COVID-19 Knowledge, Attitudes, Practices, and vaccination hesitancy in Moshi, Kilimanjaro Region, Northern Tanzania

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ABSTRACT
Background: The COVID-19 vaccinations have reignited optimism in many cultures devastated by the pandemic's tremendous loss of lives and livelihoods. Vaccination hesitancy is a critical and growing international problem in the global effort to manage the COVID-19 pandemic. To successfully handle vaccination hesitancy concerns, it is necessary to understand the levels of knowledge, attitudes, and behaviors on COVID-19. The purpose of this study was to understand people's knowledge, behaviors, and attitudes about COVID 19 and its related vaccines.
Methods: In October 2021, a cross-sectional study with 232 participants was conducted. A standardized interviewer-administered questionnaire was used to collect data.
Results: Most respondents in the present survey heard about COVID-19 between January and March 2020. Social media and newspapers are the most effective sources of information on COVID-19, reaching 34.48 % of the population. Basic COVID-19 knowledge was reported to be moderate. Nearly half of the respondents (48.3 %) thought SARSCOV-2 was man-made, while 36.21 % were unsure. Good preventive behaviors were indicated by 49.14 % of subjects. Overall, we find that around 65 % of people are reluctant to get vaccinated against COVID-19. Male gender, low education, and occupation were shown to be more hesitant about vaccination. In this study, healthcare workers were averse to getting the COVID-19 vaccine. The reasons for vaccination hesitation were "unknown safety" of the vaccines (17.4 %) and "unknown long-term consequences" of the vaccines (18.97 %). Almost a third (27.59 %) of those interviewed said they had no intention of being vaccinated.
Conclusion: We report moderate knowledge on COVID-19, as well as effective preventive practices, but negative attitudes regarding COVID-19 vaccination, resulting in low vaccination rates of 6.9%. Misinformation regarding COVID-19 appears to play a key role in vaccination reluctance.

Keywords: *COVID-19; behaviors; knowledge; attitudes; practices; vaccination hesitancy*

INTRODUCTION

SARS-CoV-2 infection, also known as new coronavirus illness (COVID-19), was first diagnosed in Wuhan, China, in December 2019, and the World Health Organization proclaimed COVID-19 a pandemic in less than three months. By early May 2020, 3.3 million people had been infected in 213 countries, resulting in 238,628 deaths. The COVID-19 outbreak has resulted in numerous cases of illness and mortality around the world, and the unavailability of a COVID-19 vaccination has played a significant role in the high morbidity and mortality rates. Vaccines for COVID-19 are now being rolled out and made available in several countries. Vaccines' importance as one of the most significant successes in the fight against communicable diseases has been recognized for a long (Olson *et al.* 2020; Dubé *et al.* 2016).

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Due to the very efficient nature of vaccination programs on the African continent against vaccine-preventable diseases as a result of high and sustainable uptake, Africa has historically reported impressive reductions in mortality and morbidity from infectious diseases (Dubé *et al.* 2016; Cooper *et al.* 2018). As a result, vaccination adoption is crucial for personal health, protecting vulnerable people, improving socio-economic life, and achieving population health and safety through immunity. The development of COVID-19 vaccines has rekindled hope in many societies that have been devastated by the pandemic's massive loss of lives and livelihoods. Nonetheless, as the acquisition and distribution of COVID-19 vaccines gain traction, tensions and challenges have surfaced and are developing in tandem. Supply issues, vaccine nationalism, inequitable vaccine distribution and access both within and between nations, and COVID-19 vaccine hesitancy (VH) are only a few examples (National Academies of Sciences 2021; Lancet 2021; Eaton 2021; World Health Organization 2021). When vaccination services are available and accessible, vaccine hesitancy refers to a refusal to get immunizations. It is not only widespread and inaccurate, but it is also extremely contagious (Wiyeh *et al.* 2018). The effectiveness and safety of vaccine campaigns to control COVID-19 are not the only factors to consider.

The general public's and healthcare personnel's acceptance of vaccines appears to play a critical part in the pandemic's successful management. VH and rejection appear to be a rising problem, according to recent continental and global surveys (Murphy *et al.* 2021; Fisher *et al.* 2020; Neumann-B+Âhme *et al.* 2020; Lazarus *et al.* 2020). The highest acceptance rates among adults were found in Ecuador (97.0 %), Malaysia (94.3 %), Indonesia (93.3 %), and China (93.3 %), according to a comprehensive evaluation of global COVID19 acceptance rates from 33 different nations (91.3 %). Kuwait (23.6 %), Jordan (28.4 %), Italy (53.7 %), Russia (54.9 %), Poland (56.3 %), the United States (56.9%), and France (58.9%) had the lowest COVID-19 vaccination acceptance rates (Sallam 2021). In a separate large community-based study on COVID-19 vaccine hesitancy in the US, it was found that 22% of the respondents were hesitant to take these vaccines if they were available (Khubchandani *et al.* 2021). Although data on acceptance rates appear to be scarce, published studies reveal that acceptance rates range from 27.7% in the Democratic Republic of the Congo to 78.1 % in Israel 13]. In the Middle East, Russia, Africa, and various European nations, low rates of COVID-19 vaccine uptake have been recorded (Cooper *et al.* 2018; Murphy *et al.* 2021; Fisher *et al.* 2020; Sallam 2021; Cardenas 2021).

Tanzania embraced the vaccination strategy when it received the first consignment of 1,058,450 doses of Johnson & Johnson COVID-19 vaccines in July 2021, and 1,065,600 doses of Sinopharm vaccines supplied by the Chinese government via the COVAX facility in early October 2021. Despite all of these initiatives to battle the disease through the vaccine, according to a recent report, only 1.5% of Tanzanians have been fully vaccinated [https://ourworldindata.org/covid-vaccinations?country=OWID_WRL], which makes the campaign for covid19 vaccination in Tanzania a challenge. VH poses a serious challenge in the global attempt to control the COVID-19 pandemic at a time when the virus is undergoing fast alterations linked with successive waves of outbreaks.

Vaccination Hesitancy has already been documented in African nations following the introduction of new vaccines. Tanzanians, like many other Africans, were regarded at danger of under-immunization before the COVID19 pandemic, with lower levels of routine vaccine uptake and trust in vaccination (Le Polain de Waroux *et al.* 2013; Aaron *et al.* 2017; Vasudevan *et al.* 2020). Furthermore, these populations may be more prone to COVID-19 vaccine disinformation, particularly due to anti-vaccination buzz, as well as a lack of reliable information due to language hurdles and social marginalization.

In Tanzania, where the first strategy for reducing COVID19 was a mixed model that included hand sanitization, mask-wearing, social distancing, and the use of indigenous medicines without lock-down, an understanding of community members' hesitance is crucial. The purpose of this study was to gather information on COVID19 knowledge, practices, and attitudes as a disease and COVID19 vaccination in one of the regions most affected by COVID19 morbidity and mortality: the Kilimanjaro region in Northern Tanzania.

METHODOLOGY
Study Design, Site, population, and procedures
A cross-sectional study was conducted in October 2021. Individuals who visited their relatives who were admitted or undergoing medical care at Kilimanjaro Christian Medical Centre were requested to respond to structured questions regarding COVID19.
Due to the country's-imposed measures to control COVID19 resistance at the time of data collection, we opted to interview individuals who visited the mentioned health care facilities while also complying with COVID19 control restrictions. Due to the absence of similar studies on COVID19 in the study area, the sample size was determined to be 232 using a single population proportion formula based on the assumption that the probability of having poor knowledge, attitude, and preventive practice toward COVID19 was 50.0% percent, with a 95.0% confidence interval and a 5% margin of error.

Scoring and definitions of dependent Variables
COVID-19 knowledge assessment
To measure participants' knowledge of covid-19, a total of 23 items were employed. Each correct answer received a score of one, while incorrect answers received a score of zero. Using Bloom's cut-off point, participants' total knowledge was classified as excellent if their score was between 80 and 100% (23-18.4), moderate if their score was between 60 and 79 percent (18.17-13.8), and low if their score was less than 60 percent (13.8) (Feleke *et al.* 2021).

Assessment of attitude towards health seeking
Three items were used to examine participants' attitudes regarding obtaining medical help. A right response received a score of one, while a wrong answer received a score of zero. Bloom's cut-off point was used to describe the attitude toward health seeking as positive if the score was between 80 and 100 percent (3-2.4), neutral if it was between 60 and 79 percent (1.8-2.37), and negative if it was less than 60 percent (1.8) (Seid & Hussen 2018).

Prevention practice assessment
Six factors were used to measure prevention practice against covid-19. A right response received a score of one, while a wrong answer received a score of zero. Using Bloom's cut-off point, participants' overall preventative practice against covid-19 was classified as excellent if the score was between 80 and 100 percent (6-4.8), moderate if the score was between 60 and 79 percent (4.74-3.6), and bad if the score was less than 60 percent (13.6) (Feleke *et al.* 2021).

Assessment of attitude towards COVID-19 vaccine
Three questions were used to examine people's attitudes regarding the COVID-19 vaccination. A right response received a score of one while a wrong answer received a score of zero. The attitude toward the COVID-19 vaccination was classified as positive if the score was between 80 and 100 percent (4-

3.2), neutral if the score was between 60 and 79 percent (3.16-2.4), and negative if the score was less than 60 percent (2.4). 2018 (Seid & Hussen 2018).

Quality assurance
The reliability of the knowledge, attitude, and practice questionnaires was assessed, and the Cronbach's alpha values were 0.71, 0.78, and 0.76, respectively, indicating acceptable internal consistency. Four research scientists were involved in data collection. The whole data gathering procedure was overseen and controlled by the senior supervisors. The completed questionnaires were checked by the supervisors for completeness and consistency of replies. Before the actual data collecting began, the questionnaires were revised as needed.

Data management
Data were exported to Microsoft Excel 2016 for cleaning and coding. The cleaned data was transferred to STATA version 15.1 for analysis. To summarize categorical data, frequencies and proportions were employed. Bloom's cut-off of 80% was utilized to assess if respondents had adequate knowledge (80%), indicating a favorable outcome. Chi-squared test was conducted to evaluate the respondent factors and responses related to limited knowledge and poor practice. With a p-value of 0.05, the test revealed the strength of the relationship between risk variables and knowledge and practice. Finally, the information was arranged and classified.

Study Variables
Independent Variables
Demographic details include sex, age, academic qualification, the highest level of education, work environment, and sources of information on COVID-19. Specific items were specific questions for the determination of knowledge, attitudes, and practices regarding CPOVID-19 and vaccination hesitancy.

RESULTS
Social demographic characteristics of participants
The socio-demographic characteristics of respondents are summarized in Table 1. A total of 232 participants were interviewed. The median age of respondents was 33 (IQR: 25,45). One hundred and sixty-eight (72.41%) of the participants were male, while 36.21%(84) had secondary school education. Compared to other occupations, the majority of participants (24.14%) were traders 46.55 % (108). One hundred and sixty-eight (72.41%) of these participants did not suffer income reduction due to the COVID-19 pandemic.

Source of information on COVID-19
Figure 1 shows that most of the participants (55.17%)had heard about COVID-19 for the first time between January and March 2020. The combination of social media, news media, and newspapers was the strongest source of information regarding COVID-19, reaching 34.48% of participants with newspapers alone contributing 32.76% as the strongest source of information (Fig 2).
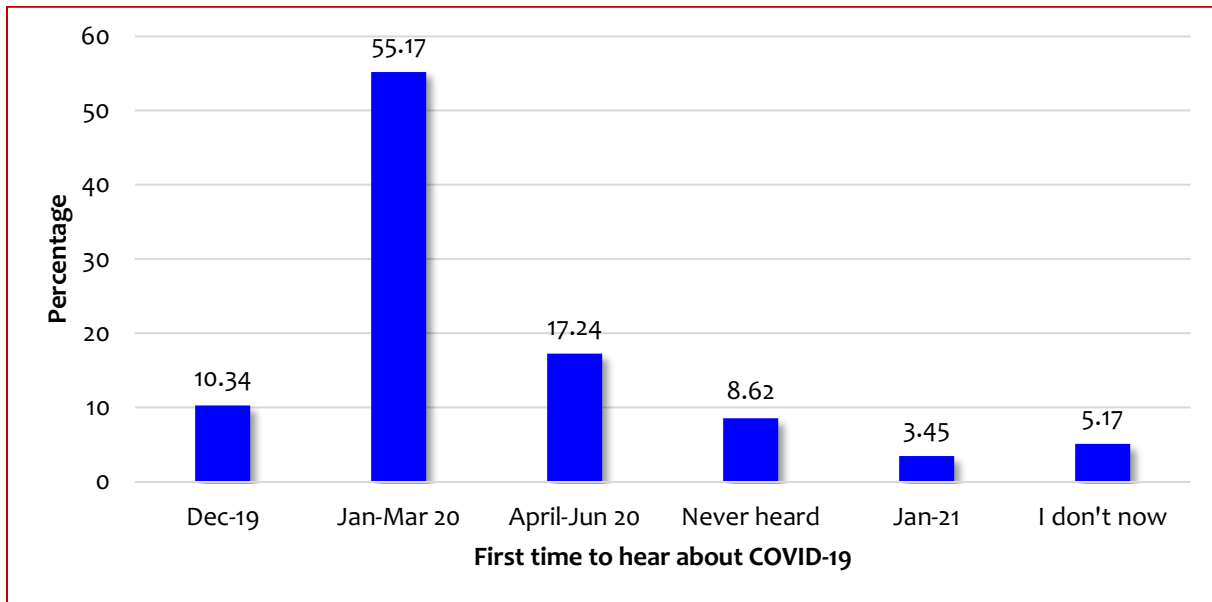
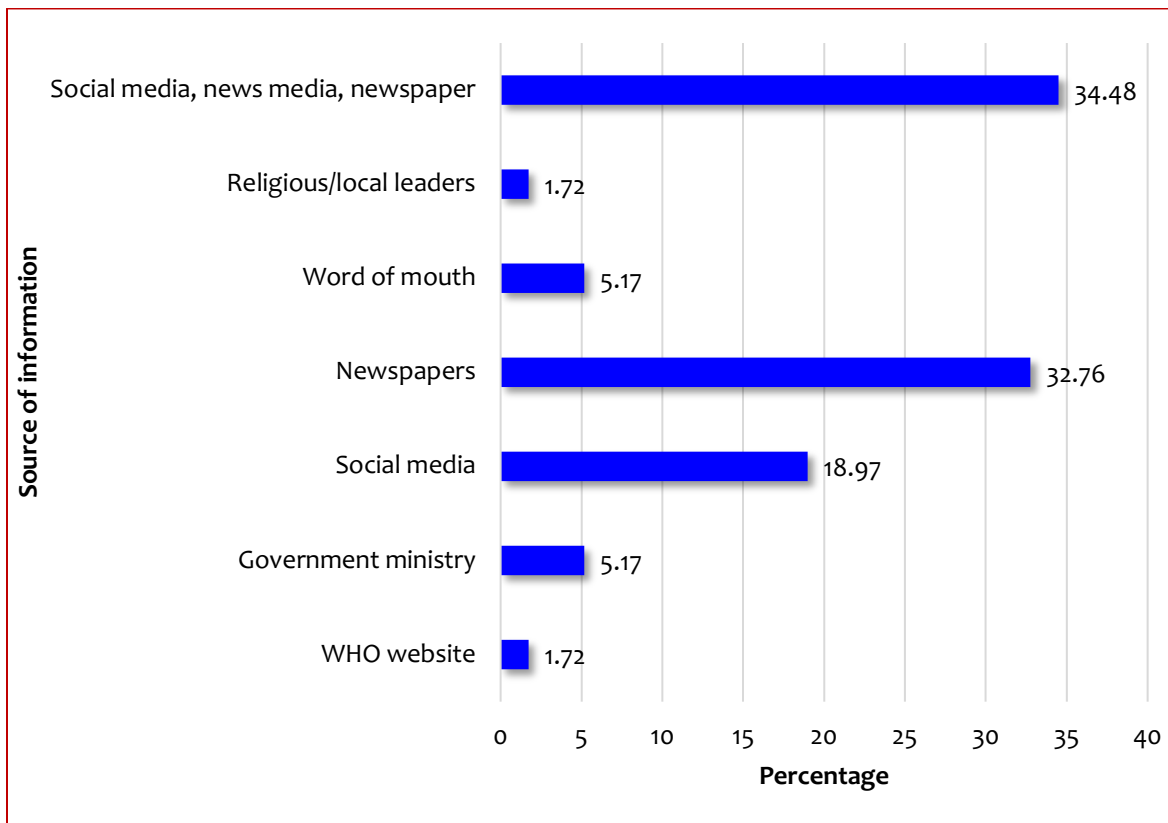**Fig1: Percentage distribution of participant's first-time hearing about COVID-19 (n=232)**

Fig.2 Percentage distribution of Respondent's source of information about COVID-19 (n=232)

COVID-19 knowledge assessment

Table 2 displays the knowledge results for COVID-19. Many participants (65.52%) had a moderate understanding of COVID-19. In terms of primary COVID-19 symptoms, "coughing" was cited by 224 (96.55%) of the participants, followed by "touching" and "handshaking," which were both noted by 212 (91.38%) of the questioned people. Other symptoms cited by 208 (89.66 percent) and 204 (87.93%), respectively, were "runny nose" and "fever." When asked if SARS CoV-2, the cause of COVID-19, was a man-made or natural virus, 112 (48.3%) of participants answered it was man-made, compared to 36 (15.52%) and 84 (36.21%) who replied "natural" and "do not know," respectively. The majority (77.59%) of participants cited China as the origin of the virus that causes COVID-19. Overall, interviewed participants displayed "moderate" knowledge of COVID-19.

Attitude toward health COVID-19 health seeking
In this paper, we assessed the attitude of participants towards COVID19 and associated health-seeking behaviors. Most participants (82.76%) had not contracted COVID19 before this survey (figure 2). More than half of the participants (58.62%) were willing to test for COVID19 voluntarily. All participants showed readiness to seek medical care from a hospital for treatment of other diseases despite the COVID19 preventive measures in place. Regarding isolation, if they contracted COVID19, 156 (67.24%) of the participants preferred hospital isolation to home isolation *(Table 3)*. Most of the participants (n=136, 58.62%) had a neutral attitude towards COVID-19 health-seeking. The most important reasons for vaccination hesitancy were unknown safety of the vaccines (17.4%) and unknown long-term effects of the vaccines (18.97%). Nearly a third (27.59%) of the participants declared to have no intention to get vaccinated whatsoever.
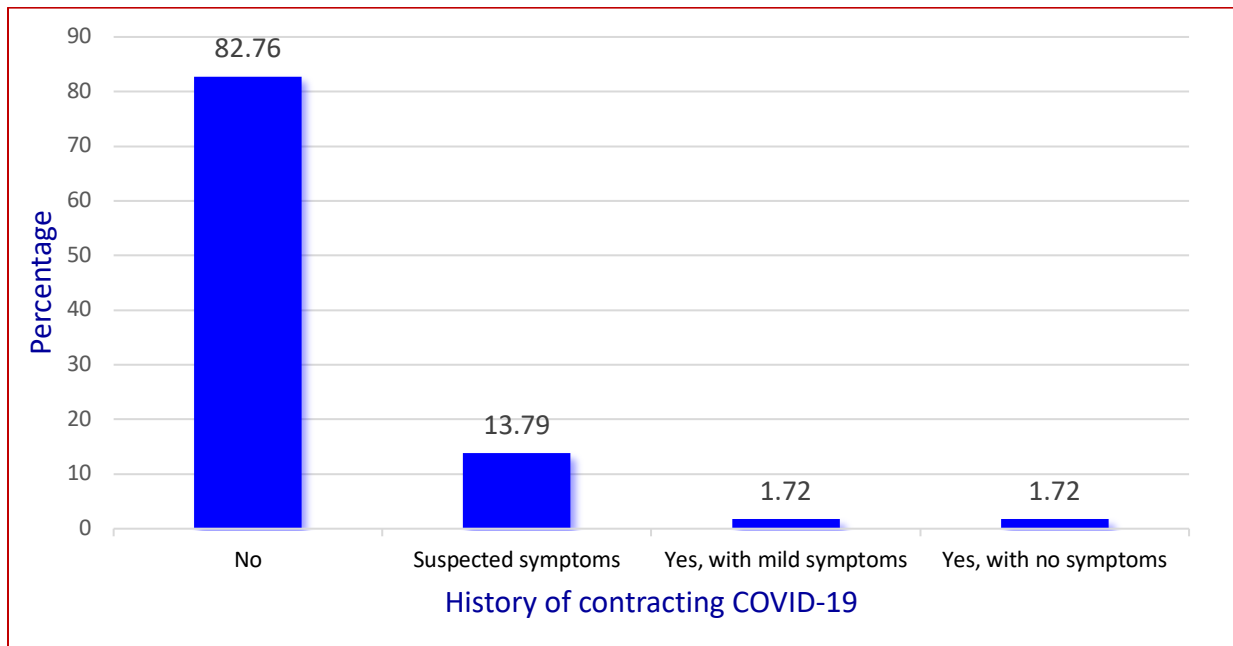

Fig. 2 History of contracting COVID-19: Percentage distribution of participants with a history of contacting COVID-19 (n= 232)

COVID-19 prevention practices

Results presented in Table 4 indicate that most of the participants had good COVID-19 prevention practices 114 (49.14%) of the participants showed to accept and practice prescribed preventive measures. The most adopted preventive practice was "hand sanitization", adopted by all participants. To prevent COVID-19, 224 participants (96.55%) practiced "physical distancing", whereas 216 (93.10%) wore "face masks". Participants who reported practicing "Confinement" were 212 or 91.38% of those interviewed.

Knowledge and attitude to COVID19 vaccine
One hundred and fifty-two (65.52%) of interviewed participants had a negative attitude towards COVID19 vaccines. One hundred and ninety-six (84.48%) of participants acknowledged the presence of a COVID19 vaccine in Tanzania. Despite this knowledge, only 84 (36.21%) of the participants were willing to be vaccinated for fear of unknown long-term effects 18.97% of participants, whereas only 16 (6.9%) were vaccinated against COVID19. The overall attitude towards COVID19 vaccination was reported to be negative (Table 5).

Factors associated with COVID-19 vaccine hesitancy
A chi-square test was performed to understand the factors that were associated with observed knowledge, attitude, and practices towards COVID19 and COVID19 vaccines. Fisher's exact test was used to provide the significant results of the variables. A p-value of <0.05 was selected to show the statistical significance of the associations. Gender, education level, participant occupation, work environment, workplace crowdedness, and COVID19 knowledge were all found to be linked with vaccine hesitancy (p<0.05)(Table 6& Figure 3). Male gender, least education level, for occupation: teachers, health care workers, and students, showed the highest level of COVID19 vaccine hesitancy. In addition, poor knowledge of COVID19 was an important factor for vaccine hesitancy whereby only 16.67% of participants with poor COVID19 knowledge compared to 39.5% and 9.09% of those who showed moderate and good knowledge, had a positive attitude toward COVID19 vaccination (Chi-20.06, p=0.001). Consistently, participants who showed poor COVID19 preventive practices were the most hesitant to vaccination against COVID19 (Chi=5.42, p=0.03).
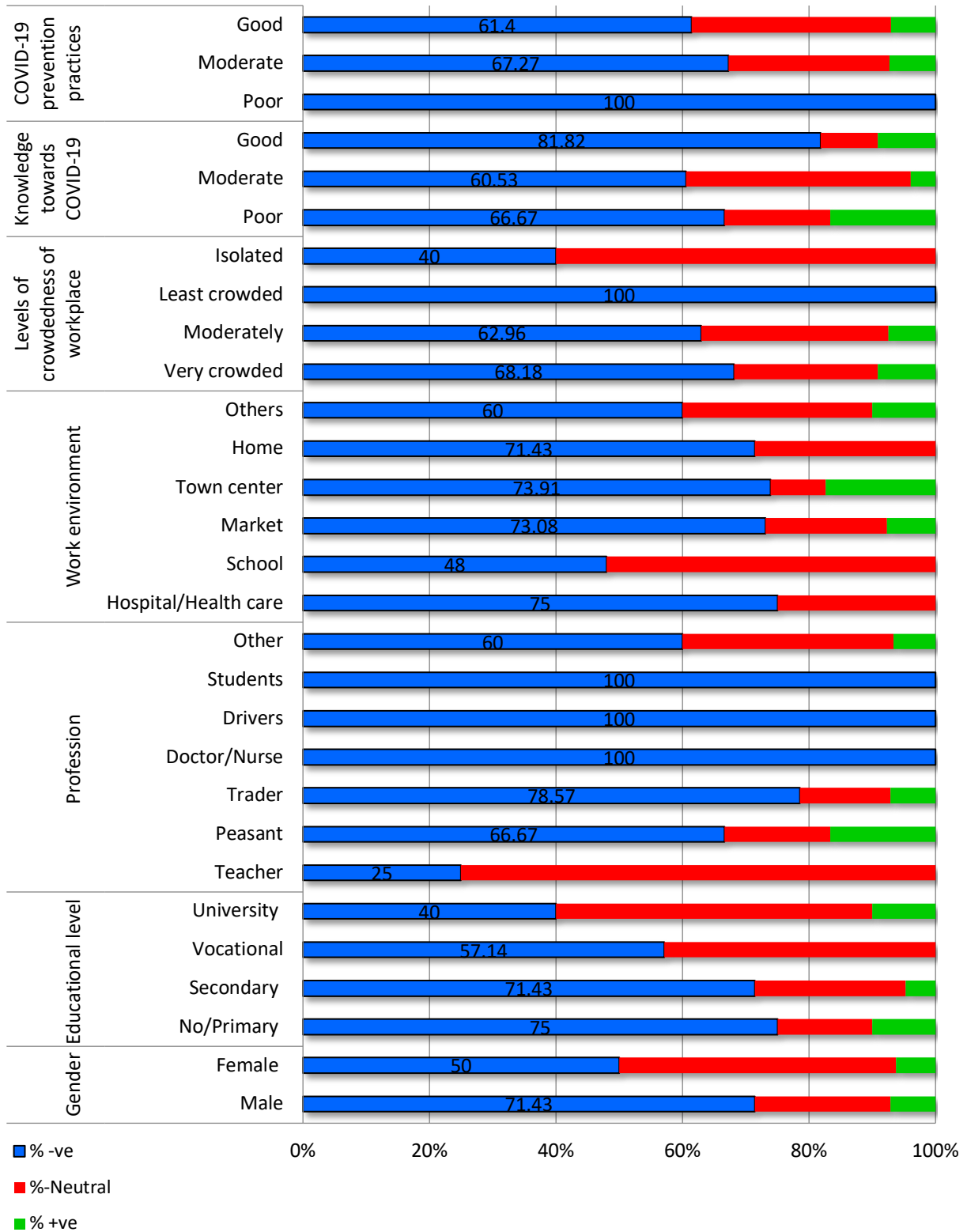
Figure 3: Significant Factors associated with COVID-19 Vaccine Hesitancy

Discussion

This is among the first studies that report on the knowledge, attitudes, and practices of COVID-19 in Tanzania. Ahead of most other studies, this study has also investigated factors for COVID-19 vaccination hesitancy among one of the Tanzanian regions most hit by COVOD-19, Kilimanjaro region. In the current study, the majority of respondents heard about COVID-19 between January and March 2020, indicating a timely awareness of the pandemic in Tanzania. Our findings indicate the combination of social media, news media, and newspapers as the strongest sources of information regarding COVID-19, reaching 34.48% of the population as represented by interviewed participants. During epidemics, effective communication is frequently a critical component of health crisis response. Attempts to connect with the public can take several forms and come from a variety of sources. Given the proliferation of smartphones and the rising worldwide availability and distribution of the internet, social media has become a significant communication channel for communicating health emergencies (Yu & Li), alleviating challenges of public health communication through its affordances and functionality (Schillinger *et al.* 2020). Mobile phone use has also increased the rate at which behavioral change information concerning epidemics is disseminated (Dong & Zheng 2020).

In line with other studies conducted in Tanzania (Khamis & Geng 2021), findings in this study show that social media platforms are an effective way in spreading health-awareness information about COVID-19. Furthermore, while social media use serves as an efficient means of communication during pandemics, alternative ways need to be in place for those with limited internet access. We report that 32.76% of the respondents in this study heard about COVID191 through newspapers. During a pandemic, reliable and timely communication has been stressed as key to the success of any control measures that involve the public (Manganello *et al.* 2020). Beyond the requirement for timely information, there is a need for robust and credible health communication channels, which citizens can trust, rely on, and act on. This is where traditional media such as newspapers becomes a helpful public realm in terms of engaging with the audience and discussing the path forward in terms of the progress made, problems encountered, and plans in place to beat the virus with concerned members of the public.

When participants were interviewed for their knowledge of the basic symptoms of COVID19, moderate knowledge was observed. Of interest was the response to the question of whether SARS COV2, the virus that causes COVID19 was natural or man-made where nearly half of the respondents (48.3%) said it was man-made whereas 36.21% did not know whether it was man-made or natural. Tanzania and other African countries have been working to increase awareness and provide information to the public through various channels of communication (e.g., radio, television advertisements, public health messages by prominent celebrities and national leaders, pamphlets, and signboards in public places) about the mode of infection, symptoms, and infection control measures. However, misinformation about COVID-19 remains intact in these countries.

As previously reported by other studies (Osuagwu *et al.* 2021), misinformation about COVID19 is a significant barrier to global public health since it may inadvertently aggravate public health challenges by indirectly facilitating increased disease transmission (El Sayed 2020). Unfortunately, most social media has been flooded with information regarding the origin and implications of the disease while much of the information about COVID19 its symptoms, transmission routes, and response mechanisms have been largely unreliable (Palade & Balaban 2020; Jelnov 2020; Sahoo *et al.* 2020; Amgain *et al.* 2020). Despite this knowledge and best preventive practices observed in the current study, a considerable proportion of the participants believed the virus was man-made, with

evil intentions against targeted communities. Our findings that only 6.9% of the participants were vaccinated against COVID19 largely explain the basis of the vaccination hesitance.

Overall, our study found a high proportion of COVID19 vaccine reluctance of approximately 65 percent. When participant characteristics for vaccine reluctance were examined, male gender, participants with the least education, and occupation (teachers, health care workers, and students) were shown to be more apprehensive about vaccination. Our findings are both similar and dissimilar to those of other studies. For example, contrary to our findings, a study in the United States found that vaccine hesitancy was higher in females than in males, but when it came to education, the least educated participants were more likely to be hesitant about COVID19 vaccination than those with at least a bachelor's degree (Liu & Li 2021; Soares *et al.* 2021; Aw *et al.* 2021). In this study, healthcare workers (HCWs) were unwilling to get COVID19 immunization. Although the participants correctly judged the severity, prevention, and safety of the COVID-19 vaccine, they were generally hesitant or refused to be vaccinated (Aw *et al.* 2021); (Murphy *et al.* 2021; Fisher *et al.* 2020; Neumann-B+Âhme *et al.* 2020; Lazarus *et al.* 2020). VH among HCWs poses a danger to pandemic-control strategies.

Conclusion

We report an intermediate understanding of COVID19, as well as effective preventive practices, but negative attitudes toward COVID19 vaccination, which has resulted in low vaccination rates. Misinformation about COVID19 appears to be a factor in vaccine hesitancy. COVID-19 vaccination apprehension must be understood in the context of the interaction between misinformation dissemination and accompanying emotional reactions. Because social media and newspapers are effective conduits for health campaigns, vaccination programs should provide a focused, localized, and sympathetic response to misinformation.

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