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COVID-19 vaccine acceptance and hesitancy in Cameroon: a systematic review and meta-analysis

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Abstract

Background The development of effective vaccines was a promising tool for ending the pandemic. However, the success of a vaccination programme hinges on achieving substantial community acceptance. In Cameroon, numerous studies have investigated the level of acceptance, hesitancy, and perception of COVID-19 vaccines, with mixed results. To provide a comprehensive understanding of these parameters, this meta-analysis aimed to estimate the pooled proportion of COVID-19 vaccine acceptance, hesitancy and perception in Cameroon.

Methods A systematic search of online databases, including PubMed, Google Scholar, and ScienceDirect, was conducted to identify relevant research articles. This study adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The extracted data were compiled in a Microsoft Excel spreadsheet and analyzed using R statistical software (version 4.3.3). The pooled proportion of COVID-19 vaccine acceptance, hesitancy, and perception was calculated using a random-effects meta-analysis. Funnel plots, Egger's, and Begg's tests were used to assess publication bias.

Results Of the 1,346 records identified through the database search, 20 research articles were included in the systematic review and meta-analysis. The random-effects model showed that approximately 31.21% (95% CI: 23.49–38.94) of the participants was willing to accept the COVID-19 vaccine. More than two-thirds of the population (68.49%; 95% CI: 60.65–76.34) were vaccine hesitant. Half of the participants (51.81%; 95% CI: 42.70-60.93), had a negative perception of the COVID-19 vaccine. The acceptance rate progressed from the first semester of 2021 (27.21%; 95% CI: 10.38–44.05) to the first semester of 2022 (45.56%; 95% CI: 25.00-66.12). The pooled vaccine acceptance rate was 29.29% (95% CI: 19.86–38.72) for the general population and 39.24% (95% CI: 22.84–55.64) for healthcare workers. The pooled vaccine hesitancy rate was 70.39% (95% CI: 61.30–79.80) for the general population and 57.42% (95% CI: 4.05–71.80) for healthcare workers.

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Conclusion Although progress in vaccine acceptance, targeted interventions remain necessary to address vaccine hesitancy in the country. Strategies such as enhancing access to accurate information, fostering trust in institutions, and strengthening community engagement remain crucial for increasing COVID-19 vaccine uptake.

Keywords COVID-19 vaccine, Acceptance, Hesitancy, Perception, Cameroon

Background

Coronavirus disease (COVID-19) is an infectious disease caused by the severe acute respiratory syndrome 2 (SARS-CoV-2) viruses. The pandemic has resulted in an unprecedented burden on global healthcare systems and economies with a particular concern in sub-Saharan Africa [1]. Despite declining case numbers, periodic surges continue, resulting in more than 704 million confirmed cases and more than 7 million deaths worldwide as of March 3, 2024 [2].

In Cameroon, the first confirmed case of COVID-19 was reported on March 6, 2020. Following the spread of the disease in the country, the government of Cameroon introduced vaccination, among other preventive measures [3]. The Cameroonian health authorities, represented by the National Immunization Technical Advisory Groups and the Scientific Advice for Public Health Emergencies, have approved four vaccines against SARS-CoV-2 for immunization against this disease [4].

Although vaccines against COVID-19 were developed, several factors compromise their acceptance and this has become a public concern [5, 6]. Vaccine hesitancy, defined as the refusal of vaccines or a delay in acceptance despite the availability of immunization services, ranks among the top ten global health challenges. Vaccine acceptance, conversely, refers to the intention or willingness to receive a vaccine, not the actual administration (uptake) of the vaccine itself [7]. Factors contributing to vaccine hesitancy include distorted perceptions of disease risk, insufficient knowledge about vaccines, fear of side effects, and the dissemination of misinformation and fake news [8]. Vaccine hesitancy negatively impacts vaccine uptake and hinders pandemic control efforts. Furthermore, a negative perception of the COVID-19 vaccine reflects an unfavorable attitude toward its benefits.

A global meta-analysis reported an overall COVID-19 vaccine acceptance prevalence of 65%, with a lower rate of 55% for the African continent. This disparity suggests that despite the COVID-19 vaccine development, acceptance and pandemic management may be challenging [5]. A meta-analysis conducted in Ethiopia indicated that 55% of respondents were willing to receive the COVID-19 vaccine. Furthermore, a survey Cameroon revealed that 66% vaccine hesitancy rate, while approximately 33% as dangerous [9]. Despite community engagement initiatives focused on educating the public about vaccine efficacy, tolerability, and potential side effects, vaccine hesitancy was projected to persist in Cameroon between 2021 and 2022 [10].

Several studies conducted in Cameroon have yielded varying levels of COVID-19 vaccine acceptance, hesitancy and perception. Therefore, the present meta-analysis was aimed to estimate the pooled proportion of these parameters in Cameroon.

Methods

Study design

This study was conducted to assess the proportion of vaccine acceptance and hesitancy in Cameroon. This systematic review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines [11].

Study setting

Cameroon has an estimated population of about 28.6 million in 2023. The country covers a total area of 472,650 km², divided into ten administrative regions: Center, Littoral, Far North, North, Adamawa, North-West, South-West, West, East and South. Cameroon has two capitals: Yaoundé, located in the Center Region, serves as the country's political capital, while Douala, located in the Littoral Region, is the economic city that drives the country's growth [12, 13].

Eligibility criteria

The review included all published studies reporting on COVID-19 vaccine acceptance, hesitancy and perception in Cameroon. Studies with unclear outcome variables were excluded from the review. In addition, duplicate articles were reviewed and removed from the study prior to data extraction. Only articles written in the English language were included. There was no restriction on publication date as there was no previous systematic review and meta-analysis that investigated vaccine acceptance, hesitancy and perception in the country.

Article searching strategy

Based on predetermined eligibility criteria, a comprehensive review of online literature sources was conducted. A systematic search of electronic databases such as PubMed, Google Scholar, Scopus and Science Direct was performed to identify published studies. The search strategy included analysis of the text contained in the title and abstract of each study. A combination of keywords and Medical Subject Headings (MeSH) terms was used,

with Boolean logic operators ("AND" and "OR") used to refine the search. The keywords and MeSH terms included "coronavirus OR COVID-19 AND vaccine AND acceptance OR willingness OR hesitation OR intention OR perception OR attitude AND Cameroon". To ensure a comprehensive search, a manual search was conducted to identify additional published articles not indexed in electronic databases. To reach literature saturation, the reference lists of the indicated studies were also examined. The last search was conducted on November 15, 2024 (Additional files 1, Supplementary Table 1).

Data extraction

Data extraction was performed from all eligible articles. A predefined Microsoft Excel 2016 form was used to collect study characteristics including primary author, study year, region, study design, setting, study participant, sample size, reported vaccine acceptance, hesitancy, and poor perception. Two authors conducted a critical assessment of each article for relevance and quality. Disagreements among reviewers were resolved through discussion.

Data quality assessment

The quality of the included studies was assessed using the Joanna Briggs Institute quality assessment tool for prevalence studies [14]. Nine parameters were employed to assess the risk of bias for each study. Such parameters include appropriateness of the sampling frame, suitable sampling technique, adequate sample size, description of study subjects and setting, sufficient data analysis, use of valid methods for identified conditions, valid measurement for all participants, use of appropriate statistical analysis, and adequate response rate (≥ 60%). Each parameter was scored as 1 (yes) or 0 (no or unclear). The risk of bias was categorized as low (5–9), moderate (3–4), or high (0–2).

Outcome of measurement

The primary outcomes of this study were COVID-19 vaccine acceptance and hesitancy. The other outcome variable included the negative perception of this vaccine. These proportions were calculated by dividing the number of participants who indicated willingness to receive the vaccine, hesitancy to receive the vaccine, or negative perception of the vaccine by the total number of participants who responded to the question.

Operational definition

Vaccine acceptance refers to intention or willingness to receive the vaccine and not actual administration (uptake) of the vaccine itself. Vaccine hesitancy is the refusal of vaccines or a delay in acceptance despite the availability of immunization services [7]. Negative or poor perception of the COVID-19 vaccine refers to a negative attitude toward the benefits of the COVID-19 vaccine. It includes cognitive assessment of the vaccine as undesirable, untrustworthy, dangerous or ineffective, resulting in reluctance or refusal to receive the vaccine.

Statistical analysis

Data were analyzed using R Statistics version 4.3.3. Heterogeneity between studies was assessed using the I^2 test statistic. Three categories were used to classify the degree of heterogeneity (I^2 index). These categories were either low (< 25%), moderate (25–75%), or high (> 75%). Subgroup analysis was performed for study year, region, setting, and type of participants enrolled. The random-effects model was preferred when significant heterogeneity between studies was observed for the pooled estimates of vaccine acceptance, hesitancy, and perception.

Meta-regression was performed to investigate whether study characteristics could explain the variability in results across studies. The examined study characteristics included the year the study was conducted (2020, 2021, 2022 or 2023), region (studies targeting participants from all ten Regions (nationwide) of the country or less Regions (multicenter) or from a specific Region), setting (participants enrolled from hospitals or from other settings including online-and community-recruited participants), sample size (< 1000 and ≥ 1000), study participant (general or other including healthcare workers and/or students). Only study variables with meaningful and practical categories were considered. multivariable meta-regression model was used to assess whether vaccination acceptance, hesitancy, and perception varied according to the selected study variables. A p-value < 0.05 was considered statistically significant.

Publication Bias and sensitivity test

Publication bias was assessed visually using the funnel plot. A funnel plot displaying symmetrical, large, and inverted shapes, suggested the absence of publication bias. Furthermore, Egger's and Begg's tests were used to statistically examine the funnel plot asymmetry, with a significance level of $p < 0.05$. The sensitivity test was done by excluding a single individual study from the analysis at a time to explore the robustness of the findings.

Results

Selection of studies

A total of 1346 records were identified after an extensive literature search. After removing 135 duplicate studies, 1231 records remained. After review, 1208 reports were excluded based on their titles and abstracts. The content of the remaining 23 records was then assessed for eligibility and a total of 20 study reports met the eligibility criteria and were included in this systematic review and meta-analysis (Fig. 1).

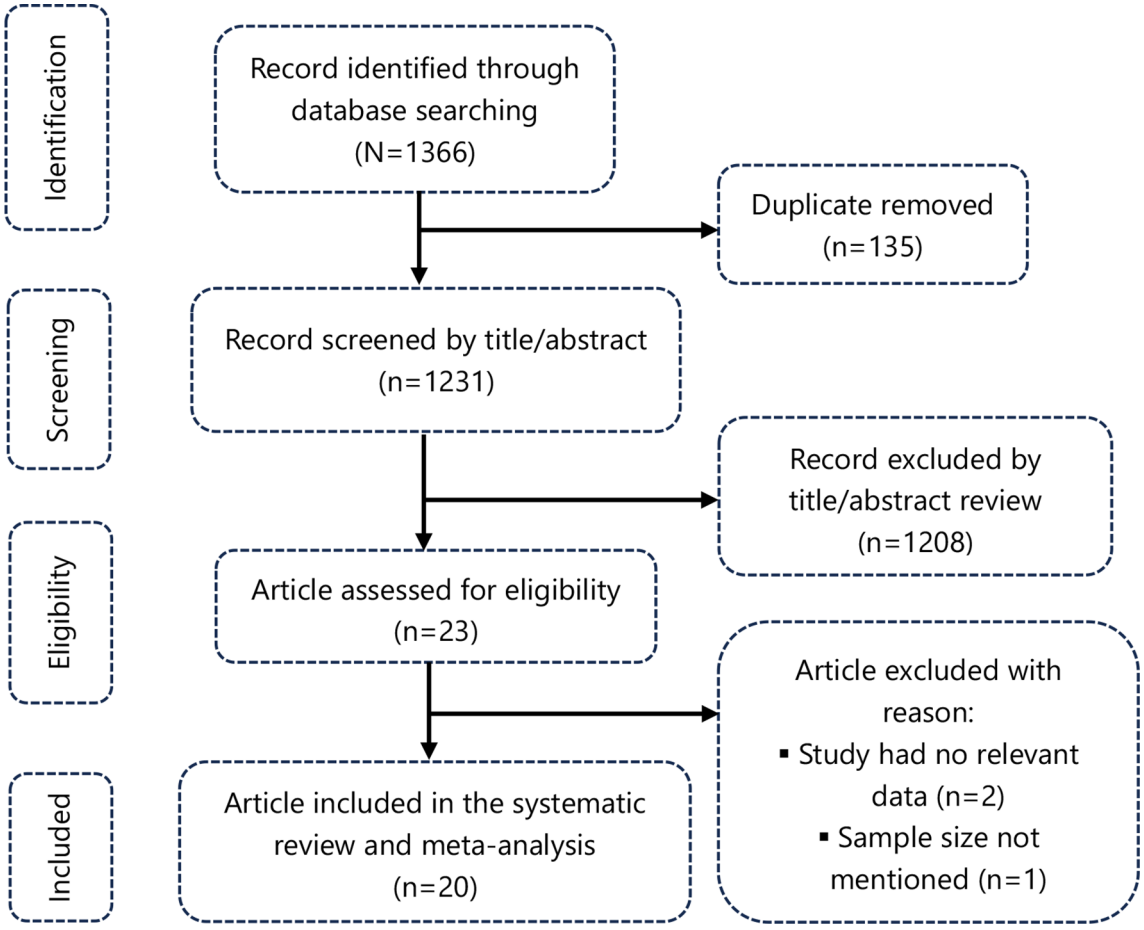

Fig. 1 PRISMA diagram flow of studies included in the meta-analysis

Summary of studies included

A comprehensive analysis included 20 studies with a cumulative sample size of 28,355 participants. These studies, conducted between 2021 and 2023, primarily involved the general population in different regions of the country and provided estimates of COVID-19 vaccine acceptance, hesitancy, and perception (Table 1).

Adherence to COVID-19 vaccine

The random-effects model indicated that approximately 31.21% (95% CI: 23.49–38.94; $n = 15$ studies) of the Cameroonian population was willing to accept the COVID-19 vaccine, with significant heterogeneity observed ($I^2 = 99.8\%$; $p < 0.001$). Conversely, more than two-thirds of the population (68.49%; 95% CI: 60.65–76.34; $n = 13$ studies), were vaccine hesitant with a high heterogeneity of studies assessed ($I^2 = 99.3\%$; $p < 0.001$). In addition, half of the participants (51.81%; 95% CI: 42.70-60.93; $n = 12$ studies), had a negative perception of the COVID-19 vaccine, with significant heterogeneity ($I^2 = 97.2\%$; $p < 0.001$) (Figs. 2, 3 and 4).

Subgroup analysis

The lowest estimates of the willingness to receive the COVID-19 vaccine were observed in the North-west Region (2.37%; 95% CI: 1.91–3.04) and among students (13.03%; 95% CI: 45.73–83.06). The acceptance rate increased from 27.21% (95% CI: 10.38–44.05) in the first half of 2021 to 45.56% (95% CI: 25–66.12) in the first half of 2022. The pooled vaccine acceptance rate was 29.29% (95% CI: 19.86–38.72) among the general population and 39.24% (95% CI: 22.84–55.64) among healthcare workers (Table 2 and Additional files 2, Supplementary Fig. 1).

The highest hesitancy rate was observed in the first half of 2021 with a pooled estimate of 75.96% (95% CI: 63.24–88.68) and in studies conducted both online and in other settings (77.62%; 95% CI: 64.83–90.41). The pooled vaccine hesitancy rate was 70.39% (95% CI: 61.30–79.80) for the general population and 57.42% (95% CI: 4.05–71.80) for healthcare workers (Table 3 and Additional files 2, Supplementary Fig. 2).

Poor perception of the COVID-19 vaccine was mainly observed in studies conducted in other setting (North-west and West Regions) (67.50%; 95% CI: 23.27–100), in multicenter studies (63.37%; 95% CI: 58.85–67.89), and

Table 1 Characteristic of studies assessing adherence to COVID-19 vaccine in Cameroon, 2020–2023

Author	Study year	Region	Setting	Study population	Design	Sample size	Sampling	Risk of bias
Abongwa et al. [15]	2021	North-west	Community	General population	CS	2531	Non-probabilistic	Low
Aka et al. [16]	2022–2023	Centre	Hospital	HCW	CS	510	Probabilistic	Low
Akwa et al. [17]	2021	Nationwide	Online	General population	CS	1750	Non-probabilistic	Low
Amani et al. [7]	2021	Nationwide	Online	General population	CS	150	Non-probabilistic	Low
Ambe et al. [18]	2022	Sout-west	Hospital	Nurse	CS	197	Probabilistic	Low
Aseneh et al. [19]	2021	National	Online	General population	CS	341	Non-probabilistic	Low
Baecher et al. [20]	2022	North-west South-west Littoral Centre	Hospital	HCW	CS	825	Non-probabilistic	High
Chefor et al. [21]	2021	Centre	Hospital	HCW	CS	247	Non-probabilistic	Low
Cho et al. [22]	2021	West Littoral Centre	Online	General population	CS	665	Non-probabilistic	Low
Dinga et al. [23]	2020	Nationwide	Online and Community	General population	CS	2512	Non-probabilistic	Low
Dinga et al. [24]	2022	Nationwide	Online and Community	General population	CS	6732	Non-probabilistic	Low
Djuikoue et al. [25]	2021	Littoral West	Community	General population	CS	1053	Probabilistic	Low
Elit et al. [26]	2022	North-west	Community	General population	CS	31	Non-probabilistic	Moderate
Gunawardhana et al. [27]	2021	Nationwide	Hospital	General population	CS	835	Non-probabilistic	Low
Ajonina-Ekoti et al. [28]	2021	Littoral	Online and University	Student	CS	591	Non-probabilistic	Low
Ngasa et al. [29]	2021	Nationwide	Online	HCW and Student	CS	371	Non-probabilistic	Low
Tambo et al. [30]	2021	Centre	Community	General population	CS	1522	Probabilistic	Low
Tchiasso et al. [10]	2021–2022	Nationwide	Community	General population	CS	6567	Probabilistic	Low
Tetsatsi et al. [31]	2022	West	Community	General population	CS	520	Non-probabilistic	Low
Ukah et al. [32]	2022	Sout-west	Hospital	HCW	CS	405	Probabilistic	Low

CS: Cross sectional study; HCW: Healthcare worker

among participants from community (61.79%; 95% CI: 41.86–81.72). The negative perception rate was 56.01% (95% CI: 41.63–70.40) in the general population and 44.96% (95% CI: 34.48–55.44) among healthcare workers (Table 4 and Additional files 2, Supplementary Fig. 3).

Meta-regression analysis

The meta-regression analysis showed that the sampling method used had a significant effect on the heterogeneity of willingness to accept the COVID-19 vaccine ($p = 0.014$). Surveys conducted before or during the introduction of the COVID-19 vaccine in Cameroon (2020–2021) revealed a significantly higher rate of vaccine hesitancy than those conducted in the following years (2022–2023) ($p < 0.001$). In addition, vaccine hesitancy was higher in studies conducted in other settings (online or community) compared to those conducted in hospital settings ($p < 0.001$) (Table 5).

Publication Bias and sensitivity test analysis

To assess publication bias, a traditional funnel plot was used, which showed asymmetry, indicating potential publication bias. For further investigation, Egger's linear regression and Begg's rank correlation tests were performed. Contrary to the visual impression of the funnel plot, the tests indicated no statistically significant publication bias for studies used to assessed the COVID-19 vaccine acceptance ($p = 0.257$), vaccine hesitancy ($p = 0.435$) and perception ($p = 0.611$) (Fig. 5).

A sensitivity analysis was also performed to assess the impact of individual studies and outliers on the overall results. This analysis showed that no single study had a significant impact on the overall results (Additional files 2, Supplementary Tables 1, 2 and 3).

Discussion

This meta-analysis estimated the pooled proportion of COVID-19 vaccine acceptance, hesitancy, and perception in Cameroon. The results of the study indicate that approximately 31.21% of the population were willing to accept the COVID-19 vaccine, while 68.49% were hesitant. A similar trend was observed in a study conducted among large rural, underserved and minority populations in Alabama, USA [33]. This vaccine acceptance rate was lower than that observed in several meta-analyses conducted in Ethiopia and worldwide [5, 9, 24, 34]. The high

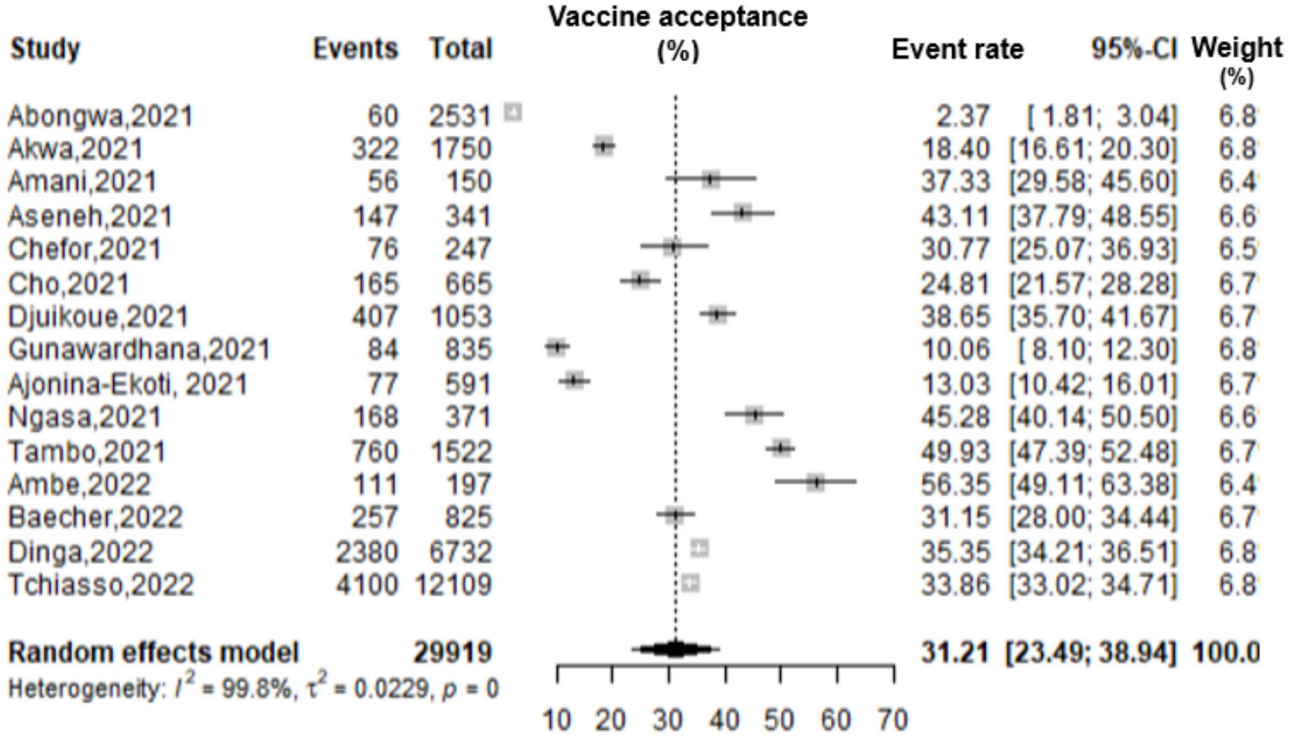

Fig. 2 Forest plot displaying the COVID-19 vaccine acceptance in Cameroon, 2020–2023

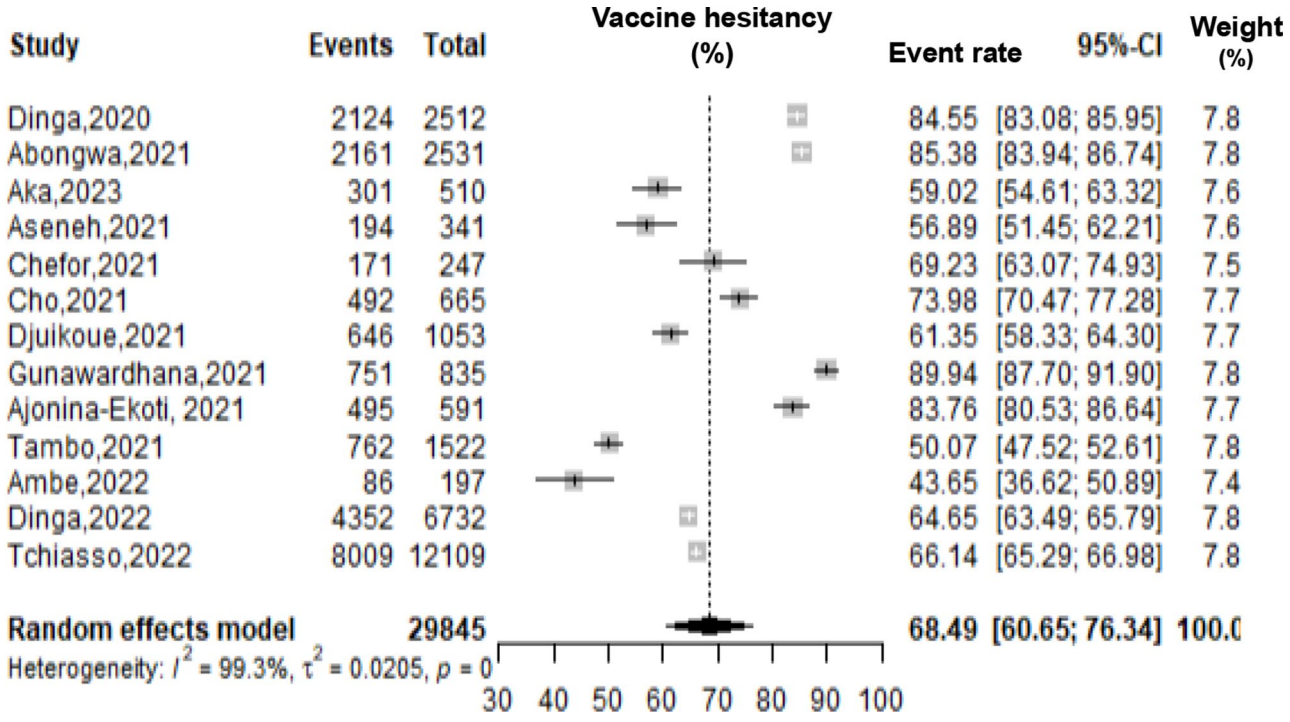

Fig. 3 Forest plot displaying the COVID-19 vaccine hesitancy in Cameroon, 2020–2023

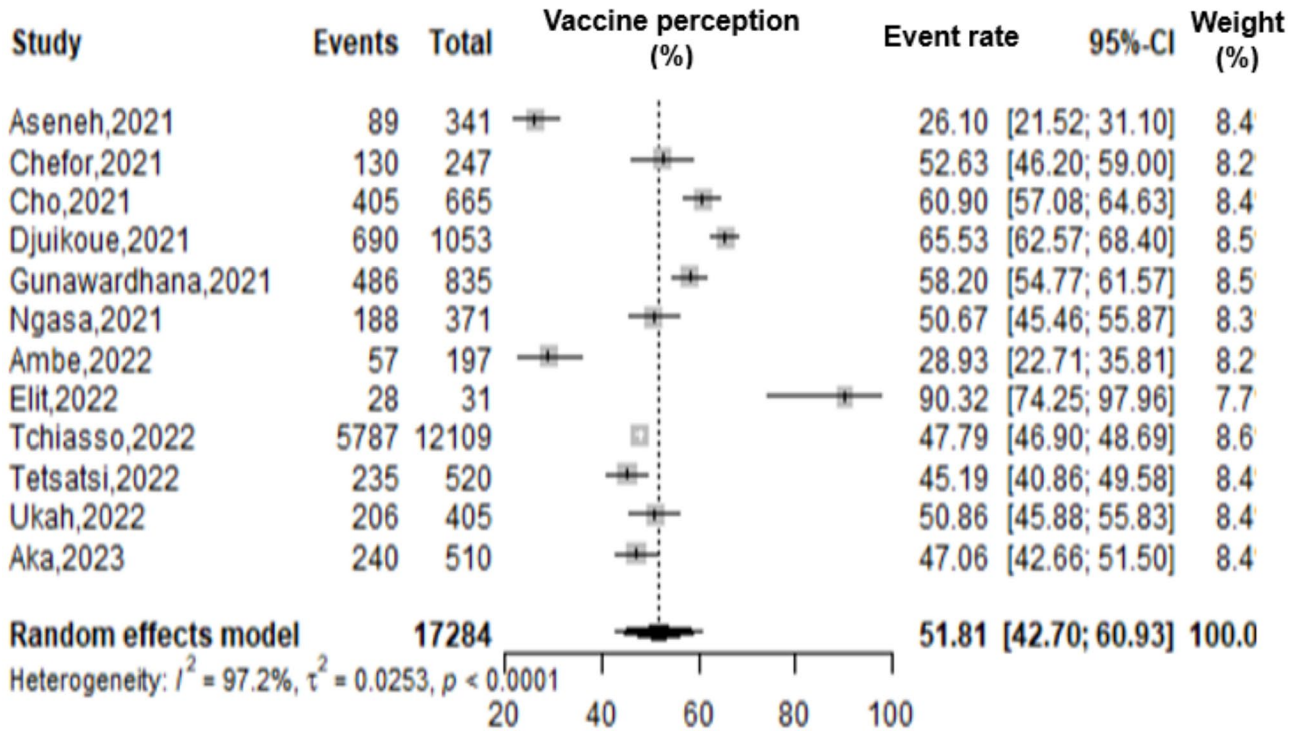

Fig. 4 Forest plot displaying the COVID-19 vaccine negative perception rates in Cameroon, 2020–2023

Table 2 Subgroup meta-analysis of COVID-19 vaccine acceptance pooled estimates in Cameroon, 2020–2023

Category	Subgroup	Sample size	Event rate[1] (%)	95% CI limits [1]		Number of studies	Heterogeneity statistic[1]	
				Lower	Upper		I^2(%)	*p*-value
Region								
	North-west	2532	2.37	1.81	3.04	1	0	-
	Nationwide	22,288	31.73	22.05	41.41	7	99.2	<0.001
	Centre	1769	40.53	21.76	59.31	2	97.2	<0.001
	Multicenter	2543	31.57	23.72	39.41	3	94.8	<0.001
	Littoral	591	13.03	10.42	16.01	1	0	-
	South-west	197	56.35	49.11	63.38	1	0	-
Setting								
	Community	17,215	31.18	11.20	51.16	4	99.9	<0.001
	Online	3277	33.56	23.10	44.02	5	97.6	<0.001
	Hospital	2104	31.90	13.39	50.40	4	98.8	<0.001
	Online and other setting	7323	24.23	2.35	46.10	2	99.5	<0.001
Study period								
	First semester 2021	6191	27.21	10.38	44.05	6	99.7	<0.001
	Second semester 2021	1900	27.48	8.94	46.02	2	95.4	<0.001
	First and second semester 2021	1965	31.46	23.21	39.62	3	94.8	<0.001
	First semester 2022	6929	45.56	25.00	66.12	2	97.14	<0.001
	Not specified	825	31.15	28.00	34.44	1	0	-
	2021–2022	12,109	33.86	33.02	34.71	1	99.8	<0.001
Participants								
	General population	27,688	29.29	19.86	38.72	10	99.98	<0.001
	Healthcare worker	1269	39.24	22.84	55.64	3	95.5	<0.001
	Student	591	13.03	10.42	16.01	1	0	-
	Healthcare worker and student	371	45.28	40.14	50.50	1	0	-

[1]Rando-effects model; CI: Confidence Interval

Table 3 Subgroup meta-analysis of COVID-19 vaccine hesitancy pooled estimates in Cameroon, 2020–2023

Category	Subgroup	Sample size	Event rate[1] (%)	95% CI limits[1]		Number of studies	Heterogeneity statistic[1]	
				Lower	Upper		I^2(%)	*p*-value
Region								
	Nationwide	22,529	72.52	60.22	84.83	5	99.6	<0.001
	Centre	2279	59.20	48.38	70.01	3	95.2	<0.001
	Multicenter	1718	67.64	55.26	80.02	2	96.8	<0.001
	Other [2]	3319	71.11	44.55	97.68	3	98.5	<0.001
Setting								
	Community	17,215	65.76	51.32	80.21	4	99.6	<0.001
	Online	1006	65.56	48.81	82.31	4	99	<0.001
	Hospital	1789	65.62	46.57	84.68	2	96.5	<0.001
	Online and other setting	9825	77.62	64.83	90.41	3	99.6	<0.001
Study period								
	First and second semester 2020	2512	84.55	83.09	85.95	1	0	-
	First semester 2021	5520	75.96	63.24	88.68	5	99	<0.001
	First and second semester 2021	588	63.00	50.91	75.09	2	89.6	0.002
	First and second semester 2022	665	73.98	70.47	77.28	1	0	-
	First semester 2022	1719	47.71	41.65	53.77	2	65.6	0.088
	2021–2022	6732	64.65	63.49	65.79	1	0	-
	2022–2023	12,109	66.14	65.29	66.98	1	0	-
Participants								
	General population	28,300	70.39	61.30	79.48	9	99.5	<0.001
	Healthcare worker	954	57.42	43.05	71.80	3	93.5	<0.001
	Student	591	83.75	80.53	86.64	1	0	-

[1]The Random-effects model; [2]Other includes Littoral, North-west and South-west Regions; CI: Confidence Interval

Table 4 Subgroup meta-analysis of COVID-19 vaccine negative perception in Cameroon, 2020–2023

Category	Subgroup	Sample size	Event rate[1] (%)	95% CI limits [1]		Number of studies	Heterogeneity statistic[1]	
				Lower	Upper		I^2(%)	*p*-value
Region								
	Nationwide	13,656	45.75	32.32	59.17	4	97.5	<0.001
	Centre	757	49.38	43.99	54.76	2	51.8	0.150
	Multicenter	1718	63.37	58.85	67.89	2	73.2	0.053
	Other[2]	551	67.50	23.27	100.0	2	98.4	<0.001
	South-west	602	40.00	18.51	61.49	2	96.5	<0.001
Setting								
	Community	13,713	61.79	41.86	81.72	4	98.5	<0.001
	Online	1377	45.92	25.66	66.18	3	98.5	<0.001
	Hospital	2194	47.69	38.06	57.33	5	94.1	<0.001
Study period								
	2021	3512	52.41	41.23	63.59	6	97.7	<0.001
	2022	13,262	52.32	32.90	71.73	5	96	<0.001
	2023	510	47.06	42.66	51.50	1	0	-
Participants								
	General population	15,554	56.01	41.63	70.40	8	98.3	<0.001
	Healthcare worker	1359	44.96	34.48	55.44	4	91.7	<0.001
	Healthcare worker and student	371	50.67	45.46	55.87	1	0	-

[1]The Random-effects model; [2]Other includes North-west and West Regions; CI: Confidence interval

Table 5 Multivariate meta-analysis of COVID-19 vaccine acceptance, hesitancy and perception in Cameroon healthcare workers in Cameroon, 2020–2023

COVID-19 vaccine estimate	Category	Moderator	Adjusted coefficient (β)	*p*-value
Acceptance	Study year	2021 vs. 2022	-0.3965	0.553
	Setting	Other[1] vs. Hospital	0.6130	0.396
	Region	Subnational[2] vs. Nationwide	-0.6440	0.268
	Sampling	Non-probabilistic vs. Probabilistic	-1.6216	**0.014**
	Sample size	<1000 vs. ≥ 1000	1.0653	0.1525
	Participant	Other[3] vs. General population	0.4229	0.570
Hesitancy	Study year	2020–2021 vs. 2022–2023	1.2502	**< 0.001**
	Setting	Other[1] vs. Hospital	1.4673	**< 0.001**
	Region	Subnational[2] vs. Nationwide	0.1790	0.593
	Sampling	Non-probabilistic vs. Probabilistic	0.2866	0.342
	Sample size	<1000 vs. ≥ 1000	-0.9047	**< 0.001**
	Participant	Other[3] vs. General population	0.9696	**0.017**
Negative perception	Study year	2021 vs. 2022+	0.31143	0.6539
	Setting	Other[1] vs. Hospital	-0.2460	0.750
	Region	Subnational[2] vs. Nationwide	0.7020	0.228
	Sampling	Non-probabilistic vs. Probabilistic	1.1791	0.323
	Sample size	<1000 vs. ≥ 1000	-1.2916	0.363
	Participant	Other[3] vs. General population	-0.0620	0.936

[1]Online and/or within Community; [2]Multicenter and/or specific Region; [3]Healthcare workers and/or students

rate of vaccine hesitancy in Cameroon may explain this lower acceptance rate. Vaccine hesitancy is a significant public health concern as it may impede efforts to control the spread of COVID-19. These findings corroborate results from studies conducted in the USA, which showed that certain ethnic groups and underserved communities exhibited higher COVID-19 vaccine hesitancy [35, 36]. A lower proportion of COVID-19 vaccine hesitancy was observed in a global meta-analysis conducted in 2023 [6].

This study highlights the critical role of information access and trust in vaccine acceptance. Limited access to credible information and potential mistrust of institutions among the general population can contribute vaccine hesitancy. This underscores the necessity for targeted public health communication strategies that address misinformation and foster trust [37]. The observed difference in hesitancy rates between the general population and healthcare workers illustrates this point.

Furthermore, approximately half of the participants (51.81%) held a negative perception of the vaccine. This can be attributed to several factors, including the dissemination of misinformation, fear of side effects, or mistrust of the vaccine efficacy. This also elucidates the high hesitancy rate observed within the Cameroonian population. Moreover, the observed high hesitancy and negative perception rates underscore the influence of socio-behavioral factors on vaccine uptake. A comprehensive understanding of these factors, including cultural beliefs, social norms, and individual attitudes, is essential for developing effective interventions to enhance vaccine acceptance.

The study observed a notable increase in COVID-19 vaccine acceptance in Cameroon between the first half of 2021 and the first half of 2022. Specifically, theacceptance rate increased from 27.21% in 2021 to 45.56% in 2022. This increase may be attributed to the Ministry of Public Health's community engagement initiatives aimed at enhancing public understanding and acceptance of the COVID-19 vaccine [10]. Additionally, a gradual increase in acceptance overtime could be attributed to the natural integration of new concepts within the population. These findings are consistent with the a global meta-analysis that also demonstrated a significant increase in vaccine acceptance was observed from 2020 to 2021 [5, 34].

The pooled vaccine hesitancy rate was 70.39% for the general population and 57.42% for healthcare workers. This result corroborates findings from a global meta-analysis, which reported higher hesitancy in the general population compared to a specific group including healthcare workers [34]. The general population may have limited access to credible sources of information regarding COVID-19 vaccines, thereby increasing their susceptibility to misinformation and myths.Furthermore, the general population may exhibit greater skepticism towards institutions such as the government agencies, pharmaceutical companies, and healthcare systems, potentially influencing their attitudes towards vaccination. This lack of access to accurate information and mistrust can lead to confusion, suspicion, and ultimately, vaccine hesitancy.

These findings have significant implications for health policy in Cameroon. Strategies to improve vaccine uptake should consider the specific factors driving hesitancy in the population [24]. This might necessitate collaborations with community leaders, religious organizations, and other trusted figures to disseminate accurate information and address concerns. The Ministry of Public Health's initiatives serve as a positive example [10, 24].

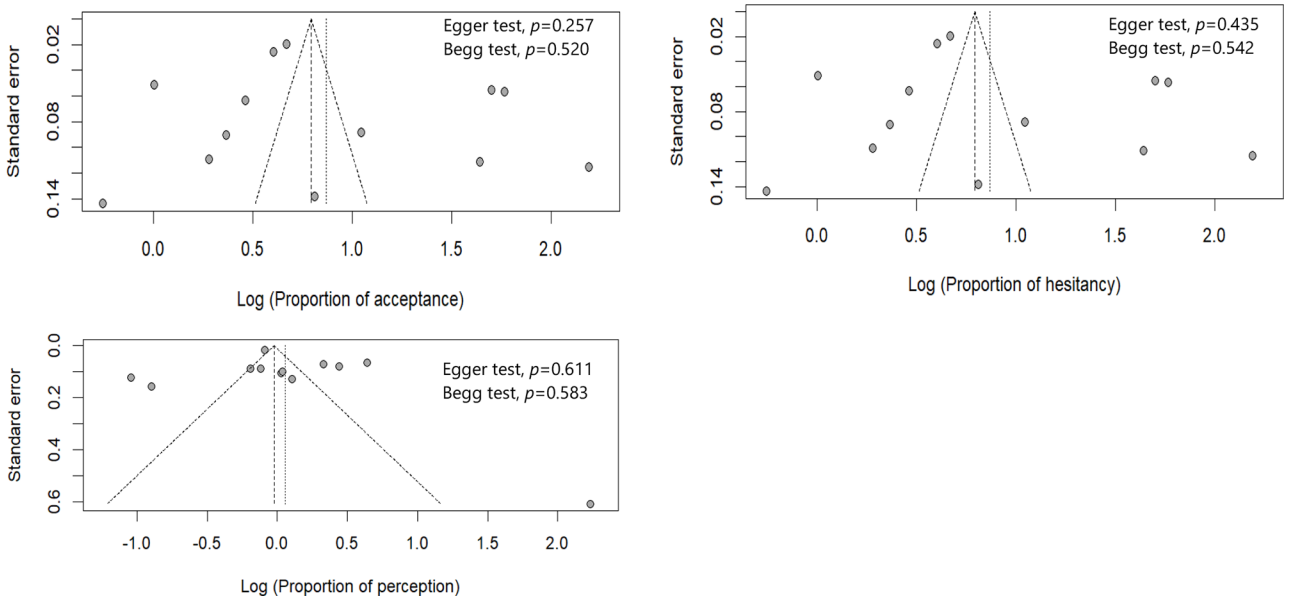

Fig. 5 Funnel plot with pseudo 95% confidence limits and the resulting Egger's and Begg's tests of studies included

Several theoretical frameworks can be applied to understand vaccine hesitancy, including the Health Belief Model, the Theory of Planned Behavior, and the Diffusion of Innovations theory [38, 39]. These frameworks can help elucidate the psychological, social, and cultural factors that influence vaccine-related decisions.

Strengths and limitations

The study's strengths include adherence to PRISMA guidelines, ensuring a transparent and systematic review process. Furthermore, the comprehensive search strategy, including multiple databases and manual searches, combined with rigorous quality assessment and appropriate statistical analysis, enhances the reliability and validity of the findings. The absence of publication date restrictions further strengthens the study. However, the lack of hesitancy rates and a specific variables to assess negative COVID-19 vaccine perceptionin certain studies limited the number of studies included and should be considered when interpreting the result related to vaccine perception. Thesearch was limited to English-language publications, potentially excluding relevant research published in other language. Although publication bias was assessed using funnel plots,Egger's and Begg's tests, the possibility of unpublished or inaccessible relevant studies remains. Furthermore, the reliance on self-reported data may introduce social desirability bias, potentially leading to overreporting of vaccine acceptance and underreporting of vaccine hesitancy.

Conclusions

The study reveals a concerning trend in Cameroon, with only 31.21% of the population willing to accept the COVID-19 vaccine, while a substantial majority (68.49%) remain hesitant. The willingness to receive the vaccine was lower than the global average. The study also identified a notable increase in COVID-19 vaccine acceptance rates in Cameroon between 2021 and 2022. The findings indicate that the general population in Cameroon exhibits greater hesitancy towards the COVID-19 vaccine compared to healthcare workers. The results of this study highlight the need for targeted interventions to address vaccine hesitancy in Cameroon. Efforts to enhance access to accurate information, build trust in institutions and strengthen community engagement are critical for increasing acceptance of vaccines against COVID-19 or future emerging or re-emerging diseases.

Abbreviations

COVID-19	New Coronavirus Disease
CS	Cross Sectional Study
HCW	Healthcare Worker
MeSH	Medical Subject Headings
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
SARS-CoV-2	Severe Acute Respiratory Syndrome 2

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Author contributions
FZLC conceived the original idea of the study. FZLC and MFE conducted the literature search. FZLC and MFE selected the studies, extracted the relevant information, and synthesized the data. FZLC performed the analyses and wrote the first draft of the manuscript. FZLC, AA, ICAN, LBKB, AN, EOG, CSN, CA and CM critically reviewed and revised successive drafts of the manuscript. All authors read and approved the final manuscript.

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Data availability
Data sources supporting this systematic review and meta-analysis are cited in the reference section. All data generated or analyzed during this study are included in this published article and supplemental materials.

Declarations

Ethical approval
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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