Determinants of COVID-19 Vaccine Uptake among Health care workers; "Case study of Mogadishu City, Somalia"

Abstract

Aims: Covid-19 disrupted the Health Care system and operations globally between 2020 and 2021 through exponential infections, disease and adverse negative economic impact as a result of the virus. Due to the high risk of infection, health care workers are a high priority target group for vaccination against COVID-19. Theobjective of current study was to assess the factors associated with COVID-19 vaccine uptake among health care workers in Mogadishu, Somalia.The study sought to establishthe proportion of vaccinated healthcare workers, determine the socio-demographic and healthcare system factors associated with COVID-19 vaccine uptake among health care workers in Mogadishu, Somalia.

Methodology: Purposive sampling was used to select the six hospitals in Mogadishu while stratified random sampling was used to select a sample of 276 participants in the sampled hospitals. Structured questionnaires were use collect data. Data was analyzed SPSS to generate descriptive statistics and logistic regression. A letter of ethical clearance was obtained from Mount Kenya University's Ethical Review Committee. Research permits were also obtained from the six hospitals whose healthcare workers were involved in the study.

Results: The study established that 54.3% (n) of the healthcare workers had taken the COVID-19 vaccine. The study found that the socio-demographic factors increased the odds of uptake of the COVID-19 vaccine were job cadre with doctors (Odds=0.859, p=0.007), Nurses (Odds=1.175, p=0.010);area of work with ICU (Odds=0.614, p=0.014), Isolation Ward (Odds=2.825, p=0.007); Age 21-30 years (Odds=1.125, p=0.002), 31-40 years (Odds=1.106, p=0.000). The healthcare system factors associated with increased odds for COVID-19 vaccine uptake were being in contact with patients with COVID-19 (Odds=0.948, p=0,008); Conducting weekly tests (Odds=0.786, p =0.010); previously testing positive for COVID-19 (Odds=0.752, p=0.041).

Conclusion: The study concluded that a significant number 45.7 %(n) of healthcare workers in Mogadishu had low or inadequate had not taken the COVID-19 Vaccine for a number of reasons, this is worrying since these are the frontline workers in the fight of COVID 19 pandemic.

Recommendations: The study recommends that health education and health promotion is necessary to enhance vaccine uptake and use among health workers particularly during such pandemics. Policymakers and administrators should develop clear guidelines and create supportive environment to enhance health education and health promotion during pandemics.

Keywords: *Healthcare Workers, Socio-Economic Factors, Healthcare Systems, Vaccine, Vaccination, COVID-19*

1.1 Introduction

Coronavirus disease 2019 (COVID-19) pandemic is caused by Severe Acute Respiratory Syndrome Coronavirus (Nobel SARS-CoV-2) has led to high mortality and morbidity rates in the whole world. Coronaviruses belong to a family Coronaviradae, genus Beta-coronavirus and they are enveloped single stranded RNA viruses. Coronaviruses have four structural proteins, namely; Nucleocapsid (N), membrane (M), spike (S), and envelope (E) proteins (Tsang *et al*., 2020). The disease is highly contagious, however, the spread from human to human is through respiratory droplets during coughing or sneezing. Most of the studies done globally reported that the disease spread by aerosol penetration into the upper respiratory by inhaling droplets. The COVID-19 disease started in Wuhan China at the end of 2019 and the disease spread very fast throughout the entire world (Tsang *et al.*, 2020). In February 2020, the WHO declared Covid-19 a global pandemic (Ciotti *et al*., 2020).
Over the last two years (2019 to 2021), people have suffered under the COVID-19 pandemic, researchers have been working around the clock in order to prevent this disease from spreading further and to develop a cure as well. Towards the end of the year 2020, researchers developed several different COVID-19 vaccines. Currently (November, 2021), there are more than seven COVID-19 vaccines approved by WHO includes; Johnson and Johnson, AstraZeneca/Oxford, Sinopharm, Sinovac, Moderna, Pfizer/Bion Tech, and COVAXIN. These vaccines have been reported to be safe for most people aged 18 years and above (WHO, 2021c). The vaccines have been found not to be 100% preventive against the COVID-19 disease, however, they prevent against an individual developing severe COVID-19 disease (Nzaji *et al*., 2020).

Healthcare workers are majorly the frontline workers and therefore at a higher riskof infections and deaths resulting from COVID -19. COVID-19 vaccines remain the only effective method of preventing further infection and reduction of morbidity and mortality due to the disease. Therefore, health care workers are among the priority group of persons to be adviced to receive COVID-19 vaccines (Papagiannis *et al.*, 2021). The Somalian government through the ministry of health had received three different types COVID-19 vaccines. These vaccines includes COVAXIN, AstraZeneca/Oxford and Johnson and Johnson, that is, 2051300 doses, 823200 doses, and 638900 doses respectively. There is a case of reluctant to uptake of the vaccines by a number of health care workers in Somalia (WHO, 2021a).

There are various sociodemographic factors ranging from profession to marital status that are associated with the uptake of COVID-19 vaccine among the health-care workers. A study conducted in Abia State, Nigeria, revealed that age was established to be one of the factors that determine the COVID-19 vaccination hesitancy. It was reported that a larger proportion of younger health-care workers were likely to decline the uptake of COVID-19 vaccination as oppose to the older colleagues (Amuzie *et al.*, 2021). This finding was attributed to the fact that there is a perception that young people have lower risk among the Abia State health care workers (Amuzie *et al*., 2021). Studies done in Jordan and Bangladesh showed that in both countries, the younger people were more likely to agree to take vaccines for Covid-19 if provided, with 39% of participants above 60 years old in Bangladesh declining the vaccine (Ali & Hossain, 2021; El-Elimat *et al.,* 2021).

Professionals were found to be an important factor in determining COVID-19 vaccination hesitancy in Nigeria among the health care workers from Abia State. The research determined that the clinical staff who comprised of doctors, nurses as well as other clinical health-care

workers were likely to agree to a Covid-19 vaccination in comparison with the non-clinical staff members (Amuzie *et al*., 2021). This finding on the difference on Covid-19 vaccine hesitancy based on categories of health workers was similar to the study finding where unlike other health professional cadres, medical doctors reported a lower vaccination reluctance (Biswas et al., 2021).

Li et al. (2021) led a concentrate on health-care workers (HCWs) perspectives and related factors towards Covid-19 vaccination: a fast efficient survey. Two specialists screened the writing autonomously, and 13 examinations were remembered for the efficient survey. Immunization acknowledgment shifted broadly and went from 27% to 77%. Health-care workers had uplifting outlooks on the future Covid-19 antibodies, while vaccination reluctance was yet normal. Segment factors, for example, men, more established age and doctors were positive prescient variables. Ladies and attendants had more vaccination reluctance. Past flue vaccination and self-saw risk were facilitators. Worries for wellbeing, adequacy and viability and doubt of the public authority were hindrances.

Governments have come up with measures to try contain the disease. Different vaccine manufacturers around the world have been in the race of developing vaccines against COVID-19. Various studies have been done to assess the uptake of the COVID-19. While some studies have shown a higher vaccine acceptability, others have reported vaccine hesitancy. In Somalia, however, little has been recorded in relation to the uptake of COVID-19 vaccine among health care workers. In order to eradicate COVID-19 infection, there is need to increase vaccination of citizen and more specifically the health workers face the highest risk of contraction the virus. Therefore, the study assessed the factors associated with COVID-19 vaccine uptake among health care working who are working at selected hospitals in Mogadishu, Somalia. In particular, the study investigated the socio-demographic and healthcare system factors associated with Covid-19 vaccine uptake among Healthcare workers in Mogadishu. The findings from this study will be an important input to the relevant decision and policy makers in control of such diseases especially in regards to health service providers.

The theoretical model of the study was based on the socio-demographic and healthcare system factors and is shown in Figure 1.

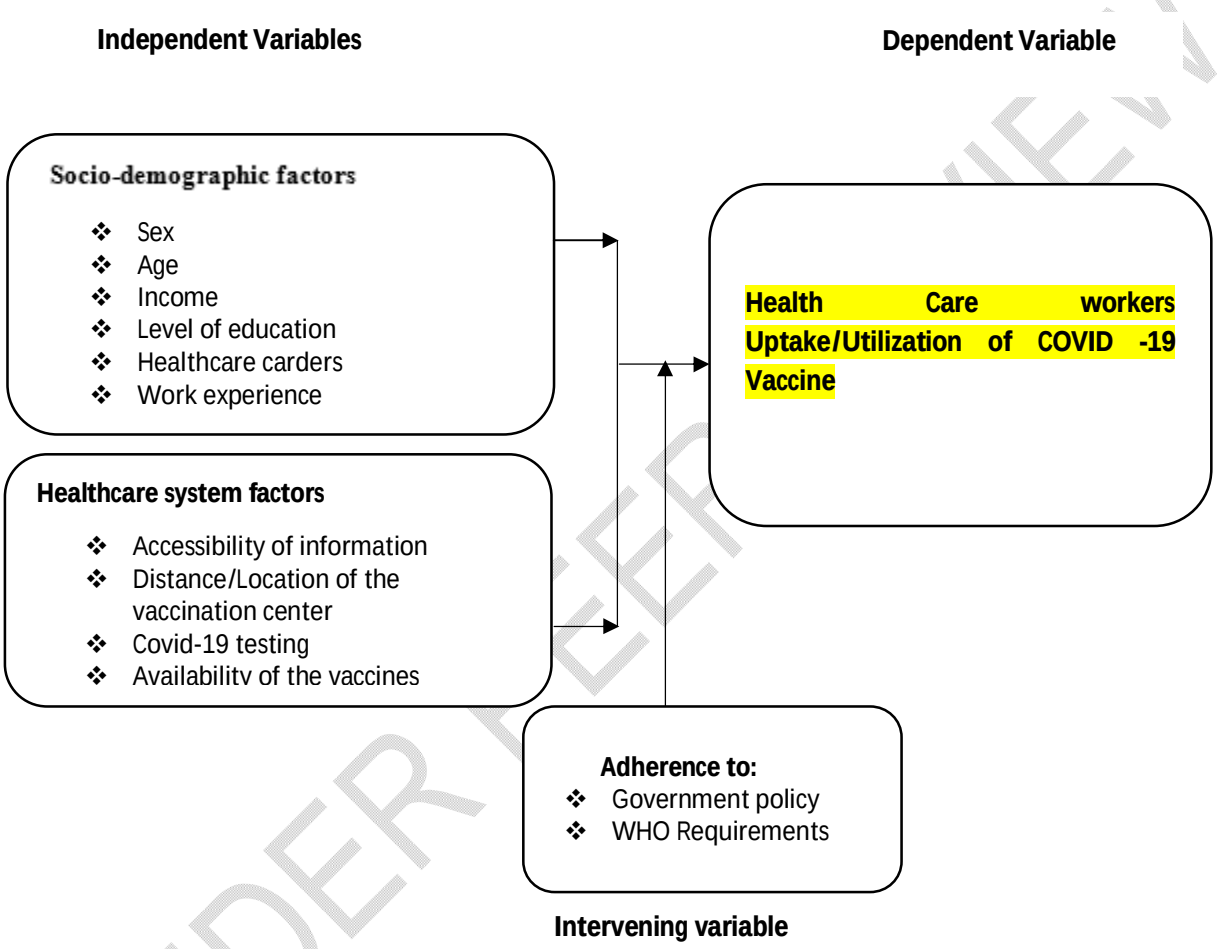

Figure 1: Conceptual Framework

In the study, socio-demographic factors were: sex; age modeled as 20-30 years, 31-40 years, 41-50 years and 51-60 years; Income levels gauged as below $100, $100 - $200, $200 - $300, $300-$400 and Above $500; education levels recognized as Certificate, Diploma, Bachelor's degree, Master's Degree and PHD; healthcare cadres which involved Doctor, Nurse, Lab-Technologists, Pharmacists and Midwives; work experience was modeled as less than a year, 2 to 4 years, 5 to 7 years and more than 8 years. Healthcare system factors involved accessibility of information on Cocid-19 vaccines, the distance or location from the vaccination center, whether the respondents

undertook Covid-19 tests, the frequency of doing so as well as the availability of the vaccines. As such, a combination of socio-demographic and healthcare system factors can affect the uptake of Covid-19 vaccines among healthcare system factors among hospitals in Mogadishu, Somalia.

2.1 Methodology

The research adopted a cross-sectional descriptive research design. The mixed methods paradigm involving both quantitative and qualitative data collection techniques was employed to collect data from the respondents using structured questionnaires and Key informant interview guides. The study targeted all health care workers working at the selected hospitals including Banadir Hospital, De martini Hospital, SOS Hospital, Shafi Hospital, Daru Shifa Hospital and Somali Sudanese Hospital in Mogadishu, Somalia. The healthcare workers included doctors, nurses, laboratory technicians, pharmacists and midwifes.

A pilot study was conducted using a sample of 27 participant from Jazeera Specialist Hospital, Mogadishuwhich did not form part of the actual study. This was 10% of the actual sample size of the research which was 276 respondents. It involved health workers and hospital mangers. To ensure the validity of the instrument, the researcher conducted a pilot study on selected location that was not included in the target population. The researcher also subjected the research instruments to the research experts and research supervisors in their development. The research instruments were revised to remove any errors and ambiguity so to enhance clarity, suitability and easily understood before proceeding to collecting data. As for the reliability, the Cronbach reliability coefficient was used. A coefficient of 0.70 and above implied the tools were adequate to be used to collect the data (Gay, 1992). Cronbach alpha scale was used to test the reliability, the 0.7 base level was achieved and as such it was considered acceptable.

The researcher sought the necessary research permits and licenses. First, the researcher sought approval letter from Mount Kenya University ethical review committee, research permits from the six hospitals where the research was carried out. The researcher and research assistants, who explained and clarified issues to the respondents, administered the questionnaires to the health care worker, and hospital managers. The research instruments that is structured questionnaires were administered to the health worker and collected after they had been filled. Interview schedule and key informants were administered to the hospital managers, which were completed and collected the same day. The participants who agreed to take part in the study signed the consent form and proceeded to fill the questionnaire and those who did not sign did not take part in the study. A letter of ethical clearance from Mount Kenya University was obtained. Ethical Review Committee. An introduction from graduate school was also sought by the researcher. All the research participants who were willing filled the consent and the researcher guaranteed them of the confidentiality of their information given during the research period where by the research used code in order to conceal their identity.

3.1 Results and Discussion

Out of 276 staff from the 6 hospitals involved in the study, 265 questionnaires were dully filled and returned as shown below. This represents a 96.01% response rate which is more than sufficient for statistical inference based on the assertions of Mugenda and Mugenda (2003) who states that a response rate of above 50% is adequate hence the response rate was well above the required rate. The results are discussed in line with the objectives below.

3.2 Uptake of Covid-19 Vaccine

The study sought to establish the proportion of vaccinated healthcare workers. 265 healthcare staff took part in the study. Of these, 144 were found to have taken the Vaccine while 121 did not as shown in Figure 2.

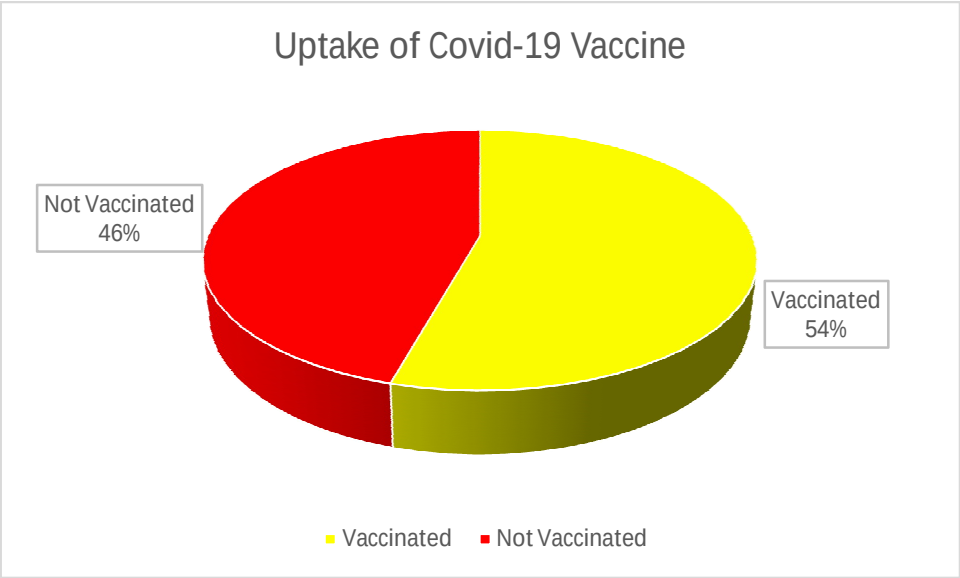

Figure 2: Uptake of Covid-19 Vaccine among Healthcare Workers in Mogadishu

Based on the table above, 54.3% of the respondents had taken the Covid-19 Vaccine while 45.7% had not taken it yet. These findings are similar to those of Shah (2020) who investigated the mindfulness and immunization designs among healthcare workers in Kenya and Uganda and found the proportion of immunization to be about 50% respectively. The similarity might be because Somalia, Kenya and Uganda are all in the East African Region and as such may share similar socio-economic practices and beliefs.

One key informant KII2 stated that, "……*We made it mandatory for the staff to take the vaccine because we were the biggest center dealing with Covid-19 cases….*" (KII 2). Another Interviewed Informant (KII 5) stated that… *"There was no obligations and Are there was no programs designed but everyone who is interested we used to give them that time…."* (KII 5).

3.3 Bivariate Analysis

The independence tests assess whether an association exists between the two variables by comparing the observed pattern of responses in the cells to the pattern that would be expected if the variables were truly independent of each other. Chi-square test was conducted for the categorical variables to determine their association with Covid-19 vaccine uptake among the healthcare workers

Table 1: Chi square Outputs

Risk Factors	Chi-Square	df	Asymp. Sig.
Gender	6.333a	1	**0.012**

Job Cadre	6.115a	4	0.191
Work Area	21.732a	8	**0.010**
Age	17.371a	3	**0.001**
Work Experience	21.836a	3	**0.000**
Education	5.819a	4	0.268
Income	22.317a	4	**0.000**
Chronic Diseases	0.813a	1	0.367
Contact with Infected Patients	17.044a	1	**0.000**
Testing at the Facility	0.000a	1	0.999
Test Status	30.678a	1	**0.000**
Frequency of Test	6.634a	3	0.157
Cost of Test	15.694a	3	**0.001**
Covid Positive	13.052	1	**0.000**
Proximity to Vaccination Center	9.387a	3	**0.025**
Vaccine Expensive	8.133a	4	0.088
Accessibility of Vaccine	15.060a	4	**0.005**
Vaccines cause diseases	9.031a	1	**0.003**
Vaccine Side Effects	6.455a	1	**0.011**
Family Members Covid Positive	3.566a	1	0.059
People with Chronic Diseases	1.286a	1	0.257

The Chi-square results indicated that Gender had a Chi-square value of 6.333 and P-value = 0.012<0.05. The area of work in the hospital was statistically significant with prevalence of covid-19 vaccination among HCWs with a chi-square value of 21.732 nd P-Value of 0.010. Age had a Chi-square value of 17.371 and a P-Value= 0.001< 0.05. The number of years of experience had a Chi-square value of 21.836 and a P-Value=0.000 and was therefore significant. Income had a Chi-square value of 22.317 and a P-value= 0.000< 0.05. Contact with Covid-19 infected patients was also statistically significant with a Chi-square of 17.044 and a P-value=0.000. Whether the healthcare officials had been tested had a chi-square value of 30.678 and a P-Value of 0.000.

In addition, a chi-square value of 15.694 and a P-Value=0.001 <0.05 shows that the cost of the Covid-19 tests was significant. Whether the healthcare workers had tested positive for Covid-19 was also significant with a Chi-square value of 13.052 and a P-value of 0.000. Proximity to a vaccination centre had a chi-square value of 9.387 and a P-Value = 0.025<0.05. Accessibility of the vaccine had a Chi-square off 15.060 and a P-Value of 0.005. Belief of whether the vaccines caused diseases was statistically significant with a Chi-square of 9.031 and a P-Value=0.003<0.05. Finally, the side effects of the vaccine had a Chi-square of 6.455 and a P-Value of 0.011 confirming its statistical significance.

3.4 Socio-Demographic Factors Associated with Covid-19 Vaccine Uptake among Healthcare Workers

The study alsosought to determine the socio-demographic factors that were used to predict the uptake of COVID-19 vaccine. The socio-demographic factors that were used to predict the uptake of COVID-19 vaccine among the healthcare workers were gender, job cadres, hospital area, age, work experience, education level, income and presence or absence of chronic diseaseas shown in table 2.1 below.

Table 2: Multivariate Logistic Model for Socio-Demographic Factors Associated with Covid-19 Vaccine Uptake among Healthcare Workers

Uptake Of Covid-19 Vaccine among Health workers	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Gender						
Male	0.483	0.409	1.115	0.291	0.691	3.436
Job Cadre						
Doctor	0.859	-0.718	0.500	**0.007**	0.24	4.071
Nurse	1.175	-0.562	-8.060	**0.010**	0.536	6.544
Lab-Technologist	0.016	1.198	0.000	0.994	0.095	10.368
Pharmacist	0.023	1.66	1.377	0.241	0.006	3.691
Hospital Area						
ICU	0.614	-1.446	2.480	**0.014**	0.056	17.987
ER	-0.745	1.432	0.026	0.872	0.076	20.822
OT	0.548	1.341	0.488	0.485	0.184	35.373
Isolation Ward	2.825	-0.389	-0.440	**0.007**	0.007	2.981
General Ward	-0.154	1.386	0.159	0.690	0.115	26.259
OPD	-0.122	1.207	0.021	0.224	0.112	12.696
IPD	-1.614	1.403	0.346	0.556	0.028	6.845
Delivery/Labor	-0.007	1.359	0.001	0.975	0.067	13.737
Age						
20-30 years	1.125	1.091	288.212	**0.002**	13004886	9.36
31-40 years	1.006	1.058	304.45	**0.000**	13172174	8.358
41-50 years	0.832	0.000	3.656	0.054	4.634038	426.038
Work Experience						
Two to four years	1.029	1.089	0.422	0.516	0.24	17.167
Five to Seven years	0.926	1.096	0.005	0.944	0.108	7.937
Eight to ten years	0.691	1.335	0.077	0.781	0.05	9.44
Highest Education Level						
High School	1.261	2.331	0.01	0.921	0.013	121.506
Diploma	0.431	1.707	0.244	0.622	0.015	12.219
Bachelor Degree	-0.893	1.583	0.005	**0.043**	0.04	19.867
Master's Degree	-0.685	1.667	0.052	0.82	0.026	17.974
Monthly Income						
Below $100	0.916	0.763	9.042	**0.003**	2.223	44.238

$100 -$200	0.829	0.788	2.903	0.088	0.817	17.936
$200 - $300	1.909	0.598	1.168	0.286	0.591	6.169
$300 - $400	1.447	0.591	0.39	0.532	0.454	4.606

The results indicated that doctors had 0.859 more odds of taking up COVID-19 vaccines among healthcare workers as compared to midwives (P=0.007). Nurses had a 1.175 more odds of taking up the COVID-19 vaccine in comparison to midwives at the hospitals in Mogadishu (P=0.010). Healthcare workers in ICU had 0.614 more odds to take the vaccine compared to those working at the pharmacy (P=0.014) while healthcare workers at the Isolation ward had 2.825 more odds to take the COVID-19 vaccine compared to those at the pharmacy (P=0.007). These findings were in line with Biswas *et al*. (2021) who established that medical doctors typically displayed a lower vaccination reluctance in comparison with other job cadres.

Healthcare workers between the ages of 20 and 30 had 1.125 times more odds to take up the vaccine compared to those aged between 51 to 60 years (P=0.002<0.05). In addition, the workers aged between 31 and 40 years had 1.006 times more odds to take up the vaccine in comparison to their counterparts aged between 51 and 60 years old (P=0.000< 0.05). Finally, healthcare workers with Bachelor degrees had 0.893 less odds to take the vaccine compare to their counterparts with PhDs (P=0.043<0.05) while the healthcare workers earning less than $100 a month had 0.916 more odds to take up the vaccine (P=0.003<0.05).

This backs the findings by Ali and Hossain (2021) as well as El-Elimat *et al. (*2021) who established that younger people were more likely to agree to take vaccines for COVID-19 if provided. However, the results dispute those of Amuzie *et al.* (2021) who established that younger healthcare workers were less likely to take up the COVID-19 vaccine in comparison to their older counterparts. The study also backs those of Samo *et al.* (2022) who found that when contrasted with more youthful, the vaccinations reluctance and refusal was higher in more established individuals age >30 years ($\chi 2 = 7.45$, $p = 0.02$).

3.5 Healthcare System Factors Associated withCOVID-19 Vaccine Uptake among Healthcare Workers

Finally, the study sought to establish the healthcare system factors associated with COVID-19 vaccine among healthcare workers. The healthcare system factors that were used to predict the uptake of COVID-19 vaccine among healthcare workers in Mogadishu Somalia were contact with COVID-19 patients, frequency of testing for COVID-19, whether they had been tested for COVID-19 before, Cost of COVID-19 test, side effects, existence of chronic diseases or whether ay family member had suffered form COVID-19 as illustrated in Table 3.1 below.

Table 3: Multivariate Logistic Model for Healthcare System Factors and Uptake of Covid-19 Vaccine

Uptake of Covid-19 Vaccine among Healthcare Workers	Odds Ratio	Std. Err.	z	P>|z|	[95%Conf.	Interval]
Contact with Covid-19 patients						
Yes	0.948	0.344	0.150	**0.008**	0.465	1.931

Covid-19 Testing at Health Facility						
Yes	1.788	0.626	1.660	0.097	0.901	3.551
Tested for Covid-19						
Yes	1.232	0.464	13.149	0.000	0.075	0.462
Frequency of Covid-19 Testing	0.493	0.247	-1.410	0.159	0.185	1.318
Once	0.577	0.270	-1.180	0.239	0.231	1.442
Weekly	0.786	0.376	0.040	**0.010**	0.467	2.080
After Two Weeks	0.493	0.247	-1.410	0.159	0.185	1.318
Cost of COVID-19 test						
Free	0.363	0.285	-1.290	0.197	0.078	1.693
$10 -$20	0.905	0.537	-0.170	0.866	0.283	2.895
$ 30 - $40	1.573	0.971	0.730	0.046	0.469	5.275
Covid-19 Positive						
Yes	0.752	-0.260	0.820	**0.041**	0.382	1.481
Proximity to Vaccination Centre						
Close-by	0.063	1.33	5.16	0.023	0.004	0.661
Fairly Close	1.402	0.487	10.970	**0.033**	0.709	2.770
Fairly Far	0.943	1.409	2.681	0.102	0.306	1.576
Vaccines Cause Disease						
Yes	0.704	0.283	0.870	**0.038**	0.320	1.547
Vaccine Side Effect						
Yes	0.918	1.011	0.117	0.733	0.195	10.248
Family Positive for Covid-19						
Yes	3.217	0.62	0.001	0.974	0.291	3.302
Chronic Disease						
Yes	1.22	0.803	2.116	0.146	0.666	15.526

The results indicated that that workers who had been in contact with patients with COVID-19 had 0.948 more odds to take the vaccine when compared to those who had not (P=0.008<0.05). In addition, healthcare workers who conducted covid-19 tests weekly had 0.786 more odds to be vaccinated compared to those who did so monthly (P=0.010< 0.05). The HCWs who had tested positive for COVID-19 at some point in the past had 0.752 more odds to be vaccinated against the virus when compared to those who had not (P=0.041 < 0.05). Finally, the healthcare workers in Mogadishu who lived fairly close to vaccination centres had 1.402 more odds to get the vaccine in comparison to their counterparts who lived far away (P=0.033 < 0.05). The findings are in line with the study by Elizondo-Alzola *et al.* (2021) who established that vaccine hesitancy among pediatric medical caretakers was down to the perception of the vaccines and medical side effects affiliated to it. This is also in line with Fakonti *et al.* (2021) who highlighted tales and paranoid fears as a factor causing COVID-19 immunization reluctance.

4.1 Conclusions

Based on the findings, the study concludes that 45.7% of healthcare workers in Mogadishu have not yet taken up the COVID-19 Vaccine for a number of reasons. This is a significant proportion that is a cause for concern given the role that healthcare workers play in the provision of healthcare and the frequency of contact with patients suffering from COVID-19. As regards the socio-demographic factors associated with the uptake of COVID-19 vaccine among thehealthcare workers, the study determined that gender, area of work, age, work experience and income levels were associated with COVID-19 vaccine uptake.Finally, the study found that contact with infected patients, the existence of COVID-19 testing at the healthcare centers, cost of tests and whether or not the healthcare workers had previously tested positive for COVID-19 were associated with the uptake of the COVID-19 vaccine in Mogadishu.The Study recommends that Health promotion is necessary to enhance vaccine uptake among health workers particularly during such pandemics. Policymakers and administrators should establish clear guidelines and a supportive environment to enhance health promotion during pandemics.

7.1 Consent

All authors declare that 'written informed consent was obtained from the participants (or other approved parties) for publication of this article and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal

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