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Original Research Article

Determinants of COVID-19 vaccine uptake among adults in Mwala Sub-county, Machakos County, Kenya

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ABSTRACT

Background: Despite the available evidence on benefits of COVID-19 vaccine, its low uptake and hesitancy remain a challenge. This study assessed individual, administrative, social, and demographic factors associated with COVID-19 vaccine uptake.
Methods: Analytical cross-sectional study design was used. The data was collected using structured questionnaires administered to 384 respondents and key informant interview guides that engaged six informants.
Results: Uptake of the first dose was 46.60% while fully vaccinated respondents were 11.70% of the total. There were significant associations between COVID-19 vaccine uptake and demographic predictors of age (χ^2=15.524, df=3, p=0.001), sex (χ^2=5.250, df=1, p=0.022), education level (χ^2=107.556, df=3, p<0.001), and marital status (χ^2=35.328, df=3, p<0.001). Some social factors such as dependence on unreliable sources of information (χ^2=32.904, df=3, p<0.001) and collective responsibility of getting vaccinated to protect others (χ^2=292.931, df=3, p<0.001) also exhibited significant associations. However, religious teachings did not influence vaccine uptake (df=1, R^2=0.099, p=0.997). Individual factors of susceptibility perception (p<0.001, R^2=0.525, df=1), severity perception (χ^2=234.515, df=3, p<0.001), safety concerns (χ^2=277.624, df=3, p<0.001), and perception that the vaccine benefits did not outdo side effects (χ^2=277.624, df=3, p<0.001) determined vaccine uptake. Administrative factors of vaccine stock-outs (R^2=0.091, df=1, p=0.997) and long queues (R^2=0.061, df=1, p=0.997) had no influence on vaccine uptake.
Conclusions: With the findings indicating poor vaccine uptake, the government should incorporate COVID-19 vaccination into the existing routine vaccination schedule and address conspiracy theories revolving around the vaccine in various social media sites during health education and awareness vaccination campaigns.

Keywords: COVID-19, Vaccine hesitancy, Vaccine uptake

INTRODUCTION

Different control and prevention community strategies against COVID-19 have been in place since its emergence in 2019 and have had a notable impact on reducing the disease burden and associated deaths. However, to completely eliminate and eradicate the disease, mass vaccination against the latter is necessary. With evidence bringing out the effectiveness of COVID-19 vaccines in lowering the disease attack rate, full acceptance of the vaccines is deemed necessary in combating the pandemic.[1] However, hesitancy and poor uptake of the vaccines has been recorded in many developing countries among them Kenya.

Earlier studies conducted in different parts of the world have associated some social, demographic, individual and

administrative factors with the poor COVID-19 vaccine uptake. Among the demographic factors is education levels, age, sex, and marital status. Higher education levels, older age, being male, and being married have been associated with higher COVID-19 vaccine uptake.[2,3] Further, social determinants of collective responsibility entailing getting vaccinated to protect others and social media misinformation attributing to missed vaccination opportunities have also affected vaccine uptake.[4,5] Individual factors such as confidence in vaccine's safety, effectiveness, and manufacturers, risk perception (severity and susceptibility), vaccine's perceived benefits, and safety concerns have also been noted to be among the factors influencing acceptance of the COVID-19 vaccines. On the other hand, administrative constraints of vaccine unavailability and long queues occasioned by few vaccination centres have been reported as factors contributing to poor vaccine uptake.

This study therefore aimed at highlighting the individual, social, demographic, and administrative factors influencing COVID-19 vaccine uptake among adults in Mwala Sub-county, Kenya.

METHODS

Research design

Analytical cross-sectional study design was used in this study. This study design was preferred since it allowed data collection at once in time and the establishment of the statistical relationship between the conceptualized study variables.

Eligibility criteria

The study engaged participants that were adult residents of Mwala sub-county and gave out their consent to respond to questions pertaining study. The study left out individuals below the age of 18 years. Additionally, all individuals that failed to consent to take part in the study were also not engaged.

Target population

This research targeted individuals above the age of 18 years residing within Mwala Sub-county. This population group was of interest to this study because it is the key target of the COVID-19 vaccination campaign.

Sampling technique and procedure

For this study, Machakos County was purposively sampled due to its low vaccination rates against COVID-19. Mwala sub-county was also purposively sampled since it is among the highly populous sub-counties in Machakos. The sample was drawn from the six wards within the sub-county whereby, selection was done from people visiting the healthcare facilities administering COVID-19 vaccines within the area. Systematic random sampling was conducted to settle on the questionnaire respondents among the people visiting Mwala level 4 hospital, Wamunyu, Masii, Katulani, Muthetheni, and Mbiuni health centres. Additionally, health administrators from the six vaccination centers were engaged in the key informant interviews.

Data collection

The study used structured questionnaires in gathering quantitative data as given by the respondents. Additionally, key informant interview guides helped in collection of qualitative data from health administrators in the six COVID-19 vaccination centres in Mwala Sub-county. These facilities include Mwala level 4 hospital, Masii, Wamunyu, Katulani, Mbiuni, and Muthetheni health centres. The data was collected from June 2022 to September 2022.

Data analysis

The data was analysed using SPSS software version 26. Frequencies and percentages were used to describe the socio-demographic findings of the study. Further, Chi-square test of association and binomial logistic regression analysis were done at significance level p=0.05 to identify the factors that influence COVID-19 vaccine uptake.

RESULTS

COVID-19 vaccination status of the respondents

Out of the 384 questionnaire respondents, only 179 participants (46.60%) had started the vaccination program. The remaining 205 respondents (53.40%) had not enrolled for a COVID-19 vaccination schedule as indicated in Table 1 below.

Table 1: Participants who had started off the vaccination schedule.

		Frequency	Valid percent
Valid	Yes	179	46.6
	No	205	53.4
	Total	384	100.0

When asked about any set targets on the vaccination exercise, one of the key informants said, "We are working towards having at least 70% of the eligible population getting fully vaccinated in order to help achieve the set national target". Another one responded, "With some ministries directing all their employees to get vaccinated, it's our concern to ensure that such targeted population gets the necessary service". From the collected data, it was established that not all respondents who had sought vaccination services were fully vaccinated. Only 45 respondents (11.70%) were fully vaccinated while 339 (88.30%) participants had not been fully vaccinated as

shown in Table 2 below. This pointed out a quite low vaccine uptake among the respondents.

Table 2: Respondents who were fully vaccinated.

		Frequency	Valid percent
Valid	Yes	45	11.70
	No	339	88.30
	Total	384	100.0

Further, the willingness to get vaccinated was quite low with only 6.30% (24) respondents intending to get vaccinated, 46.60% (179) already vaccinated, and 47.14% (181) having no intentions to get vaccinated as pointed out in Figure 1 below.

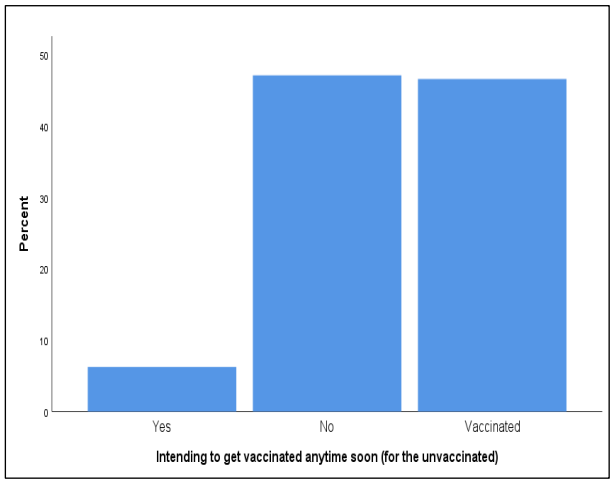

Figure 1: Individuals intending to get vaccinated.

Statistical relationship between demographic characteristics of the respondents and COVID-19 vaccine uptake

Out of the 231 male respondents, only 20 were fully vaccinated. On the other hand, only 25 female respondents were fully vaccinated. The Chi-square findings pointed out a significant association between gender and COVID-19 vaccine uptake ($\chi^{2=}5.250$, df=1, p=0.022).

On vaccine uptake by age, only 13 respondents aged between 18 and 34 years were fully vaccinated. Additionally, 22 respondents aged between 35 and 50 years were fully vaccinated while the 51-65 age group had only eight respondents attaining full vaccination against COVID-19. Only two respondents aged above 65 years were fully vaccinated. Further, a statistically significant association between age of the participants and COVID-19 vaccine uptake was established (χ^2=15.524, df=3, p=0.001).

Majority of the respondents who were fully vaccinated were educated up to the tertiary level of education (42). From the category of the study participants who were educated up to the secondary level, only one participant was fully vaccinated. On the other hand, two participants who had completed the primary level of education were fully vaccinated. No respondent was fully vaccinated among those who had not completed any level of education Upon carrying out cross-tabulations, a significant association between the education level of study participants and COVID-19 vaccine uptake was realized (χ^2=107.556, df=3, p<0.001).

Table 3: Statistical association between demographic characteristics and vaccine uptake.

Variable		Fully vaccinated		Total	Chi-square value	P value
		Yes	No			
Gender	Male	20	211	231	5.250	0.022
	Female	25	128	153		
Age (years)	18-34	13	158	171	15.524	0.001
	35-50	22	88	110		
	51-65	8	37	45		
	Above 65	2	56	58		
Education level	No school completed	0	100	100	107.556	<0.001
	Primary	2	67	69		
	Secondary	1	106	107		
	Tertiary	42	66	108		
Marital status	Single	3	136	139	35.328	<0.001
	Married	41	150	191		
	Divorced	1	15	16		
	Separated	0	38	38		

Upon comparing marital status of the respondents with their vaccination status, it was found out that only three single people were fully vaccinated. Married respondents comprised the majority of the fully vaccinated with a record of 41 participants. On the other hand, only one respondent from the category of the divorced was fully vaccinated while none of the separated individuals had taken full vaccination status against COVID-19 yet. Additionally, cross-tabulations were done whereby, a significant association was ascertained between marital

status of the study partakers and their COVID-19 vaccination status (χ^2=35.328, df=3, p<0.001) (Table 3).

Statistical relationship between social factors of the respondents and COVID-19 vaccine uptake

Regarding religion, 81.25% (312) of the respondents had their religious teachings supporting the COVID-19 vaccination exercise while the other 18.75% (72) had theirs opposing COVID-19 vaccination. Further, binomial logistic regression analysis found no statistically significant relationship between religious teachings and COVID-19 vaccine uptake (df=1, R^2=0.099, p=0.997).

On source of information about COVID-19 and its vaccine, 30 participants who relied on mainstream broadcast, three on mainstream print, and 12 on verified websites were fully vaccinated. On the other hand, none of the participants who cited social media sites as their most important sources of evidence were fully vaccinated. A statistically significant association between source of information pertaining COVID-19 vaccination and vaccine uptake was noted (χ^2=32.904, df=3, p<0.001).

A greater percentage of the study participants disagreed with the concept of collective responsibility of getting vaccinated to protect those close against COVID-19 infection (mean=2.8594, standard deviation=1.07476; strongly agree=1, agree=2, disagree=3, strongly disagree=4). In this regard, 159 (41.40%) strongly disagreed while 51 (13.28%) disagreed with this statement. On the other hand, 135 (35.16%) respondents agreed and 39 (10.16%) strongly agreed with this fact. A significant association was noted between respondents' views on intention to get vaccinated in the bid to protect others against COVID-19 and vaccine uptake (χ^2=292.931, df=3, p<0.001).

Statistical relationship between individual factors of the respondents and COVID-19 vaccine uptake

Among the 384 respondents, only 36 (9.38%) perceived themselves as highly susceptible to COVID-19 infection. A binomial logistic regression indicated a statistically significant relationship between susceptibility perception and vaccine uptake (p<0.001, R^2=0.525, df=1). Regarding severity posed by COVID-19 infection, majority of the respondents disagreed to getting vaccinated in the bid to prevent the disease from being severe on them in the event they got ill (mean=2.8906, standard deviation=1.05638; strongly agree=1, agree=2, disagree=3, strongly disagree=4). A significant association between COVID-19 severity perception and respondents' vaccine uptake was noted (χ^2=234.515, df=3, p<0.001).

A greater proportion of the study participants disagreed with the argument that COVID -19 vaccine is safe and lacks major side effects (mean=2.9635, standard deviation=1.06142; strongly agree=1, agree=2, disagree=3, strongly disagree=4). Only 39 (10.20%) strongly agreed and 106 (27.60%) agreed to this statement. On the other hand, 69 (18.00%) participants disagreed and 170 (44.30%) strongly disagreed with this statement. On the contrary, the key interview informants agreed unanimously that the vaccine is safe and despite the mild short term side effects. One of the key informants said, "the healthcare workers may all agree on safety of the vaccine due to their health literacy levels but the public majority may hold a different opinion on the same due to propaganda and the many conspiracy theories revolving around the vaccine". The key informants added that conspiracy theories emanating from social media propaganda about the vaccine were a key barrier to uptake of the latter especially among the younger generation. They further noted that they have been occasionally conducting awareness campaigns to heighten the public's understanding of vaccine safety and benefits. Statistically significant association was further noted between perception towards COVID-19 vaccine safety and vaccine uptake of the respondents (χ^2=277.624, df=3, p<0.001).

A better portion of the study participants disagreed with the argument that benefits of COVID-19 vaccine outdo the associated aftereffects (mean=2.9635, standard deviation=1.06142; strongly agree=1, agree=2, disagree=3, strongly disagree=4). Strong agreement with this statement was however noted among 39 (10.20%) respondents. 106 (27.60%) participants agreed while 69 (18.00%) disagreed with this fact. On the other end, 170 (44.30%) study participants strongly disagreed with the fact that benefits of the vaccine outdid the side effects. On the other hand, the key informants argued out that the vaccine was effective and its benefits outdid and were incomparable with the few mild side effects. A statistically significant association was further noted between perception towards benefits of the vaccine outdoing the associated aftereffects and COVID-19 vaccine uptake (χ^2=277.624, df=3, p<0.001).

Statistical relationship between administrative factors of the respondents and COVID-19 vaccine uptake

A larger proportion of the respondents was able to access COVID-19 vaccines in the nearby and accessible healthcare facilities. This entailed 317 (82.55%) respondents. On the other hand, only 67 (17.45%) participants were affected by vaccine stock-outs in the accessible healthcare facilities. This was further backed up by the key interview informants who universally agreed that vaccine stock-outs was no longer a barrier to the people seeking vaccination services. A binomial logistic regression analysis indicated no statistically significant relationship between vaccine stock-outs and vaccine uptake (R^2=0.091, df=1, p=0.997).

Table 4: Statistical relationship between administrative factors of the respondents and COVID-19 vaccine uptake.

Variable		Fully vaccinated		Total	P value
		Yes	No		
Search for vaccine affected by stock-outs in the accessible health centres	Yes	0	67	67	0.997
	No	45	272	317	
Encountered long queues in vaccination centres	Yes	0	46	46	0.997
	No	45	293	338	

Majority of the respondents were not affected by long queues in the vaccination centers. This accounted for 88.02% (338) of the study participants. On the contrary, 46 (11.98%) reported long queues as a barrier to their vaccination. The key informants further agreed that with the increased supply of vaccines, there were no long queues encountered in the vaccination centers. A binomial logistic regression model conducted did not find any statistical relationship between long queues in the vaccination centres and COVID-19 vaccine uptake (R^2=0.061, df=1, p=0.997).

DISCUSSION

Generally, COVID-19 vaccine uptake was found to be quite low (11.70%). The present study found out that an individual's gender could influence their COVID-19 vaccine uptake with female respondents reporting higher coverage as compared to their male counterparts. Similarly, a study engaging US adults reported higher COVID-19 vaccine uptake in women.[6] This can be explained by the recorded poor health-seeking behaviors among men as compared to women.[7] Age was also found to influence COVID-19 vaccine uptake whereby older individuals recorded a higher uptake than their young counterparts. Saudi Arabian residents have also reported higher uptake among older individuals in a similar study.[8] The study also associates higher education levels with higher vaccine uptake. Higher education levels are often associated with better health awareness hence higher vaccine uptake.[2] Marital status was also found to influence COVID-19 vaccine uptake with married individuals having a higher uptake. These findings agree with a study conducted in China which recorded a higher COVID-19 vaccine uptake among married individuals.[9]

Regarding social factors, the study found no significant relationship between religious teachings and vaccine uptake. However, these findings differ with those from a similar study which established an association between religion and COVID-19 vaccine uptake in Hongkong.[10] This disparity could possibly be due to other factors affecting acceptance of the vaccines in this study. This is because despite the participants in this study having their religious beliefs advocating for uptake of the vaccination services, majority were still not fully vaccinated. Source of information about COVID-19 and its vaccine had a significant influence on vaccine uptake whereby none of the individuals who were relying on social media as their key source were fully vaccinated. This is due to conspiracy theories spread through social media sites regarding the vaccines thus misinforming the people.[5] Previous studies highlight the negative impact of misinformation on vaccine uptake.[11,12] The relationship between collective responsibility and vaccine uptake was also significant. Collective responsibility entails getting vaccinated to gain immunity and protect those close from getting infected.[13,4]

Among the individual factors was risk perception (susceptibility and severity) which also indicated a significant relationship with COVID-19 vaccine uptake. Individuals who perceive themselves as more susceptible or likely to suffer higher severity from COVID-19 infection have a greater likelihood of getting vaccinated.[2,15,16] Vaccine uptake was also found to be significantly influenced by safety concerns whereby individuals who posed fears about safety of the vaccines were not willing to get vaccinated. Evidence from previous studies points out safety concerns as a critical drawback to COVID-19 vaccination.[17,18] A significant association was noted between the perception that COVID-19 vaccine benefits outdo associated after-effects and vaccine uptake. A similar relationship has been published by previous studies emphasizing on the importance of understanding vaccine benefits on full vaccine acceptance.[19,20]

In this study, administrative factors had no influence on vaccine uptake. This is because the issue of availability has been solved through government's efforts to acquire vaccines and avail them to the eligible populations. Further, the issue of long queues in the vaccination centres has been solved through equitable distribution of the doses and organised community vaccination outreaches in public places. A study conducted in Ghana however records different findings by citing long queues and waiting areas in vaccination centres as a barrier to vaccination.[21] This difference can be explained by the fact that the study was conducted in a totally different context in terms of time (early into the vaccination exercise) and country with different health policies and goals.

CONCLUSION

This study concludes that COVID-19 vaccine uptake among adults in Mwala Sub-county is low. Demographic factors of age, gender, marital status, and education level had significance influence on vaccine uptake. Some social factors such as collective responsibility and source of information about COVID-19 and its vaccine also

influenced vaccine uptake. Religious teachings on the other hand did not affect vaccine acceptance. Individual factors of safety concerns, risk perception, perceived benefits, and confidence in vaccine's safety, effectiveness and manufacturers also influenced vaccine uptake. Administrative barriers of vaccine stock-outs and long queues in vaccination centres on the other hand had no influence on vaccine uptake.

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