Trusted sources of information on COVID-19 vaccines during the pandemic in Uganda. A cross-sectional study

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Abstract

Background. COVID-19 has dramatically impacted communities worldwide, especially in developing countries. To successfully control the COVID-19 pandemic, more than 80% vaccination coverage was required, and the flow of correct information to the population was critical. However, misinformation and disinformation could impact this, increasing COVID-19 vaccine hesitancy in some communities. Several studies have assessed the effect of misinformation and disinformation on COVID-19 vaccine acceptance and other responses to the pandemic in the African continent. Thus, the most trusted sources of information on COVID-19 vaccines to the population is critical for successfully managing and controlling the pandemic. This study aimed to assess the most trusted sources of information on COVID-19 vaccines during the pandemic in northern Uganda.

Methods. We conducted a cross-sectional study on 587 adult population members in northern Uganda. Stratified and systematic sampling methods were used for selecting participants from twenty-four health facilities in the Acholi subregion. Data were collected using an interviewer-administered questionnaire with an internal validity of Cronbach's α=0.72. A local IRB approved the study, and Stata version 18 was used for data analysis. A Pearson Chi-square (χ^2) analysis was conducted to assess the association between trusted sources of information on COVID-19 vaccines among study participants and selected independent variables. Fisher's exact test assessed association when cell value following cross-tabulation was ≤5. A P-value <0.05 was used as evidence for an association between the trusted sources of information and independent variables. All results were presented as frequencies and proportions and Chi-square or Fisher's exact test P-values at 95% Confidence Intervals (CI).

Results: In a study of 587, most participants were males, 335(57.1%), in the age group of 25-34 years, 180(31.4%), and the most trusted source of information on COVID-19 vaccines were the traditional media sources such as Televisions, Radios, and Newspapers, 349(33.6%). There was no significant association between sex and sources of information on COVID-19 vaccines. However, by age group population, it was significantly associated with internet use (14.7% versus 85.3%; p=0.02), information from family members (9.4% versus 90.6%; p<0.01), and the Government/Ministry of Health (37.9% versus 62.1%; p<0.01). In addition, it was significantly associated with internet use (32.2% versus 67.8%; p=0.03), healthcare providers (32.5% versus 67.5%; p<0.018), the Government/Ministry of Health (31.1% versus 68.9%; p<0.01), and scientific articles (44.7% versus 55.3%; p<0.01) in healthcare workers compared to non-health workers.

Conclusion. The most substantial finding from our study was that the most trusted sources of information on COVID-19 vaccines in northern Uganda were Television, Radio, and Newspapers. There were no significant differences in the most trusted sources of information on COVID-19 vaccines between the sexes but significant differences by age groups and occupations, with the younger age groups and non-healthcare workers having more trust in TVs, Radios, and Newspapers. For effective management of an epidemic, there is a need for accurate communication so that misinformation, disinformation, and malinformation do not disrupt the flow of information to communities.

Introduction

The COVID-19 pandemic has been marked by widespread misinformation globally.[1] Misinformation is one form of information syndrome besides disinformation and malinformation.[2] Wardle and Derakhshan[2] defined *misinformation* as false information that is shared but is not necessarily intended to cause harm. At the same time, disinformation is false information deliberately created to harm a person, social group, organization, or country. On the other hand, malinformation is information based on reality and used to inflict harm on a person, organization, or country.[2] This understanding is further supported by Chou *et al.*[3], who assert that health misinformation is a health-related claim of fact that is currently false due to a lack of scientific evidence. In addition, the COVID-19 infodemic has extensively been promoted over mainstream and social media, which generally have limited censorship of posts on users' timelines.[3]

Several conspiracy theories have emerged worldwide, including its association with 5G technology, bioengineering from Wuhan, Bill Gates's agenda on population control using vaccines, and many others.[3,4] In Uganda, much health misinformation related to COVID-19 has been reported since the beginning of the COVID-19 pandemic.[4]

Experts, specialists, and researchers have proposed regular communications, providing updates on the status of COVID-19 in-country to encourage government agencies and Task forces to use mainstream and social media to inform and provide guidance on COVID-19 situational analysis at international, national, and local levels.[5] This is because communities need not be fed on fake news and inaccurate information because these hamper progress in the control of the pandemic.[6]

Lessons learned from the 40-year-old experience with successful control of HIV should be one reference point where researchers and academicians recommended that the best way of handling the epidemic then was by use of medical and non-medical interventions, including regular and factual behavior change communication messages.[6]

Besides, some African countries have successfully undertaken the initial steps to control the SARS-CoV-2 pandemic through proper and timely communication on the multiple public health intervention measures listed above.[7,8] The current evidence suggests that SARS-CoV-2 transmission is perhaps most significant very early in the infection prior to the development of symptoms; the same lessons that were learned from HIV in its early days when infected persons appeared normal (with no signs and symptoms of AIDS) as other community members.[6] It is proposed that since the transmission routes of SARS-CoV-2 are known, biomedical and non-medical prevention strategies that provide reliable protection become essential and should be communicated to the African population.[6] Hence, behavior change communications and regular updates on the virus become crucial interventions that African governments must adopt.[6]

An online survey recently reported that 30.2% of Ugandans considered COVID-19 a disease of the whites and expected mortality to be highest among white people from Europe and the USA.[4] It is now known that

misinformation affects public perception of risk and breeds mistrust, which may undermine acceptance and adherence to preventive measures, including acceptance of the COVID-19 vaccine. As such, the WHO and other global and national actors have responded to the threat of misinformation by running campaigns encouraging fact-checking health information.[9] However, little has been done to address COVID-19 misinformation in Uganda or to understand and address how this could influence COVID-19 Vaccine acceptance.

Furthermore, since the COVID-19 pandemic started, countries have enacted a series of non-clinical preventive mechanisms to slow the rate of SARS-CoV-2 spread.[6,7,8] However, these mechanisms can be effective only when they are correctly followed and only when individuals believe the risk of COVID-19 is high enough to warrant following them.[6,7,8] As risk perceptions decline, individuals are more likely to relax following preventive measures, and the rate of spread might increase.[6,7,8]

This study aimed to assess and determine the most trusted sources of information on the COVID-19 vaccines in adult population of northern Uganda during the pandemic.

Methods

Study design: We conducted a cross-sectional study in northern Uganda between October and November 2021.

Study sites: This study was conducted among adult community members of Northern Uganda in the nine districts of the Acholi subregion (Gulu City, Nwoya, Omoro, Lamwo, Kitgum, Agago, Amuru, Pader and Gulu districts).[10] The nine districts are part of the Acholi subregion, which has just emerged from a 20-year-old civil war between the Government of Uganda and the rebel Lord's Resistance Army (LRA), and the population is in the postwar recovery period.[11] The total estimated population of two million, three hundred thousand people is estimated in a total land surface area of 28,500km^2.[10,12,13]

During this study, Uganda had just eased the second lockdown measures to control the COVID-19 second wave. The number of COVID-19 patients had significantly reduced in COVID-19 Treatment Centers (CTUs) in many health facilities in Northern Uganda.[14] But health workers remained the frontline workforce (especially the nurses, midwives, cleaners, pharmacists, doctors, and laboratory staff).[14,15] In addition, district task forces set up by the Government of Uganda along the layers of administrative structures (national, districts, and communities) to support the management, prevention, and control of the COVID-19 pandemic in communities met weekly to discuss new developments and plans of action.[14,15]

Further, the President of Uganda announced new work methods in public settings, whereby only 30% of public and private institution staff were allowed physically in offices.[14,15] These COVID-19 control measures were to disrupt day-to-day contact between management, administration, and the community to interrupt the cycle of physical person-to-person contact to break the transmission cycle of COVID-19.[14,15]

Study participants and sampling techniques: We surveyed five hundred and eighty-seven adult participants recruited by stratified and systematic sampling techniques and collected data using a questionnaire. The questionnaire had two sections: Section A obtained information on participants' socio-demographic characteristics (age, sex, occupation, tribe, religion, district, employment status, race, highest level of education, marital status, and habits such as smoking and drinking alcohol, and comorbidities such as obesity, Asthma, heart diseases, hypertension, Diabetes mellitus, and HIV and AIDs). In section B, we assessed the population's most trusted sources of information on COVID-19 vaccines. These included traditional media sources (Televisions, Radios, and Newspapers), the Government/Ministry of Health, healthcare providers, the Internet, social media, family members, scientific articles, pharmaceutical company reports and those who did not trust any source of information on COVID-19 vaccines.

The study population selection was stratified at the regional level to the nine districts of the Acholi subregion. In the districts, again, to twenty-four health facilities where COVID-19 vaccination was carried out to the general population for free. The twenty-four selected health facilities (Government and Non-governmental facilities) for our study included Hospitals, Health Centre (HC) IVs, and Health Centre IIIs. The health facilities were St. Mary's Hospital, Gulu Regional Referral and Gulu University Teaching hospital, Independent hospital, Anaka hospital, Kitgum Government hospital, St. Joseph's hospital, Kitgum, and Dr. Ambrosoli memorial hospital, Kalongo (7 hospitals); Atiak HCIV, Lalogi HCIV; Awach HCIV; Madi Opei HCIV, Padibe HCIV, and Namukora HCIV (6 Health Centre IVs); and Palabek HCIII, Amuru HCIII, Pabbo HCIII, Koch Goma HCIII, Opit HCIII, Pader HCIII, Patongo HCIII, Cwero HCIII, Odek HCIII, Atanga-Lacekocot HCIII, and Rackoko HCIII (11 HCIIIs).

In the selected health facilities' outpatient departments (OPD), we conducted a systematic sampling technique on attendants and attendees of OPDs in OPD registers. We defined *systematic sampling* as a probability sampling method where researchers select population members at regular intervals.[16,17] We chose this sampling technique because it allowed us to get the desired sample size in the shortest period, reducing the risk of our study team acquiring COVID-19.

Last but most importantly, a systematic sampling method helps to minimize biased samples and poor survey results in addition to eliminating clustered selection with a low probability of collecting contaminated data[16,17], which was the ideal situation the research team had to achieve.

Sample size estimation: The sample size was calculated using Raosoft sample size calculator. The computation was based on a 50% response distribution, 5% margin of error, and 95% Confidence Interval (CI). This online software foundation uses a widely utilized descriptive sample size estimation formula.[18,19] Based on the assumption of a total eligible population size of 50,000 (12.5% of the total adults above 18 years old in the Acholi subregion) in the nine districts of the Acholi subregion. The minimum sample size based on the above assumptions and factoring a 10% non-response rate is 437 participants.

$$n = \frac{N}{(1+Ne^2)}$$

Where n= Sample size

N=the population size (50,000 people)

e=margin of error at 5%

Substituting the formula

$$n = \frac{50,000}{(1+50,000 \times 0.05^2)} = \frac{50,000}{(1+125)} = \frac{50,000}{126} = 397$$

Add, 10% for non-response, 39.7 +397 = 437

Based on the above assumptions, the minimum sample size and factoring in a 10% non-response rate is 437.

Data collection: Data were collected using a pretested questionnaire designed by the research team. The questionnaire was pretested in the outpatient department of Gulu Regional Referral Hospital. The result was not integrated into the final data used in this analysis. The questions achieved an internal validity of Cronbach's α=0.72. After obtaining informed consent from participants, an interviewer-guided questionnaire was administered to participants face-to-face in the Outpatients' department (OPD) room, ensuring that infection, prevention, and control (IPCs) and standard operating procedures (SOPs) for COVID-19 were in place for both participants and interviewers.[20] First, OPDs were chosen as sites for this study because they had IPCs and SOPs facilities. In addition, the OPD was the most convenient and preferred place to interview participants as the population had just emerged from a severe second wave of COVID-19. During that period, the population was still in fear and apprehension due to the distress of contracting COVID-19 and were not willing to receive researchers in their offices, homes, or environment.

Second, we adopted a face-to-face questionnaire interview as the best mode of data collection despite the risks of contracting COVID-19 because we wanted to reach out to as many participants as possible to answer our questionnaire. We could have used an online approach for data collection. However, previous surveys conducted in northern Uganda showed very few online and internet users (23%)[21] and mainly among persons who would not be eligible for this study because of age. Had we only attempted to obtain data from online and internet users, we would not have been able to reach the sample size in time.

At each of the twenty-four selected health facilities, the study was conducted in the Outpatients' Departments (OPDs), where a consented adult person (≥18 years) was recruited for the study. The target population was attendees and attendants of the OPD services. A systematic sampling of every third

attendant or attendee from the selected health facility's OPD records was recruited from morning (9:00 am to 6:00 pm) every day from Monday to Saturday) until the sample size was achieved.

Each questionnaire interview with participants lasted between 30-40 minutes in a convenient room in the OPD. As much as the questionnaire was in English, only a few participants required translation of some questions into the local language (5/587, 0.85%). Participants who could not speak (due to speech disability or inability to talk and not a language barrier) and were not residents of the Acholi subregion six months before the study were excluded. Interestingly, only two potential participants declined to participate in the survey, constituting 2/589(0.34%) of the study population. Therefore, the response rate for this study was 587/589(99.7%). Overall, the interviews went uneventfully for most participants ensuring that standard IPC and SOP guidelines were adhered to.[20]

Ethical approval: This study was approved by the St. Mary's Hospital, Lacor Institutional Research and Ethics Committee (LHIREC, No.0192/10/2021). In addition, this study was conducted following institutional guidelines. Informed consent was obtained from each individual participant aged (≥18 years). Furthermore, personal participant's information was kept confidential, excluding all personal identifiers from the research documents. Also, all the de-identified data were kept under lock and key throughout the study period. After the research was completed, residual data were archived in the Department of Surgery, Faculty of Medicine of Gulu University.

Data analysis: We analyzed this data using Stata 18[22] and used Microsoft Excel 2019 to generate graphs. We conducted a descriptive analysis of participants' sociodemographic characteristics, presenting the findings as proportions and percentages. We assessed the most trusted sources of COVID-19 information among participants and presented findings as frequencies and bar charts. The potential sources include traditional media (Televisions, Radios, and Newspapers), the Government/Ministry of Health, healthcare providers, the internet, social media, family members, scientific articles, pharmaceutical company reports, and those who did not trust any source of information on COVID-19 vaccines.

From the literature on COVID-19 vaccines, we selected independent variables such as age, sex, occupation, level of education, employment status, race, nationality, tribes, religion, districts, addresses, comorbidity, smoking and drinking status, marital status, and comorbidities for the analysis. The dependent variable was the most trusted sources of information on COVID-19 vaccines among the study population. In addition, we used Chi-square and Fisher's exact tests to assess the independent factors associated with the most trusted sources of information on COVID-19 vaccines in the region.

The results are reported as Chi-square tests and their respective P values and 95% Confidence Intervals (CI). We considered a p-value<0.05 as statistically significant.

Results

We interviewed 587 adult participants, 18 years and above, from northern Uganda, with a questionnaire response rate of 587/589(99.7%). Only two participants, 2/589(0.34%), declined to participate in this study, and 5/587(0.85%) required the English translation of the questionnaire to the local language, Acholi.

The sociodemographic and health background of participants.

Most participants in our study population were males,335(57.1%); in the age group of 25-34 years, 180(31.4%) and married or cohabiting, 341(58.9%). Most participants were Catholics, 312(53.2%); Acholi by tribe, 422(72.9%); from Gulu-Omoro districts, 220(37.5%); and had attained tertiary level of education, 261(44.5%); healthcare professionals, 136(23.2%); Ugandan by nationality, 581(99.0%); and African by race,586(99.8%). Regarding social behaviors of participants, most did not use alcohol, 401(69.0%); and did not smoke cigarettes, 545(94.1%). On their health background information, most participants did not have comorbidities, for example, Diabetes mellitus, 571(97.3%); heart diseases, 571(97.3%); obesity, 578(98.5%); hypertension, 559(95.2%); Asthma, 572(97.4%); HIV and AIDs, 577(98.3%) and other chronic diseases, 542(92.3%). Their most trusted source of information on the COVID-19 vaccine was from TVs, Radios, and Newspapers, 349(33.6%) (Table 1).

The most trusted sources of COVID-19 vaccine information among the study population. The study found that most participants trusted the traditional media houses (Television, Radio, Newspapers, and websites) (59.5%) on COVID-19 vaccine information, followed by the Government/Ministry of Health (37.8%), healthcare providers (35.2%), internet (14.8%), social media (14.1%), family members (9.5%), scientific articles (8.0%), pharmaceutical company reports (4.1%), and those who did not trust any source of information on COVID-19 vaccine (3.6%) (Figure 1).

Preferred sources of information on COVID-19 vaccine by sex of participants in northern Uganda.

Most study participants trusted COVID-19 vaccine information from TVs, radios, and newspapers, with females at 160(45.9%) and 189(54.2%) in males. However, most females, 219(43.8%) and males, 281(56.2%) did not trust COVID-19 vaccine information from the internet; most females, 217(43.1%) and males, 287(56.9%) did not trust information from social media; most females, 164(43.3%) and males, 215(56.7%) did not trust information from healthcare providers; most females, 164(43.3%) and males, 201(55.1%) did not trust information from the Government; most females, 232(43.7%) and males 299(56.2%) did not trust information from family members. Furthermore, most females, 242(43.0%), and males, 321(57.0%), did not trust information from pharmaceutical company reports on COVID-19 vaccines. Most females, 235(43.5%), and males, 305(56.5%), did not trust information from scientific articles. In addition, most females, 243(42.9%), and males, 323(57.1%), did not trust any sources of information on COVID-19 vaccines. Overall, there was no significant statistical difference between male and female participants in northern Uganda on the most trusted sources of information on COVID-19 vaccines (Table 2).

Trusted sources of information on COVID-19 vaccine by age group of participants in northern Uganda. There were significant associations between age groups on the most trusted sources of information on COVID-19 vaccines among the study population. There was significantly less trust among the study population in COVID-19 vaccine information from the internet (14.7% versus 85.3%; p=0.02), from families (9.4% versus 90.6%; p<0.01), and Government/Ministry of Health (37.9% versus 62.1%; p<0.01) compared to those who trusted them. Younger participants were more pessimistic to internet, families, and Government on COVID-19 vaccine information during the period (Table 3).

The most trusted sources of information on COVID-19 vaccines by occupation of participants in northern Uganda.

The study found that the most trusted sources of information on COVID-19 vaccines between healthcare workers and non-health workers were significant different with non-health workers relying mainly on traditional media sources (TVs, Radios, Newspapers) (16.3% versus 83.7%; p<0.01); Internet (32.2% versus 67.8%;p=0.03); Healthcare providers (32.6% versus 67.5%;p<0.018); Government/Ministry of Health (31.1% versus 68.9%;p<0.01), and scientific articles (44.7% versus 55.3%; p<0.01) (Table 4).

Table 1: Sociodemographic characteristics and health backgrounds of participants from northern Uganda.

Sociodemographic characteristics		n (%)
Sex	Female	252(42.9%)
	Male	335(57.1%)
Age in years	<25	150(26.2%)
	25-34	180(31.4%)
	35-44	157(27.4%)
	>45	86(15.0%)
Marital status	Married/cohabiting	341(58.9%)
	Unmarried/others	238(41.1%)
Religion	Catholic	312(53.2%)
	Protestant	245(41.7%)
	Others	30(5.1%)
Tribe	Acholi	425(72.9%)
	Lango	41(7.0%)
	Others	117(20.1%)
Districts	Gulu-Omoro	220(37.5%)
	Kitgum-Lamwo	133(22.7%)
	Amuru-Nwoya	92(15.7%)
	Agago-Pader	86(14.7%)
	Others	56(9.5%)
Levels of formal education	Tertiary	261(44.5%)
	Secondary	225(38.3%)
	Primary	64(10.9%)
	None	37(6.3%)
Occupations	Health professional	136(23.2%)
	Agriculture/self-employed	115(19.6%)
	Employed/retired	82(14.0%)
	Student/unemployed	105(17.9%)
	Others	149(25.4%)

Nationality	Ugandan	581(99.0%)
	non-Ugandan	6(1.0%)
Race	African	586(99.8%)
	Caucasian	1(0.2%)
Health background information		
Alcohol use	No	401(69.0%)
	Yes	180(31.0%)
Smoking status	No	545(94.1%)
	Yes	34(5.9%)
Diabetes Mellitus	No	571(97.3%)
	Yes	16(2.7%)
Heart diseases	No	571(97.3%)
	Yes	16(2.7%)
Obesity	No	578(98.5%)
	Yes	9(1.5%)
Hypertension	No	559(95.2%)
	Yes	28(4.8%)
Asthma	No	572(97.4%)
	Yes	15(2.6%)
HIV	No	577(98.3%)
	Yes	10(1.7%)
Other diseases	No	542(92.3%)
	Yes	45(7.7%)
What is your most trusted source of information on COVID-19 vaccine?	TVs, Radios, and Newspapers	349(33.6%)
	Internet	87(8.4%)
	Social Media	83(8.0%)
	Healthcare practitioners	206(19.8%)
	The Government/MoH	222(21.4%)
	Family members	56(19.8%)

Pharmaceutical company reports	24(2.4%)
Scientific articles	47(4.5%)
No trusted source of information	21(2.0%)

In Table 1, most participants were males,335(57.1%); in the age group of 25-34 years, 180(31.4%) and married or cohabiting, 341(58.9%). Most were Catholics, 312(53.2%); Acholi by tribe, 422(72.9%); and from Gulu-Omoro districts, 220(37.5%), and had attained tertiary level of education, 261(44.5%), healthcare professionals, 136(23.2%); Ugandan by nationality, 581(99.0%) and African by race,586(99.8%). Regarding social behaviors, most did not use alcohol, 401(69.0%); and did not smoke cigarettes, 545(94.1%). On the health background information, most participants did not have comorbidities for example, Diabetes mellitus, 571(97.3%); heart diseases, 571(97.3%); obesity, 578(98.5%); hypertension, 559(95.2%); Asthma, 572(97.4%); HIV and AIDs, 577(98.3%) and other chronic diseases, 542(92.3%). Their most trusted sources of COVID-19 vaccine information were from TVs, Radios, and Newspapers, 349(33.6%)

Figure 1 shows the most trusted sources of COVID-19 vaccine information among participants in northern Uganda. Most (59.5%) from traditional media houses, 37.8% from the Government, 35.2% from health workers, 14.8% from internet, 14.1% from social media and least among those who did not trust any sources of information at 3.6%.

Table 2: Preferred sources of information on COVID-19 vaccines by sex of participants in northern Uganda.

Dependent variables		Sex (n=587)		X^2 P-value
		Female (%)	Male (%)	
TV, Radios, and Newspapers	No	92(38.7%)	146(61.3%)	0.08
	Yes	160(45.9%)	189(54.2%)	
Internet	No	219(43.8%)	281(56.2%)	0.31
	Yes	33(37.9%)	54(62.1%)	
Social Media	No	217(43.1%)	287(56.9%)	0.88
	Yes	35(42.2%)	48(57.8%)	
Health care workers	No	164(43.3%)	215(56.7%)	0.90
	Yes	88(42.7%)	118(57.3%)	
Family members	No	232(43.7%)	299(56.3%)	0.25
	Yes	20(35.7%)	36(64.3%)	
Government/Ministry of Health	No	164(44.9%)	201(55.1%)	0.21
	Yes	88(39.6%)	134(60.4%)	
Pharmaceutical company reports	No	242(43.0%)	321(57.0%)	0.90
	Yes	10(41.7%)	14(58.3%)	
Scientific articles	No	235(43.5%)	305(56.5%)	0.33
	Yes	17(36.2%)	30(63.8%)	
No trusted source	No	243(42.9%)	323(57.1%)	0.99
	Yes	9(42.9%)	12(57.1%)	

In Table 2, there is no significant statistical difference between male and female participants in northern Uganda on the most trusted sources of information on COVID-19 vaccines.

Table 3: Trusted sources of information on COVID-19 vaccines by age group of participants in northern Uganda.

Dependent variables		Ages (years) n, (%)				X^2 P-value
		<25	25-34	35-44	>45	
Traditional Media (TVs, Radios, and Newspapers)	No	58(24.9%)	77(33.1%)	64(27.5%)	34(14.6%)	0.89
	Yes	92(27.1%)	103(30.3%)	93(27.4%)	52(15.3%)	
Internet	No	135(27.6%)	142(29.0%)	139(28.4%)	73(14.9%)	0.02*
	Yes	15(17.9%)	38(45.2%)	18(21.4%)	13(15.5%)	
Social Media	No	131(26.6%)	146(29.7%)	135(27.4%)	80(16.3%)	0.06
	Yes	19(23.5%)	34(41.9%)	22(22.2%)	6(7.4%)	
Health care workers	No	100(27.0%)	116(31.4%)	105(28.4%)	49(13.2%)	0.37
	Yes	50(24.9%)	64(31.8%)	50(24.9%)	37(18.4%)	
Family members	No	141(27.2%)	173(33.3%)	133(25.6%)	72(13.9%)	<0.01*
	Yes	9(16.7%)	7(12.9%)	24(44.4%)	14(25.9%)	
Government / Ministry of Health	No	109(30.6%)	119(33.4%)	81(22.8%)	47(13.2%)	<0.01*
	Yes	41(18.9%)	61(28.1%)	76(35.0%)	39(17.9%)	
Pharmaceutical company reports	No	145(26.4%)	174(31.7%)	150(27.3%)	80(14.6%)	0.51
	Yes	5(20.8%)	6(25.0%)	7(29.2%)	6(25.0%)	
Scientific articles	No	143(27.1%)	167(31.7%)	138(26.2%)	79(14.9%)	0.11
	Yes	7(15.2%)	13(28.3%)	19(41.3%)	7(15.2%)	
I do not trust any source.	No	143(25.9%)	173(31.3%)	152(27.5%)	84(15.2%)	0.80
	Yes	7(33.3%)	7(33.3%)	5(23.8%)	2(9.5%)	

*Significant association

In Table 3, there were significant associations between age groups on the trusted sources of information on COVID-19 vaccine. There was a significantly lower use of internet (85.3% versus 14.7%; p=0.02); from families (90.6% versus 9.4%; p<0.01); and Government/Ministry of Health (62.1% versus 37.9%; p<0.01) compared with those who used them.

Table 4: Trusted sources of information on COVID-19 vaccines by occupation of participants in northern Uganda.

Dependent Variables		Occupation n (%)		X^2 P-value
		Health workers	Non-health workers	
Traditional Media (TV, radios, Newspaper)	No	79(33.2%)	159(66.8%)	<0.01*
	Yes	57(16.3%)	292(83.7%)	
Internet	No	108(21.6%)	392(78.4%)	0.03*
	Yes	28(32.2%)	59(67.8%)	
Social Media	No	110(21.8%)	394(78.2%)	0.06
	Yes	26(31.3%)	57(68.7%)	
Healthcare providers	No	69(18.2%)	310(81.8%)	<0.018*
	Yes	67(32.5%)	139(67.5%)	
Family members	No	123(23.2%)	408(76.8%)	0.99
	Yes	13(23.2%)	43(76.8%)	
Government / Ministry of Health	No	67(18.4%)	298(81.6%)	<0.01*
	Yes	69(31.1%)	153(68.9%)	
Pharmaceutical company reports	No	130(23.1%)	433(76.9%)	<0.83
	Yes	6(25.0%)	18(75.0%)	
Scientific articles	No	115(21.3%)	425(78.7%)	<0.01*
	Yes	21(44.7%)	26(55.3%)	
I do not trust any source	No	133(23.5%)	433(76.5%)	0.44
	Yes	3(14.3%)	18(85.7%)	

**Fisher's exact test P value.*

In Table 4, the most trusted sources of information on COVID-19 vaccines between health workers and non-health workers were significant different. Traditional media sources (TVs, Radios, and Newspapers) (16.3% versus 83.7%; p<0.01); Internet (32.2% versus 67.8%; p=0.03); healthcare providers (32.6% versus 67.5%; p<0.018); Government/Ministry of Health (31.1% versus 68.9%; p<0.01), and Scientific articles (44.7% versus 55.3%; p<0.01) between health workers and non-health workers, respectively.

Discussion

The most substantial finding from this study is that most participants from northern Uganda trusted traditional media sources (Televisions, Radios, and Newspapers) on COVID-19 vaccines (Table 1, Figure

1). As shown in many publications, there have been many uncertainties about the COVID-19 vaccine rollout in many communities in Uganda, mainly because of misinformation, disinformation, and malinformation circulating in many media sources that are not properly regulated.[23-27] Fortunately, this study found that most participants trusted the traditional media sources on COVID-19 vaccines such as Televisions, Radios, and Newspapers that the Government of Uganda regulates.[23-27] This may explain why COVID-19 vaccine acceptance among the population of northern Uganda has been high compared to other regions of Uganda.[27]

Experts argue that the flow of actual and correct information on COVID-19 vaccines is critical for the mobilization and engagement of the population on COVID-19 vaccine acceptance, which is crucial for the management and control of the pandemic.[26,27]

In addition, misinformation, disinformation, and malinformation are significant hindrances to successfully managing any epidemic.[23-27] Thus, the need to consistently update the population on correct and factual information remains critical for successfully controlling and managing any epidemic.[23-27]

The most trusted sources of information on COVID-19 vaccines by age group of participants. Our study found that, in general, the most trusted sources of COVID-19 vaccines among the age group of participants were the traditional media houses (Television, Radios, Newspapers, and websites) (59.5%), followed by the Government/Ministry of Health (37.8%), healthcare providers (35.2%), internet (14.8%), social media (14.1%), family members (9.5%), scientific articles (8.0%), pharmaceutical company reports (4.1%), and least among those who did not trust any sources of information on COVID-19 vaccines (3.6%) (Figure 1). This finding is significant as health planners and managers in Uganda could use this information to plan and execute future interventions to control and manage an epidemic of this magnitude. This finding is consistent with other studies conducted in the African continent[23,24,28,29] and others worldwide.[30-33]

Furthermore, there have been significant associations between younger age groups and the most trusted sources of information on the COVID-19 vaccine, with most young age groups preferring traditional media sources compared to others, such as the internet, social media, and scientific articles, which were relatively more expensive to access but also more prone to misinformation, disinformation, and malinformation.[27,34] There was significantly less trust among the study population on COVID-19 vaccine information from the internet (14.7% versus 85.3%;p=0.02), from families (9.4% versus 90.6%; p<0.01), and Government/Ministry of Health (37.9% versus 62.1%; p<0.01) compared to those who trusted them (Table 3). These findings can be used positively by planners and implementers of healthcare systems in Uganda to support the rollout of COVID-19 vaccines in Uganda.

The most trusted sources of information on COVID-19 vaccines by occupation in northern Uganda. Our study found that the most trusted sources of information on COVID-19 vaccines between healthcare workers and non-health workers differed significantly. Non-health workers trusted traditional

media sources (TVs, Radios, Newspapers) more than health workers. For example, the trust on traditional media sources was (16.3% versus 83.7%; p<0.01); Internet (32.2% versus 67.8%; p=0.03); healthcare providers (32.6% versus 67.5%; p<0.018); Government/Ministry of Health (31.1% versus 68.9%; p<0.01), and scientific articles (44.7% versus 55.3%;p<0.01) than healthcare workers (Table 4). This finding is interesting as the general population would expect healthcare workers to be more receptive to information on COVID-19 vaccines, as this would help them to sensitize and mobilize the population on the rollout of vaccines for the management and control of COVID-19 in the population. This finding contrasts many studies in Uganda and elsewhere.[26-28]

With regards to health workers' trusted sources of information, the most frequently selected source of information on COVID-19 vaccines was the Government/Ministry of Health, followed by healthcare providers, traditional media (TVs, Radios, and Newspapers), internet, social media, family members, and pharmaceutical reports in the descending order, respectively (Table 3). However, the most trusted sources of information on the COVID-19 vaccine among non-health workers were traditional mass media/news media websites, followed by messages from the Ugandan Ministry of Health and the healthcare providers (Table 3). Health workers also consult WHO information for guidance on COVID-19 vaccines and scientific articles, but the numbers are less compared to non-health workers (Table 3). This flow of COVID-19 vaccine information must be improved in the following ways: improvements in the content and format of information, increased training and learning opportunities, improvements in dissemination strategies, and empowerment of health workers.[35]

Remarkably, this study has found that many people in northern Uganda have confidence on the traditional media sources as the most trusted sources of information on COVID-19 vaccines, as this can be used by Ugandan Ministry of Health planners to strategize on how to reach out to the population for the control of any emerging epidemic in Uganda.

These results suggest that plans to promote factual and accurate information flow on COVID-19 vaccines must take a dual focus: working with communities and leaders influential in the said communities and analyzing patterns of use and access to the different media sources. Further, qualitative research should identify how the most trusted sources of information on COVID-19 are interpreted and spread through community networks.

Strengths and limitations of this study. This study had many strengths:

1. It was conducted on a large sample size among community members in northern Uganda, so most information obtained can be generalizable.
2. We used a systematic sampling method, which is a probability sampling method, and thus, the information obtained can represent findings in a specific location of similar settings.
3. The information obtained helps inform policy on disseminating to the population on health-related matters.

However, this study had some limitations:

1. The nature of the study design is cross-sectional with inherent limitations of not measuring variables over time, thus risk capturing the dynamism of changing times and perceptions of participants.
2. We captured the views and opinions of adult participants ≥18 years old, yet most of the population in northern Uganda was below 18 years old.[10] This presents a challenge of representation bias among younger age groups and may become problematic when designing strategies for preventing and controlling such diseases in future outbreaks.
3. Our findings that most participants in our study had attained the tertiary level of education pose a challenge of representation as information obtained from studies in northern Uganda show that most of the population do not have tertiary education.[10] This finding may present a selection bias of our study population.

Generalizability of results: These findings can be generalized among rural communities in sub-Saharan Africa within similar contexts.

Conclusion

The most substantial finding from our study was that the most trusted sources of information on COVID-19 vaccines in northern Uganda were Television, Radio, and Newspapers. There were no significant differences in the most trusted sources of information on COVID-19 vaccines between the sexes but significant differences in age groups and occupations of participants, with the younger age groups and non-healthcare workers having more trust in TVs, Radios, and Newspapers. For effective management of an epidemic, there is a need for accurate communication so that misinformation, disinformation, and malinformation do not disrupt the flow of information to communities.

Declarations

Ethics approval and consent to participate: St. Mary's Hospital Institutional Review and Ethics Committee (LHIREC, No. 0192/10/2021) approved all experimental protocols in this study. In addition, the study was conducted following all relevant institutional guidelines and regulations. We obtained informed consent from each participant and their legal representatives to participate in this study.

Consent to publish: We obtained informed consent from the participants for publishing the information.

Availability of data and material: All datasets supporting this article's conclusion are within this paper and are accessible by a reasonable request to the corresponding author.

Competing interests: All authors declare no conflict of interest.

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Authors' contributions: DLK, JA, and FWDO designed this study—JA, FWDO, POA, SB, CO, FPP, and DLK supervised data management. ENI, JA, FWDO, EO, and DLK analyzed and interpreted the data. FPP, NOA, POA, CO, DO, GSO, EO, ENI, FWDO, POO, DO, JNO, BS, CO, RN, and DLK wrote and revised the manuscript. All Authors approved the manuscript.

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Figures

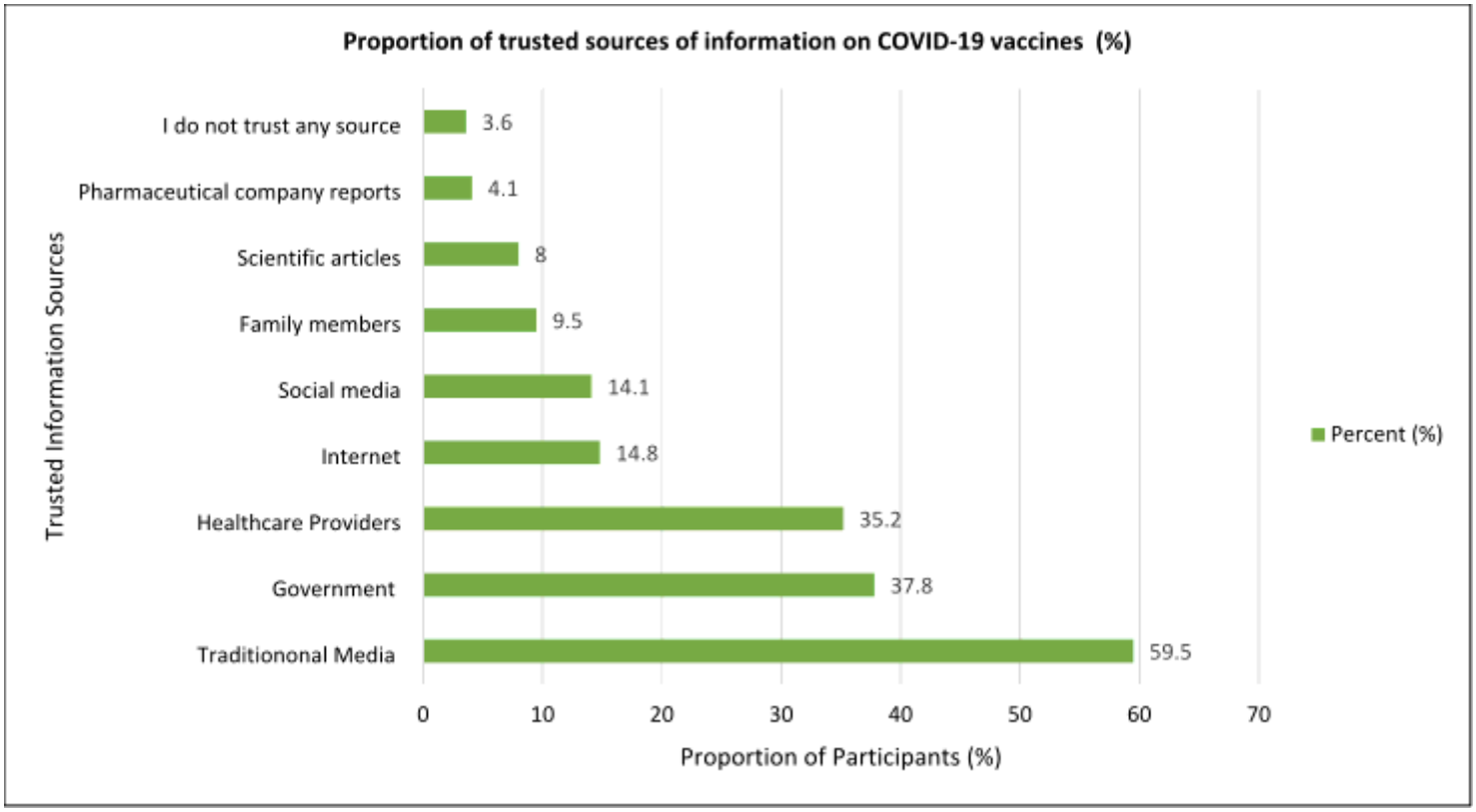

Figure 1

The proportion of trusted information sources on COVID-19 vaccines in northern Uganda.