy ☐ Difficult ☐ Very difficult

26. Are yellow fever vaccines available in your community?

☐ Yes ☐ No

27. If NO, what is the main barrier to accessing the yellow fever vaccine? (Main barrier).

☐ Distance to health facility ☐ Lack of vaccine supply ☐ Cost of vaccination ☐ Other (please specify below)

28. How frequently are yellow fever vaccines offered in your community?

☐ Always available ☐ Available sometimes ☐ Rarely available ☐ Not available

Any other remarks:

Appendix 4: Consent form



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Participant ID: _____

Title: **Yellow fever vaccine hesitancy: A study among parents of children below 5 years of age in Kyetume parish, Uganda.**

Introduction: My name is Edwin Bakiza, a Master of Public Health student at Uganda Christian University (UCU). I'm conducting research on yellow fever vaccine hesitancy among parents and caregivers of children between 12 months and 5 years of age in Kyetume parish, Mukono, Uganda.

Invitation to participate: I invite you to participate in this study and answer questions about your child (or children's) yellow fever vaccination. There is no cost for you to participate, and you will not receive any monetary compensation.

What to expect: The interview will be confidential and your name and any other identifying information will not be shared in the research findings. You can ask questions throughout the interview and you are free to decline participation or even withdraw at any time during the interview.

Benefits: This study aims to improve understanding of yellow fever vaccine hesitancy and the findings may be used to develop intervention programs to increase vaccination rates. There are no anticipated risks associated with participating in this interview.

Confidentiality: All information collected will be kept confidential.

Sharing of findings: The research findings will be shared with my supervisor, and the university.

Contact information: If you have any questions or concerns please contact me on telephone +256 777167 291 or email: edwinbakiza@gmail.com

Consent: By signing below, you confirm that you have understood this information and you agree to participate in this study voluntarily, well knowing that you can withdraw at any time.

Participants signature	_____	Date	_____
Witness 'signature (for those that cannot read and write)	_____	Date	_____
Researchers signature	_____	Date	_____

Version 1, Oct 24

Appendix 5: REC-clearance letter



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Office of the Vice Chancellor
Research Ethics Committee UG-026



11th November, 2024

EDWIN BAKIZA

Uganda Christian University

+256 777167 291

Email: edwinbakiza@gmail.com

UG-REC-026 APPROVAL NOTICE

To: Edwin Bakiza, Principal Investigator

Re: UCU-REC Application titled: *Understanding Yellow Fever Vaccine Hesitancy: A Study Among Parents And Caregivers Of Children Below 5 Years In Kyetume, Mukono - Uganda..*

Application Number: UCUREC-2024-1059

Version: 4.1

Type: ☐ INITIAL REVIEW
☐ Protocol Amendment
☐ Letter Of Amendment (Loa)
☐ Continuing Review
☐ Material Transfer Agreement
☐ Other, Specify:



I am pleased to inform you that the **UG-REC-026**; UCUREC approved the above referenced application.

Approval of the research is for the period from **11th November, 2024**, to **11th November, 2025**

This research is considered minimal risk category.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and additions to the protocol or the consent form must be submitted to the REC for re-review and approval prior to the activation of the changes. The REC application number assigned to the research should be cited in any correspondence.

1 of 2

Research and Ethics

P.O. Box 4, Mukono, Uganda, Plot 67-173, Bishop Tucker Road, Mukono Hill
Tel: +256 (0) 312 350 885 Fax: +256 (0) 4142 90 800 Email: rec@ucu.ac.ug Web: www.ucu.ac.ug
UCUREC is accredited by Uganda National Council for Science & Technology, FDA, and National Institutes for Health of the United States of America



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Office of the Vice Chancellor
Research Ethics Committee UG-026



3. Reports of unanticipated problems involving risks to participants or other must be submitted to the REC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for REC review.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by subjects and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Regulations require review of an approved study not less than once per 12-month period. **Therefore, a continuing review application must be submitted to the REC eight weeks prior to the above expiration date of 11th November, 2025 in order to continue the study beyond the approved period.** Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study, at which point new participants may not be enrolled and currently enrolled participants must be taken off the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. Your research details have been shared with the Executive secretary of Uganda National Council for Science and Technology (UNCST) and you are **not** required to get clearance since you are a Master's Degree research. Refer to UNCST Research registration and clearance Policy and guidelines (July 2016) in Uganda section 6(e).

The following is the list of all documents approved in this application by UG-REC _026:

	Document Title	Language	Version	Version Date
1.	Protocol	English	1.0	2024-10-04
2	Questionnaires	English	1.0	2024-10-04
3	Informed Consent Form	English	1.0	2024-10-04

Signed and Stamped

Prof. Peter Waiswa.
UCUREC Chairperson,
pwaiswa@musph.ac.ug



2 of 2

Research and Ethics

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