



Factors Influencing COVID-19 Vaccine Refusal in an Unstable Socio-Political Area: The Case of Eastern of the Democratic Republic Congo

¹Héritier Nsenge Mpia, ²Moïse Kambale Kasambya, ³Vingi Mutegeheki Baraka, ⁴Dorcas Masika Muyisa, ⁵Mystère Kanduki Kivuyirwa, ⁶Zawadi Sirisombola Corine, ⁷Moïse Katembo Kasolene, ⁸Dunia Kavira Shangwe

^{1,2,3,4,5,6,7,8}Université de l'Assomption au Congo

¹ORCID: <https://orcid.org/0000-0001-7428-8092>

DOI: <https://doi.org/10.55248/gengpi.2023.4220>

Abstract

The purpose of this research was to identify factors that affect the resistance of the population of eastern DR Congo to be vaccinated against Covid-19. Therefore, quantitative research based on primary data obtained from a survey was conducted in North Kivu Province. The questionnaire had 35 items with 410 respondents. After processing of the data, 318 records were retained. There were 151 women (48.55%) and 160 men (51.45%). Using the exploratory factor analysis (EFA), the authors shifted from 35 items to 6 main factors affecting vaccine resistance when they used Cronbach's Alpha test for each rotated factor. Cronbach's Alpha test for the reliability of the questionnaire was 0.67; the Bartlett test was 2490.79, and the KMO test was 0.70. Total cumulative variance was 30.1% explained by the six retained which are Psycho-medical background, Demographic, Social origin, Lack of trust in government actions, Previous issues about the Ebola vaccine in North Kivu, and Socio-political belonging.

Keywords: EFA, Covid-19, Vaccine Resistance, Socio-political instability, Crisis, Eastern DR Congo

1. Introduction

The Congolese political context remains delicate, and existing political fractures continue to exacerbate community tensions and the level of insecurity in crisis areas. This political situation is taking place in a complex humanitarian context deteriorated by the Covid-19 pandemic that has undermined the country's economic growth (FEWS, 2022). The epidemiological situation of Covid-19 continues to worsen (Modeawi, et al., 2021). According to the Congolese government data, the 7-day average of new cases increased from 92 on June 1 to 369 on June 20. Vaccination coverage is also low, with a total of 44,840 people vaccinated as of June 21. As of June 18, 2021, more than 37,519 confirmed cases have been recorded since the beginning of the pandemic in the DR Congo, which continues to have unfavourable effects on the household economy, particularly through the loss and decline of income. The vaccination campaign that began in April 2021 is struggling to convince the population (FEWS, 2022).

As of June 25, 2021, 51,427 people have been vaccinated in the DR Congo since the launch of the vaccination campaign on April 19, 2021, according to the government (FEWS, 2022). Given that the vaccination campaign that began in April 2021 is struggling to convince the population, there is a risk of an increase in cases in the coming months in the DR Congo (Ditekemena, et al., 2021). The epidemiological situation of Covid-19 continues to deteriorate, particularly in the far north of eastern DR Congo, where the number of infected people is increasing daily. Some health zones are considered by the Ministry of Health as the main sources of contamination, notably Butembo, Beni, Musienene and Kyondo, which have already recorded 2,667 cases since the beginning of the pandemic (FEWS, 2022). Humanitarian access to the entire population in need remains a major concern in DR Congo (Ditekemena, et al., 2021). The operations of humanitarian actors are limited or hampered due to insecurity, lack of infrastructure, and the isolation of some areas of the country. However, although FEWS does not have the latest updates, assistance is continuing where possible and should improve the food security of many households, including the IDPs and returnees who are receiving this assistance (FEWS, 2022).

Covid-19 arrived in the Province of North Kivu after the Ebola epidemic and that there was already resistance to receiving the vaccine during the first epidemic. WHO (2020) stated that factors that led to the non-receipt of the Ebola were beliefs in traditional practices, the lack of dialogue between health experts and the local population, the non-involvement of local authorities, both administrative and customary, the security situation, and the lack of confidence in health experts, etc. Therefore, it would be the same factors that led to the refusal to receive the Covid-19 vaccine.

In this research, the authors set the following objectives:

1. To know the significant factors influencing the resistance to vaccination against Covid-19 in the eastern Democratic Republic of Congo
2. To investigate the population of the North Kivu Province to detect the antecedents that condition their refusal to the Covid-19 Vaccine.

2. Literature Review

Edwards et al. (2021) showed in their study that levels of vaccine coverage in populations will be needed, even with vaccines that have a high level of efficacy, to prevent and stop coronavirus outbreaks. They used representative online longitudinal survey methods of more than 3000 Australian adults that examine demographic, attitudinal, political, and social attitudes, as well as correlates of hesitancy and resistance to the Covid-19 vaccine (Edwards, Biddle, Gray, & Sollis, 2021). The model used in this study is the ordinal probit model using the probit command in STATA 15.1. The results obtained show that 59% of the respondents would get vaccinated, 29% have a low level of hesitation, 7% have a high level of hesitation, and 6% have a high level of resistance (FEWS, 2022). The findings of this research suggested that vaccine hesitancy, which represents another significant proportion of the population, can be addressed through public health messages (Edwards, Biddle, Gray, & Sollis, 2021).

Murphy et al. (2021) thought that identifying and understanding vaccine hesitancy in the population for Covid-19 could help future public health messages. This study had four objectives: the prevalence of vaccine hesitancy and resistance in Ireland and the United Kingdom; sociodemographic, political, and health variables associated with Covid-19 vaccine hesitancy and resistance; psychological indicators of vaccine acceptance; and, finally, consumption of and confidence in information about Covid-19. Using nationally representative data from populations in Ireland with a sample size of 1041 and 2025 for the UK, these authors found that vaccine hesitancy and resistance were evident in 35% and 31% respectively. The finding is that vaccine-hesitant/resistant respondents in Ireland and the UK differed on a number of sociodemographic and health criteria but were similar on a wide range of psychological constructs (Murphy, et al., 2021).

The study conducted by Cordina et al. (2021) on people living in Malta aimed to explore attitudes and factors influencing attitudes towards the Covid-19 vaccine among people living in Malta; but also, to identify reasons why individuals are unsure or unwilling to be vaccinated. For the methodology, they used two consecutive, short, anonymous online surveys using social media platforms that collected data from adults. In both studies, respondents were primarily women with tertiary education. More than 50% said they were willing to be vaccinated. Vaccine hesitancy was present in the study population, with 32.6% being unsure and 15.6% stating that they were not ready to be vaccinated. In general, the lack of vaccine safety was the main reason given for unwillingness to be vaccinated. Predictors of willingness to be vaccinated were the belief that the Covid-19 vaccine will protect the health of those who receive it (Cordina, Lauri, & Josef, 2021).

In addition, Riad et al. (2021) concluded in their research that factors such as pharmaceutical level, a misconception of natural immunity, individual's belief in the risk-benefit ratio of vaccines and individual's attitude towards new vaccines influence more students in about twenty countries. Their results were statistically presented as follows: in a total of 6,639 respondents, 70.5% were women, and 63.3% were between 17 and 22 years old. In answering the question of willingness to get vaccinated against Covid-19, only 63.5% accepted the vaccine, 22.5% were reluctant to be vaccinated, and 13.9% were refractory to the vaccine (Riad, et al., 2021).

Shmueli (2021) applied behavioral theoretical models using hierarchical logistic regression to predict intention to receive the Covid-19 vaccine on a dataset of 398 eligible respondents with 27 predictor variables categorized into 3 including 10 sociodemographic predictor variables, 7 health-related predictor variables, 6 health belief model predictor variables, and 4 planned behavior variables. The results of his research revealed that 80% of 398 eligible respondents reported being willing to receive the Covid-19 vaccine. Participants were more likely to be willing to be vaccinated if they reported higher levels of perceived benefits of the Covid-19 vaccine, perceived severity of Covid-19 infection, and incentives to act (Shmueli, 2021).

Umakanthan et al. (2021) were able to identify areas of vaccine hesitancy against Covid-19. To achieve this, a longitudinal online survey covering 3000 adults from India was used as the method for this study. This survey was conducted via the web portal. Statistical analysis was done using the STATA 15.1 Software Oprobit Command Test. The results revealed that one in two Indians, or 58.5%, should definitely be vaccinated. The vaccine hesitancy was divided into low and high levels. Low-level vaccine hesitancy was denting on responses that were likely to be vaccinated or 28.70%. High-level vaccine hesitancy was 7.2% of respondents who were probably unlikely to be vaccinated. Vaccine resistants were respondents who did not take the vaccine (Umakanthan, Patil, Subramaniam, & Sharma, 2021).

Kasai et al. (2020) in their research stated that the implementation of neonatal screening for sickle cell disease during the Covid-19 pandemic represents a major challenge in the DR Congo. With this in mind, their study aimed to determine whether socioeconomic factors are associated with the acceptability of neonatal screening for sickle cell disease during Covid-19 in Kisangani, DR Congo. Their results showed that the acceptability of neonatal screening for sickle cell disease during Covid-19 remains low in Kisangani. They suggest that the government identify effective communication channels to promote initiatives in the health sector (Kasai, et al., 2020).

3. Method and Materials

3.1. Sampling Procedures

As for the data collection procedure, we used simple random sampling since our study population was well defined and homogeneous (West, 2016). We conducted an anonymous Internet survey using an electronic questionnaire distributed via Google form to 410 respondents of voting age in the Province of North Kivu, DR Congo.

3.2. Data Analysis and Tools

This study was based on quantitative research which is a data collection technique that allows the researcher to analyse behaviours, opinions or even expectations in quantity (Abuhamda, Ismail, & Bsharat, 2021). The authors used a questionnaire technique that allowed us to interview the target population in order to collect data (Einola & Alvesson, 2020) on the factors influencing the population's resistance to receiving the Covid-19 vaccine in eastern DR Congo. Our questionnaire consists of 35 questions grouped into three sections: demographic, socio-political, and health sections. The questionnaire was constructed based on the results of the empirical literature review conducted by the authors.

The table below illustrates how we encoded our items such that the first column represents the item number reference in the dataset, the second column contains names of items, the third column has each code allocated to the item after encoding, and as they appear in the questionnaire and the last column refers to the domain from which each item was reported:

Table 1: Core Dataset of the research

Item No.	Item	Feature's Code	Domain
IT1	Gender	GENDER	0 = F, 1=M
IT2	Place of birth	POB	0 =Urban, 1=Rural, 2=Semi urban
IT3	Place of growth	PGU	0 =Urban, 1=Rural, 2=Semi urban
IT4	Current residence	RESIDENCE	0=Urban, 1=Rural, 2=Semi urban
IT5	Age	AGE	0=Between 18 and 27 years old, 1=Between 28 and 37 years old, 2=Between 38 and 47 years old, 3=Between 48 and 57 years old, 4=Between 58 years old and above
IT6	Marital status	MS	0=Single, 1=Married, 2 =Widow, 3 =Other, 4=Divorced
IT7	Education Level	EDUCATION	0=University, 1= Secondary school, 2= No study, 3 =Professional studies, 4 = Primary school
IT8	Profession	PROFESSION	0=Unemployed, 1=Teacher, 2= Housewife, 3=Student, 4= Businessman/Businesswoman, 5= Farmer, 6=Health care worker (doctor/nurse), 7=Government employee, 8=Guard
IT9	Religion	RELIGION	0=Protestant, 1=Catholic, 2=Jehovah's Witness, 3=Evangelical, 4=Adventist, 5=Anglican, 6=Muslim, 7=Kimbanguist, 8=Pentecostal, 9=Animist, 10=Other
IT10	I was born in a zone where there is a higher rate of insecurity	BOZHI	1=Yes, 0= No
IT11	I have politicians in family	POLIFA	1=Yes, 0= No
IT12	I belong to a civil society group	CISOG	1=Yes, 0= No
IT13	I belong to a political party	POPA	1=Yes, 0= No
IT14	I used to travel in other Provinces of DR Congo	NATRI	0=Low, 1=Medium, 2=Regular, 3=No
IT15	I used to travel abroad	INTRI	0=Low, 1=Medium, 2=Regular, 3=No
IT16	I lost someone close to me during massacres and insecurity	EBRELDE	1=Yes, 0= No
IT17	I am traumatized by insecurity situations in the Province of North Kivu	INSECTRAUMA	1=Yes, 0= No
IT18	I trust international NGOs	TRUSTNGO	1=Yes, 0= No
IT19	I trust national Congolese government	TRUSTGOVNA	1=Yes, 0= No
IT20	I trust the North Kivu provincial government	TRUSTGOVPRO	1=Yes, 0= No
IT21	I have been living in an area threatened by Ebola	LIVEBOLA	1=Yes, 0= No
IT22	I received the Ebola vaccine during the Ebola epidemic	RECEBOVAC	1=Yes, 0= No
IT23	I believe that Ebola existed in the Province of	EBOTRUST	1=Yes, 0= No

	North Kivu		
IT24	I trusted to the effectiveness of the vaccine of Ebola in a certain level	EBOVACRUST	0=Not confident, 1=Weak, 2=Average, 3=Confident, 4=Nothing to report
IT25	I had a relative who received the Ebola vaccine	RELEBOVACREC	1=Yes, 0= No
IT26	I had a relative who died after receiving the Ebola vaccine	EBOVACKILL	1=Yes, 0= No
IT27	I believe that the Ebola vaccine had harmful consequences for the people who received it	EBOVACCHARM	1=Yes, 0= No
IT28	I think there are more pharmaceutical than human interests in the vaccination campaign against Covid-19	PHAINTER	1=Yes, 0= No
IT29	I usually listen to information about the Covid-19 vaccine through some means	VACCOVNEWS	0=Social medias,1=International TV,2=Local radio,3=Local TV,4=On the street,5=International radio,6=None
IT30	I believe that Covid-19 exists in the world	COVIDINTEXTIST	1=Yes, 0= No
IT31	I believe that Covid-19 exists in DR Congo	COVIDNATEXIST	1=Yes, 0= No
IT32	I believe that Covid-19 exists in the Province of North Kivu	COVIDREGEXIST	1=Yes, 0= No
IT33	I have a relative who is a physician	NURSERELATIVE	1=Yes, 0= No
IT34	I believe in the effectiveness of vaccines against Covid-19	EFFECTVACOV	1=Yes, 0= No
IT35	I trust in a special type of treatment against Covid-19	TRAITEMENT	0=None, 1=Traditional, 2=Chloroquine, 3=European vaccine, 4=US vaccine

As we conducted a factor analysis study to analyze factors influencing resistance to the Covid-19 vaccine in a region experiencing security instability, we made use of EFA to empirically capture and identify factors influencing this resistance. The rationale for choosing exploratory factor analysis was based on one of its three uses, which is to minimize the number of variables for future research while maximizing the amount of information in the analysis (Oamen, 2021). The original set of variables was reduced to a smaller set that explains most of the variance in the original set (Steiner & Grieder, 2020). The authors used the Varimax method which allowed them to rotate the factors orthogonally while minimizing the number of variables that have a high density of change on each factor (Oamen, 2021). Cronbach's alpha allowed us to establish the correlation between our variables. This is a statistic used to measure the internal consistency of questions asked in a questionnaire (Shrestha, 2021).

Seven libraries helped the authors in the analysis and processing of this research. These libraries are Pandas, Numpy, factor_analyzer, calculate_bartlett_sphericity, calculate_kmo, matplotlib, and seaborn. factor_analyzer is a python module for performing exploratory and factorial analysis with several optional rotations. This module allowed us to perform Exploratory Factor Analysis using either a minimum residual solution, a maximum likelihood solution or a principal factor solution (Persson & Khojasteh, 2021). NumPy is the Python library dedicated to scientific computing providing very powerful computational functions, but also data structures, equally powerful (Velt, 2020). Matplotlib is one of the most widely-used Python libraries for 2D graphics. It can produce a wide variety of high-quality graphs (Sial, Rashdi, & Khan, 2021).

The Pandas library aims to integrate the functionality of numpy and matplotlib, to give a convenient tool for analysing and visualizing data. Seaborn is a library that allowed us to create statistical graphs in Python (Sial, Rashdi, & Khan, 2021). We performed the KMO test to examine the strength of the partial correlation between the variables. We considered eigenvalues greater than 1 to judge the number of factors to be retained in our EFA using the Kaiser criterion (Padil, Kasim, Ismail, Zin, & Muda, 2020). Bartlett's sphericity test was used to test the null hypothesis that the correlation matrix is an identity matrix (Shrestha, 2021).

4. Results et discussions

First, the authors presented the demographic results of the respondents who were surveyed in this research. In the questionnaire, nine items were associated with the demographic section of the study and here are the results:

Table 2: Demographic profile of respondents

Profile	Proportion (n)	Percentage (%)
---------	----------------	----------------

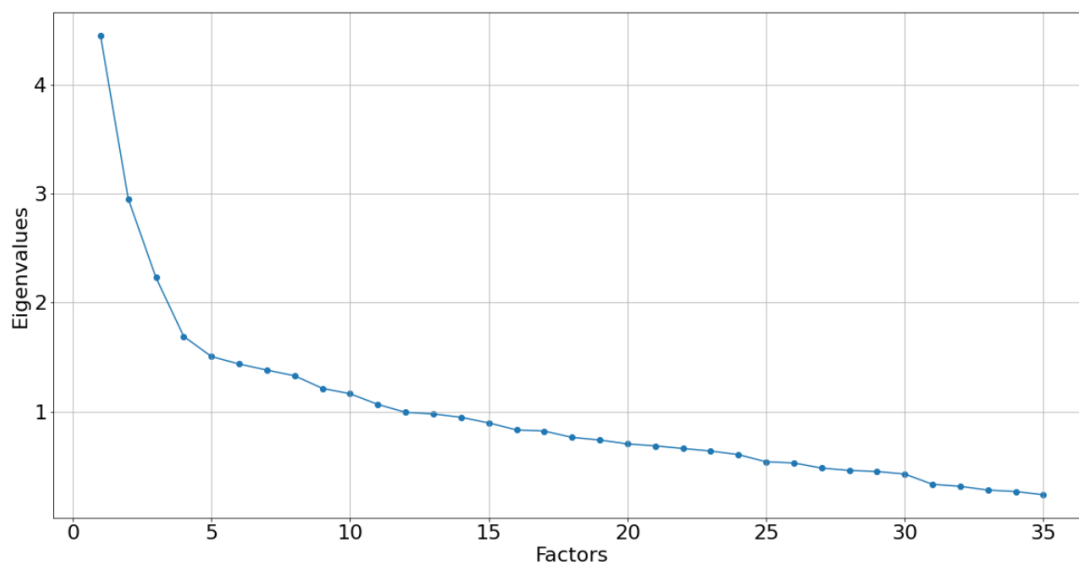
Gender		
M	160	51.45
F	151	48.55
Place of birth		
Urban	156	50.16
Rural	98	31.51
Semi urban	57	18.33
Place of growth		
Urban	198	63.67
Rural	53	17.04
Semi urban	60	19.29
Current residence		
Urban	261	83.92
Rural	24	7.72
Semi urban	26	8.36
Marital status		
Single		
Married	209	67.20
Other	73	23.47
Widow	14	4.50
Divorced	12	3.86
	3	0.96
Age		
Between 18 and 27 years old		
Between 28 and 37 years old	186	59.81
Between 38 and 47 years old	65	20.90
Between 48 and 57 years old	27	8.68
Between 58 years old and above	15	4.82
	18	5.79
Education level		
University		
Secondary school	179	57.56
No study	80	25.72
Professional studies	25	8.04
PrimarySchool	14	4.50
	13	4.18
Profession		
Student		
Businessman/Businesswoman	109	35.05
Housewife	59	18.97
Unemployed	36	11.58
Teacher	35	11.25
Health care worker	26	8.36
Farmer	23	7.40
Government employee	17	5.47
Guard	5	1.61
	1	0.32
Religion		
Catholic		
Protestant	192	61.74
Adventist	64	20.58
Jehovah's Witness	16	5.14
Other	11	3.54
Evangelical	9	2.89
Anglican	5	1.61

Pentecostal	5	1.61
Muslim	5	1.61
Kimbanguist	2	0.64
Animist	1	0.32
	1	0.32

Based on the recommendation of (Effendi, Matore, Khairani, & Adnan, 2019), items were categorized into the new factors by taking only those items that have a factor load of more than the absolute value of 0.3. After checking the internal consistency of our items, the alpha was 0.67. For the exploratory analysis of our factors, we performed Bartlett's test of sphericity and KMO. With Bartlett's test, Chi-square reached 2490.79 while for the KMO test, the authors had a result of 0.70. Since Bartlett's test was significant at the $p = 0.0$ level, the null hypothesis of any EFA research stating that the matrix of our items is identical (Jowkar, Derakhshanian, Hosein, & Rahmani, 2013) was rejected.

Kaiser criterion indicated to retain 11 factors. However, the authors did not focus only on these results because the Kaiser criterion is more adapted to the PCA than to the EFA since Kaiser criterion in its origin was designed to extract the eigenvalues from the units at the diagonal of the correlation matrix. While with EFA, the eigenvalues are derived from the diagonal communality estimates of the generated correlation matrix (Courtney & Gordon, 2013). Hence, the choice of authors to use the scree plot technique in order to visually identify the major factors with the greatest variance to be retained (Courtney & Gordon, 2013). Therefore, from the scree plot analysis, the authors confirmed the results obtained from the Kaiser criterion by retaining 11 factors.

Figure 1 : Scree Plot illustrating factors to retain



In order to ensure the best internal consistency of each of these factors, the authors were able to compute the Cronbach's Alpha test that we have illustrated in the following table with the maximum number of items for each selected factor. The results showed that only the six first factors had acceptable alpha values. Hence, the authors retained six factors instead of 11 illustrated in the above Scree plot:

Table 3: Reliability test results for each factor

Factors	Cronbach's Alpha	Items' Numbers
Factor 1	0.69	9
Factor 2	0.74	3
Factor 3	0.73	3
Factor 4	0.71	3
Factor 5	0.61	4
Factor 6	0.72	6

Based on 35 questions initially asked, we had 410 respondents. After analysis and processing, we retained 318 responses that contained complete information in all columns and rejected 91. From these 35 items, thanks to the module named factor_analyzer, the authors were able to classify them into 6 factors. The total cumulative variance explained by the 6 retained factors was 30.1%. In the following table, we can see that only 28 items out of 35 were classified into six extracted factors. Below is a summary table of the factors and items as categorized with the rotation values:

Table 4 : Extracted Factors

Factor	Eigenvalue	Variance	Related Items	Item No.	Factor Load
1	4.45238104	2.498831	Gender	IT1	0.313808
			I am traumatized by the insecurity situations in the Province of North Kivu	IT17	0.342160

			I have been living in an area threatened by Ebola	IT21	0.466421
			I received the Ebola vaccine during the Ebola epidemic	IT22	0.377927
			I believe that Ebola existed in the Province of North Kivu	IT23	0.557014
			I had a relative who received the Ebola vaccine	IT25	0.427916
			I believe that Covid-19 exists in the world	IT30	0.425270
			I believe that Covid-19 exists in DR Congo	IT31	0.579564
			I believe that Covid-19 exists in the Province of North Kivu	IT32	0.517826
2	2.95290202	1.777388	Age	IT5	0.835563
			Marital status	IT6	0.705699
			Education level	IT7	0.540731
3	2.22967185	1.769721	Place of birth	IT2	0.674919
			Place of growth	IT3	0.704009
			Current residence	IT4	0.570850
4	1.69030021	1.731466	I trust international NGOs	IT18	0.465905
			I trust national Congolese government	IT19	0.735334
			I trust the North Kivu provincial government	IT20	0.770411
5	1.50537598	1.468255	I trust the effectiveness of the vaccine of Ebola in a certain level	IT24	0.497528
			I had a relative who died after receiving the Ebola vaccine	IT26	-0.393398
			I believe that the Ebola vaccine had harmful consequences for the people who received it	IT27	-0.559937
			I think there are more pharmaceutical than human interests in the vaccination campaign against Covid-19	IT28	-0.368227
6	1.43674703	1.301089	Profession	IT8	0.360877
			I have politicians in family	IT11	0.352714
			I belong to a civil society group	IT12	0.446479
			I belong to a political party	IT13	0.390228
			I believe in the effectiveness of vaccines against Covid-19	IT34	0.402472
			I trust in a special type of treatment against Covid-19	IT35	0.359255

As it can be seen from Table 4, the authors concluded that factor loadings for Factor 1 have a high link with IT1, IT17, IT21, IT22, IT25, IT23, IT30, IT31, and IT32. After interpretation, factor 1 was named Psycho-medical background. Factor 2 having high factor loadings for IT5, IT6, and IT7 was labelled Demographic. Factor 3 presented high factor loadings for IT2, IT3, and IT4. Hence, the authors labelled it Social origin. Factor 4 being connected to IT18, IT19, and IT20, was labelled Lack of trust in government actions. Previous issues about the Ebola vaccine in North Kivu was the name the authors chose to label Factor 5, which has high loadings for IT24, IT26, IT27, and IT28. As Factor 6 had higher factor loadings for IT8, IT11, IT12, IT13, IT34 and IT35, the authors labelled it Socio-political belonging.

5. Conclusions and Recommendations

The objective of this study was to identify factors that affect resistance to vaccination against Covid-19 in North Kivu Province, a region of the DR Congo that has been threatened by political instability and war for more than two decades and that still has some cases of Ebola. To do this, quantitative research based on primary data obtained from a questionnaire was conducted. The questionnaire had 35 items that had 410 respondents, after analysis and processing of the data, only 318 were retained; of these, there were 151 women or 48.55% and 160 men or 51.45%. After computing the Exploratory Factor Analysis, we passed from 35 items to 11 factors. However, we tried to compute the Cronbach's Alpha test for each of the eleven factors. The results of that test showed that only the six first factors were relevant, with alpha equals to 0.69, 0.74, 0.73, 0.71, 0.61, 0.72 respectively. Therefore, instead of retaining 11 factors, the authors retained only six factors as illustrated in table 4. Those factors are Psycho-medical background, Demographic, Social origin, Lack of trust in government actions, Previous issues about the Ebola vaccine in North Kivu, and Socio-political belonging. Cronbach's Alpha test for the questionnaire was 0.67; Bartlett's test was 2490.79 and the KMO test is 0.70.

The authors estimate that the context in which the province of North Kivu finds itself today, that of the security and health situation, leads to strong resistance to vaccination against Covid-19. The authors hope that the Congolese government should get involved in raising awareness among the

population in order to gain its trust. But there must also be a frank collaboration between international organizations and local and religious authorities. The Congolese government is invited to invest in the fight against insecurity in the eastern region of the DR Congo in order to ensure a wide dissemination of the vaccination campaign against Covid-19 because the unstable security situation in eastern DR Congo does not allow the population to be sensitized and receive the vaccine.

After an analysis of factors that influence the resistance to getting vaccination against Covid-19, the horizons open to future researchers in the prediction of total vaccination in a zone of social-political instability.

References

- Abuhamda, E. A., Ismail, I. A., & Bsharat, T. R. (2021). Understanding Quantitative and Qualitative Research Methods: A Theoretical Perspective for Young Researchers. *International Journal of Research*, 8(2), 71-87. doi:10.2501/ijmr-201-5-070
- Cordina, M., Lauri, M. A., & Josef, L. (2021). Attitudes towards COVID-19 vaccination, vaccine hesitancy and intention to take the vaccine. *Pharmacy Practice*, 19(1), 2317. doi: 10.18549/PharmPract.2021.1.2317
- Courtney, M., & Gordon, R. (2013). Determining the Number of Factors to Retain in EFA: Using the SPSS R-Menu v2.0 to Make More Judicious Estimations. *Practical Assessment, Research, and Evaluation*, 18(8), 1-14. Récupéré sur <https://doi.org/10.7275/9cf5-2m72>
- Ditekemena, J. D., Nkamba, D. M., Mutwadi, A., Mavoko, H. M., Fodjo, J. N., Luhata, C., . . . Colebunders, R. (2021). COVID-19 Vaccine Acceptance in the Democratic Republic of Congo: A Cross-Sectional Survey. *Vaccines*, 9, 153. Récupéré sur <https://doi.org/10.3390/vaccines9020153>
- Edwards, B., Biddle, N., Gray, M., & Sollis, K. (2021). COVID-19 Vaccine Hesitancy and Resistance: Correlates in a Nationally Representative Longitudinal Survey of the Australian Population. *Plos One*. Récupéré sur <https://doi.org/10.1371/journal.pone.0248892>
- Effendi, M., Matore, E. M., Khairani, A. Z., & Adnan, R. (2019). Exploratory Factor Analysis (EFA) for Adversity Quotient (AQ) Instrument among Youth. *Journal of Critical Reviews*, 6(6), 234-242.
- Einola, K., & Alvesson, M. (2020). Behind the Numbers: Questioning Questionnaires. *Journal of Management Inquiry*, 30(1), 102-114. Récupéré sur <https://doi.org/10.1177/1056492620938139>
- FEWS. (2022). *République Démocratique du Congo: Perspectives sur la sécurité alimentaire*. Famine Early Warning Systems Network. Récupéré sur https://fews.net/sites/default/files/documents/reports/DRC_FSO_2021_06_final.pdf
- Jowkar, A. A., Derakhshanian, H., Hosein, M. H., & Rahmani, Z. A. (2013). A factor analysis of identifying the customer behavior patterns: A case study in Tehran. *European Online Journal of Natural and Social Sciences*, 2(3), 1347-1353.
- Kasai, E. T., Opara, J. P., Agasa, S. B., Gulbis, B., Uvoya, N. A., Nguma, J. D., . . . Djang'éing'a, R. M. (2020). Acceptabilité du dépistage néonatal de la drépanocytose au cours de la pandémie au COVID-19 à Kisangani, en République Démocratique du Congo. *The Pan African Medical Journal*, 37, 299. Récupéré sur <https://doi.org/10.11604/pamj.2020.37.299.26654>
- Modeawi, M. N., Baya, J. L., Bosso, B., Kobe, J. K., Kusagba, J. M., Magbukudua, J. M., . . . Ngbolua, K.-t.-N. (2021). COVID-19 Pandemic in Democratic Republic of the Congo: An Opportunity for Economic Recovery. *Britain International of Exact Sciences (BioEx) Journal*, 3(2), 103-113. Récupéré sur <https://doi.org/10.33258/bioex.v3i2.434>
- Murphy, J., Vallières, F., Bentall, R. P., Shevlin, M., McBride, O., Hartman, T. K., . . . Hyland, P. (2021). Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature Communications*, 12(1). doi:10.1038/s41467-020-20226-9
- Oamen, T. E. (2021). An Exploratory Factor Analysis of Work-Attributes of Pharmaceutical Sales Workforce during COVID-19 Lockdown. *Journal of Contemporary Research in Social Sciences*, 3(1), 11-27. doi:10.33094/26410249.2021.31.11.27
- Padil, H. M., Kasim, E. S., Ismail, N., Zin, N. M., & Muda, S. (2020). An Exploratory Factor Analysis of Financial Literacy and Awareness of Investment Scam. *International Invention, Innovative & Creative (InIIC) Conference* (pp. 61-67). MNMF.
- Persson, I., & Khojasteh, J. (2021). Python Packages for Exploratory Factor Analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, 28(6), 983-988. Récupéré sur <https://doi.org/10.1080/10705511.2021.1910037>
- Riad, A., Huang, Y., Abdulqader, H., Morgado, M., Domnori, S., Koščík, M., . . . Iads-Score. (2021). Universal Predictors of Dental Students' Attitudes towards COVID-19 Vaccination: Machine Learning-Based Approach. *Vaccines (Basel)*, 9(10), 1158. doi:10.3390/vaccines9101158
- Shmueli, L. (2021). Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model. *BMC Public Health*, 21, 804. Récupéré sur <https://doi.org/10.1186/s12889-021-10816-7>
- Shrestha, N. (2021). Factor Analysis as a Tool for Survey Analysis. *American Journal of Applied Mathematics and Statistics*, 9(1), 4-11. doi:10.12691/ajams-9-1-2
- Sial, A. H., Rashdi, S. Y., & Khan, A. H. (2021). Comparative Analysis of Data Visualization Libraries Matplotlib and Seaborn in Python. *International Journal of Advanced Trends in Computer Science and Engineering*, 10(1), 277-281.

Steiner, M. D., & Grieder, S. (2020). EFAtools: An R Package with Fast and Flexible Implementations of Exploratory Factor Analysis Tools. *Journal of Open Source Software*, 5(53), 2521. Récupéré sur <https://doi.org/10.21105/joss.02521>

Umakanthan, S., Patil, S., Subramaniam, N., & Sharma, R. (2021). COVID-19 Vaccine Hesitancy and Resistance in India Explored through a Population-Based Longitudinal Survey. *Vaccines*, 9(10), 1064. doi: 10.3390/vaccines9101064

Velt, A. (2020). *Python pour la Data Science. Analysez vos Données par la Pratique avec Numpy, Pandas, Matplotlib et Seaborn.* (Eni, Éd.)

West, P. W. (2016). Simple Random Sampling of Individual Items in the Absence of a Sampling Frame that Lists the Individuals. *New Zealand Journal of Forestry Science*, 46(15). doi:10.1186/s40490-016-0071-1

WHO. (2020). *Covid-19 Vaccines: Safety Surveillance Manual.* World Health Organization. Récupéré sur https://www.who.int/docs/default-source/covid-19-vaccines-safety-surveillance-manual/covid19vaccines_manual_communication.pdf