

Analysis of the COVID-19 Vaccine Infodemic and Predictive Factors of Vaccination Status in Lubumbashi, Democratic Republic of the Congo

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Abstract

Objectives: To analyze vaccine infodemics during the COVID-19 pandemic and the predictive factors of vaccination status among young people aged 16 to 25, active people aged 26 to 65, and older people over 65 in the city of Lubumbashi, in the Democratic Republic of Congo. **Design:** A cross-sectional analytical study was conducted in the city of Lubumbashi from 3rd to 13th December 2022. **Participants:** The present study focuses on two distinct types of participants: the head of household and, in the absence of the head of household, a person aged ≥ 16 who has resided in the household for a minimum of six months. **Main Outcome Measure:** COVID-19 vaccine infodemic and predictive factors of vaccination status in Lubumbashi. **Results:** The dissemination of misinformation regarding vaccines was also reported, with participants expressing concerns about the efficacy, potential risks, and safety of the vaccines, as well as allegations of commercial and political motives behind their distribution. Furthermore, a significant proportion of the sample had not received the vaccination, with 29.78% of the sample having received the vaccine, compared to 70.22% who had not. Logistic regression analysis revealed that factors such as marital status, religious affiliation, and confidence in scientific authorities were significant predictors of vaccination status. **Conclusion:** The infodemia analysis demonstrates the alarming level of health literacy deficiency among the Lushoise population. A minority of the participants in our study had been vaccinated, suggesting a need for greater recognition of the threat posed by infodemia. It is imperative that awareness-raising campaigns and CREC strategies for future emerging infectious diseases, or the introduction of a vaccine for the novel coronavirus into the vaccination schedule, focus on the predictive factors reported.

Keywords

Infodemic, COVID-19 Vaccines, Vaccination Status, Predictive Factors, Lubumbashi

1. Introduction

The coronavirus strains have been known since 1960 and are responsible for 15% of colds in humans each year (Ahmed et al., 2020). Prior to 2020, earlier strains of the coronavirus were responsible for the outbreaks of severe acute respiratory syndrome (SARS) in 2002 and Middle East respiratory syndrome in 2012 (Zhu et al., 2020). However, the novel coronavirus, SARS-CoV-2, spread worldwide and affected the health of millions of people (Zoumpourlis et al., 2020). The first case of COVID-19, involving an individual who had travelled from Europe, was recorded on 10 March 2020 in the Democratic Republic of Congo (DRC).

The novel SARS-CoV-2 triggered two parallel pandemics of biological and social order, as a result of which vaccines were drawn into the complex and rapidly evolving landscape of information surrounding the pandemic (UNICEF, 2020). A number of previous studies on misinformation in healthcare have demonstrated that the dissemination of false and misleading claims has a detrimental impact on public attitudes towards vaccines. A study conducted in the DRC during the Ebola outbreak revealed a detrimental impact of misinformation on vaccine acceptance. The term “infodemic,” coined by the World Health Organization (WHO), is used to describe the spread of misinformation about the virus (Zorlu, 2020). This concept regained its place on the global agenda after the Director General of the WHO declared in February 2020 that “we are fighting not only a pandemic, but also an infodemic” (Organization, 2020). It is defined as “a massive collection of information emerging during an epidemic, some of which is true, others false, which spreads quickly like a virus and complicates health organizations” (Örgütü, 2020).

The most significant distinction between the present and the past is the rapidity of information dissemination and the proliferation of diverse platforms that facilitate this process. The traditional and digital media environments, which have a beneficial impact on citizen participation, occupy a significant position in the democratic process.

In the literature, rumors and conspiracy theories about COVID-19 vaccines on platforms and field surveys are spreading quickly. The authors reported theories such as: “controlling the human population with microchips that invaded the world” (Islam et al., 2021), “the COVID-19 virus dies at 27°C”, “certain foods strengthen the immune system and prevent disease” and “the virus mainly affects the elderly rather than infants and children” (Hoşgör & Aközlü, 2021), “government/media exaggeration”, “China’s biological weapon”, “the population control strategy” and “the scourge of the modern era due to the sins committed by people”

(Olatunji et al., 2020). It is imperative to acknowledge the role of the infodemic in the emergence of vaccine hesitancy and resistance (Örgütü, 2020; Brennen et al., 2020). It would appear that countries with less developed economies are experiencing greater distress as a result of the pandemic (Imhoff & Lamberty, 2020). The proliferation of misinformation could exacerbate the impact of the ongoing pandemic in these countries.

The vaccine is regarded as the sole means of returning to a state of pre-pandemic normality in the context of the ongoing global pandemic caused by the SARS-CoV-2 virus (Ullah et al., 2021). The initial administration of a vaccine for the novel coronavirus (SARS-CoV-2) outside of a clinical trial occurred on 8 December 2020. The primary objective was to achieve vaccination coverage of 20% by the end of 2021, as defined by the Access Mechanism Vaccines against Coronavirus Disease (COVAX) and the WHO (Hung et al., 2020). In order to achieve the aforementioned goal, the WHO has established a global strategy with the objective of reaching 70% coverage in all countries by mid-2022. The interim target is 40% coverage by the end of 2021 (Cinelli et al., 2020).

The DRC has not yet achieved this objective, according to the partial data available on the Expanded Programme on Immunisation (EPI) website. There are currently 1,030 functional sites offering vaccination against the novel coronavirus. A total of 22,525,525 individuals (vaccination coverage, CV = 4.2%) had received the full vaccination course, while 34,397,860 individuals (6.4%) had received the first dose of the vaccine throughout the country. These figures represent the cumulative data from the four vaccination campaigns against Covid-19, the last of which was closed in June 2023 (Programme Elargi de Vaccination (PEV), 2023). In collaboration with partners such as UNICEF, the DRC authorities implemented risk communication and community engagement (CREC) strategies (The United Nations International Children Emergency Funds (UNICEF), 2020).

The objective of this study was to analyze COVID-19 vaccine infodemics; determine the level of confidence in sources of information and predictive factors of vaccination status among young people aged 16 to 25, working people aged 26 to 65, and people aged over 65 years in the city of Lubumbashi, in the Democratic Republic of Congo.

2. Methods

Study design and area

This cross-sectional analytical study was conducted in the city of Lubumbashi (population approximately 183,000) from 3rd to 13th December 2022. Situated in the southeastern part of the province of Haut-Katanga, in DRC, Lubumbashi comprises 11 health districts: Kampemba, Lubumbashi, Mumbunda, Ruashi, Tshiamilemba, Kisanga, Katuba, Kamalondo, Camps Vangu, Kowe, and Kenya (Figure 1, Chenge et al., 2010).

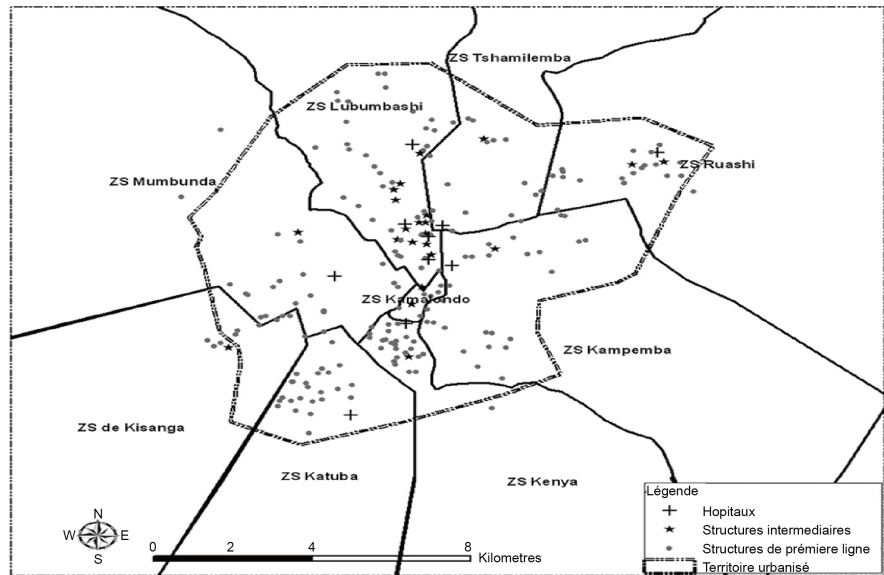


Figure 1. Health map of the city of Lubumbashi, DRC, subdivided into health districts (Chenge et al., 2010).

Study population

The study focuses on two distinct types of participant: the head of household and, in the absence of the head of household, a person aged ≥ 16 who has resided in the household for a minimum of six months.

Sample size

The random cluster sampling method was utilised for the data collection process (Henderson & Sundaresan, 1982), with an anticipated coverage of 70% in accordance with the WHO (Cinelli et al., 2020), a design effect of 2, and a number of clusters (equivalent to 11 health zones) equal to 11. The population size was considered infinite (Epi Info 7.2.6.0). The calculated sample size was 1,826 households (IC 99.9%) with a 10% margin of error, and was revised to 2,009 households.

Data collection

The questionnaire was created on Kobo Toolbox and configured on the investigators' Android phones (ODK Collect application). The questionnaire was pre-tested with 46 heads of households, or 10% of the total sample; and allowed us to make modifications according to relevant feedback from the investigators. The pre-survey forms were not taken into consideration in the final database.

The information collected focused on sociodemographic data, vaccine informatics, and the level of confidence in participants' sources of information by age group, participants' vaccination status, and predictive factors. The data was collected by investigators who were well trained for two days in the use of the ODK Collect application and those who demonstrated excellent capacity during the pre-survey, that of administering the questionnaires in one of the national languages of the DRC, preferably in Swahili and/or French to maximize informed consent and response rates.

Data management

The database was generated from the KoboToolbox server in Excel spreadsheet format (Microsoft Office, 2016). Statistical analyses were conducted with the R 4.3.2 software program. The data were presented in the form of proportions and the parameters of central tendency (mean) and dispersion (standard deviation) for the quantitative variables. Pearson's chi-square test and Student's t-test were utilized for univariate analyses. The significant variables from the multivariate analysis were then placed in the top-down multivariate logistic regression analysis, with the analysis hypothesis set at $p (<0.10)$.

Ethical issues

Informed consent was obtained from all subjects at the commencement of each interview. The study was conducted in accordance with the 1964 Declaration of Helsinki. The necessary research authorisation was obtained (reference number 450/2022). Participation in this study was entirely voluntary, and the subjects were required to sign a free and informed consent form.

3. Results

A total of 2,031 participant responses were collected between 3 and 13 December 2022. After exploratory analysis, thirteen survey forms were excluded because they did not contain complete responses, allowing 2,018 forms to be included in subsequent analyses. The overall response rate was therefore 100.45%.

Sociodemographic characteristics of households

The sociodemographic characteristics of the participants are represented in **Table 1**. The majority of participants were female, 60.36%, compared to 39.64% male, with a sex ratio of 1.5. The sample was strongly represented by participants in the age group of 26 - 65 years at 67.05% with an average age of 33.02 ± 11.30 (16 - 79) years on the scale of 16 to 79 years. The majority of participants had, respectively, a marital status of married at 65.36%, a level of secondary education (45.59%), and religion (84.44%).

Table 1. Sociodemographic characteristics of participants.

Variables	Workforce (n = 2018)	%
Sex		
Female	1218	60.36%
Male	800	39.64%
Sex ratio (F/M)	1.52	
Age (years)		
Mean age \pm SD (Min-Max)	33.02 \pm 11.30 (16 - 79)	
16 to 25	640	31.71
26 to 65	1353	67.05
66 and over	25	1.24

Continued

Level of study		
Illiterate	30	1.49
Vocational training	22	1.09
State Diploma	920	45.59
Primary School Certificate	59	2.92
Graduate Diploma	480	23.79
Bachelor's Degree	507	25.12
Marital status		
Bachelor	602	29.83
Bride)	1319	65.36
Divorced	41	2.03
Widower	56	2.78
Religion		
Atheist	17	0.84
Others	206	10.21
Christian	1704	84.44
Muslim	91	4.51

Vaccine infodemics and trust in different sources of information

The intergenerational results on halfway vaccine information and trust in information sources of the participants are shown below in **Table 2**. More than half, 57.53% of the participants, believed that vaccines were an effective means of prevention, with 57.19% aged 16 to 25, 57.43% aged 26 to 35, and 72% aged 66 and over, compared to 28.69% who thought that vaccines were ineffective, with 28.59% aged 16 to 25, 28.90% aged 26 to 35, and 20% aged 66 and over.

In **Table 2**, 33.10% of relatives thought that vaccines were ineffective (32.50% aged 16 - 25 years, 33.04% aged 26 - 35, and 52% aged 66 and over) compared to 19.18% who thought vaccines were an effective prevention, respectively at 20%, 18.77%, and 20% in the age groups of 16 - 25 years, 26 - 35 years, and 66 and over. Discussion with relatives was considered the main source of information for participants at 41.23%, with the majority aged 26 - 66 years (42.20%), followed by 16 - 25 years (39.53%), and in the minority those aged 66 and over (32%). The media was the second source of information at 21.21%; participants aged 16 to 25 were the most represented (22.34%), followed by 20.77% of 26 - 65 years and 16% for those 66 and over. Social networks were used as a source of information only among young people aged 16 to 25 and working people aged 26 to 65 at 11.25% and 7.61% respectively. Generally speaking, we see in the questions relating to knowledge of the coronavirus that the level of uncertainty (answer = Don't know) is very high (between 0.84% and 33.50%). More than one in five people are unable to answer the questions asked.

Table 2. Vaccine infodemics and trust in participants' information sources by age group.

Settings	Age group (years)			N = 2018 (%)
	16 - 25 (n = 640)	26 - 65 (n = 1353)	66+ (n = 25)	
What do you think about the COVID-19 vaccines?				
Political affair	8 (1.25)	18 (1.33)	1 (4)	27 (1.34)
Scam	8 (1.25)	19 (1.40)	0 (0)	27 (1.34)
Commercial	9 (1.41)	13 (0.96)	0 (0)	22 (1.09)
Led to death	18 (2.81)	50 (3.695)	0 (0)	68 (3.37)
Leads to sterility	2 (0.31)	3 (0.22)	0 (0)	5 (0.25)
Side effect	2 (0.31)	5 (0.37)	0 (0)	7 (0.35)
Mark of the Beast	4 (0.63)	12(0.89)	0 (0)	16 (0.76)
Effective means of prevention	366 (57.19)	777(57.43)	18 (72)	1161 (57.53)
Transmit the virus	3 (0.47)	2(0.15)	0 (0)	5 (0.25)
Dangerous vaccine	23 (3.59)	34(2.51)	0 (0)	57 (2.82)
Ineffective vaccine	183 (28.59)	391(28.90)	5 (20)	579 (28.69)
Don't know	14 (2.19)	29(2.14)	1 (4)	44 (2.18)
What do your loved ones, your family, and, in short, your community think about the Covid-19 vaccines?				
Political affair	12 (1.88)	20 (1.48)	0 (0)	32 (1.59)
Scam	3 (0.47)	10 (0.74)	0 (0)	13 (0.64)
Commercial	3 (0.47)	5 (0.37)	0 (0)	8 (0.40)
Led to death	30 (4.69)	91 (6.73)	1 (4)	122 (6.05)
Leads to sterility	5 (0.78)	3 (0.22)	0 (0)	8 (0.40)
Mark of the beast	10 (1.56)	21 (1.55)	0 (0)	31 (1.54)
Effective means of prevention	128 (20)	254 (18.77)	5 (20)	387 (19.18)
Transmit the virus	7 (1.09)	18 (1.33)	0 (0)	25 (1.24)
Ineffective vaccine	208 (32.50)	447 (33.04)	13 (52)	668 (33.10)
dangerous vaccines, poison	8 (1.25)	40 (2.96)	0 (0)	48 (2.38)
Don't know	226 (35.31)	444 (32.82)	6 (24)	676 (33.50)
Through which channel did you hear this?				
Discussions with loved ones	253 (39.53)	571 (42.20)	8 (32)	832 (41.23)
Discussions with relatives/Media	29 (4.53)	90 (6.65)	6 (24)	125 (6.19)
Discussions with loved ones/Social networks	52 (8.13)	103 (7.61)	0 (0)	155 (7.68)
Discussions with loved ones/Social networks/Media	73 (11.41)	165 (12.20)	6 (24)	244 (12.09)
Media	143 (22.34)	281 (20.77)	4 (16)	428 (21.21)
Media/Social Networks	10 (1.56)	32 (2.37)	0 (0)	42 (2.08)
Social networks	72 (11.25)	103 (7.61)	0 (0)	175 (8.67)
Don't know	8 (1.25)	8 (0.59)	1 (4)	17 (0.84)

Continued

How much trust do you have in information sources?				
Political authorities				
A lot	21 (3.28)	53 (3.92)	3 (12)	77 (3.82)
Extremely	9 (1.41)	15 (1.11)	0 (0)	24 (1.19)
Moderately	52 (8.13)	94 (6.95)	2 (8)	148 (7.33)
No way	433 (67.66)	915 (67.63)	13 (52)	1361 (67.44)
A little	125 (19.53)	276 (20.40)	7 (28)	408 (20.22)
Average score	0.51 ± 0.88	0.50 ± 0.87	0.80 ± 1.04	0.51 ± 0.88
Religious authorities				
A lot	9 (1.41)	21 (1.55)	0 (0)	30 (1.49)
Extremely	393 (61.41)	822 (60.75)	14 (56)	1229 (60.90)
Moderately	108 (16.88)	266 (19.66)	4 (16)	378 (18.73)
No way	110 (17.19)	195 (14.41)	5 (20)	310 (15.36)
A little	20 (3.13)	49 (3.62)	2 (8)	71 (3.52)
Average score	2.87 ± 1.56	2.91 ± 1.496	2.64 ± 1.68	2.89 ± 1.52
Scientific authorities				
A lot	5 (0.78)	18 (1.33)	0 (0)	23 (1.14)
Extremely	70 (10.94)	138 (10.20)	2 (8)	210 (10.41)
Moderately	105 (16.41)	263 (19.44)	5 (20)	373 (18.48)
no way	438 (68.44)	858 (63.41)	17 (68)	1313 (65.06)
A little	22 (3.44)	76 (5.62)	1 (4)	99 (4.91)
Average score	0.82 ± 1.35	0.89 ± 1.34	0.76 ± 1.27	8.87 ± 1.34

Responses to questions on infodemics and level of uncertainty (answer = Don't know) ranged from 0.84% to 33.50%.

The answers to the question "What is your level of confidence in information sources?" Scores (\pm SD) for trust in scientific authorities were highest at 8.87 ± 1.34 . Participants who did not have confidence (not at all) were the most represented at 65.06%, compared to 18.48% who had moderate confidence. This was followed by the score (\pm SD) of trust in religious authorities at 2.89 ± 1.52 . Only 15.36% of participants did not trust them (at all). This proportion was rather higher among those who were extremely confident (60.90%).

The majority of participants (67.44%) did not trust political authorities (at all) with a mean score (\pm SD) of 0.51 ± 0.88 . This mean (\pm SD) is high for those aged 66 and over (0.80 ± 1.04) compared to 16 - 25 year olds (0.51 ± 0.88) and 26 - 65 year olds (0.50 ± 0.87).

Vaccination status of participants

Table 3 presents the intergenerational results on the vaccination status of participants. Only a minority of participants were vaccinated (29.78% compared to

70.22% unvaccinated), of whom the main reasons for refusing vaccines were distrust and lack of interest, with 28.58% and 27.24%, respectively. Nearly half (42.91%) were willing to recommend their loved ones get vaccinated.

Table 3. Vaccination status of participants.

Settings	Age group			N = 2018
	16 - 25 (n = 640)	26 - 65 (n = 1353)	66+ (n = 25)	
Have you been vaccinated against COVID-19?				
No	485 (75.78)	919 (67.92)	13 (52)	1417 (70.22)
Yes	155 (24.22)	434 (32.08)	12 (48)	601 (29.78)
Reason for refusal (n = 1417)				
Physical accessibility/information	7 (1.44)	6 (0.65)	0 (0)	13 (0.92)
Political affair	1 (0.21)	2 (0.22)	0 (0)	3 (0.21)
Scam	0 (0)	5 (0.54)	0 (0)	5 (0.35)
Driven to death	30 (6.19)	57 (6.20)	1 (7.69)	88 (6.21)
Leads to the sterile.	4 (0.82)	4 (0.44)	0 (0)	8 (0.56)
Belief	6 (1.24)	18 (1.96)	1 (7.69)	25 (1.76)
Side effects	13 (2.68)	34 (3.70)	0 (0)	47 (3.32)
Health status	1 (0.21)	3 (0.33)	1 (7.69)	5 (0.35)
Ban on family/healthcare personnel	9 (1.86)	9 (0.98)	0 (0)	18 (1.27)
Disease does not exist	27 (5.57)	73 (7.94)	1 (7.69)	101 (7.13)
Lack of time	29 (5.98)	41 (4.46)	0 (0)	70 (4.94)
Lack of opportunity	9 (1.86)	9 (0.98)	0 (0)	18 (1.27)
Mark of the Beast	1 (0.21)	9 (0.98)	0 (0)	10 (0.71)
Mistrust	133 (27.42)	269 (29.27)	3 (23.08)	405 (28.58)
Not in the target age range/not mandatory	2 (0.41)	5 (0.54)	1 (7.69)	8 (0.56)
No interest	139 (28.66)	245 (26.66)	2 (15.38)	386 (27.24)
Fear of complications	36 (7.42)	61 (6.64)	1 (7.69)	98 (6.92)
Poison	4 (0.82)	3 (0.33)	0 (0)	7 (0.49)
Unprotected vaccine development process	2 (0.41)	4 (0.44)	0 (0)	6 (0.42)
Rumors about the vaccine	12 (2.47)	39 (4.24)	1 (7.69)	52 (3.67)
Testimony of a person who died after vaccination	3 (0.62)	8 (0.87)	0 (0)	11 (0.78)
Transmit the virus	8 (1.65)	11 (1.20)	0 (0)	19 (1.34)
Ineffective vaccine	1 (0.21)	1 (0.11)	0 (0)	2 (0.14)
Don't know	8 (1.65)	3 (0.33)	1 (7.69)	12 (0.85)
Would you recommend that a loved one get vaccinated?				
Yes	253 (39.53)	597 (44.12)	16 (64)	866 (42.91)
No	387 (60.47)	756 (55.88)	9 (36)	1152 (57.02)

Predictors of vaccination status

Factors that were observed to be significantly predictive of vaccinated (yes) participants, compared to unvaccinated. In univariate analysis (Table 4), age, sex, marital status, and trust in political and scientific authorities were statistically very significantly associated with vaccination status ($p < 0.05$). After adjustment, the results of the multivariate analysis show that age, sex, marital status, religion, and trust in scientific authorities as a source of information remained predictive factors of vaccination status. Married participants were 1.32 times more likely to be vaccinated than those in the single/divorced/widowed group, and the difference was statistically significant (ORa = 1.32; 95% CI: 1.04 - 1.66; $p = 0.0197$). Participants who trusted scientific authorities as a source of information had a 1.92 times greater likelihood of being vaccinated than those who did not trust scientific authorities, and the difference was statistically very significant (ORa = 1.32; 95% CI:

Table 4. Results of the final model of multinomial logistic regression of factors associated with participants' vaccination status.

Factors	N	Vaccination status		Univariate analysis			Multivariate analysis		
		Yes n = 601 (%)	No n = 1417 (%)	OR [95% CI]	p	ddf	t value	ORa [95% CI]	p
Average age (years) [Min-Max]		34.80 ± 11.49 (18 - 79)	32.27 ± 11.14 (16 - 77)	-	0.0000**	2016	4.63	0.98 (0.98 - 0.99)	0.0006**
Sex									
Female	1218 (60.36)	323 (53.74)	895 (63.16)	0.68				0.67 (0.54 - 0.82)	0.0001**
Male	800 (39.64)	278 (46.26)	522 (36.84)	(0.56 - 0.82)	0.00008**				
Level of study									
Diplomas (Primary/ Secondary/University)	1966 (97.42)	590 (98.17)	1376 (97.11)	1.59 (0.82 - 3.13)	0.218			1.43 (0.72 - 2.85)	0.30
Vocational training/No level	52 (2.58)	11 (1.83)	41 (2.89)						
Marital status									
Bride)	1319 (65.36)	420 (69.88)	899 (63.44)	1.34 (1.09 - 1.64)	0.0057*			1.32 (1.04 - 1.66)	0.0197*
Single /Divorced/ Widowed	699 (34.64)	181 (30.12)	518 (36.56)						
Religion									
Christian/Muslim	1795 (88.95)	546 (90.85)	1249 (88.14)	1.34 (0.97 - 1.84)	0.087			1.42 (1.02 - 1.97)	0.036*
Others/Atheist	223 (11.05)	55 (9.15)	168 (11.86)						
Trust in sources of information—political authorities									
Extremely/Much/Moderately	249 (12.34)	95 (15.81)	154 (10.86)	1.54 (1.17 - 2.03)	0.0024*			1.05 (0.77 - 1.44)	0.75
A little/Not at all	1769 (87.66)	506 (84.19)	1263 (89.13)						
Trust sources of information—scientific authorities									
Extremely/Much/Moderately	606 (30.03)	244 (40.60)	362 (25.54)	1.99 (1.63 - 2.44)	0.000000**			1.92 (1.53 - 2.41)	0.0000**
A little/Not at all	1412 (69.97)	357 (59.40)	1055 (74.45)						

* $p < 0.05$, $p < 0.0001$ **.

1.04 - 1.66; $p = 0.0197$). On the other hand, age and sex were protective factors for vaccination status; and the differences were respectively statistically significant ($ORa = 0.98$, 95% CI: 0.98 - 0.99, $p < 0.0006$) and ($ORa = 0.67$; 95% CI: 0.54 - 0.82; $p = 0.0001$).

4. Discussion

The present study aims to analyse the infodemics surrounding the COVID-19 vaccine and to identify the predictive factors associated with vaccination status among three key demographic groups: young people aged 16 - 25 years, working people aged 26 - 65 years, and seniors aged 65 years and over. The study is based on a sample of individuals residing in Lubumbashi, in the Democratic Republic of Congo. The sample size initially calculated exceeded the size obtained with a response rate of 100.45%, which improved the precision of the estimates and the power of the tests, and the power of our study (Lemeshow, 1990). The findings of the study indicate that over half of the participants (57.53%) perceived vaccines to be an efficacious method of prevention. Almost half of the participants were exposed to false information, with rumours concerning the ineffectiveness of vaccines (28.69%), the potential for fatality (3.37%), the danger of the vaccine (2.82%), the involvement of a scam, and a political affair. The remaining responses included references to the mark of the beast (0.76%), the theory of a commercial or political affair (1.09%), the idea that vaccines could lead to sterility or transmit the virus (0.25%), and side effects (0.35%). It is noteworthy that these figures represent a particularly concerning proportion of misinformation when viewed through the lens of relatives' opinions.

The phenomenon of fake news is not a novel occurrence. The most significant distinction between the present and the past is the accelerated rate of information dissemination and the proliferation of diverse platforms (media and digital) that facilitate this propagation and contribute to the rapid dissemination of misinformation (Fernández-Torres et al., 2021). A discussion with relatives was identified as the primary channel of information, with a response rate of 41.23%. The media were identified as a secondary source of information by 21.21% of respondents. Social networks were used as a source of information only among young people (11.25%) and the working population (7.61%). The combined information channel, comprising discussion with loved ones/social networks/media, followed by discussion with relatives/social networks and then discussions with relatives/media, accounted for 12.09%, 7.68%, and 6.19% of responses, respectively.

The findings of our study align with those of two previous investigations conducted in Lebanon, which reported that the predominant source of information for the majority of participants was television. However, these findings differ from those reported by Olatunji et al. (2020) in Nigeria during the pandemic. In that study, the most widely used sources of information regarding the novel coronavirus disease were traditional media, social media, the internet, the Nigeria Center for Disease Control, family/friends, and political leaders, in that order (Olatunji

et al., 2020).

This situation is cause for concern and sheds light on how the CREC has been managed during the pandemic and the rollout of the vaccination programme. These findings underscore the crucial role of proactive and effective communication in public health emergency response (Adebisi et al., 2021).

For example, during the pandemic, a video clip rapidly disseminated in the DRC, accusing Europeans of intending to test experimental vaccines against SARS-CoV-2 on Africans (Agence d'information d'Afrique centrale, 2020). The circulation of misinformation about vaccine safety persisted, with claims that the vaccines were produced too rapidly and that they were unsafe and could cause or exacerbate the disease (James & Lees, 2022). In July, as efforts to revitalise the vaccination campaign were underway, a politician tweeted that his brother had died the day after receiving the first dose of the COVID-19 vaccine (Kalombo Francis, 2021). The President of the Republic had previously expressed concerns about the ChAdOx1-S vaccine and had refused to be vaccinated, declaring on national television (Mediacongo, 2021).

Prior to the advent of the pandemic, the WHO identified vaccine hesitancy as one of the ten most significant threats to global health (Wiysonge et al., 2022). The most significant evidence in support of this perspective is the assertion that between 55 and 85 percent of the population must be vaccinated in order to effectively contain the spread of the SARS-CoV-2 virus (Sanche et al., 2020). The principal findings of this study indicate that a minority of participants had received the vaccination (29.78% of individuals were vaccinated, compared to 70.22% who had not been vaccinated). Almost half (42.91%) indicated a willingness to recommend vaccination to their loved ones. The primary reasons for declining vaccination were identified as distrust and lack of interest, with 28.58% and 27.24%, respectively as reported by Kalala Tshituka and Al (Kalala-Tshituka et al., 2024).

One of the key contributions of our article is to evaluate the level of trust placed in information sources. In the present study, the majority of participants expressed a lack of confidence in scientific and political authorities, with 65.06% and 67.44% respectively reporting no confidence, compared to 10.41% and 1.19% who reported extreme confidence in the latter. Conversely, 60.90% of participants exhibited extreme confidence in religious authorities, while 15.36% demonstrated a lack of confidence. This profound lack of trust in government has deleterious consequences for CREC and is a common challenge in Africa with respect to public health responses (Blair et al., 2017).

The relationship between young people and seniors with regard to information is frequently characterised in a stereotypical manner as an opposition between a generation of “digital natives,” whose principal information activity is oriented towards social networks, and a generation more critically oriented, accustomed to obtaining information through traditional media (Lits et al., 2020). In comparison, the primary information channels among different generations were found to be discussions with relatives and media. The utilisation of social networks as a

source of information was observed among individuals aged 16 - 25 (11.25%) and 26 - 65 years old (7.61%).

In examining the predictors of individuals' vaccination status in the context of the ongoing pandemic, a number of significant factors were incorporated into the analytical model. In the final model, age, sex (ORa = 0.67; 95% CI: 0.54 - 0.82; $p = 0.0001$), marital status (ORa = 1.32; 95% CI: 1.04 - 1.66; $p = 0.0197$), religion, and trust in scientific authorities as a source of information were identified as the remaining predictive factors of vaccination status.

One of the principal challenges confronting CREC in African countries is the presence of resistance and inertia. The aetiology of this phenomenon is multifaceted, encompassing cultural and religious factors (Ilesanmi et al., 2020). In the course of our study, the majority of participants (84.44%) identified as Christian. The findings revealed that individuals who identified as believers (Christian or Muslim) exhibited a 1.32-fold increased likelihood of vaccination compared to those in the atheist or other group. This difference was statistically significant (ORa = 1.42; 95% CI: 1.02 - 1.44; $p = 0.036$).

In countries where the overall level of trust in science is high, individuals are more likely to express confidence in vaccination, above and beyond their individual-level scientific trust (Sturgis et al., 2021). In Italy, the level of trust in research and in vaccines was found to be a significant predictor of the intention to be vaccinated in the general population (Palamenghi et al., 2020). In our study, participants who indicated a preference for scientific authorities as a source of information exhibited a 1.92-fold increased likelihood of being vaccinated compared to those who did not. These results highlight the need for tailored communication strategies that strengthen trust in information sources (Tm et al., 2024).

This difference was statistically highly significant (ORa = 1.32; 95% CI: 1.04 - 1.66). The results demonstrate that age was a protective factor for vaccination status (ORa = 0.98, 95% CI: 0.98 - 0.99, $p < 0.0006$), which is in contrast to the findings of other studies that highlighted a younger age and a lower education level as predictors of vaccine hesitancy (Fisher et al., 2020) and as having no association with intention to be vaccinated (Karabela et al., 2021). The sample was predominantly composed of individuals within the 26 - 65 age group, with an average age of 33.02 ± 11.30 years (ranging from 16 to 79 years). This aligns with the findings of the aforementioned study, which reported an average age of 35.9 ± 12.3 years (Karabela et al., 2021). In the Democratic Republic of Congo, at the launch of the COVID-19 vaccination campaign, priority was given to the elderly and health personnel, in line with a global strategy. The vaccine was later made freely available to the entire population.

Limits

It is important to acknowledge the limitations of the study. The majority of variables were based on self-reported information from participants, which may have introduced a potential source of bias. The analysis did not take into account the specific digital platforms that were most frequently used by the population

during the pandemic, nor did it examine the content (including both accurate and misleading information) that was circulated on these platforms. Furthermore, this study did not examine the role and vulnerability of the community of all generations in relation to the content shared on digital platforms and media.

5. Conclusion

The infodemia analysis demonstrates the alarming level of health literacy deficiency among the Lushoie population, and the vaccination status of the respondents highlights the significant threat posed by infodemia. The present study hypothesizes that marital status, religion, and reliance on scientific authorities as a source of information are predictive of vaccination status. Awareness campaigns and CREC strategies for future emerging infectious diseases or the introduction of the CoV-19 vaccine into the vaccination schedule should focus on predictive factors, with social networks for young people and the working population as information channels. The existence of suitably qualified public health professionals within the country is a prerequisite for the realization of this goal. It is imperative that studies are conducted to address the notion of health literacy in the population in relation to epidemics and pandemics. This will allow for the determination of the necessary areas for improvement.

Data Sharing Statement

The original contributions to this study are presented in the article, and the database supporting this manuscript is provided in Additional File 1 and is available from the publisher.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Abbreviations

COVID-19	Coronavirus disease 2019
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
WHO	World Health Organization
DRC	Democratic Republic of the Congo; HS, health zone.