Adv Health Behav, 2022, 6(1): 242-252
DOI: 10.25082/AHB.2023.01.001

RESEARCH ARTICLE

Determinants of knowledge, attitudes, and preventive practices for COVID-19 infection in Goma, DRC

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Received: October 9, 2022;
Accepted: December 17, 2022;
Published: December 21, 2022.

Citation: Kakozi WM, Katembo B, Mazirane P, *et al*. Determinants of knowledge, attitudes, and preventive practices for COVID-19 infection in Goma, DRC. *Adv Health Behav*, 2022, **6**(1): 242-252.
https://doi.org/10.25082/AHB.2023.01.001

Abstract: Purpose: In view of the resurgence of confirmed COVID-19 cases in the North Kivu province, particularly in Goma city, the epicenter of the disease, it is necessary to study the knowledge, attitudes and practices of the population of Goma city on COVID-19 infection. Methods: A cross-sectional study was conducted from July 15 to August 15, 2021. A 3-degree cluster survey was conducted in Goma city, in the Democratic Republic of the Congo. Bivariate and multivariate analyzes were performed by the STATA 15 software. Results: A total of 1,194 individuals responded to the survey and had heard of COVID-19. 74.62% of the respondents had good knowledge, 77.39% had positive attitude, and 45.48% practiced preventive measures against COVID-19. Determinants of good knowledge were the age groups 30-39 and 40-49, secondary and higher/university educational levels, and not having suffered from COVID-19. Determinants of positive attitude were female sex, having a professional occupation, having a family member or close relative who had suffered from COVID-19, and living in the Karisimbi municipality. Determinants of better practice were female sex, secondary and higher/university educational levels, not having a professional occupation and having a family member or close relative who had suffered from COVID-19. Conclusion: For effective control of this epidemic, it is important to strengthen risk communication with full community participation. This strategy must be coupled with measures to make prevention methods available to the benefit of the entire population.

Keywords: knowledge of COVID-19, attitudes towards COVID-19, COVID-19 preventive practices, Goma

1 Introduction

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) was first detected in Wuhan, Hubei Province, China [1]. On 31 December 2019, the World Health Organization (WHO) offices in China were informed of pneumonia of unknown cause [1, 2]. Due to the spread of the disease, the WHO described the outbreak as a public health emergency of international concern on 30 January 2020. On 11 February 2020, the WHO officially named it Coronavirus Disease 2019 and COVID-19 and declared it a pandemic on 11 March 2020 [1]. On 10 March 2020, the Democratic Republic of the Congo (DRC) recorded its first case of COVID-19 and since then, COVID-19 cases have continued to increase in the country. The first case of COVID-19 was detected on 10 March 2020 in a traveler returning from France [3].

Since then, as of 5 September 2021, more than 56,086 cases and 1,068 deaths (an overall lethality of 1.9%) have been confirmed in the DRC. Most cases were detected in the capital, Kinshasa, and the province of North Kivu was in second place with 10.4% (5,841/56,086) of cases [4]. The main mode of transmission is community based [1]. In response to the pandemic, different nations have adopted different management approaches based on various considerations, including the WHO recommendations. The DRC has introduced containment, a measure recommended by the WHO and the National Ministry of Public Health to limit the spread of the virus and which has led to the widespread closure of businesses, travel and gatherings in public places (schools, churches, markets, *etc*.) [4, 5].

But, beyond these constraints and among all these paradoxical behaviors, some factors are associated with the good knowledge, positive attitude, and better prevention practices of COVID-19 among the population of Goma city, in the DRC. The objective of this study was

to contribute to the improvement of prevention knowledge, attitude, and practices among the population of Goma city on COVID-19 and to identify factors associated with good knowledge, positive attitude, and better prevention practices of COVID-19.

2 Materials and methods

2.1 Study framework

This study was carried out in Goma city, the capital of the Province of North Kivu, which is one of the main towns in the DRC. Located at an altitude of 1,530 meters, it is built on the former volcanic lava flows on the edge and north of Lake Kivu and south of the Nyiragongo volcano between $1^\circ\ 41'\ 36''$ South and $29^\circ\ 13'\ 31''$ East on an area of 75.72 Km^2, on a population estimated at nearly 2 million inhabitants. Goma is a dense city with more than 2,333 inhabitants per Km^2, with two health zones (Goma and Karisimbi) with 10 Health Areas (Goma) and 19 Health Areas (Karisimbi) respectively. The city is made up of two urban municipalities, divided into administrative districts.

2.2 Study design, period, and population

This was a cross-sectional survey of knowledge, attitudes and practices (KAP) at the community level conducted from July 15 to August 15, 2021. The study population was represented by all subjects residing in the two health zones of Goma city.

Included in the study was anyone residing in Goma city who was $\geq$ 18 years of age and who agreed to participate in the study.

The sample size was calculated according to the following formula: $n = z^2 \times p\ (1 - p) / m^2$

n = sample size; z = confidence level (for a confidence level of 95%, z = 1.96); p = estimated proportion of the population with good knowledge of COVID-19 that is unknown for Goma city (p = 0.5 as is the case in our study); m = tolerance margin of error (5%).

The minimum size calculated was 384 people. Non-respondents were estimated to be 20% of the sample size, which amounts to 460. Since this is a random cluster survey (the two municipalities were the clusters in our study), the cluster effect must be taken into account, we have multiplied this minimum size by 2 considering that there is a small difference between the clusters. Therefore, the final minimum size was estimated at $460 \times 2 = 920$ respondents.

2.3 Data collection

Structured individual interviews were conducted with the persons to be surveyed. We developed a 48-point questionnaire based on previous COVID-19 questionnaires used in various studies [6–8]. The selection of questionnaire elements was guided by the need for contextually appropriate questions for low-income environments. A questionnaire was developed based on the objectives of the study. A two-day pre-test of the questionnaire for investigators was conducted with 20 subjects. There were 20 investigators, or 10 investigators per health area. The questionnaire was administered to each individual included in the study. The collection period was July 15 to August 15, 2021.

2.4 Study variables

The questionnaire included variables on socio-demographic profile, knowledge, attitudes and practices on COVID-19.

2.4.1 Sociodemographic characteristics

The individual socio-demographic characteristics of the respondents were collected: age, sex, education level, marital status, occupation status, and religion. In addition, we collected data on the source of information on COVID-19, having received training or attended a conference on COVID-19, having suffered COVID-19, or having a family member who had previously suffered COVID-19. These socio-demographic variables were considered as independent variables in our study. Dependent variables were knowledge, attitudes, and practices towards COVID-19.

2.4.2 Knowledge of COVID-19

Participants were asked to select from a list of possible sources on which they relied for information on COVID-19 (multiple selections possible). We used a 22-item open tool that assessed knowledge of COVID-19 and consisted of true or false statements about key facts or misconceptions about the disease. Knowledge was assessed using a 22-item questionnaire adapted from Alawa et al. [8] and modified to suit respondents. Each correct answer weighs 1 point and 0 for incorrect answers. The higher the scores, the more competent the respondent is. The COVID-19 knowledge assessment was carried out by calculating a knowledge score of which a value of 60% or more is said to be good.

2.4.3 Attitudes towards COVID-19

We surveyed a range of COVID-19-related attitude by assessing agreement with statements on a 3-point Likert scale ("I agree", "I am neutral", and "I disagree"). To identify an attitude towards COVID-19, we used a scale of -10 to 10; for a positive attitude, we assigned a score of one, for a negative attitude a score of -1, and for a neutral response, we assigned a score of zero. Attitude was considered "negative" when the sum of all responses gave a negative number and "positive" when the sum gave a positive number.

2.4.4 COVID-19 preventive practices

Participants indicated whether they have taken steps to prevent COVID-19 infection ("yes" or "no"). With respect to physical distancing, we asked if the participant was in close contact with someone outside the family (answers: "yes" or "no") and if he had shaken his hand in the last 24 hours (answers: "yes" or "no"). Participants selected one or more barriers to COVID-19 prevention from a list of possible barriers (yes or no responses). The evaluation of COVID-19 preventive measures practices was carried out using the calculation of a practice score of 60% or more, which is considered better practice.

2.5 Data analysis

The data was entered on Microsoft Excel and analyzed on STATA 16. The data analysis consisted of two parts: a descriptive part and an analytical part. For descriptive results, frequencies were calculated for qualitative variables. The means with their standard deviation were calculated for the quantitative variables.

For analytical results, bivariate and multivariate analyzes were performed. A bivariate analysis was made of crosses between variables. A comparison of proportions was made using the Chi-squared test or the Fisher test depending on their conditions of applicability. The test was significant if the p value was less than 0.05. The odds ratio with its 95% confidence interval (95% CI) allowed quantification of the strength of the bond.

2.6 Ethical considerations

The study was approved by the Medical Ethics Committee of the University of Goma. Informed consent was sought from all participants aged 18 years and older. The anonymity of the persons surveyed was respected. Data collected anonymously were kept confidential. Only the study had access to the data. As the investigation was carried out in the midst of the outbreak, the COVID-19 prevention rules were respected, including the mandatory wearing of FFP2 masks, the use of aqueous-alcoholic solution and the physical distance of at least one meter from the investigator.

3 Results

3.1 Socio-demographic characteristics of the respondents

A total of 1,350 questionnaires were distributed and 1,286 returned. Of the questionnaires returned, 1,200 contained no missing elements and were included for further analysis. This represented an effective response rate of 88.9%.

Socio-demographic characteristics of the study participants are presented in Table 1. Of the 1,200 participants, about 57.7% were men with a sex ratio of 1.28. The majority were in the 20-29 age group. Married persons accounted for 55.92% of the population surveyed. More than 80% of the respondents were educated, mainly at the secondary educational level (42.58%) and higher/university educational level (43.67%). More than half of those surveyed were residents of the Karisimbi Health Zone (53.33%). The population surveyed consisted of 44% Catholics, 37.67% Protestants, 9.75% Muslims and 8.67% other religions. More than half (59.25%) do not have a job. 51,26 of the respondents report living in a household of more than 6 persons and 35.34% live in a household of 3 to 5 persons.

Of the 1,200 respondents, 1,194 responded that they had heard of COVID-19. The main sources of information on COVID-19 among participants were information from local radio (37.94%), television (20.44%), and social media (12.65%). However, 64.66% had attended a conference, meeting or discussion on COVID-19. About 33% of the respondents had a family member or close relative who had previously experienced COVD-19 and 8.96% of the respondents reported having ever suffered from COVID-19 (Table 2).

3.2 Knowledge of COVID-19

Responses to knowledge questions related to COVID-19 are presented in Table 3. More than half (53.52%) of the participants knew that asymptomatic people could spread the virus

Table 1 Distribution of the respondents by socio-demographic characteristics

Variable	Number (n = 1200)	Percentage
Age		
20-29 years	437	36.42
30-39 years	385	32.08
40-49 years	211	17.58
≥50 years	167	13.92
Sex		
Male	674	56.17
Female	526	43.83
Marital status		
Married	671	55.92
Single	394	32.83
Widowed	96	8.00
Divorced	39	3.25
Educational level		
Illiterate	41	3.42
Primary	130	10.83
Secondary	505	42.08
Higher/University	524	43.67
Municipality		
Goma	560	46.67
Karisimbi	640	53.33
Religion		
Catholic	528	44.00
Protestant	451	37.58
Muslim	117	9.75
Other religions	104	8.67
Occupational status		
Unemployed	489	40.75
Employed	711	59.25
Family size		
1 person	60	5.03
2 persons	100	8.38
3-5 persons	422	35.34
≥6 persons	612	51.26

Table 2 Distribution of the respondents based on COVID-19 information

Variable	Number (n = 1,194)	Percentage
Have you ever suffered from COVID-19?		
Yes	107	8.96
No	1087	91.04
Do you have a family member or friend who has already suffered COVID-19?		
Yes	395	33.08
No	799	66.92
Source of information on COVID-19		
Local radio	453	37.94
International radio	112	9.38
Television	244	20.44
Social media (Facebook, Twitter, WhatsApp, ...)	151	12.65
Church	107	8.96
Family members and friends	94	7.87
Non-governmental organizations	30	2.51
No response	3	0.25
Have you ever participated in conferences or discussions on COVID-19?		
Yes	422	35.34
No	772	64.66

and 68.34% knew that it is possible to contract a virus or contagious disease by touching a surface or object that has the virus on it. However, 54.10% thought antibiotics can be used to treat COVID-19 and 43.30% said antibiotics can be used to prevent COVID-19 infection. The majority of the participants were aware that COVID-19 could infect people of all ages (82.91%) and of all racial, religious and ethnic groups (90.20%). Regarding the mode of transmission, 72.19% knew that the main mode of transmission was through respiratory droplets, but only 46.73% knew that COVID-19 can also spread via the feco-oral route. On the other hand, only 16.92% knew that eating garlic, ginger, black pepper or lemon could not reduce your chances of being infected with COVID-19 and 20.60% said that limiting the consumption of meat, eggs and fish would help limit the spread of COVID-19. As for preventive measures, more than seven out of 10 participants cited handwashing (89.53%), avoiding hand greetings (86.85%), avoiding putting fingers in eyes, nose, and mouth (76.47%), using elbow or clothing to cough and sneeze (81.74%), social distancing (83.33%), wearing a face mask (75.21%), and staying at home (71.11%). Nearly 84% of the participants correctly identified people with pre-existing medical conditions such as heart disease, diabetes, hypertension, and cancer as a high-risk group for COVID-19. Eight out of 10 participants knew that people with COVID-19 could recover (83.16%) and that older people were not the only ones infected with COVID-19 (83.67%).

Table 3 Percentage of 1,194 respondents' responses toward COVID-19 knowledge

Statement	Correct	Incorrect	Not sure
People showing no symptoms of being sick can spread a virus or contagious disease (true)	53.52%	27.72%	18.76%
It is possible to contract a virus or contagious disease by touching a surface or object that has the virus on it (true)	68.34%	10.97%	20.69%
Antibiotics can be used to treat COVID-19/coronavirus (false)	54.10%	13.90%	32.00%
Antibiotics can be used to prevent infection from COVID-19 (false)	43.30%	19.85%	36.85%
People of all ages can become infected with COVID-19/coronavirus (true)	82.91%	8.46%	8.63%
People of all racial, religious and ethnic groups can become infected with COVID-19/coronavirus (true)	90.20%	4.10%	5.70%
Eating garlic, ginger, black pepper or lemon can lower your chances of getting infected with COVID-19/coronavirus (false)	53.27%	16.92%	29.82%
COVID-19 spread from humans to humans, mainly through respiratory droplets (true)	72.19%	5.95%	21.86%
COVID-19 can also spread from feco–oral route (true)	46.73%	19.18%	34.09%
Maintaining good personal hygiene and being socially responsible would help limit the spread of COVID-19/coronavirus (true)	80.90%	6.4%	12.65%
Washing hands frequently using soap or the use of sanitizer would help limit the spread of COVID-19/coronavirus (true)	89.53%	3.69%	6.78%
Avoiding handshaking behavior would help limit the spread of COVID-19/coronavirus (true)	86.85%	6.28%	6.87%
Avoiding placing fingers into eyes, nose and mouth would help limit the spread of COVID-19/coronavirus (true)	76.47%	8.04%	15.49%
Coughing and sneezing into the elbow or within the clothing is a good practice in helping to limit the spread of COVID-19/coronavirus (true)	81.74%	7.45%	10.80%
Limiting eating meat, eggs and fishes would help limit the spread of COVID-19/coronavirus (false)	20.60%	59.38%	20.02%
Following social distancing measures and avoiding crowded places would help limit the spread of COVID-19/coronavirus (true)	83.33%	7.62%	9.05%
For someone without any symptoms of COVID-19/coronavirus, wearing a face mask is considered an appropriate and protective measure against COVID-19/coronavirus (true)	75.21%	8.88%	15.91%
Proper usage of face mask during an outbreak should include covering nose, mouth and chin with the colored side facing outside (true)	73.37%	8.46%	18.17%
Staying at home would play a significant role in helping to limit the spread of COVID-19/coronavirus (true)	71.11%	16.25%	12.65%
A person with pre-existing medical conditions such as heart diseases, diabetes, hypertension and cancer are at greater risk of COVID-19/coronavirus related infection (true)	83,92%	6,03%	10.05%
COVID-19/coronavirus can only infect old people (false)	8,54%	83.67%	7,79%
There is no chance of survival once the person is infected with COVID-19/coronavirus (false)	6.45%	83.16%	10.39%

3.3 Attitudes related to COVID-19

Table 4 presents participants' responses toward attitude questions regarding COVID-19 prevention and control. Nearly 83.42% of the participants correctly identified COVID-19 as a serious disease, 70.69% were afraid of COVID-19 and 50% said they would go to hospital if infected. Approximately 75.88% of the participants believe that physical distancing is important to prevent COVID-19. However, only 16.83% had a positive attitude to the fact that people

should be willing to give up their daily tasks to stop the spread of COVID-19. Many of them (53.27%) had difficulty distinguishing the information I hear about COVID-19 is true, false or just a rumor. About 33% of the participants trusted the government with regard to the COVID-19 policy and 54.61% said there is a lot of corruption in the government with regard to COVID-19 management. About 30% of the participants thought COVID-19 is a conspiracy created to vaccinate everyone, and 38.69% said COVID-19 was created in a Chinese laboratory.

Table 4 Percentages of 1,194 respondents' responses toward attitudes questions related to COVID-19

Responses	I agree	I'm neutral	I disagree
Affective response			
COVID-19 is a serious illness.	83.42%	8.29%	8.29%
I am afraid of COVID-19.	70.69%	15.16%	14.15%
In case of infection, I will go to the hospital as indicated.	50.00%	16.08%	33.92%
Reaction to control measures			
Physical distancing is important to prevent COVID-19.	75.88%	13.15%	10.97%
People should be willing to give up their daily duties to stop the spread of COVID-19.	16.83%	22.03%	61.14%
Disinformation			
It is hard to distinguish which information I hear about COVID-19 is true, false, or just a rumour.	53.27%	29.48%	17.25%
Institutional trust			
I trust the government	32.50%	29.40%	38.11%
There is a lot of corruption in the government.	54.61%	29.56%	15.83%
Rumors			
COVID-19 was created in a Chinese laboratory.	38.69%	37.44%	23.87%
COVID-19 is a conspiracy created to vaccinate everybody.	29.31%	37.52%	33.17%

3.4 Practices for preventive measures against COVID-19

Participants' responses toward preventive practices against COVID-19 questions are presented in Table 5. As a preventive measure, participants practiced regular hand washing (92.38%), wearing face masks (80.65%), physical distancing (61.39%), using disinfectants (53.02%), avoiding placing fingers in the eyes, nose, and mouth (48.16%), and staying at home (29.82%).

The reasons most mentioned are lack of financial means (44.22%), unavailability of means of protection to the market (41.54%), and high price of means of protection to the market (37.44%).

Table 5 Percentages of responses to questions on preventive practices against COVID-19

Statement	Yes	No
In the past 2 weeks, have you done anything to protect yourself from COVID-19?		
Wash hands	92.38%	7.62%
Stay >2 m from others	61.39%	38.61%
Avoid touching face	48.16%	51.84%
Stay home	29.82%	70.18%
Use disinfectant	53.02%	46.98%
Wear mask	80.65%	19.35%
Take medicines without prescription	46.06%	53.94%
Change diet	31.40%	68.60%
Apart from family, have you come in close (<2 m) contact with anyone in the past 24 hours?	80.23%	19.77%
Have you shaken hands in the last 24 hours (not counting family members)?	72.45%	27.55%

3.5 Levels of knowledge, attitudes, and preventive practices

By dividing 1,194 participants by their level of knowledge, attitudes, and practices related to COVID-19, Figure 5 shows that 891 (74.62%) of them had good knowledge, 924 (77.39%) had positive attitude, and only 543 (45.48%) preventive practices against COVID-19.

3.6 Factors associated with good knowledge of COVID-19

Bivariate and multivariate analyzes of factors associated with good knowledge of COVID-19 are reported in Table 6. Knowledge level was adequate for respondents aged 30-39 years (adjusted OR = 1.75 [1.17-2.62]) or 40-49 years (adjusted OR = 1.88 [1.15-3.08]), male respondents (adjusted OR = 1.55 [1.15-2.08]), respondents with secondary educational level (adjusted OR = 2.95 [2.01-4.34]) or higher/university educational level (adjusted OR = 7 1.59 [4.87-11.83]), and respondents who had not suffered from COVID-19 (adjusted OR = 2.17 [1.33-3.55]).

3.7 Factors associated with a positive attitude towards COVID-19

Bivariate and multivariate analyzes of factors associated with a positive attitude towards COVID-19 are reported in Table 7. The determinants of positive attitude were female sex

(adjusted OR = 1.38 [1.03-1.86]), having a professional occupation (adjusted OR = 1.36 [1.01-1.84]), residing in Karisimbi municipality (adjusted OR = 1.56 [1.18-2.07]), having a family member who suffered COVID-19 (adjusted OR = 1.44 [1.05-1.98]).

Table 6 Bivariate and multivariate analyses of factors associated with good knowledge of COVID-19

Variable	Total (n = 1194)	Knowledge		Unadjusted OR [95% CI]	p-value	Adjusted OR [95% CI]	p-value
		Good (n = 891), n(%)	Poor (n = 303), n(%)				
Age							
20-29 years	303	311 (71.99)	121 (28.01)	1		1	
30-39 years	183	299 (77.86)	85 (22.14)	1.37 [0.99-1.88]	0.065	1.75 [1.17-2.62]	0.006
40-49 years	150	163 (77.25)	48 (22.75)	1.32 [0.90-1.94]	0.184	1.88 [1.15-3.08]	0.012
$\geq$ 50 years	109	118 (70.66)	49 (29.34)	0.94 [0.63-1.39]	0.823	1.39 [0.82-2.35]	0.223
Sex							
Female	441	358 (68.32)	166 (31.68)	1		1	
Male	304	533 (79.55)	137 (20.45)	1.80 [1.39-2.35]	$<$ 0.0001	1.55 [1.15-2.08]	0.004
Marital status							
Married	671	496 (73.92)	175 (26.08)	0.73 [0.54-0.99]	0.043	0.53 [0.35-0.80]	0.002
Single	389	309 (79.43)	80 (20.57)	1		1	
Widowed/Divorced	134	86 (64.18)	48 (35.82)	0.46 [0.30-0.71]	0.0006	0.53 [0.30-0.96]	0.037
Educational level							
Illiterate/Primary	168	75 (44.64)	93 (55.36)	1		1	
Secondary	502	359 (71.51)	143 (28.49)	3.11 [2.17-4.46]	$<$ 0.0001	2.95 [2.01-4.34]	$<$ 0.0001
Higher/University	524	457 (87.21)	67 (12.79)	8.46 [5.68-12.59]	$<$ 0.0001	7.59 [4.87-11.83]	$<$ 0.0001
Occupational status							
Unemployed	483	335 (69.36)	148 (30.64)	1		1	
Employed	711	556 (78.20)	155 (21.80)	1.58 [1.22-2.06]	0.0007	1.12 [0.87-1.60]	0.289
Religion							
Catholic	527	398 (75.52)	129 (24.48)	1		1	
Protestant	451	341 (75.61)	110 (24.39)	1.00 [0.75-1.35]	1	0.85 [0.62-1.17]	0.319
Muslim	117	87 (74.36)	30 (25.64)	0.94 [0.59-1.45]	0.884	1.02 [0.62-1.68]	0.946
Other religions	99	65 (65.66)	34 (34.34)	0.62 [0.39-1.00]	0.054	0.62 [0.38-1.03]	0.068
Municipality							
Goma	555	400 (72.07)	155 (27.93)	1		1	
Karisimbi	639	491 (76.84)	148 (23.16)	1.28 [0.99-1.67]	0.068	1.21 [0.91-1.62]	0.196
Have you ever suffered from COVID-19?							
Yes	107	75 (70.09)	32 (29.91)	1		1	
No	1087	816 (75.07)	217 (24.83)	1.60 [1.03-2.49]	0.046	2.17 [1.33-3.55]	0.002
Do you have a family member or friend who has already suffered COVID-19?							
Yes	395	305 (77.22)	90 (22.78)	1		1	
No	799	586 (73.34)	213 (26.66)	0.81 [0.61-1.08]	0.1687	1.08 [0.79-1.48]	0.644
Have you ever participated in conferences or discussions on COVID-19?							
Yes	422	341 (80.81)	81 (19.19)	1.70 [1.27-2.27]	0.0003	1.25 [0.91-1.72]	0.173
No	772	550 (71.24)	222 (28.76)	1		1	

3.8 Factors associated with better preventive practices against COVID-19

Bivariate and multivariate analyzes of factors associated with better preventive practices against COVID-19 measures are reported in Table 8. The determinants of better practices were female sex (adjusted OR = 1.31 [1.03-1.68]), secondary educational level (adjusted OR = 3.12 [2.01-4.84]) or higher/university educational level (adjusted OR = 6.12 [3.88-9.67]), not having a professional occupation (adjusted OR = 1.36 [1.03-1.76]), and having a family member who suffered from COVID-19 (adjusted OR = 1.42 [1.09-1.84]).

4 Discussion

In the present study, the majority of the respondents (99.5%) had received information on COVID-19. The Multisectoral Committee on the Response to the COVID-19 pandemic in the DRC (MCR – COVID-19) continuously disseminates awareness-raising messages via information channels including radio and television channels, both public and private, and websites. Despite these efforts to raise awareness, false rumors continue to grow. Thus, disinformation is hampering public health efforts to address this COVID-19 outbreak. As a result, the community may take fewer measures to prevent the transmission of this disease [9].

The erroneous knowledge that older people are the only ones at risk for COVID-19 is found in the list of rumors that could give false assurances according the WHO [10]. In this respect, the MCR – COVID-19 should strengthen the Community Facilitation Cell (CFC) as people have the right to be informed and understand the risks of COVID-19. In addition, they must receive practical advice on how to protect themselves and their loved ones. The CFC advocates strategies such as tracking and managing rumors and disinformation. For example, MCR –

Table 7 Bivariate and multivariate analyses of factors associated with positive attitudes toward COVID-19

Variable	Total (n = 1194)	Attitude		Unadjusted OR [95% CI]	p-value	Adjusted OR [95% CI]	p-value
		Positive (n = 924), n(%)	Negative (n = 270), n(%)				
Age							
20-29 years	303	333 (77.08)	99 (22.92)	1		1	
30-39 years	183	293 (76.30)	91 (23.70)	0.96 [0.69-1.32]	0.856	0.93 [0.64-1.37]	0.72
40-49 years	150	168 (79.62)	43 (20.38)	1.16 [0.78-1.74]	0.53	1.00 [0.61-1.63]	0.996
$\geq$ 50 years	109	130 (77.84)	37 (22.16)	1.04 [0.68-1.60]	0.928	1.06 [0.63-1.80]	0.82
Sex							
Female	441	420 (80.15)	104 (19.85)	1.33 [1.01-1.75]	0.043	1.38 [1.03-1.86]	0.03
Male	304	504 (75.22)	166 (24.78)	1		1	
Marital status							
Married	671	522 (77.79)	149 (22.21)	1.05 [0.78-1.42]	0.785	0.93 [0.64-1.37]	0.724
Single	389	299 (76.86)	90 (23.14)	1		1	
Widowed/Divorced	134	103 (76.87)	31 (23.13)	1.00 [0.63-1.59]	1	0.85 [0.47-1.55]	0.609
Educational level							
Illiterate/Primary	168	116 (69.05)	52 (30.95)	1		1	
Secondary	502	395 (78.69)	107 (21.31)	1.65 [1.12-2.45]	0.015	1.39 [0.92-2.10]	0.115
Higher/University	524	413 (78.82)	111 (21.18)	1.67 [1.13-2.46]	0.009	1.41 [0.92-2.16]	0.119
Occupational status							
Unemployed	483	357 (73.91)	126 (26.09)	1		1	
Employed	711	567 (79.75)	144 (20.25)	1.38 [1.06-1.83]	0.022	1.36 [1.01-1.84]	0.045
Religion							
Catholic	527	412 (78.18)	115 (21.82)	1		1	
Protestant	451	351 (77.83)	100 (22.17)	0.98 [0.72-1.33]	0.956	0.95 [0.69-1.29]	0.726
Muslim	117	88 (75.21)	29 (24.79)	0.85 [0.53-1.35]	0.566	0.81 [0.50-1.31]	0.399
Other religions	99	73 (73.74)	26 (9.63)	0.78 [0.48-1.28]	0.401	0.75 [0.45-1.25]	0.273
Municipality							
Goma	555	404 (72.07)	151 (27.21)	1		1	
Karisimbi	639	520 (81.38)	119 (18.62)	1.63 [1.24-2.15]	0.0005	1.56 [1.18-2.07]	0.002
Have you ever suffered from COVID-19?							
Yes	107	83 (77.57)	24 (22.43)	1.01 [0.63-1.63]	1	1.02 [0.62-1.68]	0.947
No	1087	841 (77.37)	246 (22.63)	1		1	
Do you have a family member or friend who has already suffered COVID-19?							
Yes	395	324 (82.03)	71 (17.97)	1.51 [1.12-2.03]	0.009	1.44 [1.05-1.98]	0.025
No	799	600 (75.09)	199 (24.91)	1		1	
Have you ever participated in conferences or discussions on COVID-19?							
Yes	422	332 (78.67)	90 (21.33)	1.12 [0.84-1.49]	0.476	0.95 [0.70-1.28]	0.202
No	772	592 (76.68)	180 (23.32)	1		1	

COVID-19 should promote media monitoring, follow-up of community radio conversations on COVID-19, and telephone and emergency assistance services.

74.62% of the respondents had good knowledge of COVID-19. This level of knowledge is higher than those reported in previous Congolese [6, 11, 12] and African [8, 13] studies. These differences in outcomes could be explained by the fact that these studies were conducted during the first two waves of the COVID-19 pandemic, whereas this study dates from the third wave. So, we think that the longer the disease lasts, the better the knowledge about the disease.

In this study, as a preventive measure, respondents advocated regular hand washing with soap and water (89.53%), wearing face masks (75.21%), and social distancing (83.33%). This level of knowledge is slightly low given the importance of prevention in the fight against this COVID-19 pandemic. The level of knowledge of preventive measures was higher in the Ethiopian study by Kebede et al. [14] who had reported that the respondents had mainly mentioned good hand washing, the use of disinfectants and wearing the face mask at 95.5%, 95%, and 90.3% respectively. This high level of knowledge found in this Ethiopian study compared to our study is explained by the fact that their study population only concerned persons attending a health facility, and therefore more likely to learn about COVID-19. Thus, the MCR – COVID-19 needs to strengthen the use of reliable media channels, in order to provide key health information to the community more quickly on how to reduce the risk of contracting the virus. Thus, awareness messages are well received when the target is instructed. The educational level improves people's knowledge of COVID-19. This study shows that the odds of good knowledge among respondents secondary and higher/university educational levels were 2.95 and 7.59 times higher, respectively, than their primary educational level/illiterate counterpart. Bao-Liang et al. [15] have shown in their study in China that the high level of knowledge about COVID-19 is linked to the high educational level of the respondents.

In our study, age influenced people's knowledge of COVID-19. Respondents aged 30-39 years and 40-49 years were almost twice as likely as those aged 20-29 years to have better knowledge. Similarly, in Malaysia, people over 50 years had higher levels of knowledge. These authors believe that this would likely be a higher perception of the risk of transmission and complications of the disease [16].

Table 8 Bivariate and multivariate analyses of factors associated with better preventive practices against COVID-19

Variable	Total (n = 1194)	Preventive pratiques		Unadjusted OR [95% CI]	p-value	Adjusted OR [95% CI]	p-value
		Better (n = 543), n(%)	Not better (n = 651), n(%)				
Age							
20-29 years	303	191 (44.21)	241 (55.79)	1		1	
30-39 years	183	184 (47.92)	200 (52.08)	1.16 [0.88-1.53]	0.322	1.24 [0.88-1.73]	0.216
40-49 years	150	100 (47.39)	111 (52.61)	1.14 [0.82-1.58]	0.499	1.20 [0.78-1.84]	0.388
$\geq$ 50 years	109	68 (40.72)	99 (59.28)	0.87 [0.60-1.25]	0.495	0.90 [0.57-1.42]	0.643
Sex							
Female	441	248 (47.33)	276 (52.67)	1.14 [0.91-1.43]	0.281	1.31 [1.03-1.68]	0.038
Male	304	295 (44.03)	375 (55.97)	1		1	
Marital status							
Married	671	296 (44.11)	375 (55.89)	0.86 [0.67-1.11]	0.27	0.84 [0.60-1.17]	0.307
Single	389	186 (47.81)	203 (52.19)	1		1	
Widowed/Divorced	134	61 (45.52)	73 (54.48)	0.91 [0.62-1.35]	0.72	1.16 [0.69-1.95]	0.564
Educational level							
Illiterate/Primary	168	32 (19.05)	136 (80.95)	1		1	
Secondary	502	211 (42.03)	291 (57.97)	3.08 [2.02-4.71]	$<$ 0.0001	3.12 [2.01-4.84]	$<$ 0.0001
Higher/University	524	300 (57.25)	224 (42.75)	5.69 [3.73-8.68]	$<$ 0.0001	6.12 [3.88-9.67]	$<$ 0.0001
Occupational status							
Unemployed	483	224 (46.38)	259 (53.62)	1.06 [0.84-1.34]	0.649	1.36 [1.03-1.76]	0.029
Employed	711	319 (44.87)	392 (55.13)	1		1	
Religion							
Catholic	527	237 (44.97)	290 (55.03)	1		1	
Protestant	451	207 (45.90)	244 (54.10)	1.04 [0.81-1.33]	0.821	0.95 [0.73-1.24]	0.726
Muslim	117	58 (49.57)	59 (50.43)	1.20 [0.81-1.78]	0.423	1.24 [0.81-1.90]	0.324
Other religions	99	41 (41.41)	58 (58.59)	0.87 [0.56-1.34]	0.587	0.98 [0.62-1.56]	0.951
Municipality							
Goma	555	241 (43.42)	314 (56.58)	1		1	
Karisimbi	639	302 (47.26)	337 (52.74)	1.17 [0.93-1.47]	0.204	1.08 [0.84-1.38]	0.552
Have you ever suffered from COVID-19?							
Yes	107	61 (57.01)	46 (42.99)	1.66 [1.11-2.49]	0.016	1.18 [0.77-1.81]	0.443
No	1087	482 (44.34)	605 (55.66)	1		1	
Do you have a family member or friend who has already suffered COVID-19?							
Yes	395	213 (53.92)	182 (46.08)	1.66 [1.30-2.12]	$<$ 0.0001	1.42 [1.09-1.84]	0.009
No	799	330 (41.30)	469 (58.70)	1		1	
Have you ever participated in conferences or discussions on COVID-19?							
Yes	422	214 (50.71)	208 (49.29)	1.39 [1.09-1.76]	0.009	1.02 [0.79-1.33]	0.854
No	772	329 (42.62)	443 (57.38)	1		1	

Almost all respondents believed that COVID-19 was present, identifying COVID-19 as a serious disease (83.42%). This result is explained by the increased awareness of the disease among health authorities through the use of several local languages through media such as television and radio. Belief in the existence of the disease is important for this population to engage in the fight against this pandemic. Thus, given the increase in cases, MCR – COVID-19 must make use of existing and trustworthy networks of community engagement and interlocutors. It must inform, train and involve them in the fight activities using the local language and dialects of the community. These actors need to know about pre-existing perceptions of COVID-19, their credibility and reliability in the eyes of the community. Thus, some actions are aimed at making masks available and setting up hand washing devices and communication for wearing masks, evicting gatherings, and regularly washing hands with soap and water. Nevertheless, some people (70.69%) have a fear attitude towards COVID-19. In our study, fear of COVID-19 could explain people's refusal to be quarantined if the disease is suspected. Compulsory contact tracing, the daily MCR – COVID-19 releases on the epidemiological situation of the epidemic, as part of the COVID-19 public health responses, can make people more anxious and guilty of the effects of contagion, quarantine and stigmatization of their families and friends [17]. According to Lei et al. [18] individuals with confirmed or suspected COVID-19 may be concerned about this potentially fatal disease. Quarantine causes boredom, loneliness, and anger. This state of affairs may make it difficult for them to take medical care as well as to integrate them into the social and professional life after COVID-19. WHO recommends that all communication and case management efforts simultaneously address the fear associated with COVID-19, delivering do-not-do messages [19]. MCR – COVID-19 should take advantage of the opportunities offered by the press releases on COVID-19 to the media to share accurate information on the outbreak and how to reduce the spread of infection. It is also an opportunity to respond to fears, rumors and the current stigma. Around 33% of the participants trusted the government with regard to the COVID-19 policy. On the other hand, the results of a study carried out in Argentina showed that the population overwhelmingly approved of the government's action at over 75% and this flattering figure is linked to the very rapid reaction of the Argentine government to the arrival of the virus on the territory [19].

In this study, female respondents were significantly more likely to have positive attitudes than male respondents (80.15% vs 75.22%; adjusted OR = 1.38 [1.03-1.86]). However, men are less likely to stay at home because they bear the family burden and are forced to go to work despite the situation exacerbated by this pandemic. Those individuals who are engaged in income-generating activities, the majority of whom work for their own account or in small informal sector enterprises, are less likely to stay at home. Being confined to the home limits women's movement. Thus, they are less inclined to wear masks than men. This study reports that 45.48% of the respondents had good practices regarding preventive measures against COVID-19. The adoption of good practices, including regular hand washing (92.38%) and wearing masks (80.65%), by almost all people is explained by the commitment of the government authorities with the full involvement of community leaders in promoting activities to contain this epidemic. In China, only 2% of people reported not wearing masks outside the home [20]. Due to the risks of transmission in family and extra-family settings, the use of masks should not be limited to outside the home because inside, many people also live, and some people are forced to go out and thus more likely to bring the COVID-19 virus back into the household. It is important to note that the national recommendation is now to wear masks. It was based on the understanding that many people with mild symptoms may not know that they are infected with COVID-19.

This recommendation is supported by WHO, and other authors, including Clements [21] in its US study. As part of the fight against COVID-19, MCR – COVID-19 has made available toll-free numbers to the public. People can call for free to receive COVID-19 prevention messages. This should encourage health authorities to raise awareness of the use of masks and especially hand washing. Apart from the prevention of COVID-19, the systematic washing of hands with soap and water must be anchored in our society, as it remains an essential preventive measure against diseases of fecal peril, in particular amoebic dysentery and cholera. Therefore, it seems appropriate to involve communities in preventing the spread of COVID-19 through community actions, such as physical distancing, avoidance of public gatherings and adoption of healthy behaviors. These preventive measures must be taken now to ensure that, as the pandemic progresses, all citizens are sufficiently aware of the seriousness of the threat, with great clarity and attention to best practices, including compliance with COVID-19 prevention measures [22].

As limitations, the cross-sectional design used in this study does not allow for the generalization of results to all people in the province of North Kivu or the DRC. The results may not be representative of the entire Congolese population. In addition, a socio-anthropological approach as a complement to this study by analyzing the perceptions of populations on COVID-19 disease could have led to a better understanding of their behaviors in the face of this pandemic. The presence of the investigators during the administration of the questionnaire thus tended to increase the risk and intensity of the social desirability effect, especially since the latter were aware of the content of the replies. The telephone or online survey could have avoided this bias.

5 Conclusion

This study showed that the majority of the population surveyed had good knowledge and a positive attitude towards COVID-19. However, the level of practice of preventive measures was not satisfactory. While these results are encouraging, a great deal of effort needs to be made in the practice of preventive measures. This strategy must be coupled with actions aimed at making prevention means available to the benefit of the entire population and to promote a change in behavior conducive to healthy living. The government should take these observations into account and develop policies to prevent such malicious practices. It is also recommended that up-to-date information be provided by authentic sources.

Conflict of interest

The authors have no conflicts of interest relevant to this article to disclose.

References

[1] World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19, 11 March 2020.

[2] Mudenda S. Letter to Editor: Coronavirus disease (COVID-19): a global health problem. Journal of Pharmaceutical Research Science & Technology, 2020, **4**(1): 1-2. https://doi.org/10.31531/2581-3080.1000141

[3] Ministry of Health, Democratic Republic of the Congo. Stop Coronavirus COVID-19 DRC, Accessed September 21, 2020. https://www.stopcoronavirusrdc.info

[4] Ministère de la Santé Publique, République Démocratique du Congo. Epidémie de la maladie à coronavirus 2019 (COVID-19) en République démocratique du Congo - Rapport de situation N^{o} 248/2021 du 05/09/2021 + Hebdo S35/2021.
https://reliefweb.int

[5] Mukuku O, Tawi JM, Takulibwe AMK, *et al*. Quel serait l'impact de la réponse à la pandémie de la maladie à coronavirus (COVID-19) sur les enfants de la rue à Lubumbashi. Revue de l'Infirmier Congolais, 2020, **4**(1): 4-5.

[6] Claude KM, Serge MS, Alexis KK, *et al*. Prevention of COVID-19 in internally displaced persons camps in War-Torn North Kivu, Democratic Republic of the Congo: a mixed-methods study. Global Health: Science and Practice, 2020, **8**(4): 638-653.
https://doi.org/10.9745/GHSP-D-20-00272

[7] Olum R, Chekwech G, Wekha G, *et al*. Coronavirus disease-2019: knowledge, attitude, and practices of health care workers at Makerere University Teaching Hospitals, Uganda. Front Public Health, 2020, **8**: 181.
https://doi.org/10.3389/fpubh.2020.00181

[8] Alawa J, Al-Ali S, Walz L, *et al*. Knowledge and perceptions of COVID-19, prevalence of pre-existing conditions and access to essential resources in Somali IDP camps: a cross-sectional study. BMJ open, 2020, **11**(6): e044411.
https://doi.org/10.1136/bmjopen-2020-044411

[9] World Health Organization. Infodemic management: a key component of the COVID-19 global response. Weekly Epidemiological Record, 2020, **95**(16): 145-148.

[10] Organisation mondiale de la Santé. Maladie à coronavirus (COVID-19) conseils au public : Mythbusters. Genève : OMS ; Dernière mise à jour, 27 avril 2020.
https://www.who.int

[11] Carsi Kuhangana T, Kamanda Mbayo C, Pyana Kitenge J, *et al*. COVID-19 pandemic: knowledge and attitudes in public markets in the former Katanga Province of the Democratic Republic of Congo. International Journal of Environmental Research and Public Health, 2020, **17**(20): 7441.
https://doi.org/10.3390/ijerph17207441

[12] Michel-Kabamba N, Ngatu NR, Leon-Kabamba N, *et al*. Occupational COVID-19 prevention among congolese healthcare workers: knowledge, practices, PPE compliance, and safety imperatives. Tropical Medicine and Infectious Disease, 2020, **6**(1): 6.
https://doi.org/10.3390/tropicalmed6010006

[13] Leye MMM, Keita IM and Bassoum O. Connaissances, attitudes et pratiques de la population de la région de Dakar sur la COVID-19. Sante Publique, 2020, **32**(5): 549-561.
https://doi.org/10.3917/spub.205.0549

[14] Kebede Y, Yitayih Y, Birhanu Z, *et al*. Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma university medicalcenter visitors, Southwest Ethiopia. PLoS One, 2020, **15**(5): e0233744.
https://doi.org/10.1371/journal.pone.0233744

[15] Zhong BL, Luo W, Li HM, *et al*. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. International journal of biological sciences, 2020, **16**(10): 1745.
https://doi.org/10.7150/ijbs.45221

[16] Cao J, Hu X, Cheng W, *et al*. Correction to: Clinical features and short-term outcomes of 18 patients with corona virus disease 2019 in intensive care unit. Intensive Care Medicine, 2020, **46**(6): 1298.
https://doi.org/10.1007/s00134-020-06037-y

[17] Xiang YT, Yang Y, Li W, *et al*. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. Lancet Psychiatry, 2020, **7**(3): 228-229.
https://doi.org/10.1016/S2215-0366(20)30046-8

[18] Lei L, Huang X, Zhang S, *et al*. Comparison of prevalence and associated factors of anxiety and depression among people affected by versus people unaffected by quarantine during the COVID-19 epidemic in Southwestern China. Medical science monitor: international medical journal of experimental and clinical research, 2020, **26**: e924609-1.
https://doi.org/10.12659/MSM.924609

[19] OMS et UNICEF. La stigmatisation sociale associée à la maladie des coronavirus (COVID-19). Genève: OMS; 2020.
https://communityengagementhub.org

[20] Zhong BL, Luo W, Li HM, *et al*. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. International journal of biological sciences, 2020, **16**(10): 1745-1752.
https://doi.org/10.7150/ijbs.45221

[21] Clements JM. Knowledge and Behaviors Toward COVID-19 among US Residents During the Early Days of the Pandemic: Cross-Sectional Online Questionnaire. JMIR Public Health Surveill, 2020, **6**(2): e19161.
https://doi.org/10.2196/19161

[22] Wolf MS, Serper M, Opsasnick L, *et al*. Awareness, attitudes, and actions related to COVID-19 among adults with chronic conditions at the onset of the US outbreak: a cross-sectional survey. Annals of internal medicine, 2020, **173**(2): 100-109.
https://doi.org/10.7326/M20-1239