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ORIGINAL RESEARCH

Assessing COVID-19 Pandemic-Era Vaccine Uptake and Adherence to Prevention Measures: A Comparative Analysis Among Men and Women Using Lot Quality Assurance Sampling in Central Uganda

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Aim: This study examined citizens' knowledge and compliance with COVID-19 standard operating procedures (SOPs), vaccine acceptance and hesitancy, and factors that could influence these behaviors.

Methods: The study that utilised the Lot Quality Assurance Sampling (LQAS) approach was conducted in eight districts of Central Uganda; Kiboga, Kyankwanzi, Mubende, Kasanda, Mityana, Luwero, Nakaseke, and Nakasongola districts. Each district was divided into five supervision areas (SAs). Data were collected from 19 respondents per SA, focusing on women aged 15–49 years and men aged 15 years and above. A satisfactory performance for study indicators was determined by the LQAS decision rules.

Results: There was high awareness of COVID-19, with 98.2% of women and 99.3% of men having heard of the pandemic. However, knowledge of at least four COVID-19 preventive measures was low, reported by only 45.4% of women and 48.6% of men. Adherence to social distancing measures in the previous 24 hours was modest, with 67.2% of men and 66.5% of women complying. There was a pronounced lack of hand hygiene, with only 24.8% of women and 19.0% of men frequently washing their hands or using hand sanitizer. COVID-19 vaccine uptake was relatively high for the first dose, with 83.5% of women and 83.0% of men receiving at least one dose. However, full vaccination coverage was low, at 37.5% for women and 41.5% for men. A hesitancy to get vaccinated was driven by fear of side effects, misinformation, doubts about vaccine effectiveness, long distances and queues, and beliefs that vaccines cause infertility.

Conclusion: While awareness of COVID-19 was high, knowledge of preventative measures was lacking. The low vaccination rates highlight barriers to uptake. A tailored, trust-based messaging approach through community leaders was recommended to address these gaps. Inter-district and inter-SA disparities indicated the need for localized interventions.

Keywords: COVID-19, vaccine, vaccination, uptake, hesitancy, standard operating procedure

Background

Adherence to COVID-19 prevention guidelines and vaccination in most low-income countries is challenging due to widespread negative information dissemination.[1–3] A variety of factors influence the adherence to COVID-19 protocols and vaccine acceptance across different populations, resulting in varying uptake rates.[4]

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COVID-19 vaccines became available to a broader range of people over time, beyond those initially targeted by vaccination campaigns in most countries. However, with only 12% COVID-19 full vaccination rates by March 2022, it was estimated that Sub-Saharan Africa would need to increase its vaccination efforts by a factor of six in order to meet its mid-year vaccination targets.[5] COVID-19 vaccination uptake is influenced by acceptance, trust, and willingness to receive vaccines.[6] It has been proposed that in order to promote COVID-19 services response and vaccine uptake, it is necessary to assess the targeted populations' knowledge of ways to reduce the risk of contracting COVID-19, vaccine uptake, willingness and hesitancy to accept vaccination, and the factors influencing such decisions.[2]

The COVID-19 vaccination program began in Uganda on March 3, 2021, nearly five months after the developed world began vaccination, and there has been no assessment of the COVID-19 response or vaccination status throughout the country.[4] The purpose of this community-based survey was to determine adherence to COVID-19 standard operating procedures, the status of COVID-19 vaccination, and the reasons for vaccine acceptance and hesitancy in order to plan interventions to increase COVID-19 vaccine uptake in eight districts in central Uganda. The study also looked into what influenced respondents to accept or reject COVID-19 vaccination. All of this information is intended to guide the districts' ongoing and future COVID-19 and other epidemic response planning of related nature.

The COVID-19 response and vaccination campaign are affected by a variety of factors, some of which are complex based on geographic, cultural, and settlement context, affecting vaccine coverage and other COVID-19 response services.[7] These complex factors influencing the pandemic responses necessitate refining and contextualizing COVID-19 mitigation plans to the specific needs of geographical units identified as underperforming. As a result, evaluating existing response plans and determining the factors influencing response in the targeted communities is critical to informing any evidence-based changes needed to effectively address the pandemic. The Lot Quality Assurance Sampling (LQAS) provides for differentiating between good and poor performance geographical areas, the reason for its choice in this study. This evaluation method was previously used to track the performance of routine immunization and other health services.[8,9] It has also been used to assess factors influencing COVID-19 mitigation in Nigerian communities.[10] This LQAS survey was employed to track the COVID-19 response on the assumption that the COVID-19 pandemic would impact on the HIV/AIDS pandemic response. As a result, Mildmay Uganda found it necessary to strengthen the districts' COVID-19 response in order to avoid losing the gains made in districts where it has been implementing HIV/AIDS response interventions.

Methods

Study Design and Sampling

A cross-sectional community-based household survey was conducted in the districts of Kiboga, Kyankwanzi, Mubende, Kasanda, Mityana, Luwero, Nakaseke, and Nakasongola using the binomial LQAS methods. By combining geographical regions known as sub-counties, town councils (TC), or divisions, we stratified each district into five supervision areas (SAs), yielding 40 SAs (Table 1). The study targeted women aged 15–49 years and men aged 15 years or older (15+ years). Based on the classical LQAS principles[11] with each district stratified into five supervision areas (SAs), a two-

Table 1 The Supervision Areas (SA) for All the 8 Districts

S/N	District	Sub-county (SC)/Town Council (TC)/Division	Supervision Area (SA)
1	Kiboga	Kiboga TC	A
		Kibiga SC, Kapeke SC	B
		Bukomeero TC, Bukomero SC, Kyomya SC	C
		Dwaniro SC, Muwanga SC	D
		Kyekumbya SC, Lwamata TC, Lwamata SC	E

(*Continued*)

Table 1 (Continued).

S/N	District	Sub-county (SC)/Town Council (TC)/Division	Supervision Area (SA)
2	Kyankwanzi	Butemba TC, Byerima SC, Butemba SC	F
		Kyankwanzi TC, Kyankwanzi SC, Bbanda SC	G
		Sirimula SC, Nkandwa SC, Ntwetwe TC, Ntwetwe SC, Gayaza SC	H
		Wattuba SC, Wattuba TC, Mulagi SC, Masodde- Kalagi TC	I
		Bananywa, Ntunda TC, Nsambya SC, Kiryannongo SC, Kigando SC	J
3	Mubende	Mubende MC (Central & East), Bagezza SC	K
		Kasambya TC, Kasambya SC, Kigando SC	L
		Kiyuni SC, Butoloogo SC, Madudu SC	M
		Nabingoola SC, Nabingoola SC, Kibalinga SC	N
		Kitenga SC, Kalonga SC, Kyenda TC	O
4	Kassanda	Bukuya SC, Makokoto SC	P
		Kitumbi SC, Mbirizi SC, Kijuna SC	Q
		Nalutuntu SC, Myanzi SC	R
		Kassanda TC, Kassanda SC, Kilwana SC	S
		Manyogaseka SC, Kiganda SC	T
5	Mityana	Kikandwa, Ssekanyonyi, Busunju TC Namungo	U
		Bulera SC, Kalangaalo SC	V
		Kakindu SC, Malangala SC	W
		Busimbi Division, Ttamu Division, Mityana Central Division	X
		Maanyi SC, Banda SC, Butayunja SC	Y
6	Luwero	Wobulenzi TC, Katikamu SC	Z
		Bamunanika SC, Kikyusa SC, Kamira SC	AB
		Makulubita, Nyimbwa, Bombo TC	AC
		Luwero TC, Butuntumula SC,	AD
		Kalagala SC, Zirobwe SC	AE
7	Nakasongola	Kakooge SC, Kakooge TC	AK
		Wabinyonyi SC, Nakasongola TC	AL
		Kalongo SC, Kalungi SC	AM
		Lwampanga SC, Lwabiyata SC	AN
		Nakitoma SC, Nabiswera SC, Migeera TC	AO

(*Continued*)

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Table 1 (Continued).

S/N	District	Sub-county (SC)/Town Council (TC)/Division	Supervision Area (SA)
8	Nakaseke	Kapeeka SC, Semuto SC, Semuto TC	AF
		Nakaseke SC, Nakaseke TC Kasangombe SC	AG
		Wakyato SC, Butalangu TC,	AH
		Ngoma SC, Ngoma TC, Kinyogoga SC, Kinoni SC	AI
		Kiwoko TC, Kito SC	AJ
Total SAs			**40**

stage sampling plan was used to randomly select 19 villages/interview locations from each SA, yielding a district sample size of 95. A sample of 190 respondents was generated for each district for the two respondent groups, totaling 1,520 respondents for the eight districts.

A random sample of 19 interview locations was drawn from each SA using a probability proportionate to size (PPS) based on projections from the 2014 Uganda population and housing census. This method ensured that the likelihood of sampling a village was proportional to the size of its population. We began by generating a list of villages from each SA, as well as the population of each village, and then calculated the cumulative population. A sampling interval (Si) was obtained by dividing the total SA population by 19 (the SA-level sample size). A random number between 1 and Si was chosen to determine the starting village. To select the second, third, until 19 interview locations in each SA, Si was added to the random number. We used segmentation sampling to identify the random starting point, ie, the reference household, in order to select households in the sampled interview location/village. Segmentation was done by mapping, sub-dividing the village into segments of approximately equal household numbers before randomly selecting one segment. The segmentation process was repeated until selection of a segment with manageable number of households (15-<30) was selected. At this point, the households were listed and a reference household randomly selected. Segmentation was done with the help of a village guide. No interview was conducted in the reference household, but the nearest household to the reference household's front door was identified where the search for eligible respondents (women 15–49 years and men 15+ years) started.

We used a parallel sampling approach to select respondents from the households in a "next nearest" household sequence until two interviews (ie, one questionnaire set) were completed in each interview location. Administering only one questionnaire set in each interview location aids in avoiding clustering and reduces the survey design effect to close to one. To ensure independence and avoid clustering, a new random starting household was selected through re-segmentation for each questionnaire set in villages sampled more than once. Indicators were chosen because they were found to be useful in informing interventions aimed at improving adherence to the COVID-19 standard operating procedures as well as COVID-19 vaccination.

Data Analysis

Data for each indicator was analyzed using percentage coverage and 95% confidence intervals for each district separately, as well as for all the districts combined. SA performance was evaluated by comparing the SA's coverage to the overall coverage estimate for each indicator using the LQAS decision rule (DR). A DR in this study refers to the minimum number of respondents (out of those sampled per SA and per indicator) who have the characteristic of interest (correct responses, eg, received a COVID-19 vaccination) on which the SA is adjudged to have reached average coverage. Any SA whose number of correct responses equals or exceeds the DR is considered to have reached average coverage and thus has acceptable performance in the indicator; otherwise, the opposite is true. An excel spreadsheet and SPSS version 22 were used for the analysis. The Pareto chart was used to identify the common reasons for not vaccinating and those

reasons that made up to at least 80% of all reasons were classified as common. However, we removed the "trivial many" reasons that were clustered under the "other" category in the pareto analysis.

Ethics

The Mildmay Uganda Research and Ethics Committee (MUREC) (reference number REC REF 0804–2018) and the Uganda National Council of Science and Technology (UNCST) approved this study (reference number SS639ES). Informed consent was obtained from respondents who signed or thumb printed the informed consent form as proof of acceptance to participate. Participants' names were not written on any of the data collection tools or mentioned in any report including the manuscript. The study adhered to all Declaration of Helsinki (ethical principles for medical research involving human subjects).[12]

Prior to selection and interviewing minors (those aged below 18 years), written informed consent was obtained from their parents or caregivers were provided with sufficient information about the study objectives, risks and benefits of their children participating in this study, as well as about consent and confidentiality concerns. The parents were also informed of the options for withdrawing their children from the study even after having consented. Following parents' consent to their children participating in the study, the children were explained the study objectives and their rights. Thereafter, assent was obtained from them as well. For the parents who refused their children to participate in the study, such children were replaced.

Results

Characteristics of Respondents

Majority of the respondents, 22.6% of women 15–49 years and 19.1% of men 15+ years were between the ages of 30 and 34. The majority of respondents, 32.1% of women and 29.3% of men had an incomplete primary education as their highest level of education. Table 2 describes the respondents' characteristics.

COVID-19 Related Knowledge, Practice and Vaccination

We assessed COVID-19 knowledge, adherence to COVID-19 social distancing measures in the previous 24 hours, frequency of handwashing with soap and water or use of a hand sanitizer for COVID-19 prevention, and COVID-19 vaccination among women 15–49 years and men 15+ years. COVID-19 vaccination coverage was calculated among women 15–49 years old and men 18+ years old, as COVID-19 vaccination was only available to people over the age of 17 in Uganda at the time of this study. Table 3 summarizes the overall and district-level coverage (percentage) in all COVID-19-related knowledge, practice, and vaccination indicators from the study, while Table 4 presents the SA-level classification of coverage in selected indicators that are eligible for SA-level classification.

Knowledge of Ways to Reduce the Risk of Contracting COVID-19

Only 45.4% (95% CI: 41.9–49.0) of women and 48.6% (95% CI: 45.0–52.1) of men could name at least four ways to reduce the risk of contracting COVID-19. Across districts, women generally lagged behind men in understanding COVID-19 risk reduction measures. There were significant gender and district-level disparities in knowledge. For women, the percentage who could name at least four risk reduction methods varied from 23.5% (95% CI: 14.8–32.2) in Nakaseke to 68.0% (95% CI: 58.4–77.6) in Kyankwanzi and Nakasongola. Similarly, among men aged 15+, the lowest proportion was in Nakaseke (16.2%; 95% CI: 8.6–23.7) and the highest in Kyankwanzi (72.8%; 95% CI: 63.7–81.9). Districts with below-average coverage of individuals who knew at least four risk reduction methods were Luwero, Mubende, and Nakaseke for women, and Luwero, Mityana, and Nakaseke for men. Notably, Luwero and Nakaseke districts showed below average coverage for both genders for this indicator.

The findings from Table 4 regarding the classification of supervision areas regarding knowledge of at least four or more ways to reduce COVID-19 risk reveal significant gaps in knowledge about COVID-19 risk reduction measures across various districts. In Kyankwanzi, Kasanda and Mityana, one out of every five "SAs" lacked awareness of at least four recommended ways to reduce COVID-19 risks. Similarly, in Kiboga, two out of every five "SAs" had insufficient

Table 2 Characteristics of the Respondents

Categories		Overall		Kasanda		Kiboga		Kyankwanzi		Luwero		Mityana		Mubende		Nakaseke		Nakasongola	
		Women 15–49 Years	Men 15+ Years	Women 15–49 years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years
Age category (years)	<20	3.4%	4.9%	0.0%	3.2%	7.4%	1.1%	0.0%	3.2%	3.2%	5.3%	6.3%	9.5%	1.1%	3.2%	4.3%	5.3%	3.2%	8.4%
	20–24	14.8%	12.9%	6.3%	9.5%	8.4%	10.5%	15.8%	15.8%	18.3%	7.4%	25.3%	21.1%	14.7%	11.6%	12.9%	11.6%	17.0%	15.8%
	25–29	21.4%	12.9%	23.2%	9.5%	23.2%	15.8%	21.1%	15.8%	25.8%	15.8%	16.8%	9.5%	15.8%	13.7%	25.8%	12.6%	20.2%	10.5%
	30–34	22.6%	19.1%	31.6%	17.9%	22.1%	27.4%	25.3%	11.6%	20.4%	17.9%	19.0%	22.1%	19.0%	26.3%	23.7%	13.7%	20.2%	15.8%
	35–39	13.6%	14.3%	10.5%	23.2%	16.8%	16.8%	23.2%	20.0%	9.7%	12.6%	10.5%	7.4%	19.0%	14.7%	8.6%	6.3%	9.6%	13.7%
	40–44	14.6%	12.4%	21.1%	13.7%	8.4%	8.4%	12.6%	16.8%	10.8%	13.7%	17.9%	8.4%	16.8%	9.5%	15.1%	13.7%	14.9%	14.7%
	45–49	9.6%	8.6%	7.4%	13.7%	13.7%	10.5%	2.1%	9.5%	11.8%	7.4%	4.2%	5.3%	13.7%	8.4%	9.7%	6.3%	14.9%	7.4%
	50+	–	15.0%		9.5%	–	9.5%	–	7.4%	–	20.0%	–	16.8%	–	12.6%	–	30.5%	–	13.7%
Education status	A-level	4.1%	6.3%	4.1%	2.1%	3.2%	10.5%	2.1%	2.1%	4.3%	8.4%	8.4%	12.6%	5.3%	6.3%	7.5%	5.3%	0.0%	3.2%
	Complete primary	27.4%	28.6%	1.1%	27.4%	24.2%	30.5%	20.0%	24.2%	21.5%	22.1%	48.4%	49.5%	15.8%	21.1%	30.1%	25.3%	27.7%	28.4%
	Functional adult literacy	0.5%	0.7%	32.6%	1.1%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	2.1%	1.1%	2.1%	0.0%	0.0%
	Incomplete primary	32.1%	29.3%	0.0%	36.8%	36.8%	25.3%	41.1%	30.5%	23.7%	26.3%	13.7%	17.9%	39.0%	28.4%	22.6%	30.5%	46.8%	39.0%
	Never attended	8.4%	5.8%	32.6%	6.3%	7.4%	6.3%	13.7%	5.3%	4.3%	4.2%	2.1%	0.0%	15.8%	11.6%	7.5%	11.6%	2.1%	1.1%
	O-level	20.3%	22.9%	14.7%	23.2%	25.3%	21.1%	20.0%	31.6%	28.0%	29.5%	17.9%	13.7%	10.5%	20.0%	29.0%	17.9%	19.2%	26.3%
	Post-secondary	3.8%	3.0%	12.6%	0.0%	0.0%	3.2%	2.1%	3.2%	18.3%	8.4%	1.1%	2.1%	5.3%	3.2%	2.2%	4.2%	2.1%	0.0%
	Vocational training	3.3%	3.4%	0.0%	3.2%	3.2%	3.2%	0.0%	3.2%	0.0%	1.1%	8.4%	4.2%	6.3%	7.4%	0.0%	3.2%	2.1%	2.1%

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Table 3 Overall and District-Level Coverage in COVID-19 Indicators

Indicator	Overall	Kiboga	Kyankwanzi	Mubende	Kasanda	Mityana	Luwero	Nakaseke	Nakasongola
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Proportion of women 15–49 years who have heard about the COVID-19 pandemic	98.2% (97.3–99.2)	100.0% (100–100)	98.5% (96.1–101.0)	100.0% (100–100)	98.2% (95.5–100.9)	98.6% (96.1–101.0)	100.0% (100–100)	91.2% (85.4–97.0)	94.4% (89.7–99.1)
Proportion of men 15+ years who have heard about the COVID-19 pandemic	99.3% (98.7–99.9)	100.0% (100–100)	99.0% (96.9–101.0)	100.0% (100–100)	98.9% (96.7–101.0)	97.5% (94.4–100.7)	100.0% (100–100)	99.4% (97.7–101.0)	100.0% (100–100)
Proportion of women 15–49 years who know at least 4 ways / measures that reduce the risk of contracting corona virus	45.4% (41.9–49.0)	55.9% (45.8–66.1)	68.0% (58.4–77.6)	35.6% (25.8–45.4)	52.9% (42.7–63.1)	59.1% (49.0–69.2)	25.8% (16.7–34.9)	23.5% (14.8–32.2)	68.0% (58.4–77.6)
Proportion of men 15+ years who know at least 4 ways / measures that reduce the risk of contracting corona virus	48.6% (45.0–52.1)	51.4% (41.1–61.6)	72.8% (63.7–81.9)	50.4% (40.2–60.7)	60.4% (50.4–70.5)	47.4% (37.1–57.6)	39.2% (29.2–49.2)	16.2% (8.6–23.7)	58.3% (48.2–68.4)
Proportion of women 15–49 years who report to have adhered to social distancing standards during the last 24 hours	67.2% (63.9–70.6)	61.2% (51.3–71.2)	48.1% (37.9–58.3)	59.4% (49.4–69.5)	72.0% (62.9–81.2)	69.4% (60.0–78.9)	76.6% (67.9–85.4)	71.8% (62.5–81.0)	72.3% (63.1–81.5)
Proportion of men 15+ years who report to have adhered to social distancing standards during the last 24 hours	66.5% (63.1–69.9)	51.5% (41.3–61.8)	38.1% (28.2–48.1)	60.3% (50.3–70.3)	76.4% (67.7–85.1)	71.3% (62.0–80.5)	77.2% (68.6–85.8)	71.3% (62.1–80.6)	67.5% (57.9–77.1)
Proportion of women 15–49 years who frequently (at least 6 times) washed their hands with water and soap or used hand sanitiser during the last 24 hours	24.8% (21.7–27.9)	21.7% (13.2–30.1)	29.3% (20.0–38.6)	14.1% (7.0–21.3)	19.7% (11.5–27.8)	30.0% (20.6–39.4)	31.8% (22.1–41.4)	24.9% (16.1–33.8)	28.2% (18.9–37.5)
Proportion of men 15+ years who frequently (at least 6 times) washed their hands with water and soap or used hand sanitiser during the last 24 hours	19.0% (16.2–21.8)	19.0% (11.0–27.0)	19.2% (11.1–27.2)	7.1% (1.8–12.4)	12.8% (5.9–19.6)	24.2% (15.5–33.0)	26.4% (17.4–35.4)	19.7% (11.6–27.9)	24.8% (16.0–33.6)
Proportion of women 15–49 years who have received at least 1 dose of COVID-19 vaccination	83.5% (80.8–86.1)	93.7% (88.7–98.8)	92.1% (86.6–97.6)	88.7% (82.2–95.2)	73.5% (64.4–82.5)	88.3% (81.7–95.0)	91.4% (85.6–97.2)	54.1% (43.7–64.5)	69.8% (60.4–79.3)
Proportion of men 15+ years who have received at least 1 dose of COVID-19 vaccination	83% (80.0–85.0)	90% (84–96)	87% (80–94)	88% (81–95)	74% (65–83)	93% (87–98)	82% (74–90)	61% (51–71)	76% 4(67–85)
Proportion of women 15–49 years who have received complete dose of COVID-19 vaccination based on vaccine type	37.5% (34.0–41.0)	41.3% (31.0–51.5)	43.5% (33.4–53.7)	32.5% (22.9–42.1)	21.7% (13.3–30.2)	56.1% (45.8–66.3)	38.2% (28.1–48.3)	23.4% (14.6–32.3)	42.1% (32.0–52.3)
Proportion of men 15+ years who have received complete dose of COVID-19 vaccination based on vaccine type	41.5% (37.9–45.0)	51.7% (41.4–61.9)	50.7% (40.4–60.9)	33.9% (24.1–43.6)	28.7% (19.3–38.1)	64.8% (54.8–74.8)	33.1% (23.4–42.7)	31.7% (22.1–41.3)	47.8% (37.3–58.4)

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Table 4 COVID-19 Indicator Coverage Classified at the SA-Level: Red for Correct Responses < DR (Below Coverage), Green for Correct Responses ≥ DR (Average or Above Coverage)

COVID-19 indicators		Women 18–49 years				Men 18+ years			
		Know 4+ ways to reduce COVID-19 risk	Adhered to social distancing in the last 24h	Washed their hands or used sanitizer ≥6 times in the last 24h	Completed COVID-vaccination	Know 4+ ways to reduce COVID-19 risk	Adhered to social distancing in the last 24h	Washed their hands or used sanitizer ≥6 times in the last 24h	Completed COVID-vaccination
District	Average (%)	45.4%	67.2%	24.8%	37.5%	48.6%	66.5%	19.0%	41.5%
	SA	DR=7	DR=11	DR=2	DR=5	DR=7	DR=11	DR=1	DR=6
Kasanda	P	10	10	2	3	10	12	2	6
	Q	5	11	4	3	10	13	4	8
	R	12	16	6	2	14	14	2	7
	S	10	14	4	8	10	15	2	2DR=5
	T	15	18	2	2	15	19	2	5
Kiboga	A	11	15	6	9	5	5	6	12
	B	19	19	8	3	19	18	7	10
	C	12	2	1	9	9	2	0	4
	D	1	2	2	12	3	1	4	12
	E	5	17	2	8	6	17	0	12
Kyankwanzi	F	12	8	7	6	17	4	7	11
	G	15	10	4	11	14	10	2	11
	H	12	8	5	10	15	7	2	7
	I	16	12	6	8	14	8	5	11
	J	12	9	5	8	10	9	2	10
Luwero	AB	6	19	6	4	3	16	6	7
	AC	8	11	4	6	7	14	2	6
	AD	3	16	5	6	8	15	5	8
	AE	5	12	5	12	9	13	8	7
	Z	4	16	10	6	9	16	4	3
Mityana	U	6	10	6	9	7	11	4	10
	V	13	14	4	8	6	13	1	9
	W	11	15	9	16	13	17	10	19
	X	16	13	6	12	11	12	6	13
	Y	9	16	4	8	9	18	3	10DR=5

(*Continued*)

Table 4 (Continued).

COVID-19 indicators		Women 18–49 years				Men 18+ years			
		Know 4+ ways to reduce COVID-19 risk	Adhered to social distancing in the last 24h	Washed their hands or used sanitizer ≥6 times in the last 24h	Completed COVID-vaccination	Know 4+ ways to reduce COVID-19 risk	Adhered to social distancing in the last 24h	Washed their hands or used sanitizer ≥6 times in the last 24h	Completed COVID-vaccination
Mubende	K	6	13	6	7	8	12	3	7
	L	5	14	1	4	10	14	1	6
	M	4	14	3	5	6	13	2	5
	N	9	5	1	8	10	10	0	7
	O	13	8	2	8	18	6	0	8
Nakaseke	AF	1	16	2	2	0	14	1	4
	AG	6	14	4	7	3	16	4	9
	AH	8	9	9	7	5	7	8	9
	AI	10	17	14	0	8	16	9	3
	AJ	3	5	2	8DR=4	6	8	3	6
Nakasongola	AK	13	16	3	5	9	11	3	5
	AL	13	14	9	9	11	18	6	12
	AM	11	11	7	5	9	8	7	7
	AN	14	11	2	12	14	10	3	13
	AO	13	15	7	8	12	16	6	5

knowledge, while in Mubende and Nakaseke, three out of five "SAs" faced the same issue. The majority of "SAs", specifically four out of five in Luwero district did not meet the DR. Consequently, less than half of the participants residing in these "SAs" were acquainted with adequate COVID-19 risk reduction strategies. However, it is notable that the remaining "SAs" did meet the decision rule (DR), representing at least 50.0% coverage. For men aged 15 and above, the situation was particularly concerning. In Luwero, Mityana, and Mubende districts, one out of four "SAs" failed to achieve the required DR. In Kiboga, it was three out of five while it was four out of the five "SAs" in Nakaseke. In all these "SAs" where the decision rule was not attained, less than 50.0% of men aged 15 and above were knowledgeable about adequate COVID-19 risk reduction measures.

Adherence to COVID-19 Social Distancing Measures During the Last 24 hours

Women aged 15–49 years and men aged 15+ years were asked if they had had direct contact with anyone who was not staying with them in the previous 24 hours (spent more than one minute within two meters of someone or touching, including shaking hands, hugging, kissing, or touching the shoulder). Those who answered "no" were classified as following the COVID-19 social distancing measure. Table 3 shows that 67.2% (95% CI: 63.9–70.6) of women and 66.5% (95% CI: 63.1–69.9) of men reportedly adhered to the COVID-19 social distancing measures in the 24 hours preceding the survey. In Kyankwanzi district, the proportions of women 15–49 years (48.1% (95% CI: 37.9–58.3) and men 15+ years (38.1% (95% CI: 28.2–48.1) who adhered to COVID-19 social distancing measures were (each) lowest. Coverage of women 15–49 years and men 15+ years who adhered to COVID-19 social distancing measures during the 24 hours preceding the survey was lower than the average coverage in the districts of Kiboga (61.2%, 51.5%),

Kyankwanzi (48.1%, 38.1%), and Mubende (59.4%, 60.3%). In the Luwero district, social distancing was most frequent among both women (76.6% (95% CI: 67.9–85.4) and men (77.2% (95% CI: 68.6–85.8) (Table 3).

For women aged 15–49 years, Table 4 shows that one out of the five "SAs" in Kasanda and Mityana, two of the SAs in Mubende, Kiboga and in Nakaseke, and four out of the five "SAs" in Kyankwanzi, did not meet the DR of 11, implying that less than 67.2% of women 15–49 years in these SAs reported adhering to COVID-19 social distance standards in the 24 hours preceding the survey. The remaining SAs met the DR and thus had at least 70.0% coverage. Among men aged 15+ years, One out of the five "SAs" in Mityana, two out of five SAs in Nakaseke, Mubende and in Nakasongola, three out of five SAs in Kiboga, and four out of the five "SAs" in Kyankwanzi did not achieve the DR of 11. This implies that less than 70.0% of men 15+ years in these "SAs" reported adhering to COVID-19 social distancing standards. The remaining SAs met the DR and thus had at least 70.0% coverage.

COVID-19 Related Handwashing or Use of Hand Sanitiser

A respondent was considered to have frequently washed hands if s/he reported to have washed hands with water and soap or used a hand sanitiser at least 6 times during the 24 hours preceding the survey. Handwashing frequently was very low generally and in the districts among the women 15–49 years. Only 24.8% of the women (95% CI: 21.7–27.9; range: 14.1% [Mubende] – 31.8% [Luwero]) and 19.0% (95% CI: 16.2–21.8, range: 7.1% [Mubende] – 26.4% [Luwero]) of men frequently washed their hands or used a hand sanitizer during the 24 hours preceding the survey. Overall handwashing frequency was low among women 15–49 years and men 15+ years though some SAs exhibited even a poorer coverage. Whereas all the SAs should be prioritized for improvement, more effort should be put on SAs that did not attain the DR as in Table 4. The poorest of the poor performing SAs regarding handwashing or use of a hand sanitizer among women include; C in Kiboga district, and SAs L and N in Mubende district. Among the men 15+ years, SAs C and E in Kiboga district, and N and O in Mubende district fell short of the DR.

COVID-19 Vaccination

COVID-19 vaccination coverage exhibits a notable disparity between initial dose administration and series completion. Among women aged 15–49 years, 83.5% (95% CI: 80.8–86.1) received at least one dose, while men aged 18+ years showed a similar trend at 83.0% (95% CI: 80.0–85.0). However, the proportion of individuals completing the recommended vaccine series (1 dose for Johnson and Johnson, 2 doses each for AstraZenecca, Pfizer, Sputnik V and Moderna) was significantly lower, at 37.5% (95% CI: 34.0–41.0) among women and 41.5% (95% CI: 37.9–45.0) among men. Geographic disparities in vaccination completion were observed, with Kasanda district reporting the lowest coverage estimates at 21.7% (95% CI: 13.3–30.2) among women aged 15–49 years and 28.7% (95% CI: 19.3–38.1) among men aged 18+ years. In contrast, Mityana district achieved the highest coverage, with 56.1% (95% CI: 45.8–66.3) of women aged 15–49 years fully vaccinated. Among men aged 18+ years, Kiboga, Kyankwanzi, and Mityana districts reported completion rates exceeding 50%, at 51.7% (95% CI: 41.4–61.9), 50.7% (95% CI: 40.4–60.9), and 64.8% (95% CI: 54.8–74.8), respectively (Table 3).

Vaccination coverage disparities were observed in various Supervision Areas (SAs) among women aged 15–49 years. In Kiboga, Luwero, and Mubende districts, only three out of five SAs achieved the Decision Rule (DR) of 5, resulting in vaccination coverage of less than 40.0% among women in this age group. In contrast, Nakaseke and Kasanda districts had two and three SAs, respectively, that failed to attain the DR, yielding comparable coverage rates. Conversely, the remaining SAs in these districts achieved the DR, corresponding to vaccination coverage of at least 40.0% (Table 4). Similarly, among men aged 15+ years, vaccination coverage gaps were evident. In Kiboga, Luwero, and Mubende districts, one out of five SAs, and in Kasanda, Nakaseke, and Nakasongola districts, two out of five SAs, failed to reach the DR of 6, resulting in vaccination coverage of less than 45.0% among men in this age group. The remaining SAs in these districts achieved the DR, corresponding to vaccination coverage of at least 45.0% (Table 4).

Reasons for Not Getting Vaccinated

The reasons behind non-vaccination against COVID-19 among women aged 15–49 years and men aged 15+ years who reported never having received a COVID-19 vaccine were investigated. The responses, summarized in Table 5, revealed distinct patterns of reasons for non-vaccination among the men and women. Figures 1 and 2 illustrate the cumulative

Table 5 Reasons Why Women 18–49 and Men 18+ Years Have Not Received Any Dose of COVID-19 Vaccine

	Overall		Kasanda		Kiboga		Kyankwanzi		Luwero		Mityana		Mubende		Nakaseke		Nakasongola	
	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years
Do not think vaccines are effective	10.9%	14.7%	6.9%	5.8%	0.0%	37.3%	14.2%	0.0%	23.0%	10.3%	74.0%	49.8%	0.0%	39.0%	0.0%	0.0%	3.8%	14.3%
Did not care getting seriously ill from COVID-19	1.5%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.6%	6.4%	0.0%	0.0%	0.0%	6.1%	0.0%	5.0%	0.0%	0.0%
My natural immunity is better at protecting me against the COVID-19 than taking a vaccine	2.3%	2.6%	0.0%	0.0%	0.0%	7.2%	0.0%	11.1%	0.0%	0.0%	14.7%	0.0%	9.1%	12.2%	0.0%	0.0%	0.0%	0.0%
Fear of side effects	27.7%	27.3%	32.6%	46.8%	0.0%	10.5%	67.4%	24.1%	24.6%	6.0%	44.0%	13.3%	44.4%	37.6%	13.1%	36.4%	15.9%	26.2%
The COVID-19 outbreak is not as serious as people say	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	40.0%	0.0%	6.1%	0.0%	0.0%	0.0%	0.0%
COVID-19 is a hoax (The virus does not exist)	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	0.0%
No time to go for vaccination	2.7%	10.8%	7.7%	15.0%	0.0%	0.0%	0.0%	43.7%	0.0%	12.7%	0.0%	13.3%	0.0%	8.5%	1.7%	1.8%	4.4%	0.0%
Do not know where to get vaccines	1.9%	2.0%	4.4%	0.0%	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%	0.0%	1.1%	6.5%	6.9%
Long distance	10.2%	10.6%	10.7%	13.3%	11.3%	0.0%	0.0%	8.5%	14.6%	10.5%	0.0%	0.0%	13.4%	12.2%	10.4%	11.4%	10.9%	14.8%
Long time it takes to travel	6.6%	3.5%	7.6%	6.1%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	13.4%	12.2%	9.3%	1.6%	7.1%	4.0%
Long queues (time wasting) at service points	3.8%	6.4%	0.0%	0.0%	0.0%	10.5%	0.0%	10.8%	0.0%	12.7%	0.0%	0.0%	0.0%	6.1%	11.1%	6.8%	8.3%	4.3%
Vaccines associated with infertility	0.9%	4.7%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32.9%	0.0%	3.3%	0.0%	0.0%
Preferred type of vaccine not available	0.0%	1.6%	0.0%	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%	0.0%	1.1%	0.0%	0.0%
Confusing information about the vaccines	13.7%	15.7%	6.4%	8.9%	30.5%	30.5%	0.0%	12.7%	0.0%	13.9%	0.0%	0.0%	9.0%	45.4%	19.0%	13.5%	38.5%	6.8%
Other	28.5%	20.3%	38.2%	13.5%	58.2%	0.0%	18.5%	45.9%	25.1%	33.3%	0.0%	0.0%	24.2%	0.0%	40.2%	24.6%	15.0%	26.8%

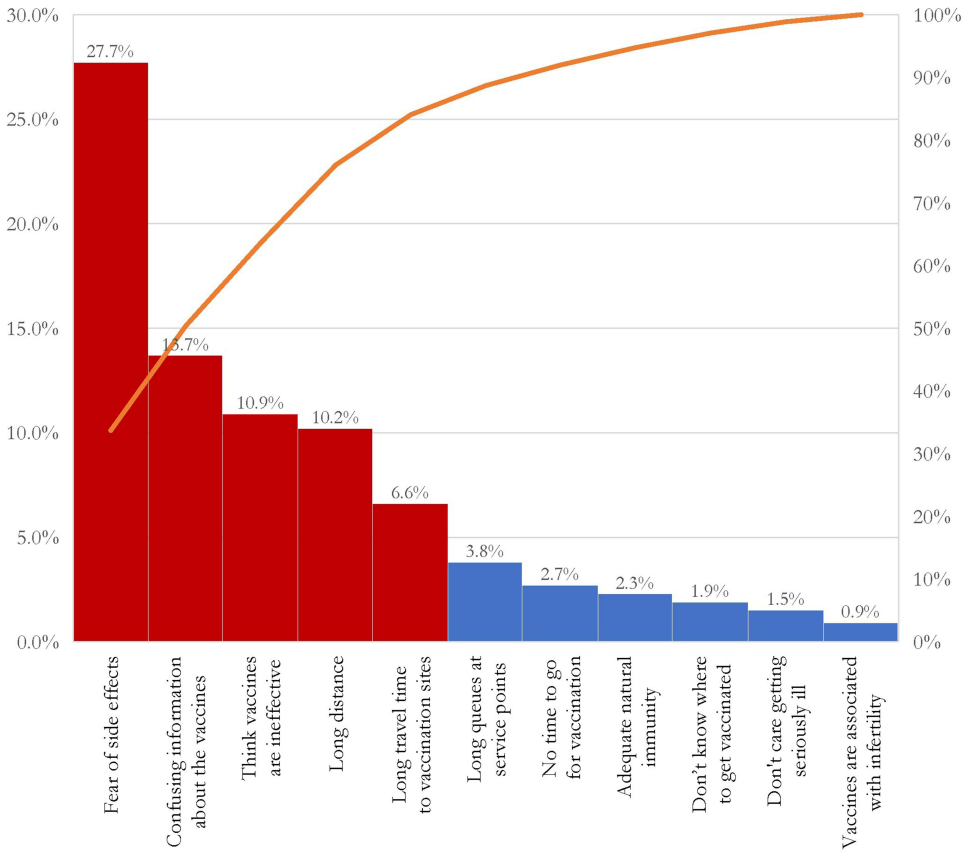

Figure 1 The common reasons for non-uptake of COVID-19 vaccination among women 18–49 years.

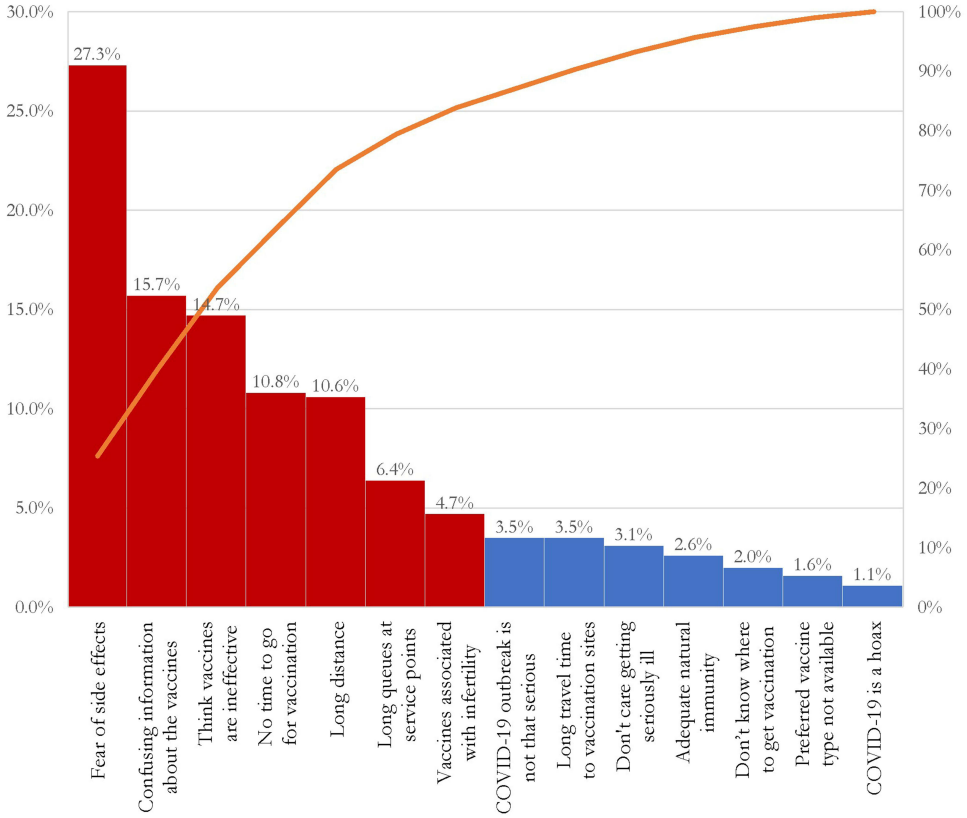

Figure 2 The common reasons for non-uptake of COVID-19 vaccination among men 18+ years.

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proportions of the most common barriers to vaccination cited by women and men respectively. Among women, the primary reasons for non-vaccination were: Fear of side effects (27.7%), Confusion regarding COVID-19 vaccine information (13.7%), Perceived ineffectiveness of vaccines (10.9%), Geographic accessibility issues, including long distances to vaccination sites (10.2%) and lengthy travel times (6.6%). In contrast, men cited the following reasons for non-vaccination: Fear of side effects (27.3%), Confusion regarding COVID-19 vaccine information (15.7%), Perceived ineffectiveness of vaccines (14.7%), Time constraints (10.8%), Geographic accessibility issues, including long distances to vaccination sites (10.6%) and lengthy queues at service points (6.4%) and Misconceptions regarding COVID-19 vaccine-related infertility (4.7%).

Motivators for COVID-19 Vaccine Uptake Among the Unvaccinated Respondents

We inquired with respondents who had not received any COVID-19 vaccine dose about their motivations for vaccination. Among vaccine-hesitant women aged 15–49, 19.0% cited trust in health workers' recommendations. Motivational factors varied by district. In Kiboga, many women expressed willingness to vaccinate if assured of the vaccines' safety based on global usage. Conversely, in Kyankwanzi, 36.4% preferred vaccines manufactured domestically. In Mityana, the majority relied on Ministry of Health (MoH) recommendations. In Luwero, 25.1% emphasized the importance of easy access to vaccines at local health facilities. For men aged 18+, 20.2% were swayed by health worker recommendations. The sight of earlier recipients without side effects influenced decisions significantly, particularly in Kiboga (28.3%), Mityana (46.7%), and Nakaseke (48.2%). Additionally, MoH endorsement held weight in Luwero (12.7%) and Mubende (39.0%). These insights underscore the localized nature of vaccine hesitancy and the need for tailored approaches to address it (Table 5).

Top motivators for women aged 15–49 to get vaccinated include health worker recommendations (19.0%), easy accessibility (16.0%), MoH endorsement (13.6%), observing side-effect-free users (11.7%), and shortened vaccination site distance (8.4%). For men 18+, motivators are health worker recommendations (20.2%), observing side-effect-free users (19.5%), MoH endorsement (12.6%), accessibility (11.0%), and concern over vaccination requirements for public places or travel (8.4%) (Table 6).

People Who Would Influence Defaulters to Take Up COVID-19 Vaccination

Respondents who had not received a COVID-19 vaccine were asked about influential figures in their decision to vaccinate. Among women aged 15–49, health workers or family doctors (31.3%), followed by village health team members (19.5%), and local leaders (19.4%) held the most sway. Family members or relatives (15.0%) and friends (9.3%) also played roles. Among men aged 18 and above, local leaders (27.8%) were most influential, followed by health workers or family doctors (24.6%), family members or relatives (14.3%), mass media information (12.1%), and village health team members (10.7%) (Table 7).

Discussion

This study demonstrates the importance of utilising localized and timely data-driven strategies for public health response management. To target interventions more effectively, healthcare managers and leaders at mid- and lower levels can use the LQAS methodology to identify areas of low public health response measure adoption or poor adherence to pandemic, epidemic, or outbreak prevention interventions.

The findings revealed that despite widespread awareness about COVID-19, knowledge of prevention measures was low among both men and women. Less than half of the respondents demonstrated knowledge of at least four ways to reduce the risk of COVID-19 contraction. Adherence to social distancing standards was also inadequate in many areas, with 17 supervision areas (SAs) for women and 14 SAs for men falling short. While first-dose vaccination coverage was high (83.5% for men and 83.0% for women), full vaccination coverage remained low (37.5% for women and 41.5% for men). Additionally, handwashing and sanitizing habits were poor, with only 24.8% of women and 19.0% of men reporting frequent hand hygiene practices in the previous 24 hours. With a significant decrease in COVID-19 cases at the time of the survey, complacency may have set in, leading to a disregard for standard operating procedures (SOPs). Additionally, a large proportion of the population had received their first vaccine dose, potentially created a false sense of protection and increased disregard for SOPs like social distancing and handwashing. The Omicron variant, which was

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Table 6 Overall and District-Level Factors/Issues That Would Motivate Respondents Who Have Not Had Any COVID-19 Vaccination to Get Vaccinated

	Overall		Kasanda		Kiboga		Kyankwanzi		Luwero		Mityana		Mubende		Nakaseke		Nakasongola	
	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years
How easy it is to get the vaccine (eg, available at our health facility in our area)	11.7%	11.0%	20.4%	9.8%	26.2%	27.3%	0.0%	8.5%	25.1%	11.8%	0.0%	0.0%	28.9%	18.3%	6.4%	6.8%	16.0%	12.9%
If the vaccines are free of charge	0.7%	7.1%	6.3%	6.0%	0.0%	0.0%	0.0%	8.5%	12.6%	6.4%	0.0%	23.6%	0.0%	12.2%	0.0%	5.0%	13.1%	0.0%
Recommendation by MoH	3.4%	12.6%	6.3%	10.0%	0.0%	0.0%	18.5%	11.1%	12.6%	12.7%	64.1%	13.3%	13.4%	39.0%	10.9%	2.7%	5.5%	8.6%
Recommendation by health worker	1.8%	20.2%	24.9%	19.3%	0.0%	0.0%	0.0%	54.4%	13.5%	7.0%	14.7%	26.6%	8.6%	26.7%	19.4%	10.0%	35.9%	39.1%
Seeing earlier users free of side effects	5.4%	19.5%	0.0%	8.9%	0.0%	28.3%	18.5%	0.0%	0.0%	4.6%	35.9%	46.7%	24.2%	6.1%	7.5%	48.2%	20.7%	25.1%
If the vaccine is affordable to everyone for free	0.0%	0.8%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%	0.0%	0.0%	0.0%	0.0%
If the COVID-19 vaccines were made in Uganda	7.9%	3.9%	0.0%	5.8%	14.9%	9.5%	36.4%	0.0%	0.0%	0.0%	0.0%	13.3%	9.1%	12.2%	0.0%	0.0%	0.0%	0.0%
If the preferred vaccine type is available	8.4%	2.5%	0.0%	9.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.4%	6.1%	0.0%	0.0%	0.0%	0.0%
If I get convinced that the vaccine has been used in other countries with no serious side-effects	0.0%	0.3%	3.7%	0.0%	26.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.6%	0.0%	4.7%	1.6%	3.8%	0.0%
If my vaccination status will determine my child being accepted in school	2.2%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.0%	0.0%	0.0%	0.0%	14.6%	0.0%	0.0%	0.0%	0.0%
If the risk of getting infected with COVID-19 increases	0.0%	4.7%	8.8%	17.3%	26.9%	17.7%	14.2%	0.0%	12.1%	0.0%	0.0%	0.0%	0.0%	6.1%	10.9%	0.0%	3.8%	0.0%
If the distance to vaccine site is shortened	20.3%	6.5%	4.4%	11.5%	0.0%	0.0%	0.0%	0.0%	14.6%	7.0%	0.0%	13.3%	17.6%	0.0%	14.1%	7.5%	0.0%	5.0%

If the time required to get the vaccine is shorter	16.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	14.6%	0.0%	0.0%	0.0%	0.0%
Opening up the economy (voluntary)	4.8%	2.8%	0.0%	6.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%	9.3%	5.0%	0.0%	0.0%
Vaccination may be pre-condition for access to public places/places of worship, business premises or travel	13.6%	8.4%	0.0%	6.6%	0.0%	7.2%	0.0%	10.8%	0.0%	6.0%	0.0%	0.0%	0.0%	36.6%	0.0%	1.6%	0.0%	0.0%
Other	19.0%	25.7%	39.4%	21.6%	16.4%	20.5%	49.4%	37.4%	9.5%	44.1%	0.0%	0.0%	13.4%	38.0%	21.7%	19.3%	8.2%	5.1%

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Table 7 Overall and District-Level Proportion of Different Categories of People Who Would Influence Defaulters to Take Up COVID-19 Vaccination

	Overall		Kasanda		Kiboga		Kyankwanzi		Luwero		Mityana		Mubende		Nakaseke		Nakasongola	
	Women 15–49 Years	Men 15+ years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years	Women 15–49 Years	Men 15+ Years
Recommendation from health workers/family doctor	31.3%	24.6%	23.6%	13.5%	68.7%	42.7%	51.1%	32.6%	26.1%	13.0%	38.1%	23.6%	40.1%	55.9%	8.0%	7.2%	57.4%	48.0%
Recommendation from local leaders	19.4%	27.8%	26.7%	50.3%	0.0%	0.0%	31.4%	40.7%	12.1%	19.4%	21.3%	50.2%	8.6%	41.4%	21.3%	1.1%	21.2%	23.4%
Recommendation from family member or relative	15.0%	14.3%	16.7%	9.5%	0.0%	38.8%	35.9%	8.5%	12.6%	12.7%	26.0%	23.6%	19.9%	18.3%	8.5%	13.4%	11.5%	11.5%
Recommendation from friends or neighbours	9.3%	10.2%	9.4%	3.6%	0.0%	17.7%	18.5%	0.0%	27.2%	0.0%	18.0%	49.8%	0.0%	12.2%	5.1%	10.6%	4.4%	17.0%
Information from Mass media (TV, radio, etc.)	2.2%	12.1%	3.1%	5.8%	0.0%	0.0%	0.0%	12.7%	0.0%	30.2%	0.0%	18.2%	0.0%	12.2%	4.7%	5.0%	3.2%	0.0%
Recommendation from VHTs	19.5%	10.7%	34.6%	8.9%	0.0%	0.0%	0.0%	12.7%	12.6%	6.4%	14.7%	18.2%	31.4%	23.1%	21.4%	14.4%	2.3%	0.0%
Recommendation from religious leaders	3.2%	8.4%	0.0%	0.0%	14.9%	9.5%	0.0%	0.0%	0.0%	4.6%	0.0%	0.0%	9.1%	30.5%	4.6%	17.5%	3.2%	0.0%
The information read, seen and heard from social media	2.5%	1.5%	0.0%	0.0%	15.6%	0.0%	0.0%	0.0%	9.5%	0.0%	0.0%	0.0%	0.0%	12.2%	3.7%	0.0%	0.0%	0.0%
Information read in the Newspaper	1.1%	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	39.0%	4.7%	0.0%	0.0%	0.0%
Recommendation from traditional healers	1.2%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.6%	12.2%	0.0%	0.0%	0.0%	0.0%
Other	15.1%	20.9%	33.0%	18.6%	16.4%	19.5%	30.9%	27.3%	12.6%	30.6%	0.0%	0.0%	0.0%	12.5%	20.7%	36.3%	0.0%	0.0%

less fatal than the previous Delta variant, may have also contributed to a sense of security. Furthermore, Uganda was nearing the end of the Omicron pandemic wave, leading to fatigue in adherence to COVID-19 prevention guidelines, as seen in other studies.[13–16] Adherence to COVID-19 standards in Uganda, had been strictly enforced by security forces. The relaxation of strict enforcement by security forces at the study time may have also played a role.[13]

The survey found high first-dose vaccination coverage rates: 83.5% (95% CI; 80.8–86.1) for women and 83.0% (95% CI; 80.0–85.0) for men. At the time of the study, Uganda's national coverage on March 14, 2022 was 64.4%, with 8,014,082 (36.5%) of the target population fully vaccinated.[17] As of mid-March In the study area, full vaccination coverage was 37.5% (95% CI; 34.0–41.0) for women and 41.5% (95% CI; 37.9–45.0) for men, with men's coverage significantly higher than the national average.[18] Women's coverage was slightly higher than the national average, but not statistically significant. The higher coverage in the study area may be due to its location in central Uganda, with better access to COVID-19 services, proximity to the central vaccines store, and a well-developed road network. As the COVID-19 vaccination program began in this region, community members may have been early adopters of the vaccine, contributing to higher coverage rates.

This study found that men had higher COVID-19 full vaccination rates than women. This is contrary to women's typical higher use of routine health services compared to men.[19] This trend is seen in other countries, where women are more hesitant to get vaccinated due to various myths, including the false belief that COVID-19 vaccines cause infertility.[7,20,21] In Uganda, 0.9% of unvaccinated women and 4.7% of unvaccinated men cited this myth as a reason for not getting vaccinated.[22] Similar gender gaps in vaccine acceptance exist elsewhere in Africa, with women showing higher rates of resistance and hesitance.[23,24] The infertility myth may lead men to discourage their wives from getting vaccinated.[7,20] Besides, early vaccine scarcity may have favored men who could travel to access vaccines, contributing to the observed gender disparity.

Despite the low full vaccination coverage observed, Mityana district stands out among all other districts for having significantly higher full COVID-19 vaccination coverage, whereas Kasanda district has the lowest coverage for women and men. The COVID-19 vaccination coverage observed in this study could also be explained by logistical, structural, and other contextual factors, as has been the case throughout Africa. Such issues have included vaccine distribution challenges, particularly in rural areas, as well as vaccine storage challenges, particularly due to poor cold chain due to a lack of electricity in rural communities.[25] Uganda has used a variety of vaccines, the supply of which has been inconsistent.[26] This resulted in situations such as preferred vaccines not being available at vaccination centers, as reported by 1.6% of non-COVID-19-vaccinated individuals, or the absence of eligible second dose vaccines for those seeking a second dose.[27] Addressing such logistical and structural issues may aid in improving vaccine access, uptake, and adherence.

The findings reveal that while there were shared concerns and barriers to COVID-19 vaccination among women and men, distinct differences also existed. Women mentioned that their motivation for COVID-19 was majorly influenced by the convenience and accessibility to vaccination sites to their residences and work places. Conversely, men would be persuaded to get vaccinated due to the requirements of COVID-19 vaccination to travel or to access their work places, vaccination status influencing access to public places and events as well as due to peer pressures, social norms. Similar gender differences in motivations have been observed in various countries, including the United States, Europe, and Australia.[28,29] As women and men have different motivations for COVID-19 vaccination uptake, this demonstrates that gender-sensitive communication strategies are needed in public health campaigns especially in disease outbreak responses. Thus, adapting messaging and responses to these gender differences such as emphasizing convenience for women and social influences for men can increase public health response uptake more so if they involve vaccinations.

The results further revealed that health workers' recommendations for vaccine uptake are a stronger motivator for COVID-19 vaccination for both women and men. This observation has been mentioned elsewhere as a motivating factor COVID-19 vaccination among both men and women.[30] Women in this study were also found to have greater trust in community health workers regarding COVID-19 vaccination information. This could be explained by the strong social relationships, a need for individualized communication, and a sense of empathy and understanding that the women may be benefiting from the community health workers also known as the Village Health Teams (VHTs) as pointed out in previous research.[31] On the other hand, men preferred more formal and authoritative sources like formal health workers

and community leaders as trusted sources of information. This is contrary to the findings in another study where health workers were a less reliable source of information and trust especially on COVID-19 vaccination given their mistrust of the vaccines deriving from the negative information from unreliable sources such as social media.[32]

The traditional gender roles of valuing authority and expertise tend to lead men to seek health information from formal sources such as health workers and community leaders.[31] It is possible that this perception is based on the belief that health workers undergo extensive training and therefore possess expertise, experience, objective, credible and reliable information.[33] In addition, the belief that local leaders are trustable sources of information may have driven male to prefer seeking information from local leaders who predominantly are male as seen in other studies.[34] Thus, gender-specific influencers and communication channels should be considered when selecting media and people to air out or carry out health education aimed at disseminating public health responses information. Empowering the trusted information sources like the COVID-19 ambassadors in this study to deliver public health response information could go a long way in achieving desired results.[35]

Observing no side effects experienced by those who have been vaccinated was equally alluded to by both men and women as a key motivating factor that increases willingness to get vaccinated against COVID-19. Consequently, testimonies and positive livid experiences given by those who have been vaccinated, can be used to demystify false beliefs, myths, and negative perceptions against COVID-19 vaccination, and help those who are unwilling to vaccinate to change their beliefs about vaccination.[24] Nevertheless, demystifying such beliefs may be difficult because it may necessitate countering myths with evidence-based messages rather than traditional health education and directing-based approaches.[36] Besides, a study has revealed that side effects of COVID-19 vaccination can be helpful in preventing severe disease among the vaccinated.[37] Hence, it is also crucial to alleviate fears, build trust and encourage vaccine uptake by emphasizing that side effects are normal, beneficial and protective. Altogether, public health campaigns can increase vaccine acceptance and uptake by leveraging healthcare professionals' recommendations and social proof, while addressing gender-specific concerns and barriers.

Comparison of the reasons given by women and men for not getting vaccinated reveals both similarities and differences. The most common reason for non-vaccination acceptance among both women (27.7%) and men (27.3%) was the fear of side effects of the vaccine. Besides, confusion regarding COVID-19 vaccine information is also a significant concern for both groups (13.7% among women and 15.7% among men). The perceived ineffectiveness of vaccines is another shared reason (10.9% among women and 14.7% among men).

The divergent cumbrances to COVID-19 uptake were lengthy queues leading to long waiting times at service points were constraints more concerning to men (10.8%) than women (6.4%) to deter them to go and receive vaccination. In addition, misconceptions regarding COVID-19 vaccine-related infertility was unique COVID-19 vaccination deterring factor more pronounced among men. On the other hand, lengthy travel distances and times is a more significant concern for women (6.6%) than men. Hence, improving COVID-19 vaccination uptake as well as any future pandemic, epidemic or outbreak vaccination related responses will require addressing any gender-specific concerns and barriers such as those highlighted in this study. For instance, alleviation of confusion and misconceptions about vaccine safety and effectiveness may be achieved through targeted health education campaigns to address any gendered misconception about vaccination and any other barriers. Additionally, mobile vaccination units or extended service hours, can help efforts aimed at addressing accessibility to vaccines brought about by geographic and time-related barriers. Promoting more inclusive vaccination strategies could benefit from addressing infertility misconception, a gender-specific concerns among men.

Conclusions and Recommendations

Despite the awareness of the pandemic in the study area located in Central Uganda, understanding of COVID-19 prevention measures was low, leading to poor adherence. While many had received at least one COVID-19 vaccine dose, completion rates were low, with disparities across districts and supervision areas. Fear of side effects, misinformation, and accessibility issues contribute to non-uptake. Targeted messages and ambassadors such as health workers, community leaders, and family members can help dispel myths and encourage vaccination. Interventions should prioritize poor-performing areas and indicators to improve coverage and uptake. By addressing these gaps, COVID-19 vaccination programs can increase effectiveness and reach more people.

Study Limitation

This cross-sectional study's findings are specific to the time period and may not be generalizable due to the evolving global COVID-19 situation. Another study conducted at a different time may yield different results.

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The authors declare that this study is part of a multi-indicator survey that includes non-COVID-19 data. As a result, other research may be published with the same study subjects and methodology but with different objectives.

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