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Willingness to accept COVID-19 vaccine and its determinants in Ethiopia: A systematic review and meta-analysis

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Introduction: Vaccination is one of the most crucial strategies in the control of pandemics such as COVID-19. Although a couple of research has been conducted to assess the willingness of the population to accept the COVID-19 vaccine, the findings are inconsistent and inconclusive. This study aimed to assess the pooled willingness to uptake the COVID-19 vaccine and its determinants in Ethiopia.

Methods: Published and unpublished articles were accessed from various electronic databases and digital libraries. A random-effects model was used to estimate the pooled effect size with a 95% confidence interval. Inverse variance (I^2) was used to visualize the presence of heterogeneity. Publication bias was assessed using funnel plots and Egger's statistical test.

Results: A total of 2345 studies were identified from several databases and 16 studies fulfilled the eligibility criteria and were included in the final meta-analysis. The pooled magnitude of willingness to accept the COVID-19 vaccine in Ethiopia was 55.19% (95% CI: 42.91, 67.48). The current meta-analysis indicated that age greater than 25 years (OR=1.49, 95% CI: 1.12, 1.98) and having a good attitude towards the COVID-19 vaccine (3.57, 95% CI: 1.46, 8.72) were significantly associated with the COVID-19 vaccine uptake.

Conclusions and recommendations: In general, the magnitude of the COVID-19 vaccine acceptance rate among the public is unacceptably low in Ethiopia. Therefore, there is a need to build public trust through the provision of reliable and consistent information about vaccines using different media outlets.

KEYWORDS

COVID-19 vaccine, COVID-19 vaccine uptake, Ethiopia, systematic review, meta-analysis

Abbreviations: AA, Addis Ababa; AOR, Adjusted Odds Ratio; CI, Confidence Interval; HCW, Health Care Worker; IAQ, Interview Administered Questionnaire; J and J, Johnson and Johnson; SAQ, Self-Administered Questionnaire; SNNP, Southern Nation, Nationalities and People.

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome 2 (SARS-CoV-2) viruses. It mainly affects an immunosuppressed group of people, who have chronic medical conditions and older ages. It can also affect all age groups and sex leading to mild illness to death in severity (1). Since the emergence of SARS-COV-2 in late 2019 in Wuhan city, Hubei province of China, billions of human life has been affected and lost (2). It is an emerging virus that is highly pathogenic and has the recent worldwide pandemic officially named coronavirus disease (COVID-19). On 16th January 2023, the world has more than 662 million confirmed cases of COVID-19 and more than 6.7 million deaths due to the disease (3).

COVID-19 vaccines are effective at preventing people from getting sick with COVID-19. It prevents severe illness, hospitalizations, and death. Getting vaccinated is the best way to reduce the transmission of SARS-COV-2, the virus that can cause COVID-19. Therefore, it is recommended for any eligible group to stay up-to-date on their COVID-19 vaccine, including people with reduced immunity (4).

World health organization (WHO) is working tirelessly with partners to develop, manufacture and deploy safe and effective vaccines. Currently, COVID-19 vaccines have reached billions of people worldwide, the evidence is overwhelming that no matter which type is administered, the vaccines offer life-saving protection against a disease that has killed millions (5). The current focus of WHO remains on reducing the severity of the diseases and death as well as capacitating health care systems to combat negative consequences of COVID-19 (6). Around the globe, there are more than 137 types of COVID-19 vaccine candidates undergoing clinical trials and 194 candidates under pre-clinical development (5, 7, 8).

WHO and other organizations were suggesting the best global vaccination approach so that all the nations of the globe would be covered in an equitable manner. Among the approaches, vaccinating the most vulnerable people first is an important one. This is followed by distributing safe and effective vaccines that are backed by sciences through exercising global cooperation and generosity, cooperating with ministries of health, civil society partners, community and religious leaders to encourage voluntary vaccinations are the most commonly suggested ones (8, 9).

To date (17 Jun 2022) globally, 9.37 billion doses of the COVID-19 vaccine were administered among which 8.6% and 52% of people were fully and partly vaccinated respectively. This can represent 60.2% of the world population. Only 9.4% of the people in lower-income countries have received at least one dose. Since the delivery of the vaccine on 7th March 2021 in Ethiopia, where about 20 million people are residing, 11 million doses of the COVID-19 vaccine were administered to about 1.6 million people (1.35% fully and 6.59% partly) (10).

Few studies conducted in Ethiopia recently utilized limited number of studies, and missed some variables like attitude of the public towards the vaccine uptake (11–14). A number of associated factors were identified so far regarding the willingness of people to take COVID-19 vaccines; perceived susceptibility, safety (fear of side effects), willingness to pay for the vaccine, history of contracting COVID-19, knowledge regarding COVID-19, sex, occupation, religion, age and marital status (9, 15, 16).

Showing a comprehensive willingness to receive the vaccine and the determinants is paramount needed for Ethiopian people who will in turn helps to develop and implement effective means of promoting COVID-19 vaccine uptake and to curb the recent shocking increase in COVID-19 transmission. Different pocket studies done so far might not represent the whole picture of the level of willingness and the associated factors in Ethiopia as most of them were limited to small sample size, limited populations, and limited study area. Despite several studies conducted in Ethiopia, their findings are inconsistent and inconclusive. Revealing information related to the vaccine uptake is crucial to increasing the acceptability of vaccines and reducing factors contributing to the hesitancy of COVID-19 vaccines among health professionals (17, 18). Hence, this study aimed to assess the pooled willingness to accept the COVID-19 vaccine and its determinants in Ethiopia.

Methods and materials

Search strategy

Reporting

This systematic review and meta-analysis assessed the willingness to receive the COVID-19 vaccine and its determinant factors in Ethiopia. Meta-analysis was reported using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (19). We checked for the presence of systematic reviews and meta-analyses on this topic to prevent duplication. Both published and unpublished studies were searched thoroughly using electronic databases such as Medline, Embase, Hinari, Pub Med, Cochrane library, Web of Science, and Google Scholar using different key terms. To find unpublished papers, some research centers, including the Digital Library of universities in Ethiopia were searched. All articles published and unpublished until January 15, 2022 were included in the review.

Pre-defined search terms were used to enable a comprehensive search strategy that included all relevant studies. All fields within records and Medical Subject Headings (MeSH terms) were used to expand the advanced Pub Med search. The search strategy was prepared and modified for the various databases using important Boolean operators with initial keywords "COVID-19 vaccine" OR "COVID-19 vaccine uptake" OR "willingness to receive COVID-19 vaccine" OR "willingness to accept COVID-19 vaccine" AND "associated factors" OR "determinants" AND "Ethiopia". Literature was downloaded to Endnote (version X7.2), to maintain and manage citation and facilitate the review process.

Selection and eligibility criteria

This systematic review and meta-analysis included studies conducted on the willingness to accept the COVID-19 vaccine and its determinants in Ethiopia. This review considered all

observational study designs that were written in the English. Participants were all residents of Ethiopia. This review included only studies conducted in Ethiopia. There were no limits on the studies based on sample size. We excluded articles, with low-quality assessment scales owing to methodological problems.

Outcome measurement

This systematic review and meta-analysis had two main outcomes. The primary outcome of review was the willingness to accept COVID-19 vaccine which was estimated as the total number of individuals with willing to take COVID-19 vaccine divided by the total number of COVID-19 vaccine takers multiplied by 100%. It is defined as those respondents who had responded "Yes" for a question "Do you accept COVID-19 vaccination if it is available?" and those who responded "No" were considered as vaccine hesitant" (20, 21).

The other outcome was the determinant factor of willingness to accept the COVID-19 vaccine which was determined in the form of an odds ratio and calculated based on the binary outcome from the included primary studies. The major factors identified after reviewing all primary articles were age (≤ 25 years or >25 years), marital status (married or not married), residence (rural/urban), knowledge towardsCOVID-19 vaccine (good knowledge/poor knowledge), attitude towards COVID-19 vaccine (good attitude/poor attitude), and history of chronic medical disorder (yes/no).

Quality assessment and data extraction

Citation management software (Endnote version X7.2) was used to combine the database search results and manually remove duplicate articles. The Newcastle-Ottawa Scale (NOS) adapted for cross-sectional studies was used for the quality assessment. Data were extracted by TT and GF. Then, checked by BW using standardized data extraction checklists on a Microsoft excel spreadsheet. For the first outcome (willingness to accept the vaccine), the data extraction checklist included the title, author name, year of publication, date of data collection, region, study design, sample size, participants, method of data collection, and number of subjects with the outcome variable. For the second outcome (determinant factors), data were extracted in a format of two by two tables, and the log odds ratio for each factor was calculated based on the findings of the original studies. Discrepancies between the two independent reviewers were resolved by including the third reviewer (BW) after discussion of the consensus.

Statistical analysis and synthesis

A systematic review was conducted to compare, contrast as well as to describe the results of the primary studies. The meta-analysis findings were analyzed using STATA version 14. The prevalence, standard error of prevalence, logarithm of odds ratio and standard error of the odds ratio (OR) for each included study were generated using the "generate" command in STATA. Heterogeneity was evaluated using the Q test and the inverse variance index (I^2). A random-effects model was used to estimate the pooled magnitude of the willingness to accept the COVID-19 vaccine. In addition, we conducted meta-regression and sub-group analyses to identify the source of heterogeneity. For subgroup analysis, the heterogeneity within groups was tested, using the same statistical methods. A subgroup analysis was conducted by the participants of the study and the data collection method.

A funnel plot of asymmetry was used to assess publication bias. Furthermore, Egger's statistical test was used to check the statistical significance of publication bias, and the I-squared statistic (I2 = 100% × (Q-df)/Q). For the Q test, a P-value of 0.10 or less was considered statistically significant, indicating marked heterogeneity among studiescand was considered statistically significant.

Results

Selection of studies

A total of 2345 published and unpublished articles related to titles were accessed in our initial literature search. Of the total identified, 1467 duplicate records were removed, leaving 878 articles. After initial screening, 845 articles were excluded based on their titles and abstracts. The abstracts and full texts of the remaining 33 studies were assessed and screened for eligibility criteria. Finally, 16 articles fulfilled all eligibility criteria and were included in the final analysis (Figure 1).

Summary of the included studies

From a total of 16 studies, 15 of the included studies were published in peer-reviewed journals and one was a preprint study (18). All the 16 articles included in this study were published in 2021. A total of 9560 participants were included in this systematic review and meta-analysis. The smallest sample size was 301 from a study conducted in Gondar town, Amhara region (22) and the largest sample size was 2178 from a study conducted by an online survey (23). All studies considered in the final review had a cross-sectional study design. Of the 16 studies included in the final analysis, six were conducted in SNNP (20, 24–28), four in the Amhara region (21, 22, 29, 30), three conducted online surveys at the national level (9, 16, 23), two in Addis Ababa (18, 31) and one in the Oromia region (32). Regarding the participants of the study, HCWs (16, 25, 30–32), general population (9, 18, 20, 23, 26, 28, 29), teachers and students (21, 22), and pregnant and lactating women (24, 27) were participated in the study. Four studies were collected *via* online surveys (9, 16, 23, 32), seven studies by interview (face to face) administered questionnaires (18, 22, 24, 26–29), and five

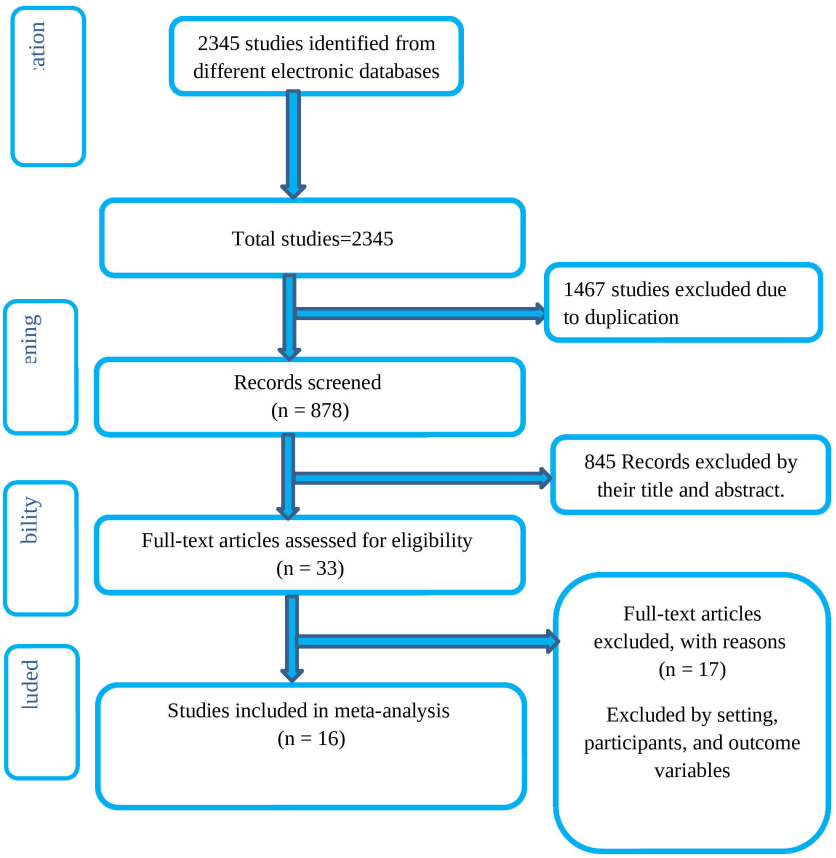

FIGURE 1
Flow diagram of the studies included in the meta-analysis.

studies were collected by self-administered questionnaires (20, 21, 25, 30, 31) (Table 1).

Substantial heterogeneity was found using χ2 and Cochrane Q test statistics (I^2 = 99.5, p < 0.001), and a random-effects model was used to estimate the pooled magnitude of willingness to accept COVID-19 vaccine. The overall pooled magnitude of willingness to accept the COVID-19 vaccine in Ethiopia was 55.19% (95% CI: 42.91, 67.48). The highest (92.33% (95%CI: 91.21, 93.45)) was observed in study conducted at national level by online survey (23), and the lowest 31.31% (95%CI: 26.83, 35.78) was reported in SNNP region (24) (Figure 2). To check for underlying heterogeneity, meta-regression models were performed using sample size and year of publication, but there was statistical insignificant for underlying heterogeneity (p = 0.546) and (p = 0.765), respectively.

Subgroup analysis

To assess heterogeneity among the included studies, subgroup analysis was performed based on the population that participated in the study and the method of data collection utilized in the primary studies. Accordingly, the highest magnitude of willingness to receive COVID-19 vaccine was reported among adult general population 62.06% (95% CI: 43.41, 80.72) whereas the lowest was observed in pregnant and lactating women 46.16% (95% CI: 17.11, 75.20) (Figure 3). According to the method of data collection utilized in the primary studies, the magnitude of willingness to accept COVID-19 was high among studies collected through online surveys 61.06% (95%CI: 32.31, 89.70) and the lowest was from studies collected by self-administered questionnaires 51.45% (95%CI: 40.79, 61.11) (Figure 4).

Result of publication bias and sensitivity analysis

To assess publication bias, a traditional funnel plot was used. The plot showed asymmetry of the plot which was suggestive of publication bias (Figure 5). Egger's test's weighted regression test and Begg's correlation test were performed to determine the significance of publication bias and there was no significant publication bias from both tests (p= 0.0.075 and 0.106), respectively. To see the effect of a single study on overall studies and outliers, a sensitivity analysis was performed and which showed that there was no single study influence on the overall included studies (Figure 6).

TABLE 1 Summary of Included Studies regarding willingness to accept COVID-19 vaccine in Ethiopia, 2022Willingness to accept COVID-19 vaccine.

S.N	Author	Year	Region	Study design	Data collection period	Population	Method of DC	Sample size	RR	COVID-19 vaccine acceptance	Prevalence (95% CI)
1	Gudisa B (28).	2021	Oromia	Cross-sectional	April 13/2021 to September 12/2021	HCWs	Online survey	422	100%	178	42.18(37.46, 46.89)
2	Kegnie S, et al. (19)	2021	Amhara	Cross-sectional	December 2020 to February 2021	Teachers	IAQ	301	99.60%	123	40.86 (35.31, 46.41)
3	Bewunetu Z, et al. (16)	2021	SNNP	Cross-sectional	March, 2021	Teachers, Banker, HCWs	SAQ	319	83.00%	147	46.08 (40.61, 51.5)
4	Birhan T, et al. (17)	2021	Amhara	Cross-sectional	20 to 30 January,2021	University students	SAQ	423	100%	293	69.26 (64.87, 73.66)
5	Rihanna M et al. (27)	2021	AA	Cross-sectional	March to July 2021	HCWs	SAQ	614	97%	242	39.41 (35.54, 43.27)
6	Abiy T et al. (18)	2021	SNNP	Cross-sectional	March 15 to 28, 2021	HCWs	SAQ	405	96.00%	196	48.39 (43.52, 53.26)
7	Yitayeh B, et al. (9)	2021	Ethiopia	Cross-sectional	February 2021 to March 2021	General Population	Online survey	1184	100%	560	42.29 (44.45, 50.14)
8	Abayomi S (20)	2021	Ethiopia	Cross-sectional	1st and 23rd of February 2021	General Population	Online survey	2178	100%	2011	92.33 (91.21, 93.45)
9	Dufera R, et al. (12)	2021	Ethiopia	Cross-sectional	June 1 to 30, 2021	HCWs	Online survey	522	100%	324	62.06 (57.90, 66.23)
10	Haimanot A, et al. (22)	2021	SNNP	Cross-sectional	March 1 to March 15, 2021	General Population	IAQ	492	98%	308	62.60 (58.32, 66.87)
11	Ayenew Mose, et al. (23)	2021	SNNP	Cross-sectional	February 1 up to March 15, 2021	Lactating mother	IAQ	630	99%	384	60.95 (57.14, 64.76)
12	Molalegn M (24)	2021	SNNP	Cross-sectional	April 1 to 30, 2021	General Population	IAQ	415	98%	189	45.54 (40.75, 50.33)
13	Agazhe A et al. (26)	2021	Amhara	Cross-sectional	May 15 to 10 June 2021	HCWs	SAQ	418	95%	226	54.06 (49.29, 58.84)
14	Shewangizaw H, et al. (21)	2021	SNNP	Cross-sectional	February to 1 March 2021	Pregnant women	IAQ	412	97%	129	31.31 (26.83, 35.78)
15	Nebiyu D, et al. (18)	2021	AA	Cross-sectional	January 20 – 31, 2021	General Population	IAQ	409	96.90%	331	80.92 (77.12, 84.73)
16	Gete B, et al. (25)	2021	Amhara	Cross-sectional	May 1–20, 2021	General Population	IAQ	416	98.60%	247	59.37 (54.65, 64.09)

Determinants of willingness to accept COVID-19 vaccine

To identify the determinants of willingness to accept the COVID-19 vaccine, several variables from the primary studies were reviewed. Thus, we identified seven main variables that strongly predicted the willingness to accept the COVID-19 vaccine. These variables were sex of participants, age of participants, marital status, residence, knowledge about COVID-19 vaccine, attitude about COVID-19 vaccine, and having a chronic medical disease (Table 2). In the pooled analysis, only two factors (age of participants and attitude about COVID-19 vaccine) were significantly associated with willingness to accept the COVID-19 vaccine (Figure 7), while the remaining five variables were not significantly associated with the outcome variable (Figures 8–12).

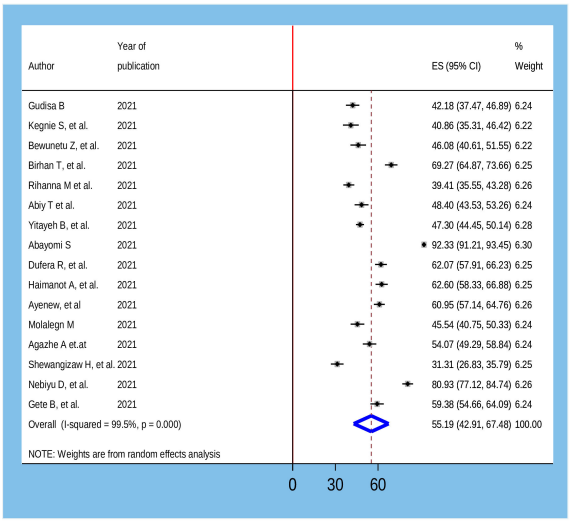

FIGURE 2
Forest plot for pooled willingness to accept COVID-19 vaccine in Ethiopia.

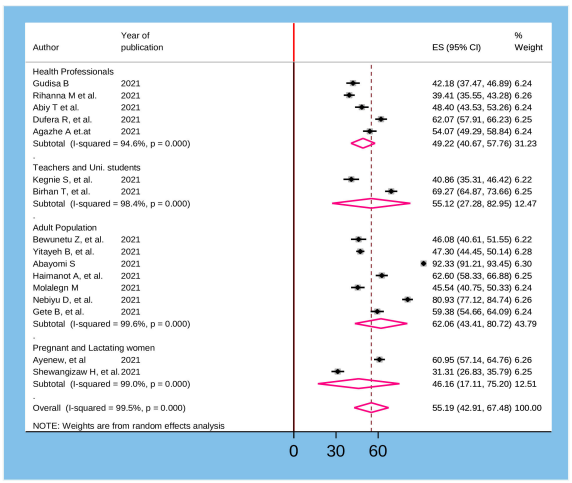

FIGURE 3
Sub group analysis based on the participants of the study for willingness to accept COVID-19 vaccine in Ethiopia, 2022.

To identify the association between the age of participants and their willingness to accept the COVID-19 vaccine, six studies were included in the meta-analysis (9, 21, 21, 26, 27, 30). We found moderate heterogeneity across studies (I^2 = 64.0%, P = 0.016), which is an indicator of the use of a random-effects model to estimate the pooled association between age of participants and their willingness to accept the COVID-19 vaccine reported by the six studies with inverse variance. The pooled result of the analysis showed that there was a statistically significant association between the age of the participants and their willingness to accept the COVID-19 vaccine. Accordingly, the likelihood of receiving the COVID-19 vaccine was 1.49 times higher among the population aged >25years than in the younger age group AOR=1.49, 95%CI: 1.12, 1.98) (Figure 9).

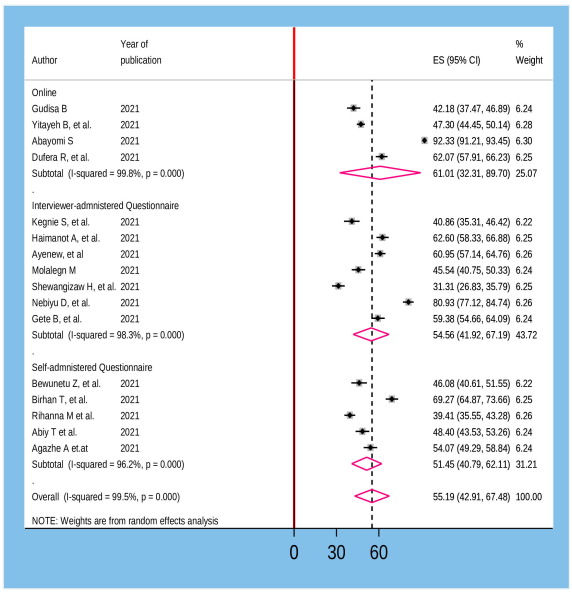

FIGURE 4
Sub group analysis based on the method of data collection for willingness to accept COVID-19 vaccine in Ethiopia, 2022.

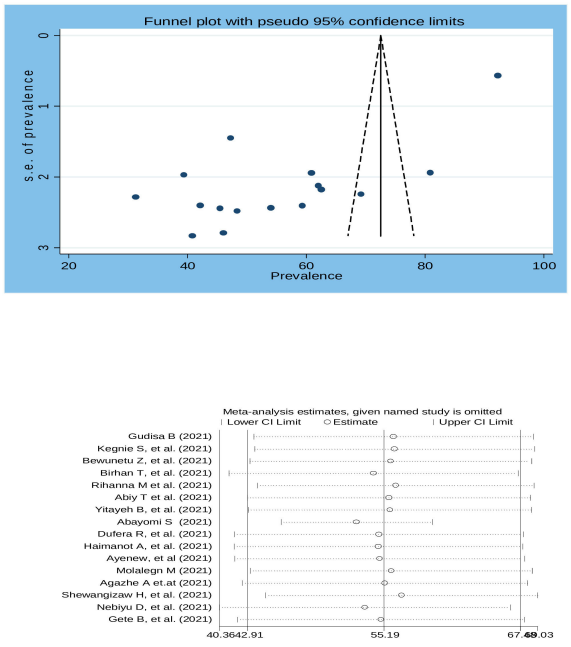

FIGURE 5
Funnel plot with 95% confidence limits of willingness to accept COVID-19 vaccine in Ethiopia, 2022.

To examine the relationship between the attitude of participants towards the COVID-19 vaccine and their willingness to accept the COVID-19 vaccine, five studies were reviewed (18, 21, 24, 25, 29). A random-effects model was used to estimate the pooled association between attitude and willingness to accept the COVID-19 vaccine (I^2 = 94.3, p-value <0.001). The pooled results of the analysis indicated that there was a statistically significant association

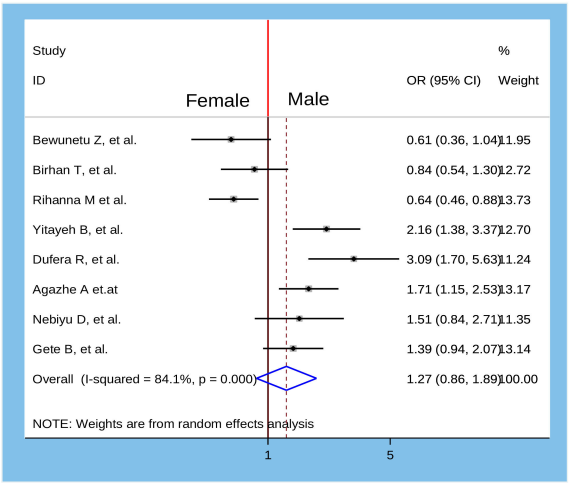

FIGURE 6
Sensitivity analysis of willingness to accept COVID-19 vaccine in Ethiopia, 2022.

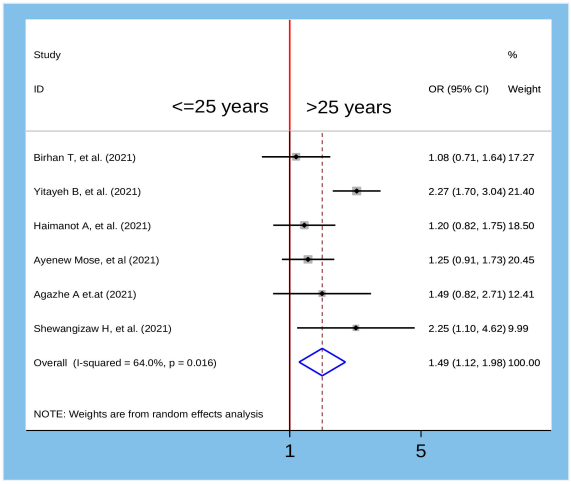

FIGURE 7
Association between sex and willingness to accept COVID-19 vaccine in Ethiopia, 2022.

between the attitude of participants and willingness to accept the COVID-19 vaccine. Population who had good attitude towards COVID-19 vaccine was 3.57 times more likely to accept COVID-19 vaccine as compared to their counterparts AOR=3.57, 95%CI: 1.46, 8.72).

Discussion

Despite the recent good news about the development of a vaccine for coronavirus disease, the world continues to face enormous crises due to COVID-19 vaccine hesitancy. It is straightforward that vaccination is the most cost-effective strategy for preventing and controlling highly contagious diseases. Hence, without enhancing the effective uptake of the COVID-19 vaccine, adherence to coronavirus preventive measures alone cannot end the spread of the virus and its crisis. Although there are plenty of primary studies on the acceptance level of a vaccine against the coronavirus in different parts of Ethiopia, they reported inconsistent and inconclusive findings. Therefore, the current review aimed to determine the pooled magnitude of the COVID-19 vaccine acceptance rate and its determinants among the public in Ethiopia. Certainly, understanding the pooled estimate of the COVID-19 vaccine acceptance level and its determinants among the public plays a vital role in controlling the spread of the virus.

TABLE 2 Determinants of willingness to accept COVID-19 vaccine in Ethiopia.

Factors	Categories	OR	Heterogeneity
Sex	Male	1.27 (95% CI: 0.86, 1.89)	(I^2 = 84.1%, P < 0.001)
	Female	Ref	
Age	≤ 25 years	Ref	(I^2 = 64.0%, P = 0.016)
	>25 years	1.49 (95% CI: 1.12, 1.98)*	
Residence	Urban	1.11 (95% CI: 0.56, 2.19)	(I^2 = 93.4%, P < 0.001)
	Rural	Ref	
Marital status	Married	0.87 (95% CI: 0.58, 1.31)	(I^2 = 85.9%, P <0.001)
	Unmarried	Ref	
Knowledge of COVID-19 vaccine	Good	1.95 (95% CI: 0.73, 5.19)	(I^2 = 96.5%, P < 0.001)
	Poor	Ref	
Attitude of COVID-19 vaccine	Good	3.57 (95% CI: 1.46, 8.72)*	(I^2 = 94.3%, P < 0.001)
	Poor	Ref	
Chronic medical disease	No	0.55 (95% CI: 0.27, 1.11)	(I^2 = 78.1%, P = 0.003)
	Yes	Ref	

*significantly associated with outcome variable at 95% CI.

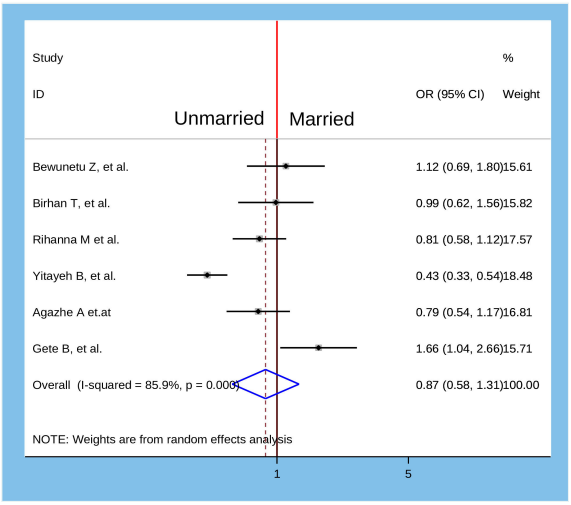

FIGURE 8
Association between age and willingness to accept COVID-19 vaccine in Ethiopia, 2022.

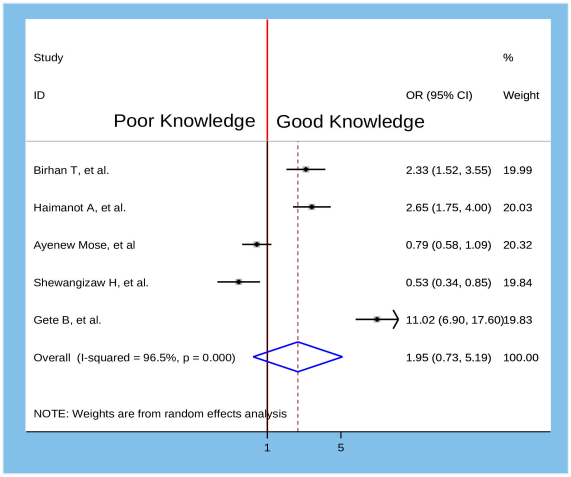

FIGURE 10
Association between residence and willingness to accept COVID-19 vaccine in Ethiopia, 2022.

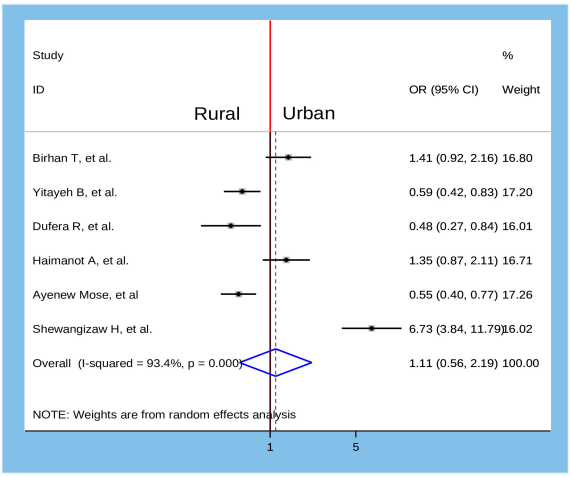

FIGURE 9
Association between marital status and willingness to accept COVID-19 vaccine in Ethiopia, 2022.

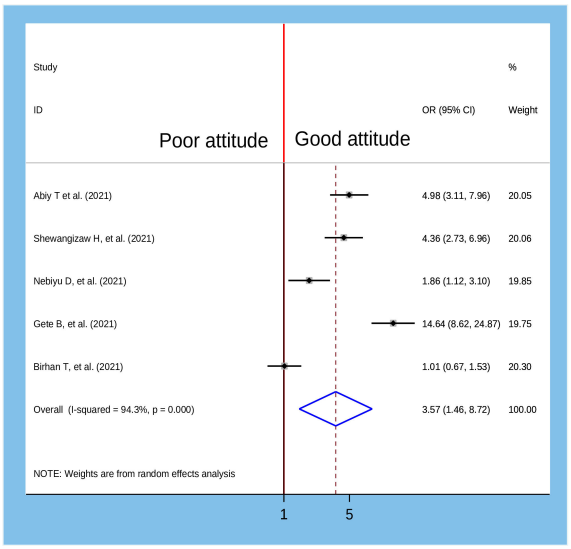

FIGURE 11
Association between knowledge and willingness to accept COVID-19 vaccine in Ethiopia, 2022.

The present meta-analysis indicated that the pooled magnitude of COVID-19 vaccine acceptance among the public was 55.19% (95% CI: 42.19, 67.48). This is congruent with the results of studies conducted in Africa (48.93%) (33), Bangladesh (65%) (34), Egypt (43%) (35), Saudi Arabia (64.7%) (36), USA(66%) (37), China(60.4-63%) (38, 39), Iran (64.2%) (40), and Malaysia(48.2%) (41). Perhaps this is due to the time during which those studies conducted was early in the introduction of the vaccine. However, it is by far lower than the studies done in Indonesia (86.8%) (42), Tonga (93%) (35), Italy (86%) (43), Turkey (84.6%) (44), Mexico (88%) (45), Brazil (83%) (45), Australia (80%) (46), and United Kingdom (86%) (47). Furthermore, it is lower than the study done in Mozambique (71.4%) (48), Pakistan (70.25-72%) (34, 49), Nepal (74%) (34), South Africa (76%) (50), France (77.6%) (51), and Vietnam (76.10%) (52). The observed discrepancy might be due to the variation between the populations in terms of access to information and educational level. In addition, it might also be due to most of the previous studies being done through an online survey in which the respondents of the study were necessarily educated population. Nevertheless, the present study finding is higher compared to the study done in Nigeria (40.5%) (53), Jordan (36.8-37.4%) (54, 55), Palestine (40%) (56), and Haiti (43%) (45). This may be due to variation in the study period and the population of interest.

In the current meta-analysis, subgroup analysis by the population of interest indicated that there were variations in the willingness to accept vaccine against COVID-19 among different included Populations in the primary studies. Accordingly, the

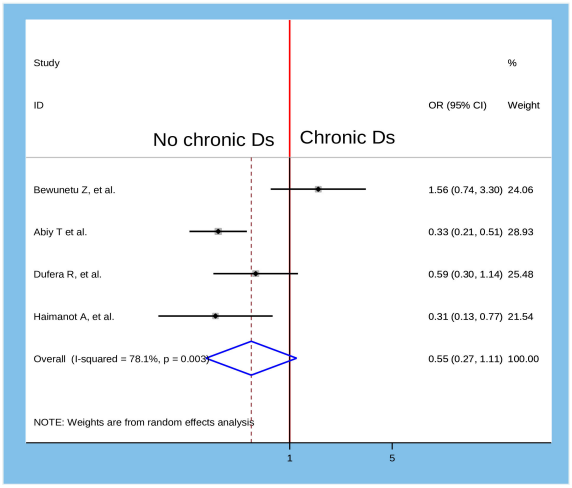

FIGURE 12
Association between attitude towards COVID-19 vaccine and willingness to accept COVID-19 vaccine in Ethiopia, 2022.

highest magnitude of willingness to receive the COVID-19 vaccine was reported among the adult general population 62.06% (95% CI: 43.41, 80.72) while the lowest was observed among pregnant and lactating women 46.16% (95% CI: 17.11, 75.20). This could be due to the feared side-effects of the vaccine among pregnant and lactating women on their fetus or infant than in the adult general population. Moreover, the finding of subgroup analysis by the method of data collection in the primary studies revealed that the magnitude of willingness to accept COVID-19 vaccine was high among studies done through online survey 61.06% (95%CI: 32.31, 89.70) and low among studies conducted by self-administered questionnaire 51.45% (95%CI: 40.79, 61.11). This is due to the fact that respondents of the online survey have a relatively better understanding of the importance of the vaccine, as they might have access to different social media outlets.

In this systematic review and meta-analysis, only two factors (age of participants and attitude about COVID-19 vaccine) were significantly associated with willingness to accept COVID-19 vaccine. This result is also similar with different systematic review and meta-analysis conducted to assess vaccination willingness for COVID-19 in which age were most frequently observed to be significantly associated with vaccine acceptance or refusal (53, 57, 58). This is due to the fact that age has impact on the willingness of people towards this vaccine. Particularly, increasing age of individuals might have a sense of responsibility and accountability for themselves and their families' relative to the youngest age groups.

Attitude of participants towards COVID-19 vaccine was also another factor which predicts the likelihood of willingness to accept COVID-19 vaccine. This is in line with studies conducted in different settings such as a systematic review and meta-analysis in Africa (58), and a global systematic review (59). This may be due to the fact that population those who had good attitude of COVID-19 vaccine may take care of themselves to minimize the risk, also they know the advantage of taking the vaccine and hence, they might accept to receive a vaccine.

Limitation

The strength of this study was that various databases were used to search literature, and both published and unpublished studies were included in the study. This study also had some limitations, of which all of the included studies in the final analysis were cross-sectional study design which may decrease causal conclusion between selected variables and outcome variable. Furthermore, most of the studies selected for final analysis were conducted only in some regions of the country, which is not the true representative of the remaining regions. Hence, the consumers of this findings need to take in to considerations regarding its generalizability.

Conclusion

In general, the magnitude of the COVID-19 vaccine acceptance rate among the public was unacceptably low in Ethiopia. Having a positive attitude towards COVID-19 vaccine uptake and being in the age category of above 25 years were independent determinants of the willingness of the public to accept the vaccine. Therefore, there is a need to build public trust through the provision of reliable and consistent information about the vaccine uptake using different media outlets. Moreover, there should be continuous media programs insisting on vaccination against coronavirus to enhance the public to have a positive attitude and perception towards the vaccine utilization.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material. Further inquiries can be directed to the corresponding author.

Author contributions

TT and BW involved in proposal development. TT andGF participated in statistical analysis. TT, GF, BW, and BRF involved inthe design, selection of articles, and data extraction. TT, BRF, GF, BW,and ML involved in developing the initial drafts of the manuscript. Allauthors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fviro.2023.1065991/full#supplementary-material

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