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Covid-19 Vaccination Hesitancy: Post-Covid-19 Lessons from Bulawayo, Zimbabwe

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Abstract: The unexpected onset of COVID-19 baffled mankind. Frantic efforts to stop the spread of the disease were employed, but to no avail. Short-term measures like steaming were proposed, but these were not fruitful, and the disease continued to spread globally. In December 2021, the Food and Drug Administration (FDA) approved the first medication. Drugs started to reach developing countries like Zimbabwe, but people had no clear information on these drugs. Delays in vaccine uptake have led to continued mortality associated with COVID-19. Hesitancy to vaccination implies that similar future outbreaks of infectious diseases will be hard to control if perceptions in people's minds are not cleared. The study applied survival analysis to establish the length of time an individual takes to finally and willingly decide to get vaccinated. This was due to many factors, including trust in the vaccine's origin and efficacy, side effects and many other perceptions. The research found that gender ($p < 0.05$), employment ($p< 0.05$), allergy ($p < 0.05$) and comorbidity ($p < 0.05$) were influential in deciding whether to get vaccinated or not. It is recommended that information on deadly diseases be available on reliable sources to circumvent misinformation and enhance the acceptability of vaccines in similar future outbreaks.

Keywords: Vaccine hesitancy, COVID-19 perceptions, information source

Introduction and Background

COVID-19 was first reported in China, Wuhan, in December 2019 (Alsoufi et al, 2020). The virus causes Severe Acute Respiratory Syndrome (SARS-CoV-2). At an advanced stage, the virus affects a patient's respiratory system. The most affected organs of the respiratory system are the lungs. The virus has many strains; the most common are the omicron and delta variants. These spread easily and caused a lot of deaths among the human population as compared to other variants.

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The World Health Organisation (WHO) declared COVID-19 a world health disaster on the 30th of January 2020. In March 2020, the alert level increased when the WHO declared COVID-19 a pandemic (Alsoufi et al, 2020; Mutambisi et al, 2021; Vurayai, 2021). According to Ogunode (2020), a million cases had been reported by April 2020, while 60,000 people had died of the disease in that same time period. This shows how devastating the disease was. In a short time period, millions of people had already been affected, and a hundred thousand had already succumbed to the disease.

The Zimbabwean government had to introduce strategies to reduce the spread of the disease. Some of the notable strategies included social distancing, continuous washing of hands using running water, sanitising whenever necessary and avoiding handshakes, especially at funerals. Curfews were introduced to try to reduce the spread of the disease. As Mbunge et al (2020) state, in Eswatini, curfews and other strategies were not that effective in reducing the spread of the disease. The only remedy was to come up with a drug that would cure the disease. These lockdowns were more pronounced in winter when the virus was seemingly likely to spread and survive longer than in warmer seasons.

At the onset of the disease, there were no vaccines; this made the disease spread easily, and the death toll as a result of the disease increased. This then forced researchers to establish vaccines for this disease. Initially, people used to rely on steaming whenever they suspected they might have acquired the disease. Even though effective as Suter et al (2021) found, steaming could not stop the spread of the disease and reduce the death rate. Later, vaccines and antiviral medication were developed through research. This is an ongoing process, and the hope is that better medication will be discovered that would reduce the spread of the disease or lessen the pain and mortality due to the disease.

When medication was available, people had mixed feelings about these medications due to information found on different platforms. Due to a lack of knowledge about the disease, no organisation or government could educate people on how the spread of the disease could be minimised. It was basically a trial-and-error method in reducing the spread of the disease. People got information about the disease from different sources, both reliable and unreliable. Radio, television, word of mouth from a friend, relative or any other person and social media were some of the sources.

The source of information differed, and some carried lies that once vaccinated, the vaccine recipient will never have children. There were many negative perceptions about the vaccine, to the extent of not even trusting the vaccine's producer. This resulted in vaccine hesitancy, and people were unwilling to get vaccinated. It took a long time for the vaccine to be accepted, and slowly, the vaccine was being accepted

by a few individuals. Even today, some people do not want to get vaccinated against COVID-19. In this research, vaccine hesitancy is defined as a delay or refusal in getting vaccinated despite the availability of the drug and vaccination services (The Lancet Editorial, 2019, p. 281).

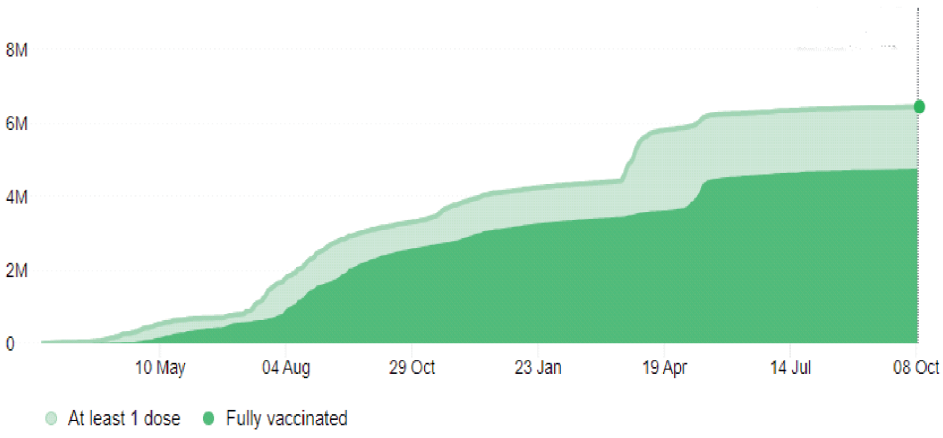

Figure 1: Vaccination statistics as of the 8th of October 2022

As of October 2022, Figure 1 shows that approximately 4 million people had been fully vaccinated. This hesitancy in getting vaccinated could be due to a plethora of factors. Even though there are platforms such as WhatsApp, Twitter, Facebook, Instagram, and others that people are highly knowledgeable about, these platforms are not efficiently used to benefit people.

Zimbabwe received its first consignment of COVID-19 vaccines in February 2021 and had its rollout in the same month (Musuka *et al,* 2021). The Zimbabwean government received 200,000 doses of the COVID-19 vaccine from the Chinese government and later bought 600,000 doses of the vaccine. Zimbabwe also acquired 75,000 doses of the COVID-19 vaccine from the Indian government. Even though these donations have been received and rolled out, approximately 2.5 years into the vaccination process, the herd immunity of 10 million or halfway through the 16 million population of Zimbabwe, had not yet been achieved.

Problem Statement and Rationale

The goal of Zimbabwe was to achieve herd immunity by vaccinating 10 million people to reduce the spread of the coronavirus. Even though the country had tried to educate

people on the efficacy of the vaccine, misinformation on social media had set back the efforts made by the government and other health-providing institutions to spread correct information on the benefits of being vaccinated.

Due to the existence of different sources of information in Zimbabwe, the authenticity of some of the information is highly questionable. Information could be received through radio, television, mobile phones, and messages or pictures on WhatsApp, Twitter, Facebook, and many other platforms. These platforms are not regulated in such a way that only authentic information is found. This increased hesitancy to vaccination and remained a nightmare for the Zimbabwean government to achieve herd immunity. With immunisation, the spread of the disease and mortality of infected patients could be reduced, and there are many other advantages. This could be achieved if only people were reliably informed about the vaccine's efficacy and the merits of attaining herd immunity.

Motivation

COVID-19 is not the first unexpected infectious disease to cause havoc among humankind. In the past, diseases like bubonic plague, leprosy, bird influenza, and smallpox were experienced and eradicated through vaccination. Infectious diseases will continue to evolve, and hence adherence to vaccination needs to be nurtured in humans to avoid a large number of people dying from such outbreaks. These outbreaks will continue to happen, and governments' and other health-providing institutions' preparedness must be encouraged. If the culture of vaccination hesitancy continues, it will be difficult to control such pandemics in the future.

Methodology

Data collection: Data collection was done in two phases. The primary data was collected from respondents who were coming for vaccination during the research period. A questionnaire was used to collect this information. In the second phase, retrospective data on people who were vaccinated before the research was collected using a data collection sheet that the researcher designed.

Primary data was collected using a mini-questionnaire that was designed to capture people's perceptions about COVID-19 vaccines. A semi-structured interview was conducted for approximately a period of one month, from the 30th of September 2022 to the 30th of October 2022. People coming for vaccination during that period were interviewed. These could be people suspected of suffering from Covid-19 or

people willingly coming for vaccination after deciding that they should take the vaccine. Information on their perceptions about the vaccine and reasons for taking a long time to accept the vaccine was finally collected. This was followed by further probing, depending on the respondent's response. A total of 251 respondents were interviewed, and their perceptions were captured.

Secondary data were collected from patients' records for patients vaccinated before the study's onset. A data collection sheet was designed to collect information about people who were coming for vaccination at Mpilo Central Hospital. Information on date of vaccination, age, gender, occupation, comorbidities, allergies and history of Covid-19 was collected. Information from 1020 people was collected from the hospital records, and a Cox regression model was used to analyse the data.

The Cox regression model:

$$h_i(t) = h_0(t)\, e^{(\beta 0 + \beta 1 x 1 + \beta 2 x 2 + \ldots + + \beta n x n)}$$

where $h_i(t)$ is the expected hazard of the i^{th} individual at time t,

$x_1, x_2, \ldots, x_n$ are explanatory variables, and $h_0(t)$ is the baseline hazard function that denotes the hazard of the i^{th} individual when all of the explanatory variables $x_1, x_2, \ldots, x_n$ are equal to zero.

Results

Descriptive Statistics: There were 251 respondents interviewed. Of the 251 respondents, 130 were females and 121 were males. The source of information was also studied. The research found that most of the participants' sources of information about COVID-19 were on social media, including WhatsApp, Facebook, and other platforms. It is common knowledge that not all information on social media is reliable. Misinformation on social media is highly rampant, and this misleads people to the extent of rejecting useful drugs that can reduce the spread of COVID-19 once herd immunity is attained. The other primary source of information was health centre notices. These were followed by radio, television, friends and relatives and finally newspapers. Figure 1 summarises this information.

Respondents indicated that they did not even trust the manufacturers of the vaccine. They also did not believe in the efficacy of the vaccines. This has implications for the acceptability of future vaccines for any outbreak that might arise. Respondents might reject vaccines due to beliefs that once existed, like during the COVID-19 era. Worrisome areas included the belief of dying after 2 years, sterility once you get vaccinated, especially for the younger population and underlying conditions acted as a

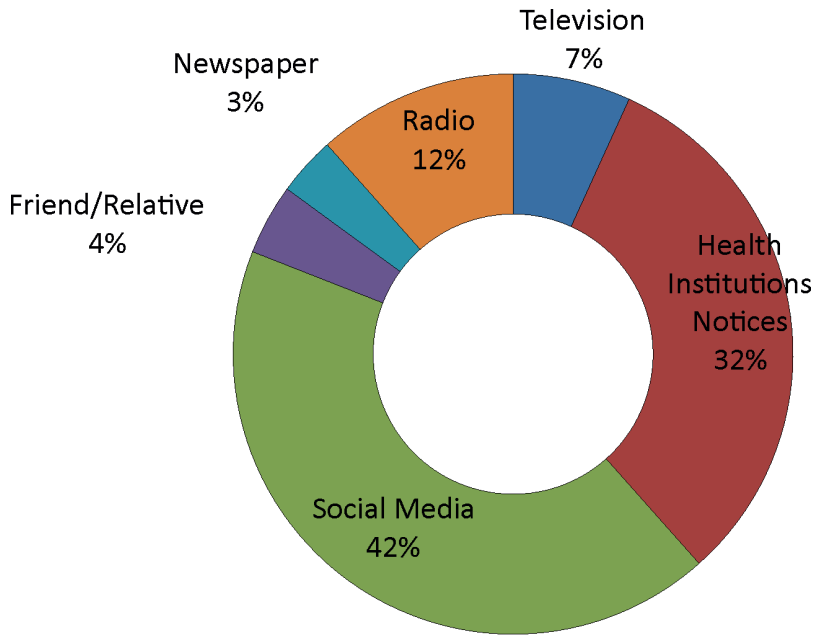

Figure 2: Sources of information frequently used for COVID-19

hindrance to the acceptance of the vaccine. Of note are the participants who prefer to wait and see if the vaccinated people will die after 2 years of vaccination or be sterile after vaccination, and make a decision thereafter. This has implications for attaining herd immunity. A summary of this information is provided in Figure 2 below.

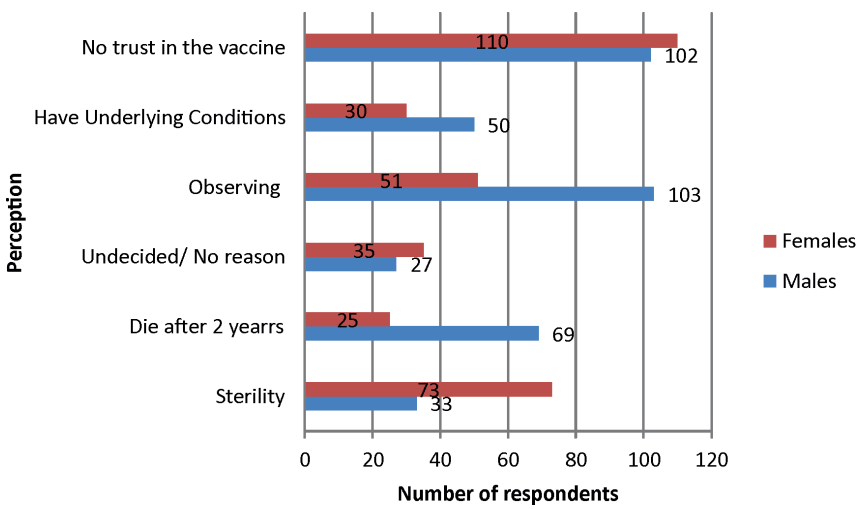

Figure 3: Perceptions harboured by respondents

One female respondent commented, *"Kuthiwa uyabungasazali ungahlatshwa – Rumour has it that you become barren once vaccinated"*. This shows that people tend to believe in everything they hear if they don't have clear information about a disease outbreak. Social media used to spread fake news about getting infertile once vaccinated. The platform also carried fake news that all those who got vaccinated will die after 2 years. This prompted other people to observe whether the vaccinated were genuinely going to die after 2 years or be sterile. This was all due to a lack of adequate information about the disease. Awareness campaigns for such outbreaks are vital so people can cooperate; otherwise, target goals like the herd count of 10 million will not be achieved within a stipulated time frame.

Indecision to get Vaccinated: A sample of 1020 participants was taken at Mpilo Central Hospital in Bulawayo. A data collection sheet was designed to collect the characteristics of people coming for the COVID-19 vaccination. At Mpilo Central Hospital, there was a central point where people coming for the COVID-19 vaccination were attended to. Due to time constraints, information collected on the sheet was limited to gender, employment, place of residence, Covid-19 history, allergies and comorbidities the participants could possibly have.

The history of COVID-19 refers to whether participants have suffered from COVID-19 or not. People usually tend to accept vaccination when they are sick rather than when they are healthy. The research, therefore, intended to find out whether a history of suffering from Covid-19 before was essential in promoting acceptance of the vaccine among the Bulawayo population. Table 1 summarises the composition of the characteristics of the sample involved in the study.

Notable points are that the number of females and males was almost the same, there were more employed people than unemployed participants, the majority of the participants were from high-density areas, very few participants had suffered Covid-19 before vaccination, the majority had no allergies, and very few had underlying conditions like hypertension and diabetes before vaccination.

Table 1: Demographic and clinical characteristics of the study participants

Participant characteristic		*Number (N)*	*Percentage (%)*
Gender	Female	472	46.3
	Male	548	53.7
Employment	Employed	737	72.3
	Unemployed	283	27.7
Residential Area	High density	790	77.5
	Low density	230	22.5

Participant characteristic		*Number (N)*	*Percentage (%)*
Covid-19 History	Yes	3	0.3
	No	1017	99.7
Allergies	Yes	156	15.3
	No	864	84.7
Comorbidity	Yes	38	3.7
	No	982	96.3
Total		1020	100

Time to vaccination was attested to be dependent on gender, employment, allergy and comorbidity. Figure 1 shows the Kaplan-Meier plots of the survival functions of gender, employment, allergy and comorbidity related to time to vaccination. The results show that the time to vaccination between males and females is statistically different. Generally, males take longer to receive vaccination compared to females, *p-value = 0.02 < 0.05*. Males took 194 days and females 192 days to complete vaccination. The difference is statistically significant with a *p-value < 0.05.*

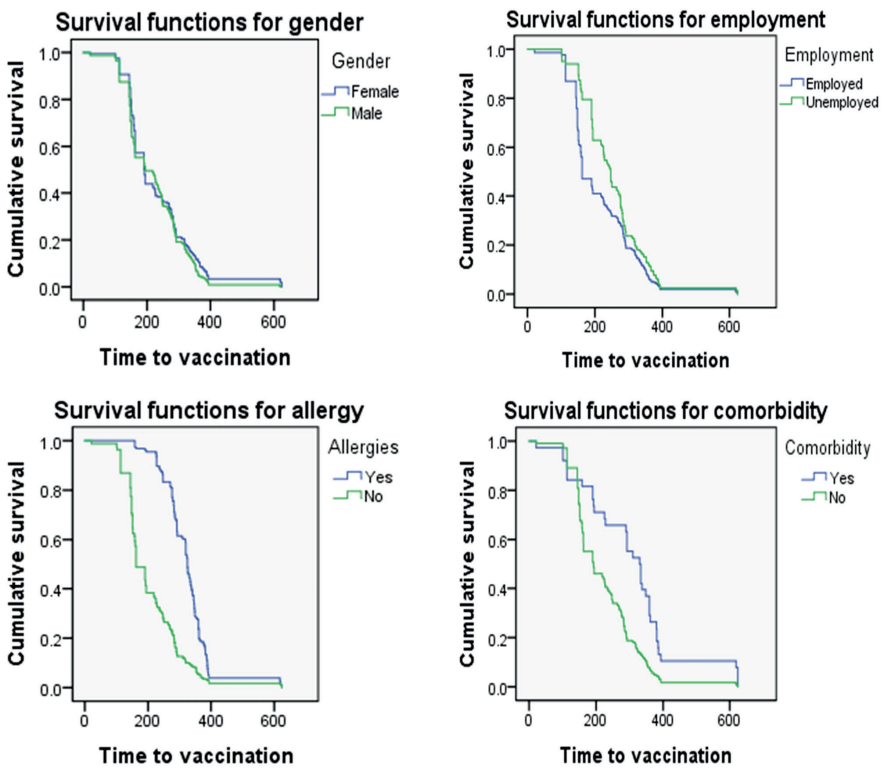

Figure 4: Survival functions for gender, employment, allergy and comorbidity

The research established that employment significantly influenced time to vaccination (*p-value = 0.001*). Employed people took a shorter time to accept vaccination than unemployed people. The respective times to vaccination were 162 days with a standard deviation of 4.72 and 247 days with a standard deviation of 5.51 days for employed and unemployed participants. The overall time to vaccination was 192 days.

The time to vaccination was also influenced by whether the participant had allergies or not. Those who had allergies took more time to get vaccinated compared to those who had no allergies. People with allergies took 324 days with a standard deviation of 3.41 days, while those without allergies took 162 days with a standard deviation of 3.83 days. These were statistically different with a *p-value* of *0.001*.

Comorbidity influenced time to vaccination. People with underlying conditions like hypertension, cancer or diabetes, to mention a few, took a longer time to receive vaccination. People with underlying conditions took 330 days with a standard deviation of 25.27 days, while those without underlying conditions took 192 days with a standard deviation of 8.60 days. These were statistically different with a *p-value* of *0.001*.

The median number of days taken by people who resided in low and high density areas was 194 and 192 days, respectively. The respective number of days for those who either once suffered or never suffered from Covid-19 was 325 days with a standard deviation of 0.82 days and 192 days with a standard deviation of 8.39 days. Overall, the median number of days to vaccination for place of residence and history of COVID-19 was 192 days.

The research established that people staying in low and high-density areas took the same time to get vaccinated. Their time to vaccination was statistically not different, *p-value* > *0.05*. This implies that the place of residence did not affect the time taken by an individual to get vaccinated. Similarly, the number of days to vaccination by people who once suffered from COVID-19 and those who had not yet suffered from COVID-19 were statistically not different, $p > 0.05$.

A Cox regression model was used to assess influential factors in determining the length of time people take to get vaccinated. It was found that age, gender, employment, allergies and comorbidity were influential in deciding whether an individual should get vaccinated or not. On the other hand, the residential area and history of COVID-19 were not influential in accepting or not accepting the vaccines. Table 2 summarises influential and non-influential variables in accepting Covid-19 vaccines.

Table 2: Cox regression model

	B	*SE*	*Wald*	*df*	*Sig.*	*Exp(B)*	*95.0% CI for Exp(B)*	
							Lower	*Upper*
Age	.009	.002	19.649	1	.000	1.010	1.005	1.014
Gender	-.129	.064	4.075	1	.044	.879	.775	.996
Employment	.258	.071	13.373	1	.000	1.295	1.127	1.487
Residential area	-.030	.076	.159	1	.690	.970	.836	1.126
History of the COVID-19 disease	-.100	.586	.029	1	.865	.905	.287	2.853
Allergies	-.823	.091	82.631	1	.000	.439	.368	.524
Comorbidity	-.474	.169	7.860	1	.005	.623	.447	.867

Before the interpretation of the research findings, according to Table 2, there is a need to test whether the developed model best explains the data. Table 3 shows that the model best explains the data with a *p-value* < *0.05*.

Table 3: Testing the significance of the model [a]

-2 Log Likelihood	Overall (score)			Change From Previous Step			Change From Previous Block		
	Chi-square	df	Sig.	Chi-square	df	Sig.	Chi-square	df	Sig.
12008.772	146.361	7	.000	162.942	7	.000	162.942	7	.000
a. Beginning Block Number 1. Method = Enter									

The proportionality assumption was also tested so that we do not erroneously interpret the findings from the Cox model when the assumptions are not satisfied. Table 4 shows that the proportionality assumption is satisfied and was not violated.

Table 4: Testing the proportional hazard assumption[a]

-2 Log Likelihood	*Overall (score)*			*Change From Previous Step*			*Change From Previous Block*		
	Chi-square	*df*	*Sig.*	*Chi-square*	*df*	*Sig.*	*Chi-square*	*df*	*Sig.*
12005.050	150.996	9	.000	3.722	2	.155	3.722	2	.155
a. Beginning Block Number 2. Method = Enter									

It has been concluded that the model is significant and the proportionality assumption is satisfied. The findings show that age was highly influential in determining the length of time one takes to decide whether to get vaccinated or not. The research found that older people have less time to decide whether to get vaccinated or not,

compared to younger people. Younger people took a longer time period to decide to accept the vaccine. Younger people were more sceptical about the Covid-19 vaccine *(HR = 1.01, p-value=0.001, 95% CI=1.005-1.014*).

On a similar note, gender was vital in determining the length of time it takes to decide whether to get vaccinated. The findings show that females have about 0.879 (or 12% less) hazard as compared to their male counterparts. This indicates that males took longer to decide to get the Covid-19 vaccine (*HR=0.88, p-value = 0.044, 95% CI = 0775-0.996*) compared to females.

The research established that employment is significant in determining the length of time one takes to decide to get vaccinated. It can be concluded that employed people are 30% faster at making a decision to get vaccinated than unemployed people. The hazard of making a decision to get vaccinated when employed is 1.30 faster than when an individual is not employed (HR=1.30, p-value = 0.001, 95% CI= 1.13-1.49).

The findings of the research show that people with allergies took more time deciding to have the Covid-19 vaccine (*HR=0.44, p-value = 0.001, 95% CI= 0.37-0.52*). On the other hand, people without allergies had a shorter time deciding to have the vaccine. Another variable of interest was comorbidity (underlying conditions). There are people with other underlying conditions like hypertension, diabetes and heart diseases. The research established that people with underlying conditions took longer to decide to get the vaccine than those without underlying conditions (*HR=0.62, p-value = 0.005, 95% CI= 0.45-0.87*).

Not all variables under study were found to influence the length of time a person takes before deciding to get the COVID-19 vaccine. Irrespective of being insignificant, it was found that people staying in high-density areas took a longer time period to decide on getting the Covid-19 vaccine as compared to people staying in low-density areas (*HR=0.97, p-value=0.690, 95% CI = 0.84-1.13*). Similarly, the history of COVID-19 was found to be not significant. Despite being insignificant, the research established that people with a history of Covid-19 took a longer time to make a decision towards getting the Covid-19 vaccine compared to people without a history of Covid-19 (*HR= 0.91, p-value = 0.865, 95% CI= 0.29-2.85*).

Discussion of Results

Many scholars have written on hesitancy to vaccination. Most have written on factors associated with hesitancy to vaccination, and these have been found to be gender, being a health worker or not, underlying conditions and many other factors like misinformation and trust in the vaccine to be administered to people (Mundagowa et

al, 2022). These factors do not show who really takes more time to get vaccinated or is more reluctant than other people or groups.

The research found that males are more reluctant to get vaccinated than their female counterparts. These research findings differ from what Ackah et al (2022) and Dereje et al (2022) found. This could be due to many factors, including the people's culture in a given country, employment patterns, etc. In Zimbabwe, most employed people are males compared to females, and due to some directives from employers, employed people tend to get vaccinated compared to unemployed people.

This research substantiates that employed people take a shorter time to receive vaccination than unemployed people. The research established that employed people had a shorter time to vaccination, and this was also echoed by Khubchandani et al (2021), Tan et al (2022), Liu et al (2022) and Marzo et al (2022). Age was another factor found to be more significant in influencing acceptance of the COVID-19 vaccine. The research established that younger people are more hesitant to accept the COVID-19 vaccine than elderly people. These results are in agreement with what Soares et al. (2021) found and also in line with what Marzo et al. (2022) found, that elderly people are more likely to accept the COVID-19 vaccine than younger people.

This could be explained by the fact that employment in Zimbabwe is low, and elderly people are most likely employed and are forced by their companies to get vaccinated so that they can be employable. This increases the chance of elderly people getting vaccinated compared to younger people who are unemployed. Therefore, these results depend on Zimbabwe's economic situation.

People with allergies were found to take a long time to get vaccinated. This could be because the side effects of the COVID-19 vaccine were not known. People feared that getting vaccinated might put their lives in danger, as they may react to the vaccine, since little information was known about these vaccines. These results were in line with what Abrams (2021), Turner et al (2021), and Chiang et al (2022) found. Previous research by Soares et al (2021) found that people with comorbidities had lower odds of refusal of the COVID-19 vaccine. This research established that people with comorbidities took longer to get vaccinated than people without comorbidities. These findings echoed what was found by Vallecillo et al (2022), Dietze et al (2022) and Sullivan et al (2022) that patients with opioid use disorder were less likely to get vaccinated with the COVID-19 vaccine. The fear was about the vaccine's efficacy and safety among most of the patients with underlying conditions. This was aggravated by the fact that side effects were not known, and this could worsen their already problematic conditions.

Other factors under study were place of residency and history of COVID-19. Generally, in Zimbabwe towns, there are western and eastern suburbs. Western suburbs are areas with people of low income and were meant for workers during the colonial period. Eastern suburbs are for affluent people and were meant for employers during the same colonial period. The research found that the place of residency did not influence the time a person takes to get vaccinated. Kricorian et al (2022) found that place of residency had an influence on uptake of the COVID-19 vaccine. This research concluded that the place of residence did not significantly influence the time to vaccination. People in low-income or high-density areas have similar time to vaccination as people living in low-density areas.

Another factor found not to influence the time to Covid-19 vaccination was a history of the disease. The time to vaccination for people who have once suffered from the disease is similar to that for those who have not yet suffered the disease. On one note, Biswas et al (2021), Caserotti et al (2021), and Marzo et al (2022) found that place of residence influences uptake of the COVID-19 vaccine. On a different note, Hossain et al (2022) found that those who have not been vaccinated up to 18 years, meaning they have no history of the disease or never suffered from it, showed high reluctance to the vaccine. This shows contradicting findings in different areas and suggests the complexity of making a decision to get vaccinated might not be influenced by past experience of Covid-19. Contrary to previous research findings, the disease's history might not significantly affect the time of vaccination.

Conclusion

Zimbabwe failed to achieve herd immunity due to misinformation from sources of information that were not official. Most of the information was from social media, and this increased hesitancy to vaccination. These sources carried many myths about the origin of COVID-19 and associated vaccines, which slowed down acceptance of COVID-19 vaccines. The time taken to receive the vaccination was longer among people with allergies and those with underlying conditions. Employed people had a shorter time to get vaccinated, possibly because all civil servants were expected to get vaccinated so that they would not transmit the disease to other people, as they constantly interacted with different people at work. Unemployed people rarely interacted with many people, and they were mostly at home due to lockdowns and curfews.

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