Covid-19 Vaccine Acceptance in Ethiopia: A Systematic Review and Meta-Analysis

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Abstract

Background

The Coronavirus Disease-2019 pandemic impacted the everyday lives of the global population whereas a considerable proportion of people are offhand of taking the vaccine. And hence this study assessed the overall level of vaccine acceptance in Ethiopia.

Methods

Database search for articles was made systematically across Google Scholar, Web of Science, Science Direct, Hinari, EMBASE, Boolean operator, and PubMed. Selection, screening, reviewing, and data extraction was made by two reviewers independently using a Microsoft Excel spreadsheet. The modified Newcastle-Ottawa Scale(NOS) and the Joanna Briggs Institute prevalence critical appraisal tools were used to assess the quality of evidence. All studies conducted in Ethiopia, reporting vaccine acceptance were incorporated. The extracted data were imported into the Comprehensive meta-analysis version3.0 for further analysis. Publication bias was checked by using Beggs and Eggers tests. Heterogeneity was checked by Higgins's method. A random-effects meta-analysis model with a 95% confidence interval was computed to estimate the pooled effect size (prevalence). Furthermore, subgroup analysis based on the study area and sample size was done

Introduction

The Coronavirus Disease (COVID)-19 pandemic impacted the everyday lives of the global population (1–4) to the extent that it disrupted the normal economic and social activities of the world population. (5–9) The COVID-19 disease is caused by a highly contagious acute respiratory syndrome coronavirus 2 (SARS CoV-2) that didn't have got the vaccine by the time of its emergency, whilst the global communities took different measures to contain the infection, of which lockdowns and border closures was one. (10–12)

There has been an implementation of various public health measures including but not limited to hand hygiene, lockdowns, and social distancing by most parts of the world for the prevention of COVID-19 disease, however, little was recognized for its role. (13) Furthermore, a vaccine was suggested as standing key for the prevention and control of the disease. (14, 15)

Barriers to vaccine acceptance are complex; furthermore, they are context-specific fluctuating across the place, time, and vaccine type. (16) However there has been a continuous distribution of COVID-19 Vaccines across the world population including Ethiopia, hesitation against vaccines comes to be an obstacle to having adequate coverage across a various populations. Moreover, vaccine hesitation was identified by World Health Organization as among the top global health threats by the year 2019. (17, 18)

Corpus of evidence about COVID-19 vaccine uptake suggested that a considerable proportion of people are offhand of taking the vaccine. A global report on COVID-19 vaccine acceptance reported the acceptance rate to be under 67%. (19)

To the best of the researcher's knowledge, the overall level of COVID-19 vaccine acceptance in Ethiopia was not investigated well. Therefore, this study assessed the level of vaccine acceptance in Ethiopia.

Question

What is the overall level of COVID-19 Vaccine Acceptance in Ethiopia?

Methods

Reporting: The preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline (20) was used to report this meta-analysis.(Additional file 1 research checklist).

Searching strategies: The reviewers followed the PRISMA systematic review protocol as a reporting guideline for the PRISMA checklist, eligible studies for the study were selected in terms of titles, abstracts, and then full articles based on inclusion criteria. EMBASE, PubMed, Hinary, Google Scholar, Web of Science, Science Direct, and African Journals Online were systematically searched for articles that included Medical Subject Headings and free text languages. These databases were searched by using both controlled and free-text languages. In terms of free-text searches, the keywords included the following combination of terms: (Willingness, OR COVID-19 Vaccine OR Acceptance) AND Ethiopia. The controlled searches included the following Medical Subject Headings (MeSH) terms: "COVID-19 Vaccine Acceptance" and "Ethiopia" as recommended for each database. The search terms were used individually and in combination using "AND" and "OR" Boolean operators. The search was guided by PICO, population- a population that was intended to take the vaccine.

Inclusion and exclusion criteria: The following types of studies; study population comprised any age group, study outcome is willingness or intention to take vaccine, and study design is cross-sectional were included and articles published in English language were also included. However, qualitative studies were excluded from the systematic review and meta-analysis.

Outcome of interest: **PICO**: The population of the study was any age group and the outcome of interest was vaccine acceptance which thus was reported was "Are you willing to take COVID-19 Vaccine if available to you?" and measured as yes and no or willing versus unwilling. The level of vaccine acceptance was presented as frequency and percentage.

Screening and Data Extraction: Two reviewers (SAT and GGD) screened titles and abstracts against the inclusion criteria. Then an independent assessment was made for the full text of the articles by the two reviewers based on the predetermined inclusion and exclusion criteria. Inconsistencies between the reviewers were dealt with by a discussion and consensus of all the investigators. Data extraction was

made by three authors (TM, GZM, and BGE) independently from a random sample of 20% of the papers to check consistency and found no variation across.

Study Quality Assessment: A structured data abstraction form was constructed in Microsoft excel. Attention was given to clarity of data, objective, study design, population, sample size, and proportion of vaccine acceptance. (**Table 1**) The methodological qualities of each article were assessed based on a modified version of the Newcastle-Ottawa Scale for the cross-sectional study. (21) Moreover, the Joanna Briggs Institute prevalence critical appraisal tool for use in the systematic review was used for the critical appraisal of the studies. (22)

Data Synthesis and Statistical Analysis: Data were extracted using a Microsoft Excel spreadsheet and imported to Comprehensive meta-analysis version3.0 software for further analysis. The pooled effect size with a 95% confidence interval of national COVID-19 vaccine acceptance was determined using a weighted inverse variance random-effects model. Heterogeneity across the studies was assessed using the I² statistic, where 25, 50 and 75% represent low, moderate, and high heterogeneities consecutively. (23) A funnel plot and Beggs and Eggers tests were used to check the risks of publication bias. (24)

Results

Selection of the studies: A comprehensive literature search of the database yielded a total of 67 published articles, of which 20 articles were retrieved from Google Scholar, 13 articles from PubMed, 12 articles from African Journals online, 7 articles from Hinari and 15 articles from EMBASE, Web of Science and Science Direct. Thirty one articles were excluded for duplication and scope. The other 18 articles were excluded for no report on the outcome. A total of 18 full-text articles that fulfilled the eligibility criteria with a total sample size of 10873 were included in the final analysis for the systematic review and meta-analysis. (**Figure 1**)

Characteristics of the Included Studies: Pertinent information about authors, population, Publication year, study area, sample size, outcome, and main findings from the selected articles were extracted and presented in table 1. All articles were cross-sectional and conducted in Ethiopia. The studies were conducted in Southern region (25-29), Addis Ababa (30-33), Amhara region(34-38), and online or telephone. (39-42) The sample size of the selected studies ranged from 301 to 2178. (**Table 1**) **Table 1 Characteristics of included studies, their area, sample size and outcome**

Author	Year	Region	Sample size	Prevalence
Haimanot Abebe et al , 2021 (25)	2021	Southern,(Guraghe)	492	62.60%
Rihanna Mohammed et al, 2021 (30)	2021	Addis Ababa	614	39.70%
Fitalew Tadele Admasu, 2021 (31)	2021	Addis Ababa	422	42.30%
Addisu Tadesse Sahile et al , 2022 (32)	2022	Addis Ababa	407	39.80%
Birhan Tsegaw et al , 2021 (34)	2021	Debre Berhan	423	69.30%
Simegnew Handebo et al, 2021 (35)	2021	Gondar	301	54.80%
Ayenew Mose and Alex Yeshaneh, 2021 (26)	2021	Southwest(Wolkite)	396	70.70%
Ayenew Mose, 2021 (27)	2021	southern	630	61.0%
Shewangizaw Hailemariam et al, 2021 (28)	2021	Southwest	412	31.30%
Agazhe Aemro et al, 2021 (36)	2021	North west	440	54.10%
Ayenew Mose et al, 2021 (29)	2021	Southwest	420	58.80%
Yitayeh Belsti et al, 2021 (39)	2021	Online	1184	31.40%
Agerie Mengistie Zeleke et al , 2021 (37)	2021	North west	538	29.00%
Dufera Rikitu Terefa et al, 2021 (40)	2021	Online	522	62.10%

Abayomi Samuel Oyekale, 2021 (41)	2021	Telephone	2178	92.30%
Nebiyu Dereje et al, 2021 (33)	2021	Addis Ababa	422	80.90%
Metadel Adane et al, 2021 (38)	2021	North East(Dessie)	404	64.0%
Bereket A Guangul et al, 2021 (42)	2021	Online	668	72.20%

Subgroup Analysis

Based on the subgroup analysis finding, the highest level of vaccine acceptance (68.7%; 95%CI: 34.1%-90.3%) was reported in an online or telephone surveys whilst a lower level of vaccine acceptance (51.8%; 95% CI: 33.3%-69.8%) was reported in Addis Ababa. Regarding the sample size, the highest level of vaccine acceptance (74.0 %; 95% CI: 23.5%-96.4%) was reported in studies with a sample size of larger than 800.(**Table 2**)

Table 2 Level of COVID-19 Vaccine Acceptance by study area and sample size.

Variables	Characteristics	Included studies	Sample size	Prevalence (95%CI)
Area	Addis Ababa	4	1865	51.8 %(33.3%-69.8%)
	Amhara	5	2106	54.2 %(39.4%-68.3%)
	Southern	5	2350	57.0 %(44.4%-68.7%)
	Other(online/telephone)	4	4552	68.7 %(34.1%-90.3%)
Sample size	>400	2	697	63.5 %(59.8%-67.0%)
	400-800	13	6814	55.2 %(46.7%-63.4%)
	>800	3	3784	74.0 %(23.5%-96.4%)

COVID-19 Vaccine Acceptance: In this systematic review and meta-analysis, the pooled estimate of COVID-19 vaccine acceptance was illustrated by forest plot. The pooled prevalence of vaccine acceptance in Ethiopia was 57.8 %(95% CI: 47.2%- 67.8%). (**Figure 2**)

Assessment of Publication Bias: The funnel plot was found to be relatively symmetrical and Begg's and Egger's tests showed the absence of significant publication bias at a p-value of >0.05. (**Figure 3**)

Heterogeneity: For the identification of the possible causes of variation across the studies, meta-regression analysis was conducted using sample size and study area. The result showed that there is no significant heterogeneity across the studies. (**Table 3**)

Table 3 Sources of heterogeneity across the studies

Source of Heterogeneity	Coefficient	Standard error	p-value
Study Area	0.0731	0.4951	0.8827
Sample size	0.529	0.5709	0.3535

Discussion

The current systematic review and meta-analysis were aimed at providing comprehensive evidence on the level of COVID-19 vaccine acceptance in Ethiopia. This study found an overall level of vaccine acceptance in Ethiopia at 58.7%; this was consistent with the findings of 48% among adults in Saudi Arabia(43), 67% among adults in Kuwait(44), 62.6% in Jordan(45), 63% in Hong Kong(46), 65.75 in Japan(47), 53% in Pakistan(48), 61.7% in Iraq(49), 65.6% in Qatar(50) and 51.6% in Turkey(51)

A higher level of vaccine acceptance than the current study was reported in different countries with the level of vaccine acceptance of 75.3% of adults in China(52), 86.2% among healthcare workers in China (53), 74.65 in Bangladesh(54), 85% in Israel(55), 91.3% among adults in China(14), 94.3% in Malaysia(56) and 91.5% among Nurses in Italy(57). This variation might be due to variation in availability of vaccine type, and population characteristics.

The finding from this study was also consistent with the results from 64% in UK(58), 63.5% in Kenya(59) and 50.2% in Nigeria(60). In the contrary; in this study the level of vaccine acceptance was higher than the findings of 21.4% in Lebanon(61) and 27.7% in Democratic Republic of Congo(62). Such variation might be due to variations in sample size and level of awareness among the studies.

The level of vaccine acceptance was reported at higher Level than report of the current study was reported in different countries including 78% in Scotland(63), 78.5% in Greece (64), 75% in Portugal(65), 77.65 in France(66), 68.5% in United States (67), 80% in Canada(68), 90.1% in South Africa(69), and 80.9% in Uganda(70). This difference might be due to population characteristics and availability of vaccine options.

Conclusion

The level of COVID-19 vaccine acceptance in Ethiopia was lower than necessary to achieve herd immunity. The highest level of vaccine acceptance was reported in online or telephone surveys whereas a lower level of vaccine acceptance was reported in Addis Ababa. With regards to the sample size, the highest level of vaccine acceptance was reported in studies with a sample size larger than 800.

Declarations

Author Contribution

SAT and TM were involved in development of the protocol, design, selection of the study, data extraction, statistical analysis, and developing the initial draft of the manuscript. GGD, GZM, and BGE got involved at preparation and editing the final draft of the manuscript. All authors read and approved the final draft of the manuscript.

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All the data is contained within the article

Conflicts of Interest

The authors declare no conflict of interest

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Figures

Figure 1

PRISMA flow diagram for showing screening and selection process of duties

Figure 2

Forest plot of pooled prevalence of COVID-19 vaccine acceptance

Figure 3

Funnel plot of the included studies