

AN ANALYSIS OF SOCIO-DEMOGRAPHIC AND CULTURAL FACTORS ON COVID-19 MEASURES IN THE REGION VICTIM OF OUTREACH OF EBOLA DISEASE: EVIDENCE FROM NORTH KIVU PROVINCE OF THE DEMOCRATIC REPUBLIC OF THE CONGO.

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1. Abstract

Public health measures have been identified as a preventive strategy for influenza pandemics. However, there is no insight related to the role that play socio-demographic, cultural, geographical distance, psychological, behavioural factors towards the low COVID-19 measures. In order to fill this gap in the existing literature review, the present article has used a random sample of 2123 people living in North Kivu, logistic and multiple linear regression to investigate, analyze and assess the effects of socio-demographic, socio-cultural, geographical distance, psychological, behavioural factors that are driving the COVID-19 vaccine in the Province of Nord Kivu, that was victim of the outreach of Ebola and pandemic of COVID-19. The results revealed that there was a low adherence of COVID-19 measures, female had 39% (95% CI (0.47;0.79]) decrease to adhere to COVID-19 measures compared to male. Those with age group above 15-24 had higher odds (AOR=3, 95% CI (1.31;5.59]) to adhere to COVID-19 measures than those with age group of 15-24. People with high education had higher odds (AOR=2, 95% CI (0.95;5.53]) to adhere to COVID-19 measures than those with no education. The odds of COVID-19 measures of rural residence occurring decreased by 98% (95% CI (0.06;0.061]) compared to urban residence. Catholic church believers were majority to adhere to COVID-19 measures compared to other churches, geographical distance, psychological, behavioural affect adherence to COVID-19 measures at 30.5%. The results from this study inform policymakers and health system to engage with sensitization, communication and training as strategies for increasing the adherence to COVID-19 measures among females, young and low educated people and both leaders of churches and communities.

Keywords: COVID-19, COVID-19 measures, adherence, socio-demographic factors, cultural factors, geographical distance factors, psychological factors, behavioural factors, Ebola, North Kivu.

2. INTRODUCTION

Public health measures have been identified as a preventive strategy for influenza pandemics (WHO,2020). The effectiveness of such interventions in reducing the transmission of SARSCoV-2 is unknown and the role of factors that are driving public health measures remain unknown particularly in the low-income countries such as Democratic Republic of Congo (DRC). It was observed that on 1st December, 2019, the first case of COVID-19 at Owen in China, 30th January 2020, later , WHO declared the COVID-19 as pandemic, on African continent, it was declared on 14th February 2020 at Egypt and on 10th March 2020 at Kinshasa the first case of COVID-19. In DRC the declaration was followed of lockdown in DRC on 24th March, 2020 when the Presidential decree n°20/014 of 24th March, 2020 that proclaimed the military government, which states the health public measures such as: (1) respect of barriers measures, mandatory use of face masks in all publics and transportations (vehicle, train, flight and motobycycle), (2) Interdiction of public market, artistic production and kermes, prohibit festival, meetings which can exceed 10 people, sportive competitive indoor, transportation of deaf people should be done directly from hospital without any family ceremonies, churches should respect barrier measures and meeting should not have a maximum of 20 people, barns should respect barrier measures and not exceed 20 people, closing school from nursery school to university, (3) restriction of movement but allowed for basic needs (stay home) and (4) Mandatory COVID-19 tests for any person who is travelling at a national or international level. However, the lockdown ended on 24th July 2020.

The Democratic Republic of Congo (DRC) is among the African countries which had a low rate of vaccination coverage against the coronavirus (Mini Santé, 2022). According to the daily bulletin of the national coordination of the response to COVID-19, since the start of vaccination in the DRC on 19th April, 2021, 879,122 people, or 1.63%, have been vaccinated, including 545,828, or 1.01%, have been fully immunized against the target, including more than 50 million people. The same source points out that among those fully vaccinated, 438,805 were vaccinated with the Johnson & Johnson vaccine; while 378,682 were vaccinated in the month of February, or 45% of all people vaccinated so far. The objective is to reach two half million per month or 625,000 people per week. According to the Expanded Program on Immunization, this goal is achievable. Hence the importance of raising community awareness so that they understand the importance of getting vaccinated against this disease. The DRC offers several vaccines including Moderna, Sinovac, Pfizer and Johnson and Johnson.

It should be noted that since the start of vaccination with these products, 418 sites have been made operational on a routine basis and fifteen provinces out of twenty-six in the country are active in vaccination against COVID-19. To date, the cumulative number of cases since the start of the epidemic in March 10th, 2020 is 860,841 confirmed cases, including 860,839 and two probable cases. In total, there were 63,044 people cured and 3,137 deaths (WHO, 2022)

Hight Authority of health (2020) noted that the ability of people to understand and implement preventive and barrier measures is essential for their health and for the safety of the professionals working with them. However, the ability of people to understand and implement preventive and barrier measures within DRC and the role of factors like socio-démographic, socio-cultural, geographical distance, psychological, behavioural factors towards the low COVID-19 measures, remain unknown.

3. Materials and Methods

Ethical clearance of this study was obtained from ‘HEALTH ETHICS COMMITTEE’ nominated by the MinisterialAct n° 1250/CAB/MIN/S/ZKM/043/MC/2006 of 18th December 2006 (Reference: 13/BUR-CNES/NK/2022). A written informed consent signed by each participant before taking the survey questionnaire that was given through Kobo collect. The participation was voluntary and freedom was guaranteed to each participant.

Descriptive and correlational design was used in order to describe the variables and the relationships that naturally occur between and among them. Population was constituted of all DRC Citizen and residents living in the North Kivu Province and a random sample of 2134 people was drawn from the population. To identify statistically significant factors, it was carried out a regression analysis in order to assess the effect of a specific parameter, all else being equal. Thus the binary logit model was used with the following specification:

$$\text{Model 1: } P(\text{vacc}_i = 1 / x_i) = \Lambda(x_i \beta_i) \quad (1)$$

where

- Λ is the logistic distribution function,
- vacc_i is the dependent variable, an indicator of an i-th individual getting vaccinated against coronavirus, which takes the value 1 if a person was vaccinated (or willing to get vaccination once it is available, or had taken rapid test or PCR test), and 0 otherwise, and
- x_i is the vector of socio-demographic characteristics of person i, including gender (male, female), age (seven groups), education (4 groups), marital status (single, married, divorced, widow), place of residence (rural, urban), religion (catholic, protestants, Islam, revival churches), current occupation (government, student, private, self-employed, not working, multi-services), nationality (DRC, Rwanda) and ethnic-group (nine groups).

Second model is expressed as:

$$\text{Model 2: } \text{vacc}_i = \beta_0 + \sum_{i=1}^p \beta_i z_i + \varepsilon \quad (2)$$

- vacc_i is the dependent variable that is expressed as scores i-th individual getting vaccinated against coronavirus,
- z_i is the vector that including cultural, geographical distance, psychological and behavioral factors and

- β_i (i=1 to 4) are slopes respectively for cultural, geographical distance, psychological and behavioral factors,
- β_0 is the constant/intercept and ε is error term.

The dependent variable was COVID-19 measures, an index was created from the following statements: (1) respect of social distancing, (2) To what extent people respect face mask use?, (3) To what extent people respect hand hygiene?, (4) To what extent people respect coughing hygiene?, (5) To what extent people respect “stay home”?, (6) To what extent people respect measure of temperature? Captured on Likert scale from 1= Strongly Disagree, 2=Disagree, 3=Somewhat Disagree, 4=Neither Agree nor Disagree, 5=Somewhat Agree, 6=Agree, 7=Strongly Agree [1-4=no respect and 5-7= respect of measures]

4. LITTEARURE REVIEW.

Many studies have examined the connection between socio-demographic, individual behaviors, socio-cultural, psychological and the spread of disease. For example, Adda (2016) examines the spread of viral diseases stemming from economic activity. Uddin *et al.*, (2021) did a study in Japan on the influence of socio-demographic such as age; gender; marital status; education; work status and household annual income and personal characteristics of individuals such as having children younger than junior high school age; smoking frequency; drinking frequency; and trust in Government policy. Using both CART and regression analysis, the study notes that socio-demographic and personal attributes of individuals indeed shape the subjective prevention actions and thereby the control of spread of a pandemic. Socio-demographic attributes such as sex, marital family status, and characteristics of individuals such as having children appear to have played an influential role in Japanese citizens' abiding by the COVID-19 protection behaviors, especially with women having children being noted more conscious than the male counterparts.

In Ethiopia, Kassie *et al.*, (2020) study noted that socio-demographic characteristics such as the attitudes of HCWs, their level of education, age, sex, and years of working experience were somewhat related to COVID-19 preventive practices. Males had higher odds (AOR=1.48, 95% CI: 1.02, 2.10) of having poor preventive practice than females. Those with less than 10 years of work experience had higher odds (AOR=2.22, 95% CI 1.23, 4.00) of having poor COVID-19 preventive practice than those with more than 10 years of experience.

Iheanacho *et al.*, (2021) noted in a study in Nigeria that clinical HCWs had higher adherence scores (average 9.0 out of 12) as opposed to nonclinical HCWs (average 6.6 out of 12). This was attributed to the need for extra precaution in clinical HCWs because of working close to patients and knowledge differences relative to nonclinical HCWs

Bright Amanya *et al.*, (2021) point out in a study among Ugandan HCWs that, adherence was considerably associated with having received training on COVID-19 preventive measures (OR=2.86, 95% CI 1.04-7.88, p=0.039), having COVID-19 NPIs guidelines in the workstation (OR=2.90, 95% CI 1.06- 8.09, p=0.036), and adequate organizational support (OR=3.08, 95% CI 1.08-8.78, p=0.031). However, no statistically significant association was recognized between adherence and socio-demographic features of the participants such as age, level of education, working hours, work experience, and profession.

Holder (2022), in tracking Coronavirus Vaccinations around the World as indicated by the New York Times, mentioned that more than 5.31 billion people worldwide have received a dose of COVID-19 vaccine, equal to around 69.2% of the world population. In low-income countries, only 20.7% of people have received at least one dose. The African countries had received a dose of 27% which is considered as very low compared to other continents.

Robinson (2020) conducted cross-sectional study in the United States and Canada found that 20% of Canadians would not get vaccinated if the vaccine were available. The most significant correlation was between refusing to be vaccinated of COVID-19 and distrust of the benefits of the COVID-19 vaccine. Among the significant factors of refusal of the vaccine, it was noted the female sex, the fact of having completed a complete or partial college education rather than not having completed it, the fact of being unemployed and the fact of belonging to a minority

Di Meo & Bentivegna (2021) stated that migrants' Quarantine and COVID-19 Pandemic in Italy: a Medico-anthropological View points out the COVID-19 pandemic represents an important risk factor for migrants' health. The ongoing COVID-19 pandemic represents a major risk factor for migrants' health, both for the increased risk of getting infected and for the negative health outcomes related to barriers in accessing health services.

Liang *et al.*, (2016) pointed out the semantics that people use when structuring a message are a type of functional knowledge that reveals sociocultural factors. Bhatt & Bolonyai (2011) had found that social factors such as attitudes, motivations, the social and political context are just as important as linguistic factors in multilingual environments. SoleimanvandiAzar *et al.*, (2021) argued that It is worth to mention that cultural factors always play an important role in the nonobservance of norms and, especially, in health. Without knowing them, it is not possible to give a complete explanation of the reasons for not following the established norms. Suyanto *et al.*, (2020) stated that the COVID-19 pandemic has forced people to develop new social constructs to face the so-called new normality, and added that social change can occur in many ways, such as in economic activities, lifestyle, behaviors, structure of society, ideology, beliefs, values and even in things that were previously thought indispensable

5. RESULTS.

5.1. Level of COVID-19 measures in community

Table 1 below presents the level of respect of COVID-19 measures.

Table 1. A Level of COVID-19 measures in community

COVID-19 measures	No respect of COVID-19 measures	Respects of COVID-19 measures
Distancing	1421(66.9%)	700(33.1%)
Face mask use	1079(50.8%)	1040(49.2%)
Hand hygiene	974(45.1%)	1145(53.9%)
Coughing hygiene	1369(54.5%)	752(35.5%)
Stay home	1697(79.9%)	424(20.1%)
Measure of temperature	1697(79.9%)	424(20.1%)
Total	1584(74.6%)	537(25.4%)

Source: Primary Data April 2022

Table 1 shows the level of respect of COVID-19 measures for each measure, for distancing only 700 (33%) participants had respected COVID-19 measures against 1421(66.9%) did not respect, face mask use 1040 (49%) against 1079 (50.8%) did not respect, hand hygiene 1145 (53.9%) against 974 (45.1%), 752 (35.5%) coughing hygiene against 1369 (54.5%), 424 (20.1%) stay home against 1697 (79.9%) and 424 (20.1%) stay home against 1697 (79.9%). These results present similarities with the results in Bentivegna *et al.*, (2021) and Rumppler *et al.*,(2020)

By comparing these results with the reality as experienced on the ground, it is very obvious that the populations of the North Kivu Province had knowledge of the preventive measures for COVID-19, but the problem is mainly at the level of application and the capitalization of these measures at the community level. Despite the existence of these measures which constitute the life-saving means of fighting against COVID-19, the populations are still reluctant to apply them. However, the Government is not sitting still as it is stepping up awareness campaigns to bring people back to COVID-19 control activities. Reasons why WHO, UNICEF and Gavi show that around 62 million doses were administered on the continent in February, compared to 54 million in January. The increase was achieved mainly through vaccination campaigns in populous countries, such as the Democratic Republic of Congo, Ethiopia, Kenya and Nigeria. To boost adherence to COVID-19 vaccination, the World Health Organization (WHO), UNICEF, Gavi, the Vaccine Alliance, and other partners are supporting vaccination campaigns in at least 10 priority countries to reach 100 million people by the end of April 2022.

Table 2: Level adherence to COVID-19 measures

Respect of Measures	Frequency	Valid Percent	Cumulative Percent
Respect of measures	537	25.3	25.3
No respect of measures	1584	74.7	100
Total	2121	100	

Source: Primary Data, April 2022

The results from Table 2 showed that there was 25.3% of adherence to COVID-19 measures against 74.7% no adherence to COVID-19 measures. From these figures in Table 2, it is clear that there was a low adherence to COVID-19 measures.

Table 3. Association between socio-demographic factors and COVID-19 measures.

No	Independent Variables	Dependent variable		Chi-square	df	Decision
		COVID-19 measures respect				
		Yes	No			
		Frequency(%)	Frequency(%)			
1.	Gender					
	Male	296(55.1)	685(42)	27.94***	1	statistically significant
	Female	241(42.4)	919(58)			
	Total	537(100)	1584(100)			
2.	Level of education					
	None	14(2.6)	149(9.4)	38.24***	3	Statistically significant
	Primary	50(9.3)	190(12)			
	Secondary	302(56.2)	709(44.8)			
	University	171(31.8)	536(33.8)			
	Total	537(100)	1584(100)			
3.	Place of residence					
	Urban	516(96.1)	1068(57.4)	174.28***	1	statistically significant
	Rural	21(3.9)	516(32.6)			
	Total	537(100)	1584(100)			
4.	Marital status					
	Single	115(21.4)	505(31.9)	29.38***	3	statistically significant
	Married	391(72.8)	947(59.8)			
	Divorced	4(0.7)	21(1.3)			
	Widow	27(5)	111(7.0)			
	Total	537(100)	1584(100)			
5.	Religion					
	Catholic	310(57.7)	581(36.7)	73.14***	3	statistically significant
	Protestant	183(34.1)	796(50.3)			
	Muslim	21(3.9)	94(5.9)			
	Revival Churches	23(4.3)	113(7.1)			
	Total	537(100)	1584(100)			

* statistically signification at 10%

** statistically signification at 5%

*** statistically signification at %

Table 3 reveals that from 537 participants who respect COVID-19 measures, there were more male 296(55.1%) who respect COVID-19 measures compared to female 241(42.4%). To test the association between and COVID-19 measures,

chi-square test was used and the results indicated that there was statistically significant association between gender and COVID-19 measures ($\chi^2 = 27.94$, $df=5$, $p\leq 0.01$). Table 3 reveals that of 537 participants who respect COVID-19 measures, majority did secondary school 302(56.2%) followed by those who university 171(31.8%) and the last was those who had not been at school 14(2.6%). To test the association between level of education and COVID-19 measures, chi-square test was used and the results indicated that there was statistically significant association between level of education and COVID-19 measures ($\chi^2 = 38.24$, $df=3$, $p\leq 0.01$). The results in Table 4.13 revealed that from 537 participants who respect COVID-19 measures, majority were from urban 516 (96.1%) against 21(3.9%) from rural area. To test the association between place of residence and COVID-19 measures, chi-square test was used and the results indicated that there was statistically significant association between place of residence and COVID-19 measures ($\chi^2 = 174.28$, $df=1$, $p\leq 0.01$). Table 3 shows that with marital status, there were more married 391(72.8%), followed by single 391(21.4) and last by widow 27(5%). To test the association between marital status and COVID-19 measures, chi-square test was used and the results indicated that there was statistically significant association between marital status and COVID-19 measures ($\chi^2 = 29.38$, $df=3$, $p\leq 0.01$). The results from Table 3 showed that there were more catholic 310(57.7%), followed by protestant 183(34.1) and last by revival churches 23(4.3%). To test the association between religion and COVID-19 measures, chi-square test was used and the results indicated that there was statistically significant association between religion and COVID-19 measures ($\chi^2 = 73.14$, $df=3$, $p\leq 0.01$).

Table 4: Association between socio-demographic factors and COVID-19 measure.

	Independent Variables	Dependent variable: COVID-19 measures respect		Chi-square	df	Decision
6.	Current occupation	Frequency (%)	Frequency(%)			
	Government	61(11.4)	91(5.7)	54.93***	5	statistically significant
	Students	45(8.4)	203(12.8)			
	Private	64(11.9)	338(21.3)			
	Self employed	187(34.8)	412(26)			
	Not working	167(31.1)	50(3.0%)			
	Multi tasks	13(2.4)	50(3.2)			
	Total	537(100)	1584(100)			
7.	Ethnical Group					
	Nande	388(72.3)	608(38.1)	193.99***	8	statistically significant
	Hunde	42(7.8)	243(15.3)			
	Hutu	29(5.4)	273(17.2)			
	Tutsi	4(0.7)	16(1.00)			
	Twa	0(0)	3(0.20)			
	Tembo	3(0.6)	30(1.9)			
	Nyanga	14(2.6)	67(4.2)			
	Kanu	57(11.4)	349(22.1)			
	Total	537(100)	1584(100)			
8.	Age group					
	15-24	74(13.80)	342(21.60)	68.23***	5	statistically significant
	25-34	188(35.00)	711(44.90)			
	35-44	154(28.70)	238(15.00)			
	45-54	75(14.00)	154(10.00)			
	55-64	28(5.20)	89(5.00)			
	65+	18(3.400)	45(2.800)			
	Total	537(100)	1584(100)			
	DRC	534(99.6)	1579(99.7)	0.04	1	Not statistically significant
	Rwanda	2(0.40)	5(0.03)			
	Total	536(100)	1584(100)			

* statistically signification at 10%, ** statistically signification at 5%, *** statistically signification at 1% $df=$ degree of freedom

The results from Table 4 showed that there were more self-employed 187(34.8%), followed by not working 167(31.1) and last by multi-tasks 13(3.2%). To test the association between current occupation and COVID-19 measures, chi-square test was used and the results indicated that there was statistically significant association between current occupation and COVID-19 measures ($\chi^2 = 54.93$, $df=5$, $p\leq 0.01$).

Table 4 revealed that there were only two nationalities such as Congolese with 534(99.6%) and Rwandese with 2(0.4%). To test the association between nationality and covid-19 measures, chi-square test was used and the results indicated that there was not statistically significant association between nationality and COVID-19 measures ($\chi^2 = 0.04$, $df=1$, $p> 0.01$). The results from Table 4 showed that there were more Nande ethnic group 388(72.3%), followed by combined Kanu and Kumu 57(11.1) and last, by Twa 0(0%). To test the association between ethnic group and COVID-19 measures, chi-square test was used and the results indicated that there was statistically significant association between ethnic group and COVID-19 measures ($\chi^2 = 193.99$, $df=8$, $p\leq 0.01$).

Table 4 shows that there were more participants 188(35%) in age-group 25-34, followed by age-group 35-44 with 154(28.7%) and last by age group of 65+ with 18(3.40%). To test the association between age-group and covid-19

measures, chi-square test was used and the results indicated that there was statistically significant association between age-group and COVID-19 measures ($\chi^2 = 68.23, df=5, p < 0.01$).

Table 5: Correlation matrix on COVID-19 measures.

	COVID-19 measures	Cultural	Geographical	Behavioral	Psychological
COVID-19 measures	1				
Cultural	0.280***	1			
Geographical	0.277***	0.357***	1		
Behavioral	-0.022	0.101***	0.291***	1	
Psychological	0.225***	0.474***	0.301***	0.296***	1

Source: Primary Data April 2022, * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Table 6: Relationship between Socio-demographic factors and COVID-19 measures

Dependent variable: COVID-19 measures			
Independent Variables	B	Exp(B)	95%CI for Exp(B)
Gender (male)	-0.50***	0.61	[0.47;0.79]
Age-group [15-24]			
25-34	0.95***	2.59	[1.74;3.84]
35-44	1.27***	3.55	[2.25;5.59]
45-54	1.18***	3.24	[1.90;5.53]
55-64	0.94***	2.56	[1.31;4.98]
65+	1.30***	3.66	[1.66;8.10]
Place of residence(urban)	-3.94***	0.02	[0.06;0.061]
Marital status(single)			
Married	0.32*	1.38	[0.97;1.96]
Divorced	-0.60	0.55	[0.14;2.11]
Widow	-0.34	0.71	[0.36;1.41]
Education level (None)			
Primary	0.63*	1.88	[0.95;3.74]
Secondary	1.08***	2.96	[1.58;5.53]
University	0.75**	2.11	[1.10;4.06]
Religion [Catholic]			
Protestant	-0.39***	0.68	[0.52;0.87]
Muslim	-0.55*	0.58	[0.31;1.78]
Revival churches	-0.42*	0.66	[0.40;1.08]
Current Occupation [Government]			
Student	0.17	1.18	[0.64;2.18]
Working for private	-0.87***	0.42	[0.25;0.69]
Self-employed	-0.13	0.88	[0.58;1.35]
Not working	-0.006	0.98	[0.63;1.57]
Multi services	-0.40	0.67	[0.31;1.46]
Ethnic group[Nande]			
Hunde	-0.77***	0.46	[0.30;0.72]
Hutu	-1.09***	0.34	[0.21;0.54]
Tutsi	0.27	0.61	[0.46;3.71]
Tembo	-1.48*	0.23	[0.05;1.07]
Nyanga	-1.03*	0.36	[0.16;0.80]
Kanu	4.57***	96.42	[4.32;21.48]
Kumu	-0.98***	0.38	[0.26;0.54]
Cons	-2.28***		
Cox-Snell R-square	0.23		
Nagelkerke R-square	0.35		
Hosmer and Lemeshow Test	$\chi^2 (df = 8) = 14.85, p = 0.06 > 0.05$		

Source: Primary Data April 2022, * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

The results in Table 6 revealed that by holding all other predictors variables constant, the odds of COVID-19 respect measures occurring, for a one-unit increases in female compared to male, decreased by 39% (95% CI (0.47;0.79)). Furthermore, the results in Table 6 showed that for age group 15-24 considered as a reference age-group, the odds of COVID-19 measures occurring increased respectively by 2.59 times (95% CI (1.74;3.84)) for a one-unit increased in age group 25-34, by 3.55 times (95% CI (2.25;5.59)) for a one-unit increased in age group 35-44, by 3.24 times (95% CI (1.90;5.53)) for a one-unit increased in age group 45-54, by 2.56 times (95% CI (1.31;4.98)) for a one-unit increased in age group 55-64 and by 3.66 times (95% CI (1.66;8.10)) for a one-unit increased in age group 65+ compared age group of 15-24. The results in Table 6 revealed that for current occupation considered employed government as a reference, the odds of adherence to COVID-19 measures decreased by 58% (95% CI (0.25;0.69)) for a one-unit increased by people working for private institution. Table 6 revealed that for ethnic group considered Nande as a reference, the odds of COVID-19 adherence to vaccine occurring decreased by 54% (95% CI (0.30;0.72)) for a one-unit increased for hunde ethnic group, the odds of COVID-19 adherence to vaccine occurring decreased by 76% (95% CI (0.21;0.54)) for a one-unit increased for Hutu ethnic group, the odds of COVID-19 adherence to vaccine occurring decreased by 77% (95% CI (0.05;0.1.07)) for a one-unit increased for Tembo ethnic group, the odds of COVID-19 adherence to vaccine occurring decreased by 64% (95% CI (0.16;0.80)) for a one-unit increased for Nyanga ethnic group, the odds of COVID-19

adherence to vaccine occurring increased by 96.42 times (95% CI (4.32;1.48]) for a one-unit increased for Kanu ethnic group, the odds of COVID-19 adherence to vaccine occurring decreased by 62% (95% CI (0.26;0.54]) for a one-unit increased for Kumu ethnic group.,the odds of COVID-19 measures of rural residence occurring decreased by 98% (95% CI (0.06;0.061]) for a one-unit increased for urban residence. Table 6; revealed that for level of education considered none education as a reference, the odds of COVID-19 adherence to vaccine occurring increased by 1.88 (95% CI (0.95;3.74]) for a one-unit increased for none education, the odds of COVID-19 adherence to vaccine occurring increased by 2.96 (95% CI (1.58;5.53]) for a one-unit increased for none education, the odds of COVID-19 adherence to vaccine occurring increased by 2.11(95% CI (1.10;4.06]) for a one-unit increased for none education.

The results from multiple regression support that cultural, geographical, behavioral and psychological factor significantly predicted COVID-19 measures, with the overall predictors that explained 30.5% of the variance ($\text{adj-R}^2=.305$, $F(4,2116)=233.75$, $p<.01$). The results confirm that socio-cultural factors significantly predicted positively COVID-19 vaccine scores adherence ($\beta = .261$, $p<.001$) and COVID-19 measures ($\beta = .0603$, $p<.001$). However, similar findings were shown in the research works of Rodríguez-Priego *et al.*, (2022) about socio-cultural factors during COVID-19 pandemic that state that socio-cultural factors influenced people behavior towards COVID-19 measures.

The results suggest an important strong and positive prediction of geographical factors on COVID-19 vaccine adherence and COVID-19 measures with ($\beta = .37$, $p<.01$) and ($\beta = .54$, $p<.01$) respectively. The majority of participants had indicated that geographical distance does not influence their decision to be vaccinated but rather other factors; and they also confirmed that they will not be vaccinated against COVID-19 despite the distance involved.

The results indicate an important strong and positive prediction of psychological factors on COVID-19 vaccine adherence and COVID-19 measures with ($\beta = .409$, $p<.01$) and ($\beta = .97$, $p<.01$) respectively. Similar results were found in Yanto *et al.*, (2021) who state that psychological factors related to vaccine hesitancy and refusal included cognitive reflection, trust in authoritative figures and personality traits. In addition, the results suggest an important negatively significantly prediction of behavioral factors on COVID-19 vaccine scores adherence ($\beta = -.263$, $p<.01$) and COVID-19 measures ($\beta = -.061$, $p<.01$).

6. DISCUSSION AND CONCLUSION.

The results indicated that from 2334 sampled, 2121 respondents answered and from 2121, 537(25.3%) respect COVID-19 measures against 1584(74.7%) who do not respect them. These figures indicate there was a low respect of COVID-19 measures and these results are in line with Holder (2022), Kadkhoda (2021), Di Meo & Bentivegna (2021) and Rumpler *et al.*, (2020) results. Furthermore, the results confirm what is mentioned in the theory of planned behavioral that states that individual act rationally based on their subjective norms, attitudes and perceived behavioral control and what is posits in HBM which assume that health-related behavior depends on the combination of several factors.

The results revealed that there was a low adherence of COVID-19 measures, female had 39% (95% CI (0.47;0.79]) decrease to adhere to COVID-19 measures compared to male. These results contradict that Kassie *et al.*, (2020) study who noted that males had higher odds of having poor preventive practice than females. With age group above 15-24, it was find higher odds (AOR=3, 95% CI (1.31;5.59]) to adhere to COVID-19 measures than those with age group of 15-24. In addition, people with high education had higher odds (AOR=2, 95% CI (0.95;5.53]) to adhere to COVID-19 measures than those with no education. These results are in opposite to what were found in Maleva *et al.*, (2021) who pointed out *the* key factors behind vaccine uptake are age and education of the individual. People in older age groups and people with higher education were likely to incline towards vaccination. By contrast, young people and people with low levels of education are least likely to be vaccinated and respect COVID-19 measures. Furthermore, it was find that there were odds of COVID-19 measures of rural residence occurring decreased by 98% (95% CI (0.06;0.061]) compared to urban residence. Catholic church believers were majority to adhere to COVID-19 measures compared to others churches. It was find that socio-cultural, geographical distance, psychological, behavioural factors affect adherence to COVID-19 measures at 30.5%. Similar findings were shown in the research works of Rodríguez-Priego *et al.*, (2022), Yanto *et al.*, (2021) and Hans *et al.*, (2022) that socio-cultural, geographical distance, psychological, behavioural and trust in health system factors during COVID-19 pandemic influenced people behavior towards COVID-19 measures. The results from this study inform policymakers and health system to engage with sensitization, communication and training as strategies for increasing the adherence to COVID-19 measures among females, young and low educated people and leaders of churches and communities.

7. ACKNOWLEDGEMENT.

The author would like to thank the following health personnel and officials in the DRC and North Kivu.

The Provincial Health Division through the ZS and Expanded Programme on Immunisation (EPI) management teams in NORTH KIVU for their collaboration,

Janvier Kubuya, Aime Cikomola, steve ahuka , Audry Mulumba , Michel Kabamba, Philippe lukanu, albert kalonji ,betty Mukwege, Ilunga wa ilunga, jackson Kinyamatwe, Edmond Madihano, charles Mubawa, Herve Shamavu and Muhindo maombi

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