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Title: Socio-demographic and life style factors associated with COVID-19 infection in Kigali City, Rwanda

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Abstract

The coronavirus disease (COVID-19) caused by the coronavirus-2 (SARS-CoV-2) emerged in Wuhan Hubei, China in December 2019 and spread worldwide and resulting to 509,164 confirmed cases and 23,335 deaths reported by WHO on 27th March, 2020. The COVID-19 declared as a global pandemic on 11th March 2020. In Rwanda 129,942 confirmed cases and 1,459 deaths were reported. Since the occurrence of Coronavirus 2019, this infection sought to be complex, and little was known about the risk factors associated with coronavirus 2019 infection of infected people around the world and Rwanda. Whereby, this study sought to assess factors associated with COVID-2019 among COVID-19 cases in Rwanda. This research was a case-control study. The target population including respondents aged of 18 years or older positively confirmed using quantitative RT-PCR (Polymerase Chain Reaction) from October, 2020 to December, 2020. Then Data analyzed using SPSS IBM version 21. The P-value <0.05 was considered to demonstrate the level of statistical significance. Both research and medical

ethics including privacy and confidentiality of the respondents were respected. Findings shows that the majority 391(73.7%) of respondents were from Gasabo District, of them 185(51.2%) were COVID-19 patients. Female respondents dominated in the study 275(56.1%), of them 147 (53.5%) were cases. For cases and controls, a total of 178 (38.2%) were aged 46-64 years old, majority 368(75.1%) were married, 231(47.1%) had completed primary school, 335(68.4%) were unemployed, 51.2 % were catholic and the majority 245(50.0%) were in Ubudehe Category E. The findings show that age of respondents is significantly associated with COVID-19 infection (P=0.029). The results revealed that among 63 respondents aged 24 years and less 37(58.7%) were from the cases. Occupation of respondents was statistically in relationship with Coronavirus 2019 infection (p=0.011). Majority of unemployed respondents were observed among the cases 183(54.6%). Ubudehe classification was statistically associated with COVID-19 infections (P<0.001) in bivariate analysis. The results shows that alcohol drinking (p=0.015), travel in COVID-19 high risk zone (p<0.001), being in contact with a person with a fever (p<0.001) and living with a COVID-19 patient (p-value=0.016) were importantly linked with Coronavirus 2019 infection in Bivariate analysis. We recommend that the Ministry of Health, Rwanda Biomedical Center and its partners to train of health workforces on COVID-19 prevention and control measures in order to support groups at high risks and mitigate the transmission or recurrence of COVID-19 infection.

Introduction

Coronaviruses are a wide family of various respiratory viruses, capable to cause infection extending from minor common cold to more severe illnesses. Severe infections include Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The Coronavirus 2019 infection is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus strain. The majority of infected people with the SARS-CoV-2 virus develop respiratory symptoms. On the beginning, they feel a little bit uncomfortable, develop fever, and may have a dry cough or a painful throat or sneezing. Some people may have gastrointestinal symptoms. Others may lose the sense of smell or taste. The current pandemic disease has been caused by a type of coronavirus strain that had not been detected anywhere in the world before the infection was reported in Wuhan, China in December 2019 (WHO) (Zhu, Zhang, & Wang, 2020).

On 11th February 2020, WHO called this new coronavirus pneumonia as “COVID-19” (Yixuan, et al., 2020). On that day, the world accounted globally 43,103 confirmed cases with 2560 new cases and 1017 death cases. On the same day, in the USA 20 confirmed cases were reported

(United States of America reported 13 confirmed cases and Canada 7 cases), European region reported 46 confirmed cases, and Eastern Mediterranean region 8 cases. Early February 2021, nearly 27 million Americans had been diagnosed and 464,000 deaths reported. Majority of African countries had closed their borders to passengers arriving from different countries with infections. The businesses were closed, their populations were instructed to self-quarantine, and schools to an estimated 1.5 billion children were closed(The Economist, 2020). In Africa, the first case of COVID-19 was recorded in February 2020. It was exactly in Egypt. As of September 3rd, 2020, the Africa accounted more than 1·2 million confirmed cases and 30 000 people died from the virus, case fatality represented 2·4%, and 5% of global infections (Munyaradzi, 2020). The transmission of Coronavirus 2019 infection in Africa continent has been marked by relatively less infections, which have been deteriorated over Two months, due to various socio-ecological factors as well as early and strong implementation of public health measures taken by governments across the continent. The outbreak has largely affected the younger age group and has been more noticeable in a few countries. The sub-Saharan Africa represented almost 91% of COVID-19 infection among people of age below 60 years, and 80% majority of cases were without symptoms.

On 30th January, 2020 the WHO has declared the Coronavirus Disease 2019 (COVID-19) as a public health threat of worldwide concern (PHEIC) (R. A. Raschke et al., 2020). The current report as on 17th March,2021, global trend reported 12,383,919 cumulative cases, 406,980 new cases reported, and 2,664,386 total cumulative deaths. In America 53,160,109 total cumulative cases, and 1,277,554 death cases were also reported. In Europe, 41,563,117 confirmed cases and 916,160 death cases reported. It was reported 2,965,203 total cumulative cases and 75,203 death cases in Africa (WHO).

On 14th March, 2020 the Government of Rwanda confirmed the first tested case of COVID-19 (MOH [Rwanda], 2020). The trend was increased day to day, as Rwanda reported 93 confirmed cases and first victim on 3rd August,2020 (100% weekly change). In response and to effectively mitigate the COVID-19, Rwandan leadership initiated the Joint Task Force at national and District levels. This multidisciplinary team coordinating all the activities relating to the outbreak (Primature report 2020). The danger is actually considered as worldwide threat. The cooperation is very important at international level adequately mitigating Coronavirus disease 2019. The Leadership of Rwanda introduced strategic mechanisms of screening and detection at all its airports, ports and land borders. The Rwanda Government has also established strict quarantine measures. The existing healthcare system strengthened the infection prevention and control

measures to respond effectively to the current situation. Currently, on 19th March,2021 Rwanda reported 20,186 total cumulative cases and 280 total cumulative death cases (MOH Covid-19 Report).

At present, there is not enough studies on Coronavirus 2019 related to the epidemiology and clinical characteristics in the world, especially in Rwanda. The Republic of Rwanda is considered as one of the most important focal points of the disease throughout the East Africa Community. Therefore, this study would be conducted to analyze the association of risk factors and coronavirus 2019 infection in Kigali City, Rwanda.

So far, 20,681 confirmed cases and 287 victims of COVID-19 were reported in Rwanda on 19th March, 2021 (MOH [Rwanda], 2021). The incidence of COVID-19 has not stopped to raise up day-to-day. The Government has established a multidisciplinary team to conduct a risk-assessment and strengthen the mechanisms of preparedness and response in order to contain the outbreak (MOH [Rwanda], 2020).

Therefore, little was known about the socio-demographic and economic characteristics of COVID-19 Patients. The overall objective of this study is to determine the socio-demographic and economic characteristics of confirmed COVID-19 cases in Kigali City.

Methods

Study population

Cases were comprised of confirmed cases, and controls composed of negative cases aged or more than 18 years those who were tested PCR positive in Kigali City from October 2020 to December, 2020.

Sample size

The number of items was calculated using the following formula of **Casagrande method:**

The used formula thus was the following:

$$n = \frac{[Z1-\alpha/2\sqrt{2P(1-P)}+Z1-\beta\sqrt{P1(1-P1)+P2(1-P2)}]2}{(P1-P2)2}$$

Where: **n** = desired sample size or number of items, **α** = Type I error (0.05), **β** = Type II error (0.10)

At 95% confidence, $\mathbf{Z_{1-\alpha/2}}$ = 1.96, **P** = (P1+P2)/2 = (0.5+0.3)/2 = 0.4.

At 90% power, $\mathbf{Z_{1-\beta}}$ = 1.28 (This is the usual standard for most confirmatory studies).

P1= since the prevalence of COVID-19 positive cases are not known, an assumed proportion of 50% (i.e. 0.5) will be used.

P2= since the prevalence of COVID-19 negative cases are not known, an assumed proportion of 35% (i.e. 0.35) will be used.

$$n = \frac{[1.96\sqrt{2(0.4)(1-0.4)} + 1.28\sqrt{0.5(1-0.5)+0.35(1-0.35)}]2}{(0.5-0.35)2}$$

$= \frac{[1.96\sqrt{0.48}+1.28\sqrt{0.21}]2}{0.04} = 223$

After adding 10% of attribution rate, the sample size was 245 cases equal to 245 controls. The fractional ratio of cases and controls was 1:1

Sampling technique

In this study, confirmed cases to be COVID-19 positive attended health facilities in Kigali City and those diagnosed to be COVID-19 positive were recruited consecutively as cases and those confirmed to be COVID-19 negative were recruited consecutively as controls in the study area. Both cases and controls participated in the study after signing the consent.

Data collection methods

Instruments for Data collection

The collection of Data was performed with aid of a designed data collection sheet for both respondents. The data collection sheet was also translated into Kinyarwanda to facilitate the collection of data. During interviews, participants were asked questions related to their family background and demographic, lifestyle, economic, clinical and comorbidities factors in association with pandemic and related barriers.

Procedures of data collection

The health care providers working in the study area were recruited to collect the data in order to ensure confidentiality and reliability as participants have more trust towards them. They were

trained before conducting the study, and informed about the objectives of the study and general questions being questioned.

Reliability and validity of instruments

Pre-testing of questionnaire to validate its reliability was conducted among 5 cases and 5 controls having the same characteristics as the study population. The purpose of this preliminary interview was to assess level of cognition and identification for possible problems. (Yue, 2016). Thus, to assess the instrument's validity, the confirmed cases were compared with a reference standard established by the WHO for Covid-19 case definition (WHO, 2020)

Data Analysis

Statistical Package for Social Science (SPSS) was used for data entry and data analyses. Expressive analysis was conducted for the demographic determinants in cases and controls using rates and percentages. Chi-square test utilized to demonstrate the relationship between the dependent variable and independent determinants in order to recognize which one had important association. Odds ratio (OR) such as unadjusted and adjusted with corresponding 95% confidence interval was valuated. The level of arithmetical importance was set at P-value <0.05. The evaluation was conducted with aid of Binary logistic regression analysis to regulate confounding factors in association with the dependent and independent variables.

Ethical Considerations

The School of Postgraduate studies at Mount Kenya University Rwanda was first approved the research proposal and clearance was obtained from the ethic committee of the Institutional Research and Ethics committee of Mount Kenya University Rwanda. After obtaining ethical approval, permission to access to the Covid-19 patients' medical records was obtained from the department in charge of Covid-19 in Kigali City. Confidentiality was always being maintained by storing data into a password-protected database and data was specifically used for academic reasons.

Results

Socio-demographic characteristics associated with Coronavirus 2019 infection

The demographic characteristics of respondents (cases and controls) including residence, gender, age group, marital status, educational level, occupation, religion and "ubudehe" categories. These are represented in the table 1.

Table 1: Socio-demographic characteristics of cases and controls

Variables	Cases	Controls	Total	Chi-square	P-value
	n(%)	n(%)	n(%)		
District				1.010	0.603
Gasabo	185(51.2)	176(48.8)	361(73.7)		
Kicukiro	47(47.5)	52(52.5)	99(20.2)		
Nyarugenge	13(43.3)	17(56.7)	30(6.1)		
Gender				2.992	0.084
Male	98(45.6)	117(54.4)	215(43.9)		
Female	147(53.5)	128(46.5)	275(56.1)		
Age group				10.792	**0.029**
≤24	37(58.7)	26(41.3)	63(12.9)		
25-35	63(55.3)	51(44.7)	114(23.3)		
36-45	59(55.1)	48(44.9)	107(21.8)		
46-64	80(42.8)	107(57.2)	187(38.2)		
65+	6(31.6)	13(68.4)	19(3.9)		
Marital Status				2.139	0.144
Married	177(48.1)	191(51.9)	368(75.1)		
Single	68(55.7)	54(44.3)	122(24.9)		
Education level				1.866	0.393
No formal education	17(45.9)	20(54.1)	37(7.6)		
Primary	123(53.2)	108(46.8)	231(47.1)		
Secondary and above	105(47.3)	117(52.7)	222(45.3)		
Occupation				9.086	**0.011**
Unemployed	183(54.6)	152(45.4)	335(68.4)		
Self employed	38(40.4)	56(59.6)	94(19.2)		
Civil servant	24(9.8)	37(60.7)	61(12.4)		
Religion				5.616	0.060
Catholic	122(48.6)	129(51.4)	251(51.2)		
Protestant	66(45.5)	79(54.5)	145(29.6)		

Muslim	57(60.6)	37(39.4)	94(19.2)		
Ubudehe				75.703	**<0.001**
A-C	4(6.8)	55(93.2)	59(12.0)		
D	78(41.9)	108(58.1)	186(38.0)		
E	163(66.5)	82(33.5)	245(50.0)		

Source: Primary data (2021)

Results presented in table 1 showed majority 391(73.7%) of particpants were from Gasabo District, of them 185(51.2%) were COVID-19 patients. Female respondents dominated in the study 275(56.1%), of them 147 (53.5%) were cases. The majority of respondents 187 (38.2%) were aged 46-46 years old, 368(71.1%) were married of them 48.1% were cases and 51.9% were from controls. Regarding the education level, 231(47.1%) of respondents had primary education while 222(45.3%) had secondary education and above, of respondents with secondary education 52.7% were from controls. Half of the study participants were affiliated to Catholic Church (51.2%), and were in ubudehe category E (50.0%).

Life style and Travel history of the respondents

The Table 2 presents life style and travel history of cases and controls including smoking, alcohol consumption, dietary diversity, physical activity, citizenship, travel history in COVID-19 high risk zone, participation in burial event of COVID-19 victims, being in contact with patient with fever and respiratory disease or having history of living with COVID-19 patients at home.

Table 2: Life style and travel history of cases and controls

Variables	Cases n(%)	Controls n(%)	Total n(%)	Chi-square	P-Value
Smoking				2.076	0.150
Yes	12(66.7)	6(33.3)	18(3.7)		
No	233(49.4)	239(50.6)	272(96.3)		
Alcohol drinking				5.940	**0.015**
Yes	70(59.8)	47(40.2)	117(23.9)		
No	175(46.9)	198(53.1)	373(76.1)		
Fruit and vegetable				0.834	0.361
Yes	233(49.6)	237(50.4)	470(95.9)		
No	12(60.0)	8(40.0)	20(4.1)		
Physical activity habit				0.294	0.587
Yes	125(48.8)	131(51.2)	256(52.2)		

No	120(51.3)	114(48.7)	234(47.8)		
Citizenship				2.700	0.100
Rwandan	240(49.6)	244(50.4)	484(98.8)		
Foreign	5(83.3)	1(16.7)	6(1.2)		
Travel history				2.033	0.151
Yes	6(75.0)	2(25.0)	8(1.6)		
No	239(49.6)	243(50.4)	482(98.4)		
Travel in COVID-19 high risk zone				20.248	**<0.001**
Yes	22(27.2)	59(72.8)	81(16.5)		
No	223(54.5)	186(45.5)	409(83.5)		
Participated in burial ceremony of a COVID-19				1.364	0.243
Yes	11(39.3)	17(60.6)	28(5.7)		
No	234(50.6)	228(49.4)	462(94.3)		
Be infected by an individual suffering from fever and respiratory tract infection				22.403	**<0.001**
History of living with COVID-19 patient at home					
Yes	69(36.5)	120(63.5)	189(38.6)		
No	176(58.5)	125(41.5)	301(61.4)		
History of living with a COVID-19 patients at home				5.858	**0.016**
Yes	66(42.0)	91(58.0)	157(32.0)		
No	179(53.8)	154(46.2)	333(68.0)		

Source: Primary data (2021)

Findings captured in the table 2 shown the life style and travel history of respondents. Smoking was not common among both cases and control where only 18(3.7%) were smokers, of them 12 (66.7%) were from cases. A total of 117(23.9%) respondents were alcohol drinker, of them more than a half 70(59.8%) were from cases while 47(40.2%) were from controls. Eating fruit and vegetables was common among both cases and controls where 470(95.9%) had the habit of eating fruit and vegetable, 50.4 % were from controls. The habit of doing physical activity was somehow good where 256(52.2%) responded that they use to do regular physical activities, 48.8% were from cases. The majority 484 (98.8%) of the respondents were Rwandan, and did not travel in COVID-19 high risk zone (83.5%). The results of this case control study revealed that only 28 (5.7%) participated in the burial ceremony of a COVID-19 death, of them 11(39.3%) were from cases. One third 189(38.6%) with 120(63.5%) controls and 69(36.5%)

cases have been infected by an individual suffering from fever and respiratory tract diseases. A total of 157 (32.0%) respondents had the history of living with COVID-19 patients at their home, of them 66(42.0%) were from cases.

Socio-demographic and economic factors in relationship with COVID-19 in Kigali City

The findings presented in table 1 show that age of respondents is significantly associated with COVID-19 infection (P=0.029). The results revealed that among 63 respondents aged 24 years and less 37(58.7%) were from the cases. Occupation of respondents was statistically in relationship with Coronavirus 2019 infection (p=0.011). Majority of unemployed respondents were observed among the cases 183(54.6%). Ubudehe classification was statistically associated with COVID-19 infections (P<0.001) in bivariate analysis. Other socio-demographic and economic characteristics such district of residence, gender, marital status, religion did not show any statistical significance in bivariate analysis (Table 4.1).

Life style and travel history factors associated with COVID-19 in Kigali City

The second objective of this research was to investigate the life style and health related factors associated with COVID-19 in Kigali City.

The results presented in the table 4.2 shows that alcohol drinking (p=0.015), travel in COVID-19 high risk zone (p<0.001), being in contact with a person with a fever (p<0.001) and living with a COVID-19 patient (p-value=0.016) were importantly linked with Coronavirus 2019 infection in Bivariate analysis.

In crude analysis, alcohol drunker has 68% increased risk of infection compared to those who were not drinking, but no statistical association observed in multivariate analysis. Similar finding was observed for respondents with travel in COVID-19 high risk zone history where they were at 3 times risk of infection, but the statistical significance was not persisted in multivariate analysis. Living with a COVID-19 patient in the same household was associated with 60% risk of being

infected by COVID-19 in bivariate analysis, without any association observed in multivariate analysis.

Discussion

This study assessed socio-demographic, life style and travel history, and comorbidities linked with Coronavirus 2019 infection at Kigali City, Rwanda. However, no statistical significant association was observed after controlling the potential confounders. These have small similarity of those of Daniele et al., (2021), who reported 76.25% of patients aged between 20 and 60 years presented higher susceptibility to Coronavirus 2019, with patient's average age of 42.30 ± 17.60 years in the Brazilian Amazon. Also based on the retrospective cohort study conducted by Hiluf Ebuy Abraha et al., (2021) on patients with confirmed COVID-19 admitted to Kuyha COVID-19 treatment management Center in northern Ethiopia. The results revealed similarity to this study, where 29 years old was the average age of the cohort, and the 66.9% of the majority of patients with age between 20- 39 years. The ratio of children aged < 20 years was 9.2 while the percentage of patients aged ≥ 60 years was only 5.7%. A higher incidence of COVID-19 infection in respondents aged 24 years and less can be due to several setting and activities associated with Coronavirus infection, including work status, school and domestic related conditions. More cases had lower educational level and living in crowed households. There was a strong association between respondents of age group ≤24 years with the risk of increased COVID-19 infection. The unemployed respondents represented 31% of risk of having COVID-19 (AoR 0.31, 95%CI: 0.134-0.741; p=0.008) related to civil servant respondents. Coronavirus 2019 results of the current study confirm the findings by Sabrina et al., (2021) who reported higher proportion of COVID-19 cases in retired or economically inactive persons in the provinces around Copenhagen, Denmark. The higher incidence of COVID-19 infection was also observed within the respondents with low living and family incomes. Similarly, the case-control study conducted by Andreia et al., (2021) within the Lisbon and Tagus Valley area in Portugal,

revealed that 82.2% of tertiary education reported to be linked with increased risk of Coronavirus 2019 infection. Hence, these results suggested the importance' to improve the health of individuals with lower educational level, as long as they are subject to manual labors with poor health literacy and lower income. This resulting to experience unfavorable life and unable to afford most basic primary needs, whereby developing less immune body defense and, become susceptible with increased risk of infection. Our study had some limitations. We only considered patients who have been admitted for mild COVID-19. So far, we did not have access to data of severe coronavirus 2019 cases admitted in Kanyinya treatment center, as it was difficult to gather required information due to their clinical status and restricted isolation. Our conclusions regarding risk of infection related to comorbidities, are therefore potentially biased. Additionally, patient's medical files of confirmed cases that contain information on the variables of interest (i.e. clinical presentation, travel history, and self-reported comorbodities) were generally filled after interview for those who able to accept to share information. The results of this work reported that the participants being in contact with affected Coronavirus 2019 patients were 2.44 times expected to be affected by Coronavirus 2019 clients compared to respondents without being in contact with COVID-19 patients. The respondents living with a Coronavirus 2019 patient in same crowed household have 60% less exposure of contamination with Coronavirus 2019 infection (Adjusted Odds Ratio (AoR): 1.60, 95%CI: 1.092-2.351; p=0.016) compared to respondents not living with a COVID-19 patient in the same house. The similarity was also reported in another work of contextual determinants for SARS-CoV-2 spread, revealed that household overcrowding (AoR= 1.47; 95% CI: 1.14-1.91) decreased the risk of infection (Andreia et al., (2021). The respondents with history of having a dry caught have high 7 times high risk of contracting COVID-19 (AoR 7.55, 95%CI: 3.250-17.545; p<0.001), compared to the respondents not having history of dry caught. Similarly, the findings of the study conducted by Daniele et al., (2021) reported that cough (61.9%) was included in the most frequent symptoms.

In the further analysis, the respondents having history of chronic headache have 5 times high risk of contracting COVID-19 (AoR 5.66, 95%CI: 3.007-10.688; p<0.001) compared to the respondents not having history of not having chronic headache. The similarity was also highlighted in the study on risk factors in association with the severe COVID-19 infectivity in a region of Amazon, where headache represented 24.5% of 24,671 confirmed patients (Daniele et al., 2021).

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