



Research Article

COVID-19 Vaccine Uptake and Associated Factors among Health Workers in Nansana Municipality, Central Uganda: A Cross Sectional Study

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Citation: Katumba C, Patience N, Nakitto AMS (2023) COVID-19 Vaccine Uptake and Associated Factors among Health Workers in Nansana Municipality, Central Uganda: A Cross Sectional Study. J Community Med Public Health 7: 391. DOI: <https://doi.org/10.29011/2577-2228.100391>

Received Date: 29 November, 2023; **Accepted Date:** 14 December, 2023; **Published Date:** 18 December, 2023

Abstract

The Uganda government has been working tirelessly to scale up Covid-19 vaccine uptake among health workers and the public, although the uptake is still low. This study targeted health workers because they were among the first priority groups to be vaccinated against Covid-19 and their role model in behaviour change to positively impact the public to uptake the vaccine. The study would give a clear understanding of how health workers can positively impact the public to uptake the Covid-19 vaccine. This study was carried out to determine the prevalence of full and partial Covid-19 vaccine uptake among health workers, socio-demographics associated with the vaccine uptake, the effect of Covid-19 vaccine accessibility and the knowledge and attitudinal factors among health workers associated with Covid-19 vaccine uptake. A descriptive cross-sectional survey was conducted in Nansana municipality in the months of February and March, 2023 and a total of 365 health workers participated in this study. The full and partial Covid-19 vaccine uptake among health workers was 81.6% and 5.5% respectively, whereas Males and Moslems were more likely to get a full Covid-19 vaccine uptake. Covid-19 vaccine accessibility didn't affect Covid-19 vaccine uptake among health workers and they were more knowledgeable about the Covid-19 vaccines' safety and had a positive attitude towards Covid-19 vaccine acceptability. More research should be done to ascertain Covid-19 vaccine uptake during the early and late phases of the pandemic, more legislation to make Covid-19 vaccination mandatory and continuous massive Covid-19 vaccine information communication to Ugandans.

Keywords

Health worker refers to an employee of a health facility who is directly involved in the delivery of health services in that facility, and they include nurses, midwives, allied health professionals, and doctors.

Allied health Professionals includes clinicians, pharmacy technicians, laboratory technicians and assistants.

Health Facility refers to a Health Centre II, III, IV, medical Centre and clinic.

Vaccine Safety and Efficacy, Safety means that Covid-19 Vaccines are harmless and have no any negative consequences after their administration whereas vaccine efficacy means reduction in Covid-19 cases in a group of people who have received a Covid-19 vaccination.

Full Covid-19 Vaccination refers to a complete Covid-19 vaccination dose per vaccine brand dose schedule.

Partial Covid-19 Vaccination refers to an incomplete Covid-19 vaccination dose per vaccine brand dose schedule.

Introduction

A disease of unknown origin was first reported in Wuhan Hubei Province of China in December 2019 [1]. Most cases were epidemiologically linked to Huanan seafood wholesale market where inoculation of patients' bronchi-alveolar fluids led to identification of Corona-virus, SARS-CoV2 [2].

Globally, more than 6.9 million deaths attributed to this disease have been recorded since its outbreak in 2019 [3]. The case fatality ratio was higher in developed countries and countries with larger population sizes [4]. Countries in Southern Africa were the most affected in Africa with the highest number of deaths due to the disease [5]. However, developing countries especially in Africa were also greatly affected due to the decline in the economic activities which led to low revenue collections by respective governments hence limiting their support to the health care systems contributing greatly to the inability of fully managing Covid-19 and its complications [6].

The fear of immediate and long term side effects from the Covid-19 vaccine, concerns about vaccine efficacy, and fear of the Covid-19 vaccine causing disease were some of the factors that affected health workers' decisions to undergo vaccination [7]. However, lack of transparent information regarding the Covid-19 vaccine, the increasingly evolving SARS-CoV-2 science, rapid vaccine developments, and the intense politics within research bodies and authorities were also some of the other factors that affected health workers' acceptability [8,9].

Uganda's full and partial Covid-19 vaccination rate was still too low at 19.2% and 30.5% respectively in November 2021 regardless of the revamped vaccination campaign by the ministry of health to also include children to be vaccinated [10]. A fostered vaccination campaign is still needed to vaccinate more Ugandans in order to acquire a herd immunity for the population against Covid-19 [11].

Wakiso district where Nansana municipality is located, is the most populated among all districts in Uganda [12]. This has largely impacted the districts' capability to serve everyone due to the limited resources and hardships faced by health workers to reach every resident in the district for the vaccination [13]. This has greatly contributed to the district's low Covid-19 vaccination rate which is still less than 50% making Wakiso rank among the three worst performing districts with Amudat and Nabilatuk regarding Covid-19 vaccination in Uganda [13].

Vaccine acceptance among the general public and the healthcare workers, may have a decisive role for successful control of the pandemic [14]. Since Healthcare workers were among the first groups to receive Covid-19 vaccination in Uganda,

it is important to consider their attitudes, knowledge and other factors associated with vaccine uptake to better address barriers to widespread vaccination acceptance. Increasing COVID-19 vaccine uptake among health workers will play a major role in combating this Covid-19 pandemic since Health workers are better source of information for the vaccines to the public, their communication can improve adherence to vaccination recommendations among the public through role modeling behavior leading to high vaccine acceptance. Therefore this study will help to fully understand Covid-19 vaccine uptake and its associated factors among health workers to better address any challenges and to support their efforts to advise the public and actively do the vaccinations [15].

The aim of this study was to determine the prevalence of full and partial Covid-19 vaccine uptake among health workers in Nansana municipality, to assess the socio-demographic factors associated with Covid-19 vaccine uptake, to determine whether Covid-19 vaccine accessibility affects Covid-19 vaccine uptake among these health workers and to investigate healthcare workers' acceptability and their knowledge and attitudes towards Covid-19 vaccine safety and efficacy among health workers in Nansana municipality.

Materials and Methods

Study design and Study Population

A descriptive cross-sectional survey was carried out at a time from February 2023 to March 2023 to study about Covid-19 vaccine uptake and associated factors among health workers in Nansana municipality. Since this study was population based and carried out in health facility settings, with the short time available to finish up the study, a cross-sectional survey was used [16]. This study targeted health workers working in Health Centres II, III, IV, Medical Centres and Clinics within Nansana Municipality, central Uganda.

Sample size determination and sampling method

The sample size was determined by using Wright Fisher's formula which states that

$$n = \frac{z^2 pq}{d^2}$$

Where

n - Desired sample size

z - Standard deviation at a desired degree of accuracy which is 95% and the standard deviation is 1.96

p - Proportion of the population with the desired attribute. Approximately 70% of health worker at Iganga Hospital had received their first dose while 40% had received their second dose of the Covid-19 vaccine by September 2021 respectively

[17]. Using 40% as full Covid-19 Vaccine Uptake among health workers,

We estimated p to be 40% = 0.4

$q = 1-p$, so $q=0.6$

d – Margin of error which I set was as commonly used in health survey usually estimated at 5%, $d= 0.05$

Therefore, according to Wright Fisher’s formula, the sample size was 369 people. We considered a dropout rate of approximately 10%, an extra of 41 people was considered if some of the 369 participants fell off from the study.

If, n is the sample size required, $n=369$, d is the dropout rate, $d=0.1$

Adjusted sample size N is obtained as, using the formula $N = n/(1-d)$ [18].

$N= 369/(1-0.1)$

$N=410$ people

Therefore, extra sample size calculated was $N-n$, $410-369=41$ people. However only 365 participants were fully interviewed making a 98.9% response rate. Multi-stage sampling method was used to obtain the study participants [19]. Two of the four divisions

in Nansana municipality were purposively selected based on level of development; that is Nabweru (urban) and Busukuma (peri-urban).

From the selected divisions above, three parishes were randomly selected from each division making a total of six parishes that is Maganjo, Kawanda and Wamala from Nabweru division and Magigye, Busukuma and Kiwenda from Busukuma division respectively.

Seventy seven health facilities from those parishes were then selected depending on their registry with the respective Ministry of Health Bodies i.e. Ministry of Health for Government Health facilities and for Private Health Facilities’ registry is done under Uganda Medical and Dental Practitioners ‘Council for medical centres and Allied Health Practitioners’ Council/Nurses and Midwives Council for Clinics.

Sixty five health facilities were selected from Nabweru division with 35 of these selected from Maganjo parish, 6 health facilities from Wamala and 24 health facilities from Kawanda Parish. Twelve health facilities were selected from Busukuma division with 5 from Magigye parish, 5 from Busukuma parish and only 2 health facilities from Kiwenda parish (Table 1).

Division	Parish	Medical Centre	Clinic	HCI	HCIII	HCIV	Total Health Facilities
Nabweru	Maganjo	19	15	1	0	0	35
	Wamala	3	2	0	1	0	6
	Kawanda	15	7	0	2	0	24
Busukuma	Busukuma	1	1	1	2	0	5
	Magigye	1	4	0	0	0	5
	Kiwenda	0	0	0	1	1	2
Total		39	29	2	6	1	77

Table 1: Health facilities selected from Nabweru and Busukuma divisions.

All health workers found in each of the health facilities in table 1 above and had consented were interviewed and consisted of nurses and midwives, allied health professionals and doctors. Parishes' names were written down on separate papers which were folded and put in a small basket, the basket was shaken several times. The folded papers were then randomly picked to select parishes to participate in the study.

From the selected Parishes, 365 participants were successfully interviewed however most of the participants were selected from Nabweru division parishes (246) and other few from Busukuma Division parishes (119).

Inclusion and exclusion criteria

All Health workers who consented and worked with the selected Health centres II, III, IV, clinics and medical centres, in Nansana municipality, were interviewed. Those who didn't consent and those who were not on duty at the time of the study did not participate in the study.

Data collection methods

A structured and unstructured questionnaire was used to collect data, and it consisted of open and closed ended questions in English. Three research assistants (post Advanced level education) were trained for three days in executing questionnaires to the Health workers. The interview took less than 25 minutes.

Most of the health workers were interviewed and their answers written in the questionnaire by research assistants while others self-administered the questionnaire. The data that was collected include; demographic data, Covid-19 vaccine brands and number of vaccine doses received, data about Covid-19 vaccine accessibility, acceptability, knowledge and attitudes towards Covid-19 vaccine safety and efficacy among health workers in Nansana municipality.

Knowledge on Covid-19 Vaccination, attitudes towards Covid-19 vaccination, vaccine brands, predisposing factors to Covid-19 infection, Vaccine brands available on market and side effects experienced depending on different received brands.

Data management, analysis plan and presentation

The data collection tools were pretested to ensure clarity and logical sequence and relevant adjustments were made before data collection. The questionnaire was pretested on ten health workers working with Fabian Pharmacy Limited Bombo and ten students at Victoria University who are practicing health workers.

Consequently, any questions that was reported as unclear (vague or confusing) was corrected before data collection and analysis.

The average time required to effectively execute the interview was determined and in case the time exceeded 25 minutes, the questionnaire was revised by reducing the number of questions but maintaining the quality to answer the research questions. The Research Assistants (RAs) were trained for a period of three days on how to administer the tool for the study.

During actual data collection, a Team leader, who was supervising the RAs ensured data quality control by sitting with some Research Assistants during the interviews following a schedule, and ensured the data was collected in an unbiased way and also reviewed all questionnaires upon completion to check for completeness and accuracy. The team leader gave a report to the Principal Investigator (author), each day. Any issues raised in the reports, if any, were addressed on a regular basis.

Upon completion for the data collection exercise, data was entered, cleaned, coded and analyzed using SPSS and MS Excel. Univariate analysis was used to generate descriptive statistics of different variables especially socio-demographic characteristics. For qualitative variables, descriptive statistics such as relative (percentage) and absolute frequencies was used.

An odds ratio (OR) analysis (Crude odds ratio and Adjusted Odds ratios at 95%CI) using a binary logistic regression analysis model were also employed to determine any independent relationships with Covid-19 vaccination coverage. A binary logistic regression analysis was used because variables in the study were categorical. A p-value <0.05 at 95%CI, was considered significant taking into account the Odds (Adjusted or Crude).

All quantitative analyses were subjected to two-tailed significance tests, with statistical significance set at $p < 0.05$.

The data was in terms of percentage frequency distribution tables, pie-chart and summary statements. This formed the basis for the interpretation, conclusion and recommendations.

Results

A total of 365 health workers were interviewed from the six parishes of Nansana municipality. 173 health workers from Maganjo, 62 from Kawanda and 11 from Wamala parishes of Nabweru division. From Busukuma division a total of 119 participants were interviewed with 52 from Magigye, 54 from Busukuma and only 13 from Kiwenda parishes.

Prevalence of full and partial Covid-19 vaccine uptake among health workers at Nansana municipality

Table 2 below shows the vaccination status of the health workers at Nansana municipality relating to full, partial and no Covid-19 vaccination.

Covid-19 vaccine brand	Partial vaccination (other vaccines =1 dose, Johnson and Johnson=0)	Full vaccination (Johnson and Johnson ≥1 dose, other vaccines ≥2)	Number vaccinated
Modena	1	28	29
Sinovac	2	29	31
Pfizer	11	52	63
AstraZeneca	6	104	110
Johnson and Johnson	0	85	85
Total	20	298	318

Table 2: Number of Covid-19 vaccine brand doses and full, partial and no vaccination status among Health Workers in Nansana municipality.

From the table above, Among the 365 health workers who participated in the study, 318 (87.1%) health workers had received at least one dose of Covid-19 vaccine. 298 (81.6%) had received a full Covid-19 vaccination and 20 (5.5%) had received only a dose of Moderna, Sinovac, Pfizer and AstraZeneca. Therefore the full and partial Covid-19 vaccine prevalence among health workers at Nansana municipality is 81.6% and 5.5% respectively.

Socio-demographic factors associated with Covid-19 vaccine uptake among health workers at Nansana municipality

Table 3 below shows the socio-demographic characteristics of health workers who participated in the study.

Socio-Demographic Frequency Characteristic (N=365)	N (%)	
Sex		
Male	145	-39.70%
Female	220	-60.30%
Age		
18-25	127	-34.90%
26-35	165	-45.30%
36-45	52	-14.30%
46+	20	-5.50%
Marital status		
Single	213	-58.40%
Married	141	-38.60%
Widowed	6	-1.60%
Divorced	5	-1.40%

Education		
Certificate	170	-47.00%
Diploma	154	-42.50%
Degree	33	-9.10%
Masters	5	-1.40%
Occupation		
Nurse/midwife	190	-52.90%
Allied health profession	148	-41.20%
Doctor	20	-5.60%
Others	1	-0.30%
Tribe		
Baganda	181	-51.10%
Basoga	75	-21.20%
Banyankole/Bakiga	59	-16.70%
Banyoro	10	-2.80%
Batooro	6	-1.70%
Others	23	-6.50%
Religion		
Catholic	106	-30.00%
Moslem	79	-22.40%
Protestant	124	-35.10%
SDA	7	-2.00%
Born again	36	-10.20%
Others	1	-0.30%

Table 3: Socio-demographic characteristics of participants.

Table 3 above shows the socio-demographic information of the 365 Health workers who participated in the study based on their sex, age, marital status, education, occupation, tribe, and religion. Most participants were female (60.8%) with majority falling between the ages of 18-35 (80.3%), 34.8% being in the age range of 18-25, 45.5% being 26-35 and 5.5% being 46 and above.

Most Health workers were single (58.4%), with 38.6% being married. Most of them had a certificate (47.0%) and a diploma (42.5%) in medical education with only a few with a degree (9.1%) or Masters (1.4%). Additionally most health workers were

Nurses/midwives (52.9%) followed by Allied health Professionals with 41.2% whereas a smaller percentage were doctors (5.6%) and other professionals (0.3%).

Among the 365 participants, Baganda were the most popular (51.1%) followed by Basoga (21.2%) and Banyankole/Bakiga (16.7%). Protestants (35.1%) were the majority followed by Catholics (30.0%) and Moslems (22.4%).

Table 4 below shows summary of binary logistic regression analysis for the socio-demographic characteristics with Covid-19 vaccine uptake among health workers at Nansana municipality.

Variable	B	COR 95%CI	AOR 95% CI	P-Value
Sex				
Male	3.961	0.016 (0.002-0.118)	0.019 (0.003-0.142)	0.001***
Female			Reference	
Age				
18-25	0.001	1.113 (0.622-1.991)	1.000 (0.490-2.043)	0.999
26-35	0.304	1.655 (0.669-4.093)	1.351 (0.438-4.196)	0.598
36-45	0.286	2.317 (0.505-10.626)	1.331 (0.223-7.964)	0.754
46 and Above			Reference	
Marital Status				
Single	-0.155	1.162 (0.667-2.026)	0.856 (0.407-1.803)	0.683
Married	18.819	3.850 (0.002-0.432)	1.489 (0.483-1.942)	0.999
Widowed	0.026	0.358 (0.058-2.210)	1.027 (0.590-17.995)	0.986
Divorced			Reference	
Health Sciences Education Level				
Certificate	0.105	1.133 (0.645-1.989)	1.110 (0.509-2.423)	0.793
Diploma	-0.110	0.895 (0.358-2.238)	0.896 (0.137-5.850)	0.908
Degree	17.655	3.891 (0.001-2.327)	4.647 (0.012-2.014)	0.999
Masters			Reference	
Health worker Cadre				
Nurse or Midwife	-0.296	0.707 (0.408-1.224)	0.744 (0.359-1.541)	0.426
Allied Health Professional	1.869	3.704 (0.478-2.870)	6.483 (0.357-1.177)	0.206
Doctor	1.687	3.149 (0.001-2.456)	2.093(0.298-2.013)	0.999
Other			Reference	
Tribe of participants				
Baganda	0.376	1.346(0.642-2.822)	1.456(0.570-3.718)	0.432
Basoga	0.170	1.133(0.522-2.462)	1.185(0.462-3.041)	0.724
Banyankole/Bakiga	0.185	0.925(0.188-4.554)	1.204(0.187-7.750)	0.845
Banyoro	-1.861	0.231(0.045-1.196)	0.156(0.012-2.031)	0.156
Batooro	-0.435	0.655(0.240-1.786)	0.647(0.190-2.209)	0.487
Other			Reference	

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Religion				
Catholic	-0.025	1.101(0.554-2.190)	0.957(0.417-2.282)	0.954
Moslem	1.063	3.033(1.445-2.369)	2.896(0.118-2.750)	0.020***
Protestant	-1.096	0.433(0.091-2.064)	0.334(0.050-2.245)	0.260
SDA	0.782	2.015(0.710-5.718)	2.185(0.695-6.874)	0.181
Born Again	16.843	5.250(0.015-4.865)	20.647(0.021-2.123)	1.000
Other			Reference	

COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio

Table 4: A logistic regression analysis for the socio-demographic characteristics associated with Covid-19 vaccine uptake among health workers.

The p-value represents the statistical significance of the association between the socio-demographic variable and Covid-19 vaccine uptake. There was no statistically significant difference in vaccine uptake based on age, marital status, medical health education and Occupation. However there was a statistically significant difference in Covid-19 vaccine uptake based on sex, among the males 0.019 (95%CI: 0.003-0.142, P=0.001) and religion, among the Moslems 2.896 (95%CI: 0.118-2.750, P=0.020).

Therefore sex and Religion are the socio-demographic factors associated with Covid-19 vaccine uptake among health workers at Nansana municipality.

Covid-19 vaccine accessibility and Covid-19 vaccine uptake among health workers at Nansana municipality

Table 5 below shows the responses of participants regarding the accessibility of the Covid-19 vaccines to them.

Variable	N (N %) N=365
Can you easily access the Covid-19 vaccine?	
Yes	171(52.6%)
No	154 (47.4%)

Table 5: Covid-19 vaccine Accessibility among Health workers in Nansana municipality.

The table above shows the responses of the participants regarding their concerns about the accessibility of Covid-19 vaccines, with 171 (52.6%) agreeing that the vaccine is easily accessible to them and 154 (47.4%) disagreeing that the vaccine is not easily accessible.

Table 6 shows an association between Covid-19 vaccine accessibility and Covid-19 vaccine uptake among health workers at Nansana municipality.

Can you easily access the Covid-19 vaccine?	Not Vaccinated N =67	Full Vaccinated N=298	COR at 95%CI	P-Value
Yes	25(16.2%)	129(83.8%)	0.678 (0.388-1.187)	0.173
No	38(22.2%)	133(77.8%)		*

*indicates a variable reference. COR means Crude Odds Ratio, CI means 95% confidence Interval

Table 6: Covid-19 vaccine accessibility and Covid-19 vaccine uptake among health workers at Nansana municipality.

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From the table above, the P-value between Covid-19 vaccine accessibility and full Covid-19 vaccine uptake is 0.173 which is way above the set $P < 0.05$ at 95% C.I, 0.678 (95% CI: 0.388-1.187, $P = 0.173$) indicating a no significant relationship between Covid-19 vaccine accessibility and Covid-19 vaccine Uptake among health workers at Nansana municipality. Therefore Covid-19 vaccine uptake among health workers wasn't affected in any way by Covid-19 vaccine accessibility.

Health workers' acceptability and their knowledge and attitudes towards Covid-19 vaccine safety and efficacy in Nansana municipality

Table 7 below shows summary statistics of knowledge and attitudinal factors among health worker's relating to Covid-19 vaccine acceptability, safety and efficacy.

Variable	N (N %)
N=365	
Acceptability	
After this Covid-19 wave era, no need to further to follow Covid-19 Standard Operating Procedures	
Agreement	75(21.6%)
Disagreement	272(78.4%)
Covid-19 vaccination may be a business issue	
Agreement	110(35.7%)
Disagreement	198(64.3%)
Facility recommends hence its mandatory	
Agreement	222(69.6%)
Disagreement	97(30.4%)
Legally mandatory to take Covid-19 vaccine	
No	75(21.4%)
Yes	276(78.6%)
Willing to go for Covid-19 vaccination whether it's free or Paid for	
Agreement	286(96.3%)
Disagreement	11(3.7%)
Safety	
Rapid Covid-19 vaccine development	
Agreement	107(36.4%)
Disagreement	187(63.6%)
There's enough convincing data about the vaccines	
Agreement	211(66.1%)
Disagreement	108(33.9%)
Covid-19 Vaccine is free and has no harm	
Agreement	261(76.3%)
Disagreement	81(23.7%)

I might have adverse effects soon after vaccination	
Agreement	223(66.4%)
Disagreement	113(33.6%)
Covid-19 vaccination might be faulty	
Agreement	91(31.2%)
Disagreement	205(68.8%)
Efficacy	
Immunity Protective against Covid-19 comes after	
First dose	26(7.4%)
Second dose	219(62.6%)
Two weeks after first dose	62(17.7%)
Not Sure	40(11.4%)
Others	3(0.9%)
What to do in case of Hypersensitivity from the vaccine	
Counsel	104(29.8%)
Give anti-allergic drugs	65(18.6%)
Refer	173(49.6%)
Impossible to get hypersensitivity	5(1.4%)
Others	2(0.6%)

Table 7: Knowledge and attitudinal factors towards Covid-19 vaccine Acceptability, safety and Efficacy.

Table 7 above presents summary statistics for various knowledge and attitudinal aspects related to Covid-19 vaccines, including efficacy, acceptability, and safety. The data is based on responses from 365 health workers. After Contracting Covid-19, 21.6% of respondents agreed that there would be no need for further following SOPs after the Covid-19 wave era, while 78.4% disagreed. Among the 365 participants, 35.7% of respondents agreed that Covid-19 vaccination may be a business issue, while 64.3% disagreed. 36.4% agreed that the rapid Covid-19 vaccine development is a concern, while 63.6% disagreed.

69.6% of the health workers agreed that the facility recommends them to get the Covid-19 vaccine and it is mandatory, while 30.4% disagreed. Additionally, 78.6% of respondents agreed that taking the Covid-19 vaccine is legally mandatory, while 21.4% disagreed. Among the 365 health workers, 286 (96.3%) 96.3% agreed that they are willing to go for Covid-19 vaccination whether it's free or paid for whereas 11 (3.7%) disagreed. 36.4% agreed that rapid Covid-19 vaccine development has affected their decision in getting the vaccine while the 63.6% disagreed with this.

66.1% of respondents agreed that there is enough convincing data about the Covid-19 vaccines, while 33.9% disagreed about this. 76.3% of respondents also agreed that the Covid-19 vaccine is free and has no harm, while 23.7% were in disagreement with this.

7.4% of respondents believed immunity against Covid-19 is achieved after the first dose of the vaccine, 62.6% believed after the second dose, and 17.7% believed immunity is acquired after two weeks from getting the Covid-19 vaccine although 11.4% were not sure, and 0.9% had other responses. About get adverse effects soon after vaccination, 66.4% agreed that it may happen although 33.6% disagreed with this. 31.2% of respondents agreed that Covid-19 vaccination might be faulty, while 68.8% disagreed.

29.8% of respondents recommended counselling, 18.6% recommended giving anti-allergic drugs, 49.6% recommended referring to a healthcare professional, 1.4% believed it was impossible to get hypersensitivity, and 0.6% had other response (Table 8).

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Variable	Not Vaccinated N=67	Fully Vaccinated N=298	B	COR 95%CI	AOR at 95%CI	P-value (Significant if P-value<0.05)
Acceptability						
After this Covid-19 wave era, no need to further to follow SOPs						
Agreement	12(16.0%)	63(84.0%)	0.220	0.787 (3.96-1.564)	1.246 (0.443-3.500)	0.677
Disagreement	53(19.5%)	219(80.5%)				*
Covid-19 vaccination may be a business issue						
Agreement	21(19.1%)	89(80.9%)	-0.803	0.904 (0.502-1.625)	0.448 (0.191-1.052)	0.065
Disagreement	41(20.8%)	157(79.2%)				*
Facility recommends hence its mandatory						
Agreement	33(14.9%)	189(85.1%)	-0.089	0.453 (0.254-0.807)	0.915(0.412-2.035)	0.828
Disagreement	27(27.8%)	70(72.2%)				*
Legally mandatory to take Covid-19 vaccine						
No	23(14.9%)	38(85.1%)	-1.111	3.571 (1.926-3.617-	3.038 (1.964-3.306)	0.013***
Yes	40(14.5%)	236(85.5%)	0.899	2.219 (0.560-8.800)	2.458 (0.477-12.667)	0.282
Don't Know	3(21.4%)	11(78.6)				*
Willing to go for Covid-19 vaccination whether it's free or Paid for						
Agreement	64(19.2%)	270(80.8%)	0.447	1.817 (0.529-6.240)	1.564(0.262-9.326)	0.623
Disagreement	3(11.5%)	23(88.5%)				*
Safety						
Rapid Covid-19 vaccine development						
Agreement	25(89.7%)	82(11.3%)	-0.411	1.279 (0.718-2.277)	0.663 (0.279-1.575)	0.352
Disagreement	36(92.5%)	151(7.5%)				*
There's enough convincing data about the vaccines						
Agreement	42(19.9%)	169(80.1%)	0.964	1.081 (0.588-1.954)	0.381 (0.149-0.974)	0.044***
Disagreement	20(18.7%)	87(81.3%)				*
Covid-19 Vaccine is free and has no harm						

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Agreement	59(22.6%)	202(77.4%)	2.786	3.088 (1.350-7.064)	1.621 (0.667-1.691)	0.001***
Disagreement	7(8.6%)	74(91.4%)				*
I might have adverse effects soon after vaccination						
Agreement	36(16.1%)	187(83.9%)	-0.058	0.678 (0.383-1.198)	0.944 (0.439-2.029)	0.882
Disagreement	25(22.1%)	88(77.9%)				*
Covid-19 vaccination might be faulty						
Agreement	18(19.4%)	75(80.6%)	-0.018	0.990 (0.533-1.840)	0.982 (0.377-2.557)	0.970
Disagreement	40(24.2%)	165(75.8%)				*
Efficacy						
Immunity Protective against Covid-19 comes after						
First dose	3(11.5%)	23(88.5%)	-0.847	0.550 (0.158-1.917)	0.429 (0.081-2.268)	0.319
Second dose	42(19.2%)	177(80.8%)	-1.606	0.492 (0.128-1.896)	0.201 (0.029-1.374)	0.102
Two weeks after first dose	13(21.0%)	49(79.0%)	-0.800	0.615 (0.144-2.631)	0.373 (0.017-8.349)	0.534
Not Sure	7(17.5%)	33(82.5%)	-0.985	0.261 (0.018-3.824)	0.54 (0.01-54.89)	0.664
Others	1(33.3%)	2(66.7%)				*
What to do in case of Hypersensitivity from the vaccine						
Counsel	22(21.2%)	82(78.8%)	0.166	1.185 (0.541-2.594)	1.181 (0.439-3.172)	0.742
Give anti-allergic drugs	12(18.5%)	53(81.5%)	0.073	1.332 (0.719-2.469)	1.076 (0.456-2.539)	0.867
Refer	29(16.8%)	144(83.2%)	19.914	43.342 (0.000-67.545)	44.540 (0.000-65.823)	0.999
Impossible to get Hypersensitivity Others	0(0.0%) 2(100.0%)	5(100.0%) 0(0.0%)	-24.111	0.000 (0.00-18.542)	0.00 (0.00-17.52)	1.000 *
*indicates variable reference; *** Significant p-value<0.05; OR means Odds Ratio; CI means 95% confidence Interval						

Table 8: A logistic Regression analysis of knowledge and attitudinal factors associated with full covid-19 vaccine uptake among participants at Nansana municipality.

The table above presents the results of a study examining the relationship between knowledge, attitudes and Covid-19 vaccination status among 365 participants. The p-values for each statement indicate whether there is a statistically significant difference in the responses between the two groups. A p-value less than 0.05 suggests that the difference is significant. According to the results, health workers who disagreed with Covid-19 vaccine uptake being mandatory were 3.038 times less likely to get a full Covid-19 vaccine uptake as regards to those who agreed that its legally mandatory to take a full Covid-19 vaccine uptake, 3.038(95%CI: 1.964-3.306, P=0.013).

Additionally, those health workers who agreed that there's enough convincing data about the Covid-19 vaccine are 0.381 more likely to get a full vaccination than those who were in disagreement 0.381(95%CI: 0.149-0.974, P=0.044). Also, health workers who agreed that the Covid-19 vaccine is free and has no harm were 1.621 times more likely to get a full Covid-19 vaccination 1.621(95%CI: 0.667-1.691,P=0.001).

Discussion

The world was hit by a new Corona Virus disease which started from Wuhan China by December 2019 and spread all over the world [1]. Many people succumbed to the disease and almost all global Governments embarked on thorough prevention measures to protect their populations against Covid-19 [20]. Since Covid-19 immunization has been considered as the most effective way to prevent further outbreaks, various vaccine developments have been scaled up to overcome vaccine shortage [20].

Therefore, in achieving a higher Covid-19 vaccine acceptance among the general public, health workers and their knowledge and attitudes should be greatly considered since they are a great deal in role modelling behavior change, transmitting vaccine basic information, doing the actual vaccination process, and the risky nature of their work, hence studying 'Covid-19 vaccine uptake and associated factors among health workers in one municipality (Nansana) of a developing country (Uganda) was very important. This research was carried out to:

1. Determine the prevalence of full and partial Covid-19 Vaccine uptake among health workers in Nansana municipality.
2. Determine the Socio-demographic factors associated with Covid-19 Vaccine Uptake among health workers in Nansana municipality.
3. To find out whether Covid-19 vaccine accessibility affects Covid-19 vaccine uptake among health workers in Nansana municipality.
4. Assess healthcare workers' knowledge and attitudes towards Covid-19 vaccine safety, efficacy among Health Workers

at Nansana Municipality; assess Healthcare Workers' Covid-19 vaccine acceptability in Nansana municipality.

Prevalence of Covid-19 vaccine uptake

The full prevalence of Covid-19 vaccine uptake among health workers at Nansana municipality stood at 81.6%, similar to a study about Covid-19 vaccine acceptance among health workers in rural Uganda (86.7% vaccine acceptance) [21]. Similarly, a survey conducted at West Texas hospital regarding Covid-19 vaccination attitudes and behaviors among nurses with prevalence above 80% [22] and a survey that assessed Covid-19 vaccine acceptability among health workers in Saudi Arabia with a full Covid-19 vaccine uptake of 91.4% [23].

However its higher than in a study about Covid-19 vaccine uptake and self-reported side effects among health workers in Mbale City, Uganda (66% full Covid-19 vaccine uptake) and 19.2% full Covid-19 vaccine uptake prevalence in a survey about uptake of Covid-19 vaccines and associated factors among adults in Uganda.

This study was conducted almost a year after Uganda's second lock down, and in the period where the Covid-19 era had almost ceased, most Ugandans especially health workers had completed all the Covid-19 vaccine doses since 2020, leading to a high vaccine uptake among health workers in this study compared to some studies which were done when the Covid-19 had just been confirmed in Uganda [24].

Socio-demographics associated with Covid-19 vaccine uptake

This study demonstrated that males are 0.019 times more likely to get a full Covid-19 vaccination than the females 0.019(95%CI: 0.003-0.142, P=0.001). This is because 99.3% of the males in this study had fully vaccinated against Covid-19 compared to the 70% females who had fully vaccinated. This corresponds to a survey about the socio-demographic factors associated with acceptance of Covid-19 vaccine and clinical trial in Uganda, where males were 1.1 times more likely to get vaccinated against Covid-19 than females [25]. Similarly, males were 4 times greater than females in getting the vaccine in a study about Covid-19 vaccine acceptance among high risk populations in Uganda [26].

Additionally, in a study about Covid-19 vaccine acceptability and uptake among people living with HIV in Uganda, 73% males took the vaccine versus the 63% females [27]. Also, in a survey about Covid-19 vaccine uptake and associated factors in Sub-Saharan Africa, 22.2% males were vaccinated compared to the 16% of the females [28] and also in a siren study conducted in the UK, 90.8% of male health workers were more likely to be vaccinated than the 88.1% female health workers [29].

However this study contradicts with a survey done by the National Health Service about Covid-19 vaccine acceptance that showed that 90.1% of females were more likely to get vaccinated against Covid-19 compared to 87.7% of the males.

The study also demonstrated that Moslems among all religions were 2.896 times more likely to get fully vaccinated than others 2.896 (95%CI: 0.118-2.750, P=0.020). This is because most of the Moslems (77%) were fully vaccinated against Covid-19. Although there seems to be a complexity between the effects of religion on Covid-19 vaccine uptake as results from various surveys indicate varying data with different religions, this study's results are similar to a study done in United Kingdom about the intent of Covid-19 vaccination where Moslems had the great intention to be vaccinated [30]. However, the results in this study contradicts with those in a global survey of evangelicals and Covid-19 vaccine hesitancy demonstrated that more than 87% of Christians took the Covid-19 vaccine compared to all other religions [31]. Additionally, also in a study about Predictors of Intention to vaccinate against Covid-19 in a Peruvian sample showed that Catholics were more likely to vaccinate against Covid-19 compared to other religions [32] although similar data wasn't available at the moment for Uganda.

There was no significant results with other socio-demographic characteristics like age, education level, marital status, occupation and tribe. However, in some studies like Covid-19 vaccine uptake and associated factors among adults in Uganda (higher education influences vaccine uptake), Socio-demographic factors associated with COVID-19 vaccine uptake and refusal among Ugandan women (those with secondary education were significant), education level was significant [10,33]. Surveys like Socio-demographic factors associated with Covid-19 vaccine uptake and refusal among Ugandan women (70 years and above were more likely to get the Covid-19 vaccine) [33] and factors associated with acceptance of Covid-19 vaccine among university health sciences students in Northwest Nigeria [34] found out that those with 25 years and above were significant because the study had many students with 25 years and above.

Covid-19 vaccine accessibility and Covid-19 vaccine uptake

This study demonstrated that Covid-19 vaccine accessibility didn't in any way affect Covid-19 vaccine uptake 0.678(0.388-1.187, P=0.173). This is due to the fact that most respondents (52.6%) agreed that the vaccine was easily accessible and majority of them (83.8%) had fully vaccinated hence corresponding to a study conducted about Covid-19 telemedicine and vaccination at an urban safety Net HIV medical clinic, Covid-19 vaccine accessibility and availability didn't affect vaccine uptake which corresponds to this study results [35].

However there is a contradiction in a survey conducted about Covid-19 vaccine challenges in developing and developed countries which demonstrated that most countries like Sudan, Yemen, Afghanistan are greatly affected by vaccine inaccessibility due to uncertainties like wars and altitude [36]. Similarly another study about Covid-19 vaccine affordability, accessibility, and acceptability revealed several accessibility factors like socio-political contexts, affected vaccine uptake [37].

Knowledge and Attitudinal Factors Associated with Covid-19 Vaccine Uptake

Attitudinal factors

The study showed that most health workers who agreed that it's legally mandatory to take a full Covid-19 vaccine are 3.038 more likely to get fully vaccinated than those who disagreed, 3.038(95% CI: 1.964-3.306, P=0.013). This study results showed a positive attitude regarding Covid-19 vaccine acceptability among most of the health workers who were in agreement that its legally mandatory to uptake the vaccine, showing similar results to a study about Covid-19 vaccine acceptance among high-risk populations in Uganda [26], Knowledge, attitudes, and practices regarding Covid-19 vaccine among healthcare workers in Uganda [10], attitude and associated factors of Covid-19 vaccine acceptance among health professionals in Debre Tabor Comprehensive Specialized Hospital, North Central Ethiopia [38], and also in a study about knowledge and attitude towards Second Covid-19 vaccine dose among health professionals working at Public Health facilities in a low income country (Ethiopia) [39].

However this study's results were contrary to that of a study about acceptance of the coronavirus disease-2019 vaccine among medical students in Uganda which revealed a higher negative attitude to taking the Covid-19 vaccine among students [40].

Knowledge factors

The study also demonstrated that most health workers were knowledgeable about the Covid-19 vaccine safety as those who agreed that there is enough convincing data about the vaccines were 0.381 times more likely to get fully vaccinated compared to those who disagreed 0.381(95% CI: 0.149-0.974, P=0.044). Additionally, most health workers agreed that the Covid-19 vaccine is free and has no harm having a 1.621 more likelihood of getting fully vaccinated than those who disagreed, 1.621(0.667-1.691, P=0.001). This indicated a greater confidence in the safety of the vaccines among health workers hence these results suggest that knowledge about Covid-19 vaccination is positively associated with vaccination status, with fully vaccinated individuals having a better understanding of the benefits and safety of the vaccine. The findings may have implications for public health messaging and education efforts aimed at increasing vaccine uptake.

This is in line with several researches indicating that health workers are knowledgeable about the Covid-19 vaccine like in a surveys about knowledge, attitudes, and practices regarding Covid-19 among healthcare workers in Uganda, knowledge, attitude and practices towards Corona virus disease 2019 among Allied health students at Maya Paramedical school, Uganda [41] and in a survey about knowledge, attitudes, and practices of healthcare workers in Jordan towards the Covid-19 Vaccination [42].

However this study is contrary to a study about A descriptive-multivariate analysis of community knowledge, confidence, and trust in Covid-19 clinical trials among healthcare workers in Uganda where most health workers lacked sufficient knowledge about the Covid-19 vaccine [43] and also in a study about Multi-method findings on Covid-19 vaccine acceptability among urban refugee adolescents and youth in Kampala, Uganda where also youth lacked sufficient knowledge regarding the Covid-19 vaccine safety [44].

The data also suggest that there may be some confusion or uncertainty around vaccination status among some health workers, with a small percentage reporting not knowing their status which could also suggest some just wanted to be reserved and didn't want to reveal that they were never vaccinated. This comes from the unmatching full vaccination prevalence from their responses (76.2%) verses the true calculated prevalence (81.6%) [45-50].

Recommendation and Conclusion

This study found out that 81.6% of health workers were fully vaccinated against Covid-19, and only 5.5% had received partial vaccination. The study also demonstrated that males and Moslems were more likely to get a full Covid-19 vaccine uptake compared to the females and other religions respectively. Additionally, health workers had a positive attitude towards getting the vaccine as most agreed that it's legally mandatory to get fully vaccinated [51-55]. Similarly most health workers also were knowledgeable about the Covid-19 vaccine safety as most agreed that there's enough convincing data and Covid-19 vaccine is free and has no harm. Getting 100% Covid-19 vaccination rate among health workers and general public maybe quite challenging, however the following strategies can be adopted by respective authorities to ensure that herd immunity is achieved in Nansana municipality and Uganda as a whole [55-60].

More research studies should be conducted to find out some other critical issues regarding Covid-19 vaccine uptake among health workers which were not captured from this study. Issues regarding to motivational factors towards getting the vaccine among different sexes, prevalence differences regarding the time frames of that during the early stages of the pandemic and late

stages of the pandemic Covid-19 vaccine expiry and efficacy issues in many health facilities, disparities in the distribution of Covid-19 vaccines [61-70].

All Religious leaders should embrace the Covid-19 preventive messages to all their followers putting vaccination as the sole solution to the Covid-19 pandemic. The government of Uganda through the act of Parliament should implement mandatory Covid-19 vaccination policies for health workers and general public to increase vaccination rates among them especially in areas where direct patient care is offered. These policies should be well communicated and enforced with sufficient trust and transparency [71-80].

Massive information messages regarding Covid-19 vaccine safety should be given to the public by the Uganda Ministry of Health and Non-Governmental Organizations like UNICEF to impart public and health workers' confidence in the available vaccines on market.

Routine immunization schedules should also be organized at respective health facilities to encourage all members to get fully vaccinated against Covid-19. This study was conducted in a municipality (Nansana) near Uganda's capital, Kampala. It demonstrated that males and Moslems were more likely to get a full Covid-19 vaccine uptake and health workers had a positive attitude towards the Covid-19 vaccine acceptability and were knowledgeable about the Covid-19 vaccine safety [81-86].

Acknowledgement

This work has received great support from all of us, working together as a team. Many thanks to the supervisors Dr. Aisha and Ms Patience for all the support rendered. May God bless you.

Ethical Considerations

An introductory letter was obtained from the faculty of Health Sciences, department of public health which was attached to each data collection tools (questionnaires). A cover letter from the head of medical services Nansana municipality was obtained to approve this study to be conducted in Nansana municipality. The study obtained approval from The Aids Support Organization Research Ethics Committee (approval number TASO-2022-195) under the Uganda National Council for science and Technology to conduct research on humans.

Informed consent from all the respondents was obtained after explaining in detail the purpose of the study, their participation being willingly, none monetary terms among others. The information was kept confidential and no participant's name appeared on the questionnaires instead there were codes that were attached, and questionnaires were self-administered. Any information after the study that the researcher found important informed some of the participants and the health facilities by organizing health talks on

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how to prevent the Covid-19 Pandemic through Immunization and encouraging more vaccine uptake among health workers and other Preventive measures so as to improve the lives of the people. Lastly, participants' participation in this study was voluntary and private.

Study Limitation

Since the researcher was interviewing health workers already on duty, some didn't give the attention needed to ask questions and get answers from them and some Health workers had different duty schedules therefore, there was failure in accessing some of them, as some were also on leave during the time period. Some participants like one big Private hospital in Maganjo were not co-operative as they believed the study was being funded and therefore kept asking for money. Very few health workers in each of the health facilities, there could be one or two participants in most of these health facilities, and this forced us to take more health facilities to get more participants. Most of the health facilities more so in Kawanda, Busukuma and Magigy were not registered with respective councils yet they were potential participants for the study but didn't participate.

Most health workers were unable to give sufficient correct information as some couldn't remember the vaccine brands received, dose numbers and some questions were not fully answered. The weather was not conducive for the researcher and his assistants to collect data effectively, since it was a dry hot season and most facilities are far away from the main road, long distances had to be travelled under too much sunshine to collect data maybe a rainy season. Because the study was conducted in only one municipality in Uganda, the findings may not easily be generalized to Uganda as a whole.

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Citation: Katumba C, Patience N, Nakitto AMS (2023) COVID-19 Vaccine Uptake and Associated Factors among Health Workers in Nansana Municipality, Central Uganda: A Cross Sectional Study. *J Community Med Public Health* 7: 391. DOI: <https://doi.org/10.29011/2577-2228.100391>

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