

Acceptance of COVID-19 Vaccine and Its Associated Factors Among Ethiopian Population: A Systematic Review

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Introduction: Coronavirus disease 2019 (COVID-19) is a global health threat. Millions of lives were lost to COVID-19 and it has caused a substantial economic crisis throughout the world. The development of coronavirus vaccines has pinned a new hope in combating the pandemic. The success of vaccination and development of herd immunity highly depend on the willingness to be vaccinated, not merely on the availability of a vaccine. This review aims to provide comprehensive evidence on acceptance of COVID-19 vaccine and its associated factors in Ethiopia.

Methods: Literature searching was done using PubMed, Google scholar and Science direct databases. Studies conducted in Ethiopia, published in English language from inception until January 9, 2022 were included. Retrieved articles were screened based on titles, abstracts and full text reading to identify studies that met the inclusion criteria. About 21 eligible studies were included in this systematic review. The data were extracted using a data extraction checklist.

Results: A total of 2058 records were retrieved, of which 21 were eligible for this systematic review. All of the articles were cross-sectional studies published in 2021. In Ethiopia, the level of COVID-19 vaccine acceptance ranged from 31.4% to 92.33%. The vaccine acceptance level was significantly associated with age groups, sex, educational status, perceived susceptibility, perceived benefit, knowledge about COVID-19 vaccine, and other socio-demographic factors.

Conclusion: A significant portion of the studies revealed vaccine acceptance level was low. Variation of vaccine acceptance was associated with socio-demographic factors (age, sex, educational status, etc.), information-related factors, and other health-related behaviors. Dissemination of clear and adequate information concerning the vaccine might be the required prior activity to increase acceptance of the vaccine. Hence, there should be a coordinated effort to halt the pandemic through increasing the acceptance of COVID-19 vaccine.

Keywords: acceptance, COVID-19 vaccine, Ethiopia, systematic review

Introduction

Coronavirus disease (COVID-19) is a global health threat caused by a newly discovered coronavirus.¹ It was first detected in the city of Wuhan, in the province of Hubei, in China at the end of December 2019.² The principal mode of transmission is through exposure to respiratory droplets (close contact) carrying infectious virus. However, airborne transmission may be possible under circumstances.³ People with COVID-19 have had a wide range of manifestations ranging from mild symptoms to severe illness and death.⁴ Most people infected with the COVID-19 virus may experience mild to moderate respiratory illness and recover without requiring special treatment.¹ Older adults and people who have severe underlying medical conditions such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer are at higher risk of developing more serious complications.^{1,4} The World Health Organization (WHO) recommends to keep simple precautions such as physical distancing, wearing a face mask, keeping rooms well ventilated, avoiding crowds, and frequent hand washing.⁵ In spite of such preventive measures, the pandemic is still increasing. At the beginning of January 2022, there were over 304 million confirmed cases of COVID-19, and 5.4 million deaths have

been reported.⁶ As the COVID-19 pandemic continues, governments worldwide have pinned their hopes on the development of the vaccine.^{7,8}

The WHO recommends that everyone should have access to the vaccine as quickly as possible, starting with those at highest risk of serious disease or death.^{6,9} However, the newly established COVID-19 vaccines have faced much hesitancy from the start, with the lowest vaccine acceptance rates found in Kuwait (23.6%), Jordan (28.4%), Italy (53.7%), Russia (54.9%), Poland (56.3%), USA (56.9%), and France (58.9%).¹⁰ Moreover, rate of willingness to receive the vaccine ranged from 27.7% (in Congo) to 91.3% (in China).¹¹

The COVID-19 pandemic has led to a dramatic loss of human life worldwide and presents an unprecedented challenge to public health, food systems, and the world of work.¹² COVID-19 has had a strong impact on both developed and developing countries with fragile economies. It leaves the biggest negative effects on production networks, with a significant reduction in agricultural activities, tourism, trade, and industry.¹³ The economic and social disruption caused by the pandemic is devastating.^{12,14} In Ethiopia, the first COVID-19 case was reported in March 2020.¹⁵ Immediately after the first confirmed case, the Government of Ethiopia took several public health measures to prevent widespread infection.¹⁶ However the current status indicates the pandemic is still escalating in the country. Until April 4, 2021, there were 213,311 confirmed cases of COVID-19 and 2936 deaths.⁹ Moreover the pandemic exacerbated the prevailing health and socioeconomic threats as it has coexisted with the upsurge of desert locusts, social unrest and flooding in the country.¹⁷ As a result an estimated 6.7 million people were projected to be highly food insecure between October and December 2020.¹⁸ Study findings also indicated that there was a high prevalence of COVID-19 related depression, anxiety, and stress in Ethiopia.^{19,20}

Ethiopia received supplies of the vaccination against COVID-19 in the first week of March 2021 to vaccinate 20% of the target population by the end of 2021.^{15,21} The success of effective vaccination and development of herd immunity in the population is highly dependent on the willingness to be vaccinated by the community, not merely on the availability of the vaccine.²² Individual studies conducted in different regions of Ethiopia revealed fragmented information about acceptance of the vaccine.²³ A comprehensive systematic review of domestic studies is an important input for decision making, public health interventions, and controlling the pandemic in the country. This review is aimed at providing comprehensive evidence on acceptance of the COVID-19 vaccine and its associated factors in Ethiopia.

Methods

Search Strategy

This systematic review included relevant cross-sectional studies conducted in Ethiopia and published until January 2022. Search of literatures was done using three databases, namely PubMed, Google scholar and Science direct, using a combination of search terms that consists of “acceptance”, “COVID-19”, “vaccine”, “willingness”, “hesitancy”, and “Ethiopia”. Manual search of articles was performed to look for grey literatures. The two authors (FDB and SNA) independently identified articles from the databases, screened for eligibility and extracted relevant information. A total of 2058 papers were identified from the selected databases and Google, of which 21 were eligible for systematic review (Figure 1). We have also adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline on conducting and reporting this systematic review.

Eligibility Criteria

We included all cross-sectional studies that addressed the topic among the Ethiopian population, published in English language, and articles published until January 9, 2022. We excluded preprints, commentaries, poor quality studies which did not clearly report the acceptance of the vaccine and factor(s) related with vaccine acceptance and studies with inaccessible full texts (Figure 1).

Data Extraction

The collected records from searched databases were exported to Endnote version 7 software, and the duplicates were removed. Studies retrieved using the search engines were screened based on titles, abstracts and full text reading to

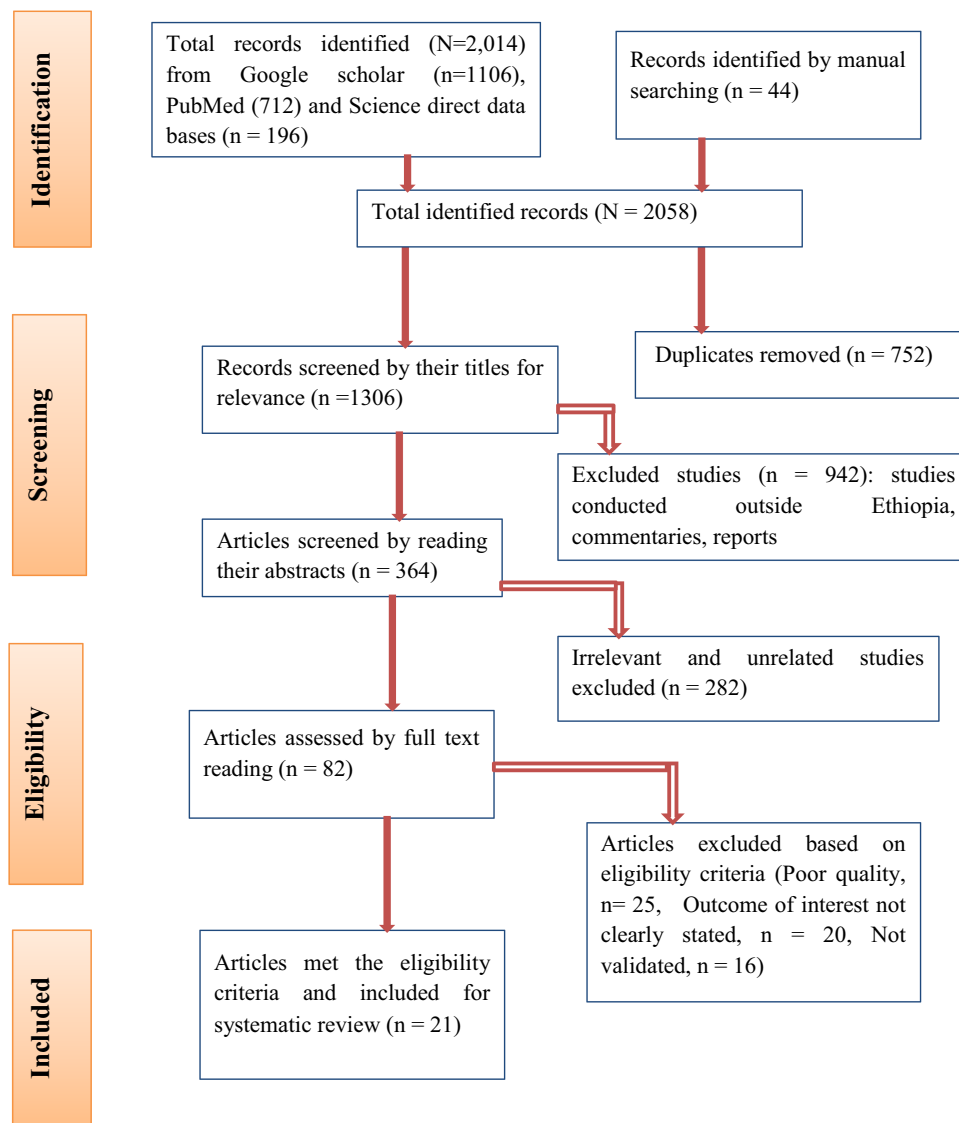


Figure 1 PRISMA flow diagram of the literature screening process.

Notes: PRISMA figure adapted from Moher D, Liberati A, Altman D, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *Journal of clinical epidemiology*. 2009;62(10).⁵⁰

identify studies that fulfill the inclusion criteria. The authors, independently, assessed the eligibility of each study and disagreements regarding inclusion of the studies were settled through discussion until concordance was reached. All studies screened by their title and abstract were read and re-read repeatedly to ease data extraction and further summarization of the results. Authors' first names, year of publication, sample size, level of vaccine acceptance, and factors associated with vaccine acceptance were included into the data extraction format.

Outcome of Interest

In this systematic review, level of COVID-19 vaccine acceptance (%), level of willingness to receive COVID-19 vaccine (%), and level of COVID-19 vaccine hesitancy (%) were the primary outcomes of interest. Socio-demographic, cultural, and health behavior related determinant factors were the secondary outcomes of interest.

Quality Assessment of Individual Studies

The two authors independently appraised the quality of individual studies. The Joanna Briggs Institute (JBI) quality appraisal checklist was used to evaluate the quality of the studies.²⁴ Studies that scored below 50% of the JBI evaluation checklist were referred as poor quality. Any disagreement between the authors during the appraisal process was discussed and resolved.

Ethical Consideration

This is the first systematic review conducted to summarize acceptance of COVID-19 vaccine in Ethiopia. Since this was a systematic review, which employed data extraction from already published research articles, it did not need a formal ethical approval and consent from participants.

Result

Characteristics of Included Studies

In this systematic review a total of 21 published articles were included. All of the articles were cross-sectional studies conducted in different areas and among different population groups of Ethiopia. All of the articles were published in the year 2021. The majority of the studies (17) were institution-based cross-sectional studies and the remaining four studies were community-based studies. The studies recruited various numbers of participants and sample sizes ranging from 232 to 2178 individuals. The study participants include health-care workers, patients, general population, school teachers and students (Table 1).

Acceptance of COVID-19 Vaccine

The acceptance level of COVID-19 vaccine has a potential variation among the reviewed studies. The smallest level was 31.4%²⁵ whereas the largest was 92.33%.²⁶ Nearly half (10) of the studies reported vaccine acceptance of less than 50%.^{25,27–35}

Factors Associated with Acceptance of COVID-19 Vaccine

All except one³⁶ of the articles included in this systematic review have clearly assessed the factors associated with acceptance of COVID-19 vaccine. According to this systematic review, almost half (10 out of 21) of the studies found a significant association between age category and vaccine acceptance.^{25,28,31,33,35,37–41} Among these, seven reported that age appeared to be positively associated with vaccine acceptance while the remaining three studies^{25,28,33} showed a negative association. Having good knowledge about the COVID-19 vaccine and/or its preventive measures was positively associated with vaccine acceptance.^{25,32,33,37,41–44} Higher educational level appeared to have a positive association with COVID-19 vaccine acceptance.^{30,33,37,41,42} Similarly, a positive attitude toward COVID-19 vaccine was significantly associated with increased vaccine acceptance rate.^{43,45,46}

More than one-third of the studies in this systematic review reported a significant association between sex of participants and vaccine acceptance. Most of these studies found higher vaccine acceptance rate among males than females.^{28–30,32,39,40} Opposite to this finding, a couple of studies found higher vaccine acceptance in females than in males.^{25,33} Four studies revealed better vaccine acceptance among participants with history of chronic disease.^{32,34,37,46} High perceived risk of getting coronavirus infection,^{29,45,47} perceived severity of the disease,²⁵ and perceived benefit of COVID-19 vaccine^{29,47} were positively associated with COVID-19 vaccine acceptance. Having good practice of COVID-19 preventive measures,^{34,38,42,44} access to the media,³⁰ previous interaction with someone infected by COVID-19,^{26,30,46} urban residence,^{33,42} having children,²⁶ being a physician or health professional,^{31,34,44} and being single^{28,33} also had a positive association with the acceptance of COVID-19 vaccine.

On the other hand, engagement with non-farm businesses,⁴⁰ those who reported that it is dangerous to overdose vaccines and who said vaccinations increase allergic reactions, private sector worker,³³ high perceived barrier,⁴⁷ participants who do not trust the Ministry of Health to assure the safety of COVID-19 vaccine and do not trust science to produce safe and effective vaccines,³⁵ were negatively associated with vaccine acceptance (Table 1).

Table I Characteristics of the Included Studies on the Acceptance of COVID-19 Vaccine in Ethiopia

S.N	Author, Year	Participants	Study Design	Sample Size	Level of Acceptance (%)	Factors Associated with COVID 19 Vaccine Acceptance
1	Angelo et al., 2021 ³⁴	Health-care workers	Cross sectional	405	48.4%	Positive association - Type of profession (physician than nurses) - HCW with a history of chronic illness - Perceived their degree of risk to be medium than low - Good preventive practices than poor - Positive attitude toward COVID-19 than negative
2	Haimanot et al., 2021 ³⁷	Adult population	Cross sectional	492	62.6%	Positive association - age \geq 46 years - attending secondary education and above - having a chronic disease - Good knowledge about the COVID-19 vaccine
3	Aemro et al., 2021 ³⁸	Health-Care Workers	Cross sectional	418	54.1%	Negative association - Age \leq 25 years - Do not wear a mask during the pandemic - Do not comply with physical distancing during the COVID-19 pandemic - Unclear information provided by public health authorities - Low risk of getting COVID-19 infection - Not sure regarding the tolerability of side effects of the vaccine
4	Duferu et al., 2021 ³⁹	Health professionals	Cross sectional	522	62.1%	Positive association - Old age health professionals (> 40 years) - Being male - who perceived their family health status as healthy - who did not have a history of receiving other vaccines before as an adult Negative association - Only academic staffs and academic staffs working in university hospitals - Who had no history of contact with confirmed COVID-19 patients or clients
5	Guangul et al., 2021 ³⁶	Health-care workers	Cross sectional	668	70.2%	-
6	Molalegn, 2021 ³⁰	Adult population	Cross sectional	415	45.5%	Positive association - Being male - Owner of college or higher education degree - Access to the media - Received any vaccine during childhood - Having a family member diagnosed with COVID-19 - Whose friends had been diagnosed with COVID-19 - Who had tested for COVID- 19

(Continued)

Table I (Continued).

S.N	Author, Year	Participants	Study Design	Sample Size	Level of Acceptance (%)	Factors Associated with COVID 19 Vaccine Acceptance
7	Zewude, 2021 ²⁶	Health-care workers	Cross sectional	232	61.6%	Positive association - Having children - Previous interaction with someone infected by COVID-19 - Perception that COVID-19 causes a severe illness - Experience of receiving the first round of COVID-19 vaccine
8	Ayeneu, 2021 ⁴²	Lactating mothers	Cross sectional	630	61%	Positive association - Residing in the urban area, - Having secondary and above educational status - Taking immunization counseling - Having good knowledge about COVID-19 vaccine - Having good adherence to COVID-19 mitigation measures
9	Fitalew, 2021 ²⁵	Cancer patients	Cross sectional	422	44.2%	Positive association - Younger age (18–30 years) - Female cancer patients - Who have information about the vaccine - Who experienced either previous or current COVID-19 infection - Who believe in the likelihood of dying of COVID-19 infection
10	Oyekale AS, 2021 ⁴⁰	Households	Cross sectional	2178	92.33%	Positive association - Being male - older age - currently working Negatively associated - Urban dwellers - Engagement with non-farm businesses
11	Ayeneu, 2021 ⁴¹	Pregnant women	Cross sectional	396	70.7%	Positive association - Being in 34–41 years age group - Completed primary education - Having good knowledge of COVID-19 and its preventive measures

(Continued)

Table I (Continued).

S.N	Author, Year	Participants	Study Design	Sample Size	Level of Acceptance (%)	Factors Associated with COVID 19 Vaccine Acceptance
12	Yitayeh et al., 2021 ³³	General population	Cross sectional	1184	31.4%	<p>Positive association</p> <ul style="list-style-type: none"> - Know about the effectiveness of COVID-19 vaccine - Believing that it is not possible to reduce the incidence of COVID-19 without vaccination - Believing that the COVID-19 vaccine should be distributed fairly to all of us - Being female - Age < 30 years old than > 31 - Unmarried - Urban in residence - Not having a health-related job - Educational status of university/above <p>Negative association</p> <ul style="list-style-type: none"> - Perceived dangerous to overdose vaccines - Perceived vaccinations increase allergic reactions - Those who reported as yes to the idea that vaccinations increase autoimmune diseases - Private sector worker in occupation - Muslim religion follower
13	Handebo et al., 2021 ⁴⁷	School teachers	Cross sectional	301	54.8%	<p>Positive association</p> <ul style="list-style-type: none"> - Being affiliated with other category of religion - Perceived susceptibility, - Perceived benefit, and - Cues to action <p>Negative association</p> <ul style="list-style-type: none"> - Having bachelor degree educational status - Perceived barrier
14	Mohamed et al., 2021 ³⁵	Health-Care Workers	Cross sectional	614	39.7%	<p>Positive association</p> <ul style="list-style-type: none"> - Having > 10 years of work experience - Those who had been working at the Emergency Department <p>Negative association</p> <ul style="list-style-type: none"> - HCWs aged <30 years - Profession other than medical doctors and/or nurses - HCWs who agreed with the statement "acquiring immunity naturally is better than via vaccination" - Who did not trust the Ministry of Health to assure the safety of COVID-19 vaccine - Participants who do not trust science to produce safe and effective vaccines - Who disagreed with the statement that "COVID-19 vaccines are safe" - Who expressed their concern about the risks of COVID-19 vaccine

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Table I (Continued).

S.N	Author, Year	Participants	Study Design	Sample Size	Level of Acceptance (%)	Factors Associated with COVID 19 Vaccine Acceptance
15	Bewunetu, 2021 ²⁷	Teachers, bank employees, and university instructors	Cross sectional	319	46.1%	Positive association - Positive attitude towards the vaccine - Belief that COVID 19 exists in the study area - Perception that prevalence and death rate reports of the government are real - Status of chronic diseases - Having a close relative/friend ever infected by COVID-19
16	Gete et al., 2021 ⁴³	Chronic patients	Cross sectional	416	59.4%	Positive association - Having health insurance - Who knew anyone diagnosed with COVID-19 - Having good knowledge about the COVID-19 vaccine - Positive attitude toward the COVID- 19 vaccine
17	Yibeltal et al., 2021 ³²	HIV- patients	Cross sectional	398	33.7%	Positive association - Who have been diagnosed with chronic diseases - Being male - Having good knowledge of COVID-19 practice
18	Yewlsey et al., 2021 ³¹	Health professional	Cross sectional	319	42.3%	Positive association - Age of 30 or above - Being physicians than nurses - Being pharmacists than nurses
19	Kegnie et al., 2021 ²⁹	School teachers	Cross sectional	301	40.8	Positive association - Being male - Teachers from private school - High perceived susceptibility to COVID-19 - High perceived benefit of COVID-19 vaccine
20	Chalachew and Seid 2021 ²⁸	Health professional	Cross sectional	250	38%	Positive association - Being male - Aged less than 32 years - Being single - Who worked in a coronavirus treatment unit, - Who had a positive coronavirus test - No current history of physical illness
21	Birhan et al., 2021 ⁴⁴	University students	Cross sectional	423	69.3%	Positive association - Being knowledgeable to COVID-19: - Being a health science student - Being in a family practicing COVID-19 prevention

Abbreviations: COVID-19, coronavirus disease 2019; HCWs, health-care workers.

Discussion

In this systematic review the vaccine acceptance rate was higher among older age groups,^{28,31,35,37-41} males,^{28-30,32,37,39} those who had attended secondary and above education,^{4,9,11,15,16} who are knowledgeable about COVID-19 vaccine,^{25,32,33,37,41,43,44} and perceive that COVID-19 causes a severe illness/death.^{25,26,29} The association between age and vaccine acceptance may be related with the fact that the impact of COVID-19 infection is more severe with

increasing age, and older unvaccinated people are more likely to be hospitalized or die from COVID-19.⁴⁸ As a result older people who perceive severity of the disease may be more likely to accept the vaccine. In line with the current finding, a survey conducted in 15 African countries found that males were more likely to accept the vaccine.⁴⁹ The possible explanation for this association might be due to the fact that males have relatively better health-seeking behavior and decision-making power than females. The effect of knowledge on vaccine acceptance is obvious, i.e. people who get the correct information about the vaccine are more likely to have a positive attitude and willing to take the action.

Participants who had a family member or friend diagnosed with COVID-19,^{26,30} worked in a coronavirus treatment unit,²⁸ tested for COVID-19,^{28,30} resided in urban areas,^{33,42} had a chronic disease,^{32,34,37} had access to the media, received any vaccine during childhood,³⁰ had a positive attitude toward the COVID-19 vaccine,^{34,43} and perceiving their family as healthier than their counterparts, have children,²⁶ previous interaction with someone infected by COVID-19,²⁶ received immunization counseling during EPI,⁴² had good practice of COVID-19 preventive measures,^{34,41} do not have a health-related job, orthodox in religion,³³ those with >10 years of work experience and those who had been working at the emergency department,³⁵ who believe COVID-19 exists in the study area, who think that prevalence and death rate reports by the government are real,²⁷ had perceived susceptibility and perceived benefit,^{29,47} who had health insurance, those who knew anyone diagnosed with COVID-19,⁴³ being a private school teacher,²⁹ being a health science student and being member of a family practicing COVID-19 prevention⁴⁴ were more likely to accept the COVID-19 vaccine. On the other hand some studies found higher vaccine acceptance among younger age group (18–30 years), females,^{25,33} and those who experienced either previous or current COVID-19 infection.²⁵

Acceptance of COVID-19 vaccine is lower among individuals who were not compliant with physical distancing, perceived unclear information by public health authorities, perceived low risk of getting COVID-19 infection, and not sure about the tolerability of the vaccine,³⁸ only academic staff and academic staff working in university hospitals (compared with those who were health office staff),³⁹ had no history of contact with confirmed COVID-19 patients compared with those who had direct contact with confirmed COVID-19 patients or clients,³⁹ health-care workers other than medical doctors and/or nurses,^{31,34,35} participants who did not trust the Ministry of Health to assure the safety of COVID-19 vaccine, participants who do not trust science to produce safe and effective vaccine,³⁵ who have close relatives or friends ever infected by COVID-19²⁷ and those with perceived barrier.⁴⁷ Supporting this evidence, a multi country survey conducted by African CDC team revealed that the majority of the vaccine-hesitant population had concerns on vaccine safety.⁴⁹ This systematic review may have limitations, for example, as some of the studies collected the data through online systems, this may introduce sampling error and information biases. Meta-analyses were not done, instead the systematically searched studies have been qualitatively summarized.

Conclusion and Recommendation

Acceptance of COVID-19 vaccine in Ethiopia ranged from the lowest level of 31.4% to the highest level of 92.33%. A significant portion of the studies found that vaccine acceptance rate is below 50%. Variation of vaccine acceptance rate among different population groups is associated with socio-demographic factors (including age, sex, educational status, residence, occupational status, etc.), information-related factors (knowledge about COVID-19 vaccine, access to mass media, etc.) and other health-related behaviors. Dissemination of clear and adequate information concerning the vaccine's benefit, effectiveness, safety, and side effects is the best prior activity to increase acceptance of the vaccine. Hesitancy, uncertainty, and rumors regarding the vaccine should be minimized by behavioral change communication. Hence, there should be coordinated efforts to halt the pandemic through increasing the acceptance of COVID-19 vaccine.

Abbreviations

COVID-19, coronavirus disease 19; ICTV, International Committee on Taxonomy of Viruses; JBI, Joanna Briggs Institute; JJU, Jigjiga University; SARS COV2, severe acute respiratory syndrome coronavirUS 2; WHO, World Health Organization.

Author Contributions

All authors made a significant contribution to the work in the conception, study design, execution, acquisition of data, analysis and interpretation of the result, took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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