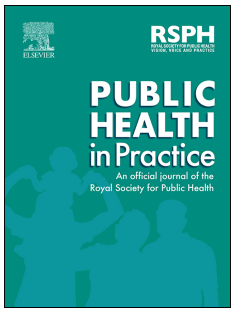
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.



Acceptance of COVID-19 vaccine among healthcare workers in Africa, systematic review and meta-analysis

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Acceptance of COVID-19 Vaccine among HealthCare Workers in Africa, Systematic Review and Meta-analysis

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Abstract

Objectives: This study is intended to assess healthcare workers' acceptance of the COVID-19 vaccine in Africa.

Study design: Systematic review and meta-analysis.

Method: The search was done using: PubMed, HINARI and Web of Science, African OnLine, and other gray and online repositories of Universities in Africa. All included articles were extracted and appraised using the standard data extraction sheet format of JOANNA Briggs Institute. Cochran Q test and I2 statistics test were used to test the heterogeneity of the studies. A Funnel plot and Egger's test were used to detect the publication bias of included studies. A Forest plot was used to present the pooled prevalence acceptance of the COVID-19 vaccine

Result: In this systematic review and meta-analysis thirteen cross-sectional studies and one nationwide survey with a total population of 23,739 were included. The pooled estimated prevalence of healthcare workers' acceptance of the COVID-19 vaccine in Africa was 56.59 (95%CI; 46.26-66.92; I2 = 99.6%, p = 0.000). Subgroup analysis was done using the regions in Africa, willingness to accept the COVID-19 vaccine was highest in the South African region accounting for 74.64 (95%CI; 44.16-105.11) followed by the North African region at 66.68 (95% CI; 50.74-82.62).

Conclusion: The overall acceptance of the COVID-19 vaccine among healthcare workers in Africa was low. Thus, further duties should be unwavering to improve the COVID-19 vaccine acceptance by healthcare workers, through consistent and committed efforts in improving political commitment, amending strategies, improving awareness, and disclosing information about the safety, side effects, and effectiveness of the COVID-19 vaccine.

Keywords: Healthcare worker, Acceptance, Willingness, COVID-19, Vaccine, Systematic review, Africa

Introduction

During the outbreak of the SARS-CoV-2 virus in 2019, nobody warned or prepared for the prevention and management. This virus belongs to a group of coronavirus families like the viruses that cause SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome)[1]. The breakout of this SARS-CoV-2 infection affected the health, social and economic dimensions of the people, with its higher societal penetration through asymptomatic or pre-symptomatic carriers who serve as a nidus for rapid disease. The spread of the infection reached all corners of the world within six months of the outbreak, which cost the lives of millions and caused short and long-term impacts on the well-being of the people. [2] [3].

Currently, several potential vaccines developed during the race for prevention and mitigation of SARS COV-2 infection, even if these vaccines developed after the disease has taken millions of lives[4][5]. SARS COV-2 vaccines were produced after different laboratory trials using several scientific methods[6][7]. The World Health Organization (WHO) accepted and approved nearly ten types of potential COVID-19 vaccines with known safety and effectiveness, from those vaccines Pfizer/BioNTech BNT162b2, Janssen (Johnson & Johnson) Ad26.COV2-S and Oxford/AstraZeneca AZD1222, were commonly accepted in the world[8]. Once more, the effectiveness of those vaccines were around 95% in preventing SARS COV-2 infection throughout different age group, sex, race, ethnicity, baseline BMI, the presence of coexisting conditions, and the reduction of hospital admission [9][10].

However, immunization against SARS COV-2 infection at the targeted level and reducing the impact of the pandemic particularly, the developing countries confronted several challenges like vaccine reluctance, hesitancy, and lack of fair distribution. The acceptance of the COVID-19 vaccine was also variable and not plentiful in different countries and regions that were lower than 60%[11][12][13]. A study from six African countries disclosed that only 48.93% of the adult population accepts the vaccine[14][15]. This poor acceptance and hesitancy were associated with overwhelming misinformation about the safety of vaccines, poor awareness, fear of side effects, sociocultural, and individual factors[16] [17][18][19].

According to a study in Israel, the COVID-19 vaccine acceptance rate among healthcare providers varied among professional difference doctors, nurses, and the entire population 78%, 61%, and 75%, respectively [20]. A similar study from the USA showed a higher proportion of

healthcare professionals working directly with patients accepting the COVID-19 vaccine (physicians 86.6% and nurses 86.3%) than those health workers working with some relation with the patients[21]. Also, about 5.5% of healthcare providers have hesitancy about vaccination against COID-19, so they would reject SARS-CoV-2 vaccination[22][23].

Healthcare workers have a high risk of getting infected with SARS-CoV-2, which puts themselves, their families, and the community in danger of potential transmission of the virus. So protecting healthcare workers is the primary public health duty[24][25]. There are few single studies conducted on the acceptance of the COVID-19 vaccine among healthcare workers in Africa. Thus the main aim of this systematic review and meta-analysis was intended to assess the overall acceptance rate of the COVID-19 vaccine among healthcare providers in Africa.

Methods

Study design: Systematic review and meta-analysis

Research questions: What are the trends of COVID-19 vaccine acceptance among healthcare providers in Africa?

Study setting: This systematic review and meta-analysis included only studies conducted in Africa.

Search Strategy

To search for appropriate articles on acceptance of the COVID-19 vaccine among healthcare workers in Africa, international databases like (Google scholar, PubMed, HINARI, Web of Science, and Scopus), and African journals OnLine and literature from electronics repositories of Universities in Africa were used.

The medical subheadings (MeSH) term and keywords used includes SARS-CoV-2, COVID-19, willingness, vaccine, acceptance, hesitancy, intention, healthcare workers, physicians, midwifery, nurses, pharmacy, laboratory technicians, medical students, health science students, and Africa and other related terms. The combination of those MeSH terms and Keywords was done by Boolean Operator ‘AND’ and ‘OR’.

Eligibility criteria

Inclusion criteria

In this systematic review and meta-analysis, articles unfolding the prevalence of COVID-19 vaccine acceptance by healthcare workers were merged.

Exclusion criteria

The articles without complete abstracts or texts reported out of the scope of the outcome of interest, poor quality, and qualitative studies were excluded.

Quality assessment

JOANNA Briggs Institute (JBI) quality appraisal checklist was obtained [26]. The quality of each article was evaluated independently by ZF, TT, MG, AG, and ZA. The disagreements were resolved by the sixth and seventh reviewers MA and AA. The number of items the JBI tool consisted of for cross-sectional studies was eight. The first is whether inclusion criteria are clearly defined. The second is appropriateness in the description of the study subject and setting. The third item is whether the measurement of exposure is valid and reliable. The fourth is the relevance in describing the objective and standard criteria used. Fifth is representing the identification of confounders appropriately. Sixth is the appropriateness of strategy to handle confounders. The seventh is the reliability and validity of outcome measurement. Finally, the eighth one is the appropriateness of the statistical analysis method used. The value of the JBI quality assessment checklist, the result of 50% and above are considered as low risk and good to be included in the analysis.

Data extraction

Microsoft Excel spreadsheet was used to remove the duplication of the data and then exported to Endnote version 8 software. Independent data extraction was done by two authors (ZF, TT, AA, AG, and MG) using a standardized JBI data extraction format. Disagreements between reviewers were resolved by the sixth and seventh reviewers (MA and ZA). Those articles without complete abstracts or texts reported out of the scope of the outcome, interest, and qualitative studies were excluded. Then the consensus reached an end.

Measurement of outcome

This systematic review and meta-analysis had one measurement of outcome variables. This measurement outcome was acceptance of the COVID-19 vaccine among healthcare workers. It focused on a single study estimating the prevalence of the COVID-19 vaccine acceptance in Africa.

COVID-19 vaccine acceptance: Was defined as the willingness of the healthcare workers to take the available COVID-19 vaccine.

Healthcare workers: Were defined as providers of the healthcare service for patients in health facilities includes; physicians, nurses, pharmacy, midwifery, laboratory technician, health science students, and others.

Data Synthesis and Reporting

This systematic review and meta-analysis estimated pooled prevalence of healthcare workers' acceptance of the COVID-19 vaccine in Africa using the standard PRISMA flowchart diagram and PRISMA checklist guideline[27].

Data analysis

A Funnel plot and Egger's regression test [42] were used to determine the publication bias of the included articles meeting inclusion criteria. To check the heterogeneity of the studies Cochran Q-test and I-squared statistics[43] were computed. Pooled analysis was conducted using the random-effects inverse-variance model due to the presence of heterogeneity of the study. A significant level of heterogeneity in the included studies dragged us to do a subgroup analysis using the regions in Africa to assess a pooled prevalence of the acceptance of the COVID-19 vaccine among healthcare workers. The STATA version 14 statistical software, was used to compute the analysis. A Forest plot was used to present the pooled point prevalence of healthcare worker's acceptance of the COVID-19 vaccine with a 95% confidence interval (CI).

Result

Literature search result

Characteristics of the included studies

The search was executed using Google scholar PubMed, Science Direct, web of science, HINARI, African journals OnLine, and other gray and online repositories of universities in Africa 1,578 articles were accessed and retrieved. Following the removal of the duplication using Microsoft Excel 258 articles left the further review of their titles and abstracts. Out of the 258 remaining articles, 122 articles we excluded after a review of their titles and abstracts. Therefore, 35 full-text articles were accessed and assessed for inclusion criteria, which resulted in the further exclusion of 21 articles. As a result, 14 studies met the inclusion criteria to undergo the final systematic review and meta-analysis. (Fig.1) (Table 1)

Acceptance of the COVID-19 vaccine among health care workers in Africa

In this systematic review and meta-analysis, a Forest plot was used to present the overall pooled acceptance of the COVID-19 vaccine among healthcare workers in Africa. Therefore, the pooled estimated prevalence of COVID-19 vaccine acceptance in Africa was 56.59 (95%CI; 46.26-66.92; $I^2 = 99.6\%$, $p = 0.000$). (Fig. 2)

Publication bias

A funnel plot was used to check a publication bias through the asymmetry distribution of the acceptance of the COVID-19 vaccine among healthcare workers in Africa (Fig.3). Egger's regression test showed a p-value of 0.004, which indicate the absence of publication bias.

Subgroup analysis

Because of marked heterogeneity in the included studies, subgroup analysis was carried out based on regions in the continent (Northern Africa, Southern Africa, Middle Africa, Western Africa, and Eastern Africa) using random effect size analysis. Hence, the Cochrane I2 statistic (= 99.6%, p = 0.000) showed the presence of marked heterogeneity. Subgroup analysis of the regions of Africa showed Eastern Africa 52.81(95%CI: 44.39-61.24), Western Africa 57.19(95%CI: 57.19-70.13), Southern Africa 74.64(95%CI: 44.16-105.11), Middle Africa 26.05(95%CI: 22.91-2918). Northern Africa 66.68(95%CI: 50.74-82.62). (Fig. 4)

Discussion

To control SARS COV-2 infection, hospital admission, and death, the provision of the COVID-19 vaccine is a precedent of public health concern. Reaching the majority of the people through immunization against COVID-19 infection is believed that create herd immunity in the general population which easily helps to prevent the spread of the infection in the community. The vaccination of healthcare workers against the COVID-19 virus reduces 80-91% of infection, related hospital admission, and mortality[44]. The African countries undergo challenges starting from the availability of SARS-COV2 vaccines hindering addressing targeted numbers of people to be vaccinated including; unfair distribution, political commitment, inadequate information about the quality, safety, and effectiveness of developed vaccines, unwillingness, and hesitancy toward COVID-19 vaccines. Unless healthcare workers and other communities get fully vaccinated the strategies for combating the covid-19 pandemic will not be realized. According to this systematic review and meta-analysis the pooled prevalence of the acceptance of the COVID-19 vaccine among health care providers was 57.53 (95%CI; 46.51-68.55; I^2 = 99.6%, p = 0.000). This finding showed healthcare workers' acceptance of the COVID-19 vaccine acceptance was not far from half which was slightly higher than the adult population's acceptance of the COVID-19 vaccine in Africa 48.93%[45]. This indicates that there is a bottleneck in achieving the vaccination strategies for controlling the pandemic in African countries and the world also.

This finding is lower than the result of studies from different countries, Pakistan 70.2%[46], Greece 78.5%[47], Canada 80.9%[48], Iraqi 61.7%[49], China 76.98%[50], France 76.9%[51], Saudi Arabia 77.8%[52], another study from Saudi Arabia 70%[53], Chicago 85%[54], and Vietnam 76.10% [54]. The justification for this might be socio-demographic characteristics and SARS COV-2 impact differences. In addition to that, the government and stakeholders from those countries may have better strategies, political determination, and commitment in responding to the pandemic in improving the consciousness of importance, and giving emphasises on the vaccination of health workers.

This finding is similar to the studies from Turkey 55.4% [55], and USA 57.5 %[56]. Conversely, this finding was higher than the result of the study from the USA 36%[57], and China 40.0%[58]. The reason for these similarities might be because of study period differences (those studies were conducted during the emerging stage of the COVID-19 vaccine while the healthcare workers were in a different dilemma about the safety and effectiveness of the vaccines or little was known about the infection and vaccine development).

In this systematic review and meta-analysis, because of the presence of marked heterogeneity in included studies which may expose the finding to publication bias, subgroup analysis was done using the regions in Africa. The existence of heterogeneity might be due to the sample size of studies, the nature of the study designs, and the study settings.

Conclusion: According to this systematic review and meta-analysis, the overall prevalence of COVID-19 vaccine acceptance among healthcare workers in Africa was lower compared to other countries. These showed the problem in providing the COVID-19 vaccine by healthcare providers and additional risk to healthcare workers. Thus, extra duties should be established to improve the COVID-19 vaccine acceptance by healthcare workers through consistent and committed efforts in improving political commitment, amending strategies, improving awareness, and disclosing information about the safety, side effects, and effectiveness of COVID-19 vaccine.

Strength of study

This systematic review and meta-analysis are the first to be conducted on African healthcare workers. We hope it answers the clinical question of overall acceptance of the COVID-19 vaccine and expedites the necessary intervention.

Limitation study

There may be more chances to do these types of studies in institutions with higher rates of the COVID-19 vaccine acceptance among healthcare workers. It may lack continental representativeness because the included data was only from 10 countries in Africa.

Abbreviations

CI: Confidence Interval; CDC: Communicable disease control; OR: Odds Ratio; JBI: Joan Briggs Institute

Acknowledgment:

Not applicable.

Authors' contribution

ZF, TT, AG, AA, and MG were participated in the design, selection of articles, data extraction, and statistical analysis. MA and ZA were involved in manuscript writing. All authors read and approved the final draft of the manuscript.

Availability of data and materials

All related data has been presented within the manuscript. The dataset supporting the conclusions of this article is available from the authors on a reasonable request.

Ethics approval and consent to participate

Not applicable

Competing interests

All authors declare that they have no competing interests.

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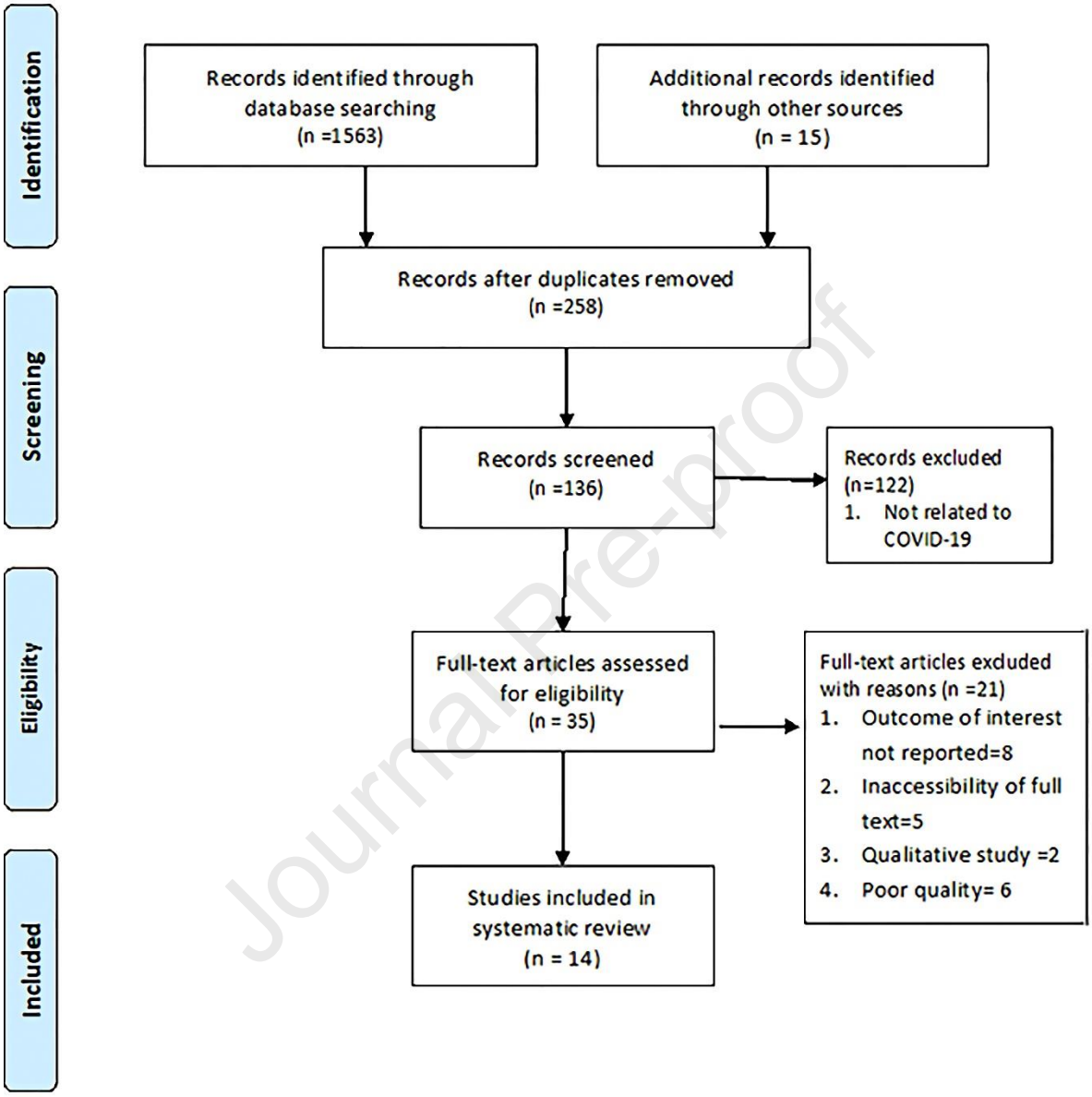


Figure 1: PRISMA flow chart of study selection for systematic review and meta-analysis of acceptance of COVID-19 among healthcare workers in Africa.

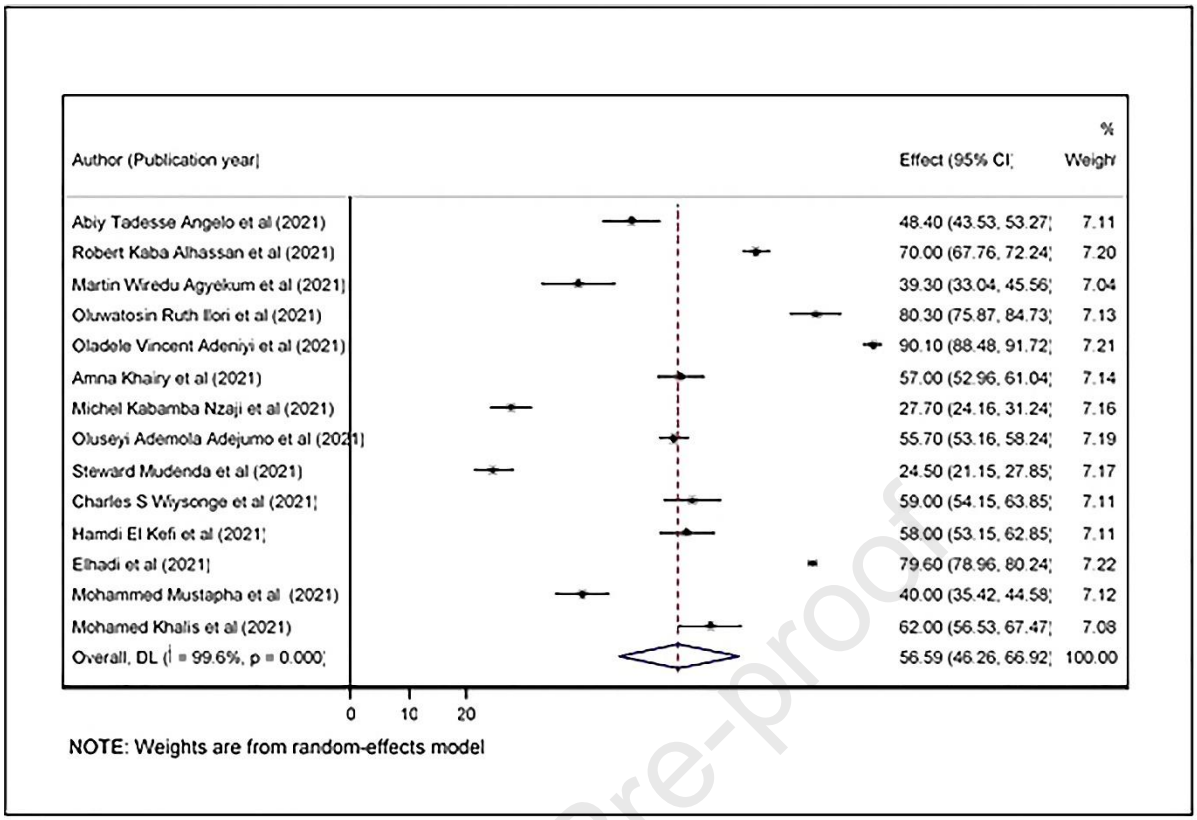


Figure 2: Forest plot of the acceptance of COVID-19 vaccine among healthcare workers in Africa with a 95%CI.

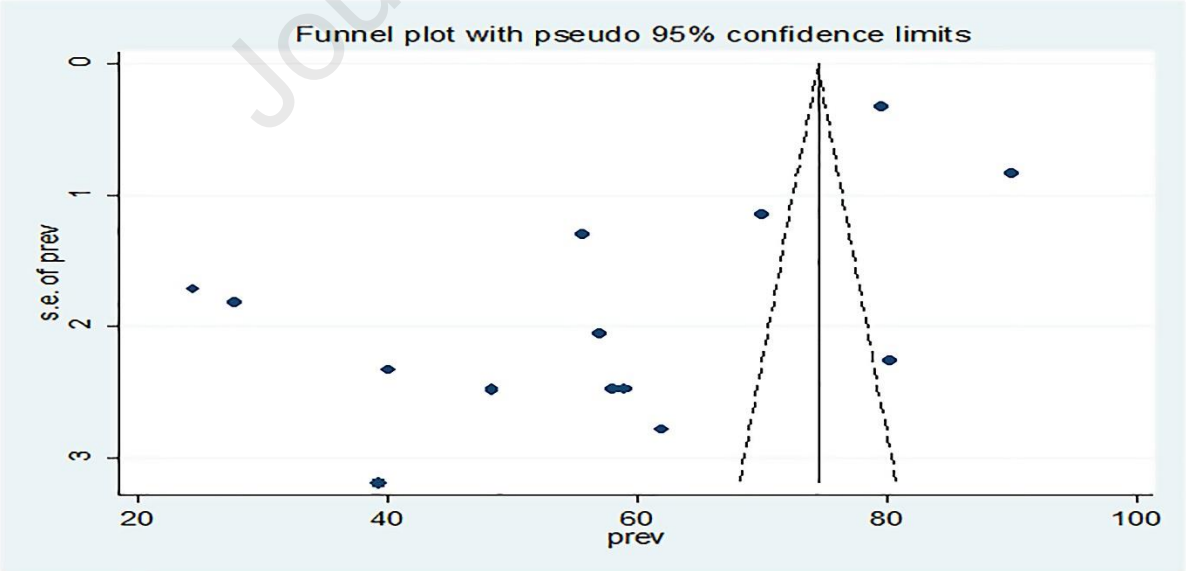


Figure 3: Funnel plot test for publication bias for acceptance of COVID-19 vaccine among healthcare worker in Africa.

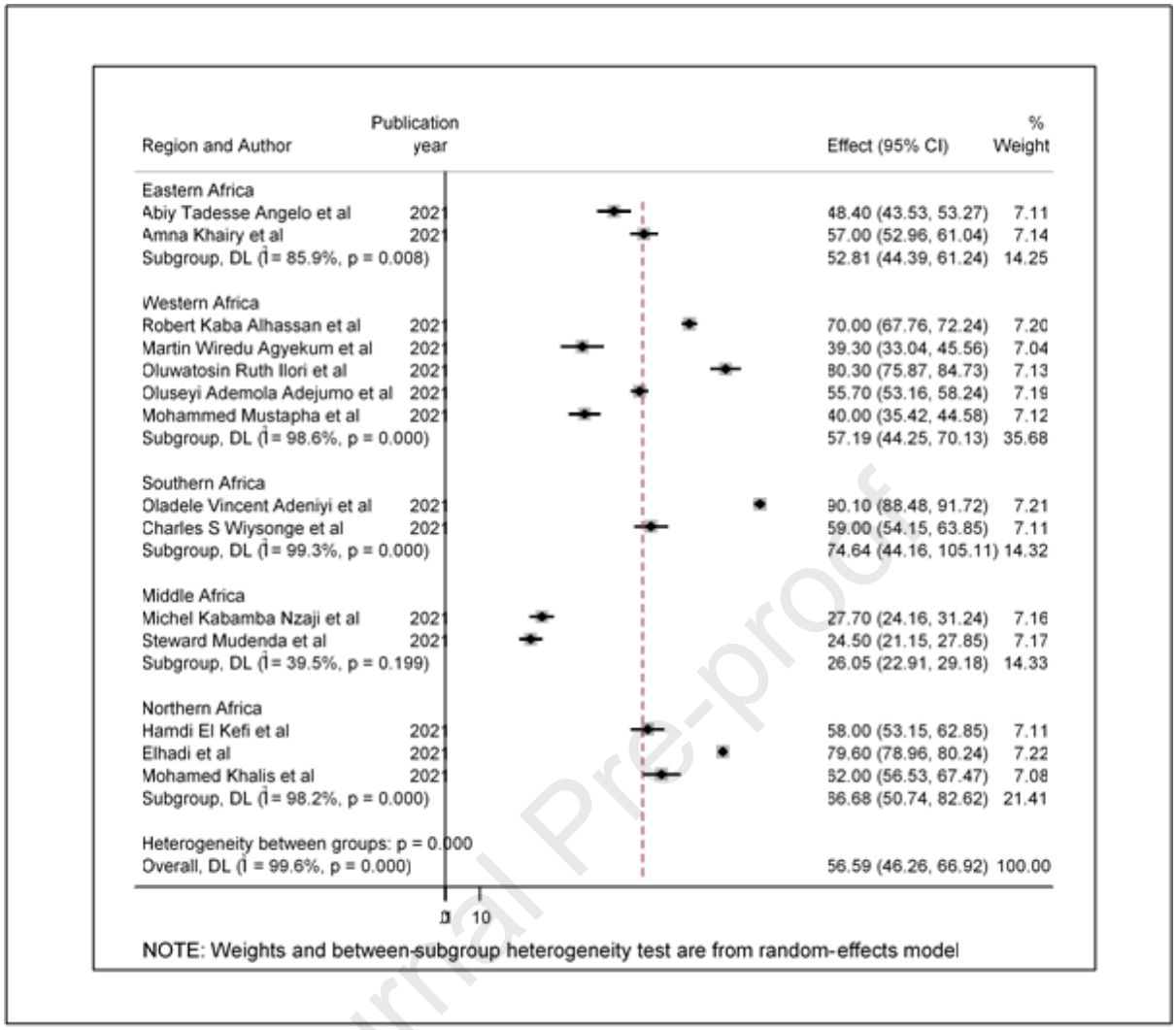
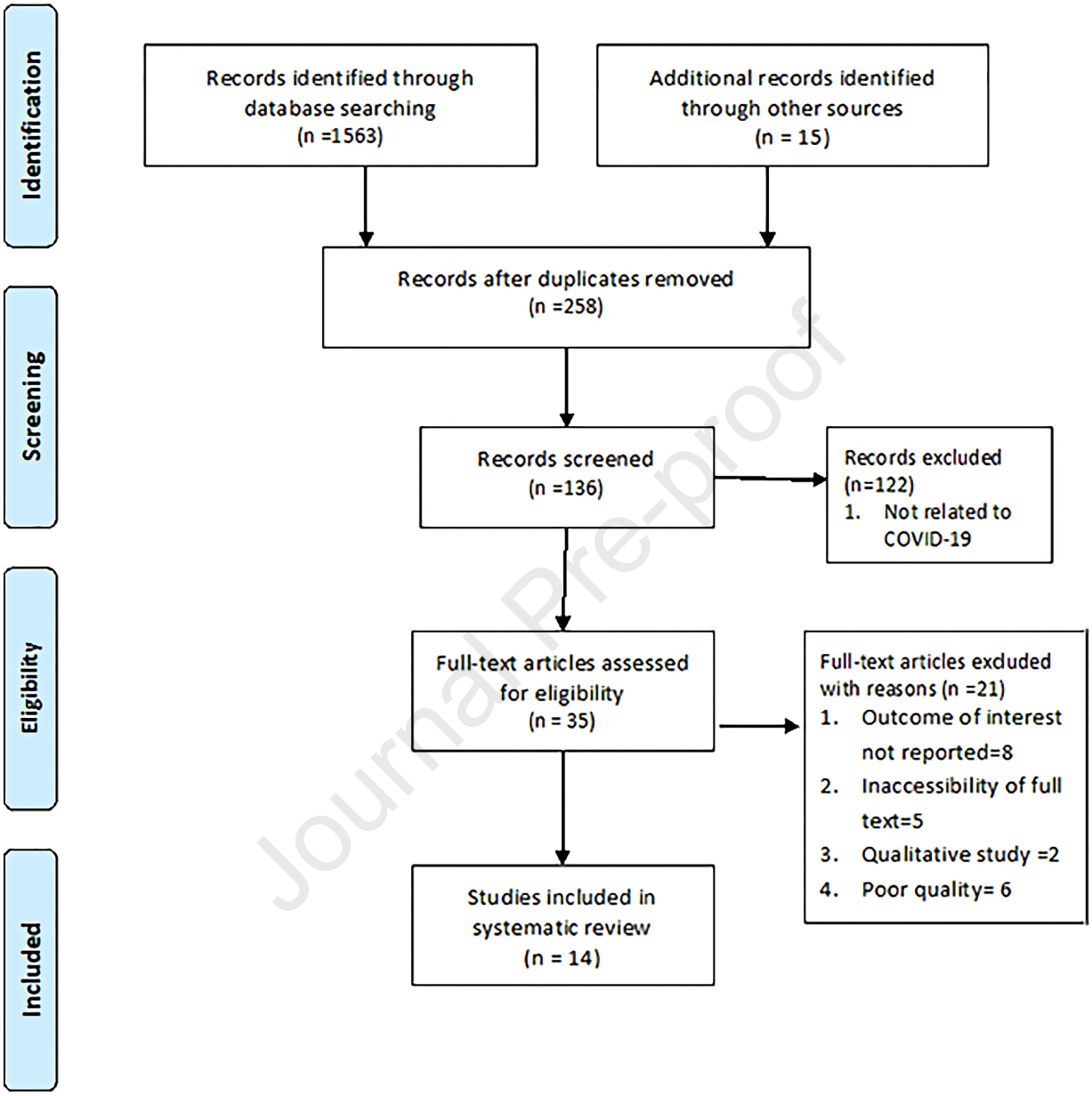


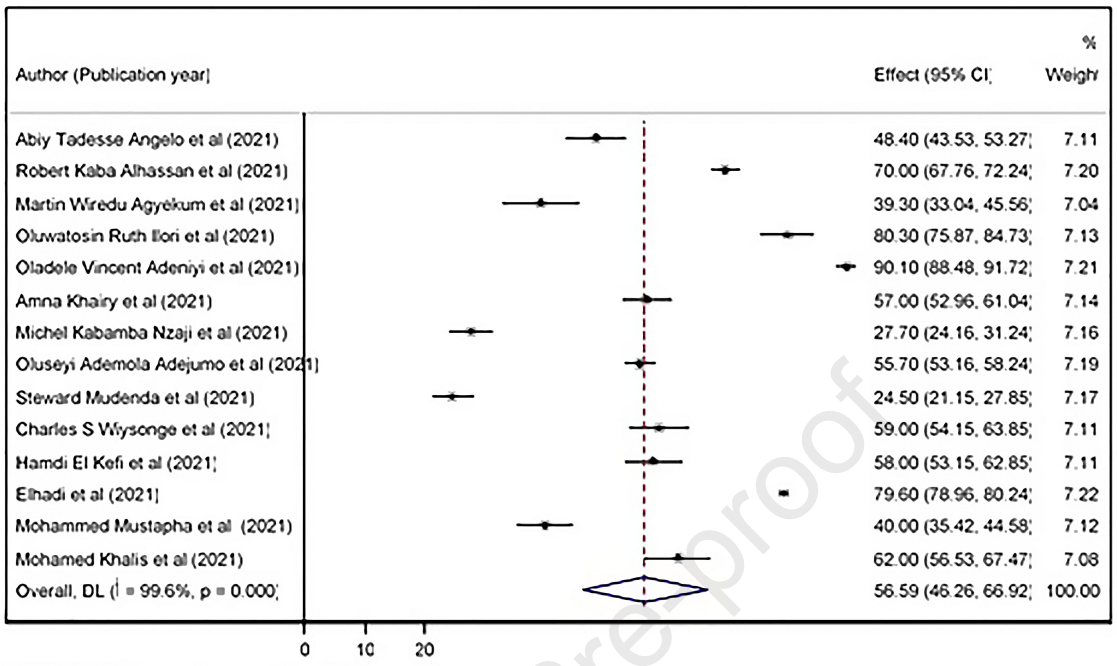
Figure 4: Forest plot show subgroup analysis of acceptance of COVID-19 vaccine acceptance among healthcare workers based on the regions in Africa.

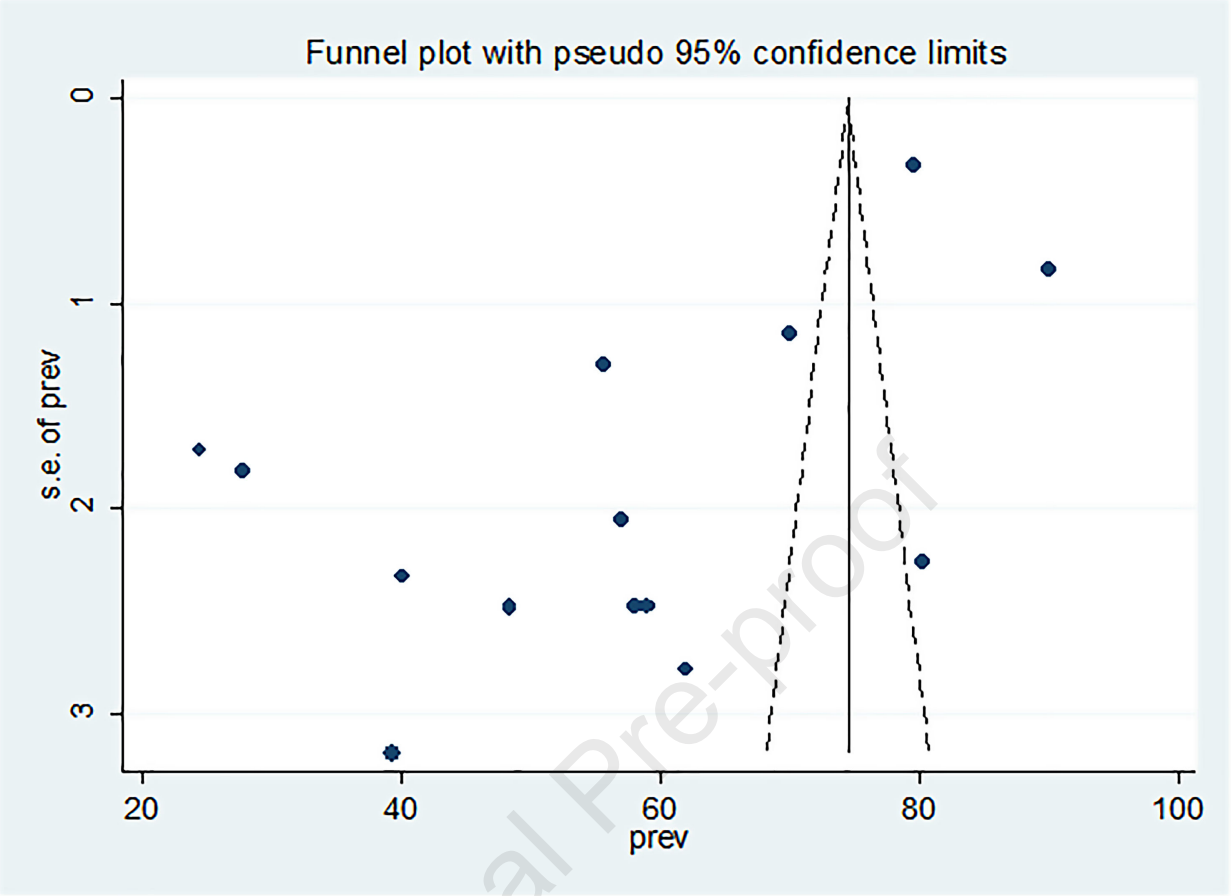
Table 1: Characteristics of included studies in meta-analysis of acceptance of the COVID-19 vaccine among healthcare workers in African, 2022.

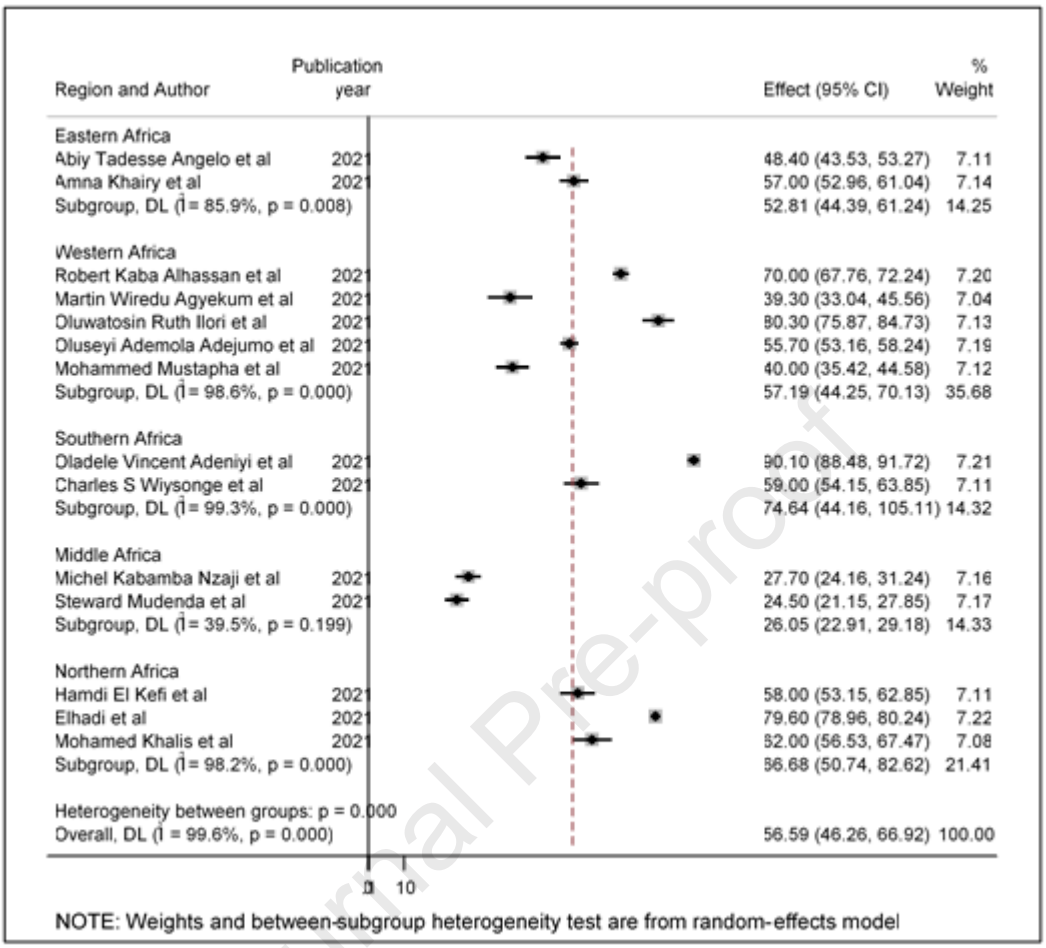
No.	Author	Publication year	Country	Region	Study design	Sampling technique	Sample size	Prevalence	Response rate	Quality
1	Abiy Tadesse Angelo et al [28]	2021	Ethiopia	Eastern Africa	Cross-sectional	Simple random	405	48.40 %	96%	Low risk
2	Robert Kaba Alhassan et al[29]	2021	Ghana	Western Africa	Nationwide Survey	Online survey	1605	70%	72%	Low risk
3	Martin Wiredu Agyekum et al [30]	2021	Ghana	Western Africa	Cross-sectional	Convenient and snowballing	234	39.30 %	-	Low risk
4	Oluwatosin Ruth Ilori et al [31]	2021	Nigeria	Western Africa	Cross-sectional	Online survey	309	80.30 %	-	Low risk
5	Oladele Vincent Adeniyi et al [32]	2021	South Africa	Southern Africa	Cross-sectional	Multi-stage	1308	90.10 %	-	Low risk
6	Amna Khairy et al [33]	2021	Sudan	Eastern Africa	Cross-sectional	Online survey	576	57%	-	Low risk
7	Michel Kabamba Nzaji et al [34]	2021	Congo	Meddle Africa	Cross-sectional	Survey	613	27.70 %	-	Low risk
8	Oluseyi Ademola Adejumo et al [35]	2021	Nigeria	Western Africa	Cross-sectional	Continent sampling	1,470	55.50 %	-	Low risk
9	Steward Mudenda et al[36]	2021	Zambia	Middle Africa	Cross-sectional	Online survey	632	24.50 %	-	Low risk
10	Charles S Wiysonge et al [37]	2021	South Africa	Southern Africa	Cross-sectional	Online survey	395	59.0 %	-	Low risk
11	Mohamed Khalis et al [38]	2021	Morocco	Northern Africa	Cross-sectional	Online survey	303	62.0 %		Low risk

12	Hamdi El Kefi et al [39]	2021	Tunisia	Northern Africa	Cross-sectional	Simple random	*398*	58%	99.5 %	Low risk
13	Elhadi et al[40]	2021	Egypt	Northern Africa	Cross-sectional	Online Survey	15,087	79.6 %	-	Low risk
14	Mohammed Mustapha [41]	2021	Nigeria	Western Africa	Cross-sectional	Online	440	40	-	Low risk









Competing interests

The authors declare that they have no competing interests.