


The Willingness to Receive COVID-19 Vaccine and Its Associated Factors: “Vaccination Refusal Could Prolong the War of This Pandemic” – A Systematic Review

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Background: The outbreak of coronavirus disease 2019 (COVID-19) in Wuhan, China, spreads globally, since its declaration by the World Health Organization (WHO) as a COVID-19 pandemic on March 11, 2020. COVID-19 vaccine is a crucial preventive approach that can halt this pandemic. The present systematic review was aimed to assess the level of willingness to receive COVID-19 vaccine and its associated factors.

Methods: A comprehensive literature search was conducted by using various online databases such as PubMed/MEDLINE, HINARI, EMBASE, Google Scholar, Web of Science, Scopus, African journals, and Google for grey literature which were used to search the related articles up to the period of May 08, 2021.

Results: The overall rate of participants' willingness to receive the COVID-19 vaccine was ranged from 27.7% to 91.3%, which was from Congo and China, respectively. Factors such as age, educational status, gender, income, residency, occupation, marital status, race/ethnicity, perceived risk of COVID-19, trust in healthcare system, health insurance, norms, attitude towards vaccine, perceived benefit of vaccine, perceived vaccine barriers, self-efficacy, up-to-date on vaccinations, tested for COVID-19 in the past, perceived efficacy of the COVID-19 vaccination, recommended for vaccination, political leaning, perceived severity of COVID-19, perceived effectiveness of COVID-19 vaccine, belief that vaccination makes them feel less worried about COVID-19, believing in mandatory COVID-19 vaccination, perceived potential vaccine harms, presence of chronic disease, confidence, COVID-19 vaccine safety concern, working in healthcare field, believing vaccines can stop the pandemic, fear about COVID-19, cues to action, COVID-19 vaccine hesitancy, complacency, and receiving any vaccine in the past 5 years were associated with the willingness of receive COVID-19 vaccine.

Conclusion: There were insufficient levels of willingness to receive COVID-19 vaccine, and several factors were associated with it. Health education should be provided concerning this vaccine to improve the willingness of the community.

Keywords: COVID-19, vaccine, willingness, acceptance, associated factors, demand

Introductions

The COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹⁻⁵ Since the first case was reported from Wuhan, China, the Chinese government has taken the emergency actions to control the outbreak and has performed preliminary steps in the diagnosis and treatment of this COVID-19

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pandemic.⁶ The commonly detected severe risk factors of COVID-19 include older age and with medical comorbidities like cancer and diabetes.¹ The outbreak of COVID-19 disease in China has been brought to global attention and declared as a pandemic by the WHO on March 11, 2020.⁷ The COVID-19 pandemic remains a global challenge.³ It is a highly contagious disease. The WHO has declared the ongoing outbreak to be a global public health emergency.⁸ There is an obvious concern worldwide regarding the fact about the emerging 2019-nCoV as a global public health threat.⁵ The pandemic of COVID-19 is spreading rapidly.⁹ The COVID-19 is spreading all over the world.^{10,11} Then, it has affected individuals of all nations, continents, races, and socioeconomic groups.¹¹ This pandemic COVID-19 has significant mortality and morbidity rate.^{1,9,12} As per the report from WHO on 14 August 2020, there have been 20,730,456 confirmed cases of COVID-19, including 751,154 deaths worldwide.¹³ Besides, the significant deaths and morbidities from the COVID-19 pandemic, there will also be a substantial economic crisis by far.¹⁴ This large morbidity and socioeconomic influence have demanded extreme measures across all continents, comprising nationwide lockdowns and border closures.¹⁵

Furthermore, the COVID-19 pandemic has the potential to overwhelmingly affect young children's development worldwide, through rises in poverty and food insecurity, loss of caregivers, heightened stress, and decreased health care. These can affect not only the whole life course of the child but also the future generations through physiological, psychological, and epigenetic changes occurring in utero and during early development that can decelerate the gains made since the turn of the century.¹⁶ Because of this COVID-19 pandemic, mental health is a major public issue.¹⁷ It has an immense influence on youth mental health.¹⁸ It has put considerable stress on patients, healthcare workers (HCWs), and healthcare systems. However, fetal diagnosis and pregnancy care must be maintained, and we must struggle to protect the susceptible population of pregnant women and their fetuses.¹⁹ COVID-19 has a higher burden on the emotional wellbeing of pregnant women and women in the early postpartum period.²⁰ Probably, there is the potential for pregnant women to be vulnerable to mental ill health during this pandemic virus.²¹ Besides, COVID-19 pandemic was significantly interrupted the childhood vaccination practices.²²

The COVID-19 pandemic is a serious public health emergency, it is particularly deadly in exposed

populations and communities in which healthcare providers are inadequately ready to manage the infection.¹⁵ The responses required for COVID-19 pandemic were such as quarantining of entire communities, closing of schools, social isolation, and shelter in-place orders which have abruptly changed daily life to control the disease.¹¹ The management of patients with severe COVID-19 status is significant in decreasing the mortality of the ongoing pandemic, but the truly essential measures include prevention, monitoring, and timely intervention. Besides, in addition to rapid medical responses, continuous efforts to better understand the pathogenesis of COVID-19 will certainly enlighten the optimal management of the increasing pandemic.⁹ The social media has the potential to provide rapid and effective dissemination routes for key information to enhance awareness about COVID-19 pandemic of the population if used responsibly and appropriately.²³

To decrease the spread of COVID-19, contact tracing, testing, and social restrictions are among the most powerful approaches adopted globally due to the lack of a COVID-19 vaccine. This leads to major physical, psychological, and economic distress suffering of most countries' citizens. Thus, a safe and effective COVID-19 vaccine is the most effective alternative to manage this pandemic.²⁴ The COVID-19 pandemic is anticipated to continue to put large impacts of morbidity and mortality, while harshly upsetting society and economies globally. Thus, governments must be ready to make certain large-scale distribution of a COVID-19 vaccine and equitable access when a safe and effective vaccine is available. This will need sufficient health system capacity and methods to improve trust in and acceptance of the vaccine and those who deliver it.²⁵ The study has found that information concerning the process of vaccine development, vaccine efficacy, and individual variety affects the proportion of participants reporting COVID-19 vaccination intentions. Behavioral economics offers an empirical scheme to approximate vaccine claims to target subpopulations resistant to vaccination.²⁶

Methods

Research Questions

1. What is the level of willingness to receive COVID-19 vaccine globally?
2. What are the factors associated with the willingness to receive COVID-19 vaccine?

Study Setting

The present systematic review includes all studies conducted in different countries globally.

Search Strategies

A comprehensive literature search was conducted. For instance, The search was conducted by using the following electronic databases: PubMed/MEDLINE, HINARI, EMBASE, Google Scholar, Web of Science, Scopus, African journals, and Google for grey literature. The search was done by using the following keywords; “willingness”, “acceptance”, “hesitancy”, “COVID-19”, “SARS-CoV-2”, “vaccine”, “associated factors”, and “determinant factors”. At this time, “AND” and “OR” Boolean operators were employed to integrate the keywords.

Eligibility Criteria

The inclusion criteria for the present systematic review were: all cross-sectional studies done among adults globally, published in English language, and articles published until May 08, 2021 duration, whereas the exclusion criteria were as follows: articles with poor quality and articles in which the outcome variable was not clearly defined and measured were excluded from the present systematic review.

Outcome of Interest

In the present systematic review, the primary outcome was the level of willingness to receive COVID-19 vaccine, which was reported within the original article. Likewise, the secondary outcome was factors associated with the willingness to receive COVID-19 vaccine, which was reported within the original study.

Data Extraction

All studies obtained from all databases were exported to Endnote version 8 software, and the duplicates were removed. Finally, all studies were exported to Microsoft Excel spreadsheet. The Titles and abstracts of studies retrieved using the search strategy and those from additional sources were screened to identify studies that satisfy the inclusion criteria. Then, studies that satisfied the inclusion criteria by title or abstract screening were undergone a full-text review for eligibility and data extraction. The Preferred Reporting Item for Systematic Review and Meta-Analyses (PRISMA) flowchart was used for the

stepwise inclusion and exclusion of the articles. The first author, publication year, country, sample size, prevalence, and factors were included into the data extraction format.

Quality Assessment

The Newcastle–Ottawa Scale (NOS) quality assessment criteria for cross-sectional studies were used to include the studies into the present systematic review.^{27,28} The quality of each study was assessed using modified NOS for cross-sectional studies. It has 10 points in three domains of modified NOS components for observational studies. Thus, the studies which were scored ≥ 5 out of 10 points were included into the present systematic review.²⁹

Results

A total of 2671 articles were identified through the search strategies. They were retrieved from PubMed/MEDLINE, HINARI, EMBASE, Google Scholar, Web of Science, Scopus, African journals, and Google for grey literature. From the total of 2671, 1403 articles were excluded because of duplication. Of the remaining 1268 articles, 1210 articles were excluded after reviewing of the titles and abstracts because they were not related. Furthermore, out of 58 articles selected for full-text screening, 2 were excluded due to lack or inaccessible of full text. Then, 56 full-text articles were assessed for eligibility based on the pre-setted criteria and 11 articles were excluded with a reason. Finally, 45 articles were met the eligibility criteria and included into the present systematic review (Figure 1).

Features of the Included Studies

Characteristics of the studies included in the present systematic review on the willingness to receive COVID-19 vaccine and its associated factors. Among the studies published up to May 08, 2021 globally, 45 studies were included in the present systematic review. The study design of all these studies were cross-sectional. Nine studies were done in the United States,^{30–38} nine studies were done in China,^{39–47} one study was done in Australia,⁴⁸ four studies were done in Saudi Arabia,^{49–52} one study was done in Kuwait,⁵³ one study was done in England,⁵⁴ one study was done in Congo,⁵⁵ one study was done in Greece,⁵⁶ two studies were done in UK,^{57,58} one study was done in Malaysia,⁵⁹ two studies were done in Japan,^{60,61} one study was done in Israel,⁶² one study was done in Bangladesh,⁶³ one study was done in Jordan,⁶⁴ one study was done in Iran,⁶⁵ one study was done in Italy,⁶⁶ one

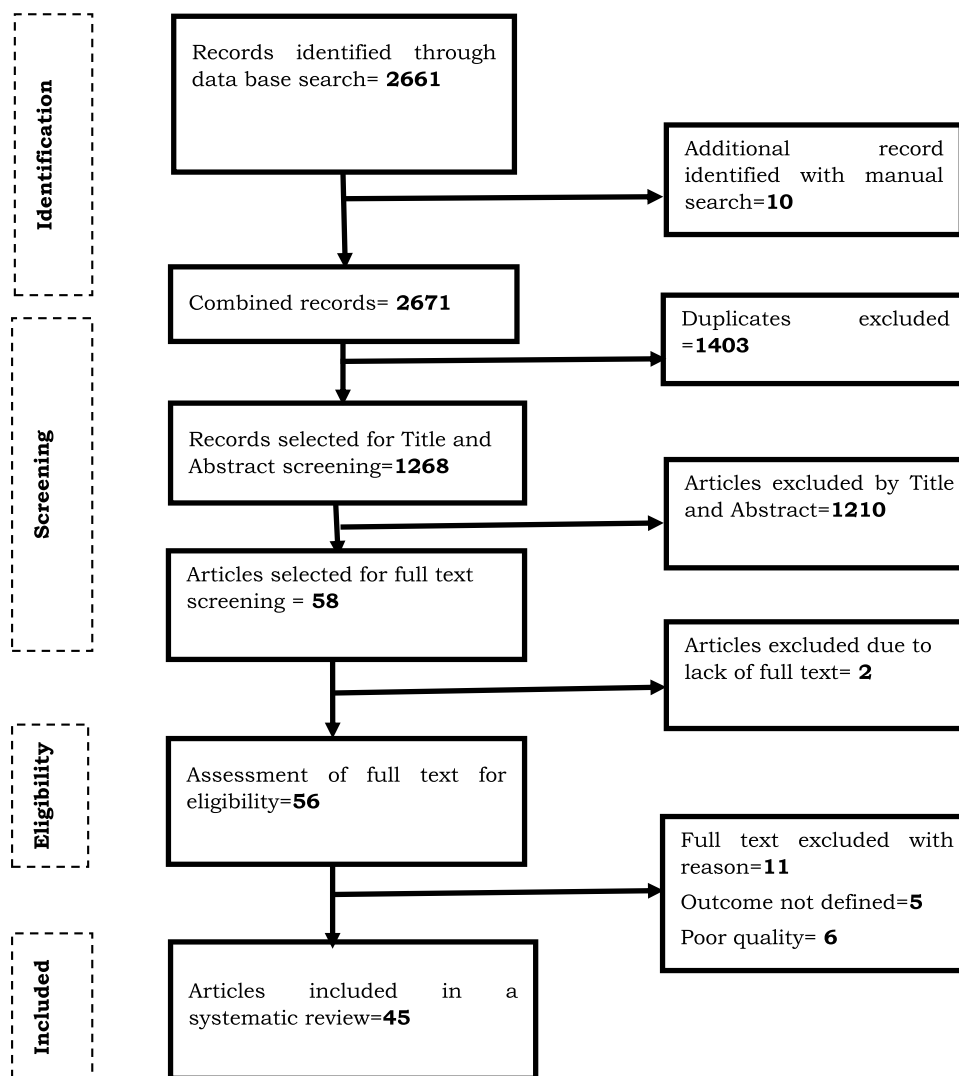


Figure 1 PRISMA flowchart diagram of the study selection for systematic review on the willingness to receive COVID-19 vaccine and its associated factors.

Note: Adapted from Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ*. 2009;339 jul21 1:b2700–b2700. doi:10.1136/bmj.b2700.⁹⁵

study was done in Ethiopia,⁶⁷ two studies were done in France,^{68,69} one study was done in Vietnam,⁷⁰ one study was done in Uganda,⁷¹ one study was done in Pakistan,⁷² one study was done in Nigeria,⁷³ and one study was done in Latin America and the Caribbean (LAC).⁷⁴ The smallest sample size was 409 and the largest was 472,521, which was reported from Ethiopia,⁶⁷ and LAC,⁷⁴ respectively (Table 1).

The Willingness to Receive COVID-19 Vaccine

As briefly displayed in (Table 1), 45 studies from various countries were included into the present systematic review.

A large variability was stated on the level of willingness to receive COVID-19 vaccine in different countries. The highest level of willingness towards receiving the COVID-19 vaccine was reported from China, which was 91.3%,⁴⁷ whereas the lowest level of willingness towards receiving the COVID-19 vaccine was recorded in Congo, which was 27.7%.⁵⁵

Factors Associated with the Willingness to Receive COVID-19 Vaccine

From a total of 45 studies, 6 studies have not assessed the factors associated with the willingness of receiving COVID-19 vaccine. They were two studies from the

Table I Characteristics of the Studies Included into the Present Systematic Review on the Level of Willingness to Receive COVID-19 Vaccine and Its Associated Factors

S.N	Authors	Year	Sample Size	Participants	Study Design	Country	Level	Associated Factors
1	Ehde et al ³⁰	2021	486	Adults with MS	CS	United States	66.0%	Educational level, and perceived risk for COVID-19 infection.
2	Guidry et al ³¹	2021	788	Adult people	CS	United States	30.7%	Education, having insurance, subjective norms, attitude towards a vaccine, perceived susceptibility to COVID-19, perceived benefit of vaccine, low vaccine barriers, and self-efficacy.
3	Kuter et al ³²	2021	12,034	Clinical and nonclinical staff	CS	United States	63.7%	Gender (male), age(older), education (more educated), Asian or White, up-to-date on vaccinations, and tested for COVID-19 in the past.
4	Kwok et al ³⁹	2021	1205	Nurses	CS	China	63%	Younger age, more confidence, less complacency and more collective responsibility
5	Lin et al ⁴⁰	2020	3541	Chinese citizens (≥18 years)	CS	China	28.7%	Perceived benefit, and perceived barriers were found to have the highest significant odds of a definite intention
6	Malik et al ³³	2020	672	Adult population	CS	United States	67%	NA
7	Mo et al ⁴¹	2021	6922	University students	CS	China	78.9%	Perceived efficacy of vaccination, and use of social media for COVID-19 vaccine-related information.
8	Reiter et al ³⁴	2020	2006	Adults ≥18 years	CS	United States	69%	Recommendation for vaccination, being moderate or liberal in their political leaning, perceived getting of COVID-19 infection, perceived severity of COVID-19 infection, or perceived effectiveness of a COVID-19 vaccine, and perceived potential vaccine harms.
9	Seale et al ⁴⁸	2021	1420	Adults ≥18 years	CS	Australia	80%	Gender(female), age (≥70 years), presence chronic disease, and private health insurance.
10	Al-Mohaithef & padhi ⁴⁹	2020	992	Adults ≥18 years	CS	Saudi Arabia	64.72%	Age (>45 years) and marital status (married)
11	Alqudeimat et al ⁵³	2021	2368	General adult population	CS	Kuwait	53.1%	Gender(male), viewed vaccines as to have health-related risks, previously received an influenza vaccine, and self-perceived chances of contracting the infection.
12	Bell et al ⁵⁴	2020	1252	Parents and guardians	CS	England	55.8%	Household income, Ethnicity, and Employment.
13	Chen et al ⁴²	2021	3195	Chinese adults	CS	China	83.8%	Lack of confidence, complacency in regard to health, and risk of the vaccine.

(Continued)

Table I (Continued).

S.N	Authors	Year	Sample Size	Participants	Study Design	Country	Level	Associated Factors
14	Nzaji et al ⁵⁵	2020	613	HCWs	CS	Congo	27.7%	Male, and having a positive attitude towards a COVID-19 vaccine.
15	Kourlaba et al ⁵⁶	2021	1004	Adult residents	CS	Greece	57.7%	Age (>65 years), those who either themselves or a member of their household belonged to a vulnerable group, believing COVID-19 was not developed in laboratories, believing that COVID-19 is far more contagious and lethal relative to the H1N1 virus, and believing that next waves are coming, higher knowledge score regarding symptoms, transmission routes and prevention and control measures against COVID-19.
16	Shaw et al ³⁵	2021	5287	HCP	CS	United States	57.5%	Age (older), gender (male), and White/Asian.
17	Shekhar et al ³⁶	2021	3479	HCWs	CS	United States	36%	Age, education, income level, gender, residency
18	Unroe et al ³⁷	2021	8243	Nursing home and assisted living facility staff	CS	United States	69%	Age (>60 years), gender (male), and race (white).
19	Williams et al ⁵⁷	2020	527	Older adults and patients with CRD	CS	UK	86%	Perception that COVID-19 will persist
20	Wong et al ⁵⁹	2020	1159	Residents (18 to 70 years)	CS	Malaysia	48.2%	Belief that vaccination decreases the chance of COVID-19 infection, belief that vaccination makes them feel less worried about COVID-19, Perception of susceptibility for COVID-19, gender(male).
21	Yoda & Katsuyama ⁶⁰	2021	1100	Residents	CS	Japan	65.7%	Age (≥70 years), residency (rural), having underlying medical conditions, and gender (male).
22	Zigron et al ⁶²	2021	506	Dentists, dental residents, and oral medicine specialists	CS	Israel	85%	Occupation (unemployment)
23	Abedin et al ⁶³	2021	3646	Adults (≥18 years)	CS	Bangladesh	74.6%	NA
24	Alfageeh et al ⁵⁰	2021	2137	Adults (≥18 years)	CS	Saudi Arabia	48%	Receiving the seasonal influenza vaccination in the past, believed in mandatory COVID-19 vaccination, and reported high levels of concern about contracting COVID-19.
25	Al-Mohaithef et al ⁵¹	2021	658	Adults (≥18 years)	CS	Saudi Arabia	53.3%	High-risk perception, and higher trust in the healthcare system.

(Continued)

Table I (Continued).

S.N	Authors	Year	Sample Size	Participants	Study Design	Country	Level	Associated Factors
26	Al-Qerem and Jarab ⁶⁴	2021	1144	Adults (≥18 years)	CS	Jordan	36.8%	NA
27	Askarian et al ⁶⁵	2020	4933	Adults	CS	Iran	64.2%	Having a greater exposure to social norms supportive of COVID-19 vaccination, higher perceived benefits of COVID-19 vaccination, having a greater COVID-19 vaccine safety concerns, age, gender (female), and working in the healthcare field
28	Barello et al ⁶⁶	2020	735	University students	CS	Italy	86.1%	NA
29	Barry et al ⁵²	2020	1512	HCWs	CS	Saudi Arabia	70%	Gender (male), believing in vaccine safety, believing vaccines can stop the pandemic, and relying on Centers for Disease Control and Prevention website for COVID 19 updates.
30	Dereje et al ⁶⁷	2021	409	Adult (≥18 years)	CS	Ethiopia	80.9%	NA
31	Detoc et al ⁶⁸	2020	3259	Adult general population and patients	CS	France	77.6%	Age (older), gender (male), fear about COVID-19, be HCWs, and perceived risk.
32	Fisher et al ³⁸	2020	991	Adults	CS	United states	57.6%	NA
33	Gagneux-Brunon et al ⁶⁹	2021	2047	HCWs	CS	France	76.9%	Age (Older), gender (male), fear about COVID-19, perceived risk and flu vaccination during previous season.
34	Gan et al ⁴³	2021	1009	Adults	CS	China	60.4%	Age, education, previous influenza vaccination history, trust in the effectiveness of the vaccine, and close attention to the latest news of the vaccine.
35	Huynh et al ⁷⁰	2021	410	HCWs	CS	Vietnam	76.10%	Perceived susceptibility and severity of COVID-19, perceived benefits of vaccination, Perceived barriers, and cues to action.
36	Kanyike et al ⁷¹	2021	600	Medical Students	CS	Uganda	37.3%	Gender (female), marital status (single), perceived risk of getting COVID-19 in the future, receiving any vaccine in the past 5 years, and COVID-19 vaccine hesitancy.
37	Luodan et al ⁴⁴	2020	8040	HCWs	CS	China	67.1%	Perception of disease severity, self-infection risk and disease can be prevented by vaccine.
38	Machida et al ⁶¹	2021	2956	Adults (20 to 79 years)	CS	Japan	62.1%	Gender, age, income level, perceived effectiveness of the COVID-19 vaccine, and willingness to protect others by getting oneself vaccinated.

(Continued)

Table I (Continued).

S.N	Authors	Year	Sample Size	Participants	Study Design	Country	Level	Associated Factors
39	Malik et al ⁷²	2021	5237	HCWs	CS	Pakistan	70.25%	Age, gender, taking direct care of COVID-19 patients, higher education, and prior COVID-19 infection.
40	Sherman et al ⁵⁸	2021	1500	Adults (≥18 years)	CS	UK	64%	Age, having been vaccinated for influenza last winter, perceiving a greater risk of COVID-19 to people, more positive general COVID-19 vaccination beliefs and attitudes, beliefs of the side effects, and belief that only people who are at risk of serious illness should be vaccinated for COVID-19.
41	Tobin et al ⁷³	2021	1228	Adults (>18 years)	CS	Nigeria	50.2%	Age, gender, trust in government, trust in public health authorities, confidence in vaccine developers, willingness to pay for and travel for a vaccine.
42	Urrunaga-Pastor et al ⁷⁴	2021	472,521	Adults (≥18 years)	CS	LAC	80.0%	Gender, residency, compliance with community mitigation strategies, afraid of getting serious ill from COVID-19.
43	Wang et al ⁴⁷	2020	2058	Adults (≥18 years)	CS	China	91.3%	Gender(male), marital status (married), perceiving a high risk of infection, being vaccinated against influenza in the past season, and believing in the efficacy of COVID-19 vaccination.
44	Wang et al ⁴⁵	2020	806	Nurses	CS	China	40%	Being in a Private sector, having chronic conditions, encountering with suspected or confirmed COVID-19 patients, and having accepted influenza vaccination in 2019.
45	Wong et al ⁴⁶	2021	1200	Adults (≥18 years)	CS	China	37.2%	Perceived severity, Perceived benefits, cues to action, self-reported health outcomes, and trust in healthcare systems.

Abbreviations: HCWs, health-care workers; HCP, healthcare personnel; CS, cross-sectional; MS, multiple sclerosis; UK, United Kingdom; CRD, chronic respiratory disease; NA, Not applicable; LAC, Latin America and the Caribbean.

United States,^{33,38} one study from Bangladesh,⁶³ one study from Jordan,⁶⁴ one study from Italy,⁶⁶ and one study from Ethiopia.⁶⁷ Generally, the present systematic review has briefly summarized factors associated with the willingness of receiving COVID-19 vaccine. They were; age, educational status, gender, income, residency, occupation, marital status, race/ethnicity, perceived risk of COVID-19, trust in healthcare system, health insurance, norms, attitude towards a vaccine, perceived benefit of vaccine, perceived vaccine barriers, self-efficacy, up-to-date on vaccinations, tested for COVID-19 in the past, responsibility, perceived efficacy of the COVID-19 vaccination, use of social media for COVID-19 vaccine-related

information, recommended for vaccination, political leaning, perceived severity of COVID-19, perceived effectiveness of a COVID-19 vaccine, belief that vaccination makes them feel less worried about COVID-19, believing in mandatory COVID-19 vaccination, perceived potential vaccine harms, presence of chronic disease, previously received an influenza vaccine, confidence, having COVID-19 vaccine safety concern, working in the healthcare field, believing vaccines can stop the pandemic, relying on Centers for Disease Control and Prevention website for COVID-19 updates, fear about COVID-19, being HCWs, close attention to the latest news of the vaccine, cues to action, COVID-19 vaccine hesitancy, receiving

any vaccine in the past 5 years, perception of disease can be prevented by vaccine, willingness to protect others by getting oneself vaccinated, taking direct care of COVID-19 patients, belief that only people who are at risk of serious illness should be vaccinated, trust in government, complacency, willingness to pay for and travel for a vaccine, themselves or a member of their household belonged to a vulnerable group, trust in public health authorities, believing COVID-19 virus was not developed in laboratories, believing COVID-19 is far more contagious and lethal relative to the H1N1 virus, compliance with community mitigation strategies, being in a private sector, encountering with suspected or confirmed COVID-19 patients, self-reported health outcomes, believing that next waves COVID-19 are coming, knowledge score regarding symptoms, transmission routes and prevention and control measures against COVID-19, and perception that COVID-19 will persist (Table 1).

Discussion

It is known that more than half of the world's population faces long-term restrictions as the new normal to avoid the spread of COVID-19.⁷⁵ As the COVID-19 pandemic is extensive across the worldwide, there is an urgent requirement to develop effective vaccines as the most powerful approach to stop the pandemic.⁷⁶ Scientists are suffering to offer a verified treatment for COVID-19. This is due to that the development of vaccines against COVID-19 and their global access are a priority to end the pandemic. However, the success of this approach depends on individuals' willingness of immunization. Questions like "what will happen if the individuals' do not want the injection?" is what makes worry the experts. Because of this, numerous experts have warned against a worldwide for the decrease in community trust in immunization and the rise of vaccine hesitancy during the past decade.⁷⁷

The present systematic review has included all cross-sectional studies conducted on the willingness to receive COVID-19 vaccine and its associated factors. This is because understanding the level of willingness to receive and the associated factors of COVID-19 vaccine would provide valuable knowledge and direction for clinical implementation and intervention development. The present systematic review has reviewed all evidences on the willingness to receive COVID-19 vaccine and its associated factors. During this, 45 cross-sectional studies from different countries were included. The findings of the present systematic review revealed that there was a large

variability on the level of willingness to receive COVID-19 vaccine in different countries. The overall rate of participants' willingness to receive a COVID-19 vaccine was ranged from 27.7% to 91.3%, which was reported from Congo and China, respectively.^{47,55} This suggests that there is a serious problem to manage and control of the current COVID-19 pandemic. For the purpose of a permanent solution, vaccines are being developed by numerous countries for the safety of their populations for the current COVID-19 pandemic.⁶⁰ This is because, if a vaccine becomes available, it might be achievable to develop herd immunity and guard those who are most susceptible to the critical consequences of COVID-19.⁷⁵ However, with this level of willingness towards receiving COVID-19 vaccine, it would be extremely difficult to manage and control the current COVID-19 pandemic. By in turn, this might prolong the period of this pandemic affecting all populations of age category globally.

Concerning to the associated factors, from a total of 45 studies included in the present systematic review, 39 of the studies have assessed the associated factors with individuals' willingness of receiving COVID-19 vaccine. From 39 studies assessed the associated factors with willingness of receiving COVID-19 vaccine, some of the studies have reported that sociodemographic factors such as age,^{32,35–37,39,43,48,49,56,58,60,61,65,68,69,72,73} educational status,^{30–32,36,43,72} gender,^{32,35–37,47,48,52,53,55,59–61,65,68,69,71–74} income,^{36,54,61} residency,^{36,60,74} occupation,^{54,62} marital status,^{47,49,71} and race/ethnicity^{32,35,37,54} were factors associated with willingness of receiving COVID-19 vaccine. This might be due to that education is a powerful strategy to disseminate the essential information about the health of individuals. In fact, the level of education of people will affect the general knowledge and awareness of the individuals in particular, whereas residency has also an effect on information achievement since the urban population receives information more easily when compared to the rural population. Occupation could also affect the willingness of individuals towards receiving COVID-19 vaccine in many ways of which like being HCWs or being stressed for his/her work is among them while they are eager for vaccination relative to their contrary. Age has also an impact on the willingness of people towards this vaccine. Particularly, older age individuals might have a sense of responsibility and accountability for themselves and their families' relative to the youngest age group individuals. The level of income also affects the willingness of an individual towards this vaccine. The possible justification would be that the expenses paid for the transport

purpose. Concerning to the marital status; this could also affect the willingness of the individual towards this vaccine, while married individuals have relatively a feeling of more responsible because of their collective family responsibilities.

Furthermore, the study reported that factors such as perceived risk of COVID-19,^{30,31,34,44,47,50,51,53,58,59,68–71} trust in healthcare system,^{46,51} health insurance,^{31,48} norms,^{31,65} attitude towards a vaccine,^{31,55,58} perceived benefit of vaccine,^{31,40,46,65,70} perceived vaccine barriers,^{31,40,70} self-efficacy,³¹ up-to-date on vaccinations,³² being tested for COVID-19 in the past,^{32,72} responsibility,³⁹ perceived efficacy of the COVID-19 vaccination,^{41,47} use of social media for COVID-19 vaccine-related information,⁴¹ recommended for vaccination,³⁴ political leaning,³⁴ perceived severity of COVID-19,^{34,44,46,70,74} perceived effectiveness of a COVID-19 vaccine,^{34,43,59,61} belief that vaccination makes them feel less worried about COVID-19,⁵⁹ believing in mandatory COVID-19 vaccination,⁵⁰ perceived potential vaccine harms,^{34,42,53,58} presence of chronic disease,^{45,48,60} previously received an influenza vaccine,^{43,45,47,50,53,58,69} confidence,^{39,42,73} having COVID-19 vaccine safety concern,^{52,65} working in the healthcare field,⁶⁵ believing vaccines can stop the pandemic,⁵² relying on Centers for Disease Control and Prevention website for COVID-19 updates,⁵² fear about COVID-19,^{68,69} being HCWs,⁶⁸ close attention to the latest news of the vaccine,⁴³ cues to action,^{46,70} COVID-19 vaccine hesitancy,⁷¹ receiving any vaccine in the past 5 years,⁷¹ perception of disease can be prevented by vaccine,⁴⁴ willingness to protect others by getting oneself vaccinated,⁶¹ taking direct care of COVID-19 patients,⁷² belief that only people who are at risk of serious illness should be vaccinated,⁵⁸ trust in government,⁷³ complacency,^{39,42} willingness to pay for and travel for a vaccine,⁷³ themselves or a member of their household belonged to a vulnerable group,⁵⁶ trust in public health authorities,⁷³ believing COVID-19 virus was not developed in laboratories,⁵⁶ believing COVID-19 is far more contagious and lethal relative to the H1N1 virus,⁵⁶ compliance with community mitigation strategies,⁷⁴ being in a private sector,⁴⁵ encountering with suspected or confirmed COVID-19 patients,⁴⁵ self-reported health outcomes,⁴⁶ believing that next waves COVID-19 are coming,⁵⁶ knowledge score regarding symptoms, transmission routes and prevention and control measures against COVID-19,⁵⁶ and perception that

COVID-19 will persist⁵⁷ were factors associated with the willingness of receiving COVID-19 vaccine.

This might be due to that behavioral factors have a critical influence on the newly developed things, particularly like that of vaccines. Perception or attitude towards COVID-19 vaccine might be due to lack of sufficient knowledge or awareness concerning to this vaccine. In fact, the information has a strong effect on the awareness of individuals because it would clarify the misunderstandings that make people confused. Besides, people might consider the personal protection behaviours as a substitute of vaccination in the prevention of COVID-19. They may believe commitment to these precautions is adequate for the prevention of this pandemic.⁷⁸ This evidence suggests that the community should be aware that personal protection behaviour could not be a substitute for vaccination to prevent COVID-19 infection. This might be because of the misinformation dissemination within the community. Furthermore, a pandemic is a community experience putting a substantial effect on all citizens and demanding a cooperative response.⁷⁹ However, vaccine hesitancy leftovers a barrier to community vaccination against extremely infectious diseases.⁸⁰ It is a key impending problem for this pandemic.⁸¹ It remains insidious and multifactorial even in individuals of COVID-19 survivors, since most recovered patients revealed to be refusing or uncertain regarding SARS-CoV-2 vaccination.⁷⁹ COVID-19 vaccine hesitancy is common and can be a barrier to the distribution of vaccines.⁸² This is because of that the community would be concerned for the safety of the vaccine, since COVID-19 vaccines were rapidly developed globally. This could contribute to vaccine hesitancy.⁸⁰

The Importance of Understanding the Level of Willingness to Receive COVID-19 Vaccine and Its Associated Factors

The COVID-19 pandemic has significantly harmed the lives of individuals globally. This is by affecting their economic welfare, their health, and changing the behavior of our society extensively. This condition may lead to a strong incentive for individuals to buy a COVID-19 vaccine.⁸³ However, there is controversy about the safety and efficacy of COVID-19 pandemic vaccines, which may contribute to low vaccination rates.⁸⁴ Besides, even though researchers have been working rapidly and collaboratively for the development of vaccines against this pandemic, the

effort of the scientific community in searching a vaccine for COVID-19 may be hindered by a diffused vaccine hesitancy.⁸⁵ The actual effectiveness of vaccination against COVID-19 might be challenged by vaccine hesitancy.⁸⁶ The decline of participants' willingness to vaccinate for COVID-19 may undermine the pandemic response and the public health advantages' of an effective vaccine.⁸⁷ Besides, the low vaccination response could make the accomplishment of herd immunity to COVID-19 difficult and unnecessarily extend the pandemic.⁸⁸

Since HCWs are amongst the first to receive COVID-19 vaccines, their perception or attitude about the safety of these vaccines should be addressed as early as possible.⁸⁹ Therefore, advanced understanding of young adults' willingness to take a COVID-19 vaccine and the possible factors affecting their vaccine intention will contribute to the development and implementation of effective methods to encourage COVID-19 vaccine uptake among this group.⁹⁰ This finding was supported by the study which reported that addressing sociodemographic determinants relating to the COVID-19 vaccination may support to augment the utilization of the worldwide vaccination program to tackle future pandemics.⁴⁹ Improving the understanding of vaccination hesitancy in the perspective of COVID-19 and finding and using policies to control it, may be as significant as discovering a safe and effective vaccine.⁹¹

Besides, in order to improve attitudes towards COVID-19 vaccination, it is very vital to start providing community health education on the COVID-19 vaccine as soon as possible prior to an availability of this vaccine.⁸⁸ Overall, based on these evidences, targeted health education interventions are required to augment the uptake of the future COVID-19 vaccine.⁴⁹ In addition to this, by educating the general population about the safety, advantages, and efficacy of vaccines can we hope to prevent the needless delay of the COVID-19 pandemic.⁸⁸ It is crucial that the public communicate their understanding that the risk of unfavorable results from anything other than rigorous product development likely will reverberate throughout the population and possibly spill into the fear of vaccines. Swift action is essential for this urgently required vaccine. However, ensuring it is safe is an ethical and humanistic responsibility even if no one in the community is inspecting.⁹²

Finally, in the present systematic review, the level of participants' willingness towards COVID-19 vaccine and its associated factors throughout different countries have

been briefly summarized. This showed that there were some countries that have very low levels of willingness towards COVID-19 vaccine. Furthermore, there were several factors that were found to have an association with the willingness to receive this vaccine (Table 1). This suggests that there is a critical problem. This is because if they have unfavorable attitude, perceptions, and hesitancy towards this vaccine, these would have a massive effect on the vaccination rate, particularly if they are HCWs. The study suggested that it is essential to ensure that both the HCWs and the public have access to reliable and sufficient information about vaccines to increase a vaccine acceptance rate.⁹³ This is due to that in fact, if HCWs will not eager to recommend the community to have COVID-19 vaccine, this would have a critical effect on the population's utilization of this vaccine. Therefore, these could prolong the era of this COVID-19 pandemic. This is supported by the study which stated that future education must be prioritized for HCWs for vaccine acceptance by the population. This is due to that their attitude regarding the vaccines has proved to be a determining factor significant to their own use of the vaccine and their willingness to recommend a vaccine to their patients.⁹⁴

Conclusion

COVID-19 has been initially reported from China. Then after, rapidly crossed all borders by infecting people of all age groups globally. It is known that this pandemic puts a critical worldwide confrontation with large impacts and several undisclosed events. This pandemic has caused a considerable loss of life and developed into a historic danger to several healthcare systems globally. The crucial element in this initiative is the human behavior to accept a COVID-19 vaccine.

The overall rate of participants' willingness to receive the COVID-19 vaccine was ranged from 27.7% to 91.3%, which was from Congo and China, respectively. Age, educational status, gender, income, residency, occupation, marital status, race/ethnicity, perceived risk of COVID-19, trust in healthcare system, health insurance, norms, attitude towards vaccine, perceived benefit of vaccine, perceived vaccine barriers, self-efficacy, up-to-date on vaccinations, tested for COVID-19 in the past, responsibility, perceived efficacy of the COVID-19 vaccination, use of social media for COVID-19 vaccine-related information, recommended for vaccination, political leaning, perceived severity of COVID-19, perceived effectiveness

of a COVID-19 vaccine, belief that vaccination makes them feel less worried about COVID-19, believing in mandatory COVID-19 vaccination, perceived potential vaccine harms, presence of chronic disease, previously received an influenza vaccine, confidence, having COVID-19 vaccine safety concern, working in the healthcare field, believing vaccines can stop the pandemic, relying on Centers for Disease Control and Prevention website for COVID-19 updates, fear about COVID-19, being HCWs, close attention to the latest news of the vaccine, cues to action, COVID-19 vaccine hesitancy, receiving any vaccine in the past 5 years, perception of disease can be prevented by vaccine, willingness to protect others by getting oneself vaccinated, taking direct care of COVID-19 patients, belief that only people who are at risk of serious illness should be vaccinated, trust in government, complacency, willingness to pay for and travel for a vaccine, themselves or a member of their household belonged to a vulnerable group, trust in public health authorities, believing COVID-19 virus was not developed in laboratories, believing COVID-19 is far more contagious and lethal relative to the H1N1 virus, compliance with community mitigation strategies, being in a private sector, encountering with suspected or confirmed COVID-19 patients, self-reported health outcomes, believing that next waves COVID-19 are coming, knowledge score regarding symptoms, transmission routes and prevention and control measures against COVID-19, and perception that COVID-19 will persist were factors associated with the willingness of receiving COVID-19 vaccine.

The present systematic review has addressed crucial issues for healthcare providers, stakeholders, governments, health policy-makers and implementers, researchers, and for the community as a whole. The significant policy effort may be vital to improve the community willingness to accept a COVID-19 vaccine to have sufficient vaccination rates. It is very significant to start providing health education to the communities on the issue of COVID-19 vaccination as soon as possible in order to improve their willingness towards COVID-19 vaccination. The general public should be aware about the safety, benefits, and efficacy of a vaccine for COVID-19 to prevent the unnecessary prolongation of the COVID-19 pandemic. Lastly, since COVID-19 vaccine is found to be a crucial preventive approach that can halt this pandemic, all barriers that could influence the willingness of receiving COVID-19 vaccine should be urgently addressed by community health strategies.

Abbreviations

COVID-19, coronavirus disease 2019; WHO, World Health Organization; HCWs, healthcare workers; SARS-CoV-2, severe acute respiratory syndrome Coronavirus 2; PRISMA, Preferred Reporting Item for Systematic Review and Meta-Analyses; NOS, Newcastle–Ottawa Scale; HCP, healthcare personnel; CS, cross-sectional; MS, multiple sclerosis; UK, United Kingdom; CRD, chronic respiratory disease; NA, not applicable; LAC, Latin America and the Caribbean.

Data Sharing Statement

The data used to support the findings of this study are on the hands of the corresponding author.

Author Contributions

The author made a significant contribution to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; and agrees to be accountable for all aspects of the work.

Disclosure

The author declares no conflicts of interest for this work.

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