COVID

Review

Epidemiology of SARS-CoV-2 Infection in Ethiopia: A Systematic Review and Meta-Analysis

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Abstract: Introduction: The Coronavirus disease of 2019 (COVID-19) is a catastrophic emerging global health threat caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 has a wide range of complications and sequelae. It is devastating in developing countries, causing serious health and socioeconomic crises as a result of the increasingly overburdened healthcare system. This study was conducted to determine the prevalence of SARS-CoV-2 infection in Ethiopia. Methods: Electronic databases, such as PubMed, Google Scholar, Web of Science, Research Gate, Embase, and Scopus were thoroughly searched from March to April 2022 to identify relevant studies. The quality of the included studies was evaluated using the Newcastle-Ottawa Quality scale for cross-sectional studies. STATA-12 was used for analysis. A random-effects model was used to compute the pooled prevalence of SARS-CoV-2 infection. The heterogeneity was quantified by using the I^2 value. Subgroup analysis was done for sex, age of study subjects, population type, diagnostic methods, and publication year. Publication bias was assessed using a funnel plot and Egger's test. A sensitivity analysis was also done. Result: 11 studies consisting of 35,376 study participants (15,759 male and 19,838 female) were included in this systematic review and meta-analysis. The pooled prevalence of SARS-CoV-2 was 8.83%. There was substantial heterogeneity, with an I^2 value of 99.3%. The pooled prevalence of SARS-CoV-2 was higher in males (9.27%) than in females (8.8%). According to the publication year, a higher prevalence was obtained in 2021 (12.69%). Similarly, it was higher in the population of specific groups (16.65%) than in the general population (5.75%). Conclusion: the national pooled prevalence of SARS-CoV-2 infection in the Ethiopian population was 8.83%. This indicates that the burden of COVID-19 is still high, which urges routine screening and appropriate treatment.

Keywords: COVID-19; SARS-CoV-2; Ethiopia; prevalence; epidemiology; coronavirus disease 2019; severe acute respiratory syndrome coronavirus 2

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1. Introduction

Coronavirus disease 2019 (COVID-19) is a rapidly emerging global health threat that has been classified as a pandemic by the World Health Organization (WHO). The coronavirus disease (COVID-19) pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1], has devastated the world in the space of just a few months. Since it was first reported on 31 December 2019, in the Hubei province of China, by the end of February 2022, over 433 million people have been infected globally, with over 5.9 million deaths [1]. At the regional level, the Western Pacific Region reported unique findings where the number of new weekly cases and deaths increased by 32% and 22%, respectively, in any of the WHO regions, including Africa [2].

COVID-19 is primarily pulmonary; whereas the majority of infected people will recover with supportive care, some patients experience cardiovascular, neurological, hematopoietic, and immune system manifestations [3]. Several risk factors have been identified that increase mortality among COVID-19 patients, including older age, male sex, and people who have comorbidities such as hypertension, diabetes, cardiovascular disease, chronic respiratory disease, cancer, or other immune diseases, which make it more likely to develop a severe form of the disease [4,5]. Furthermore, lymphopenias, high levels of C-reactive protein (CRP), serum ferritin, lactate dehydrogenase (LDH), and Coagulationopathy, such as elevated D-dimer, prothrombin time (PT), and partial thromboplastin time (PTT), have been linked to an increased risk of COVID-19 and death [6–8]. A higher D-dimer and prothrombin time have also been linked to an increased risk of acute respiratory distress syndrome (ARDS) [9].

Moreover, the COVID-19 pandemic has created a global burden for the long-term care of COVID-19 survivors [10] and has wide complications and sequelae of symptoms, resulting in a variety of adverse outcomes such as Guillain–Barré syndrome, rheumatoid arthritis, respiratory failure, pneumonia, coronary artery atherosclerosis, acute myocardial infarction, hepatic and renal system problems, as well as mental health problems, such as posttraumatic stress disorder (PTSD), depression, and anxiety. Acute lung injury, acute respiratory distress syndrome (ARDS), shock, acute kidney injury arrhythmias, and acute cardiac injury are some of the complications of a COVID-19 infection [3,10,11]. Overall, the pathology of COVID-19 is still characterized by a cytokine storm [10]. In addition to directly infecting the neural cells, SARS-CoV-2 can harm the brain in various other ways as well. The brain gets overwhelmed by proinflammatory substances as a result of persistent inflammatory reactions, which harm the neural cells and result in brain ischemia, which is linked to numerous health problems [12]. Long-term infection is also similar to the cytokine storm of other inflammatory reactions, which results in the production of more proinflammatory cytokines (IL-1 and IL-6) [13]. Moreover, It has been linked to multiple organ failure, systemic inflammation, myocardial infarction, neurological disorders, such as ischemic strokes (including cardiac and cerebral ischemia), and even death [14].

Ethiopia reported the first case of COVID-19 on 13 March 2020. By the end of February 2022, there were over 433 million confirmed cases of COVID-19 infection and 5.9 million coronavirus-related deaths. Despite the government having been working on different mitigation activities starting from the state of emergency, the burden of the pandemic is still high. Similar to developed countries, the health systems of Ethiopia are also being challenged by an ongoing COVID-19 pandemic. Thus, the health systems overburdened by outbreaks increase the number of deaths from COVID-19-related and non-COVID-19 causes [15].

Furthermore, pieces of evidence have shown that the COVID-19 pandemic affects different aspects, such as international trade and logistics [16], food security and nutrition [17], economic development [18], women and girls [19], health systems and health care workers [15,20], and education [21]. These listed problems have been more devastating in developing countries, including Ethiopia, which is more affected by the Northern war of the country beyond the COVID-19 pandemic. Thus, to resolve serious health crises with high socio-economic costs, evidence-based practices are quite essential. Therefore, knowing the epidemiology is critical to taking further preventive measures, designing alternative mitigation activities, and reducing its further spread and complications. Thus, this systematic review and meta-analysis are aimed at synthetically analyzing the epidemiology of COVID-19 and its determinant factors in Ethiopia.

2. Methods

2.1. Design and Protocol Registration

This systematic review and meta-analysis were designed to estimate the pooled prevalence of SARS-CoV-2 infection in the general population of Ethiopia. The result was reported based on Preferred Reporting Items for Systematic Review and Meta-analysis Pro-

tocols (PRISMA-P). The review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the registration number CRD42022323519.

2.2. Search Strategy and Study Selection

All articles regarding the SARS-CoV-2 infection were retrieved through a systematic search of electronic databases, such as PubMed/Central, Google Scholar, Web of Science, Research Gate, and Scopus, from March to April 2022. In addition to accounting for the studies' omission during electronic database searches, a direct Google search was carried out using listed references in the included articles. The keywords used in this study include: (1) Prevalence, seroprevalence, and magnitude, (2) COVID-19, SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus 2, Coronavirus disease 2019, (3) Ethiopia.

The comprehensive and extensive searching strategy has been employed using condition, context, population, and outcome of interest (CoCoPop) formulating questions and searching terms were "Prevalence", "epidemiology", "magnitude", "COVID-19", "SARS-CoV-2", "Severe Acute Respiratory Syndrome Coronavirus 2", "Coronavirus disease 2019", and "Ethiopia". The search terms were combined using the Boolean operators "OR" and "AND" to fit the advanced searching of articles. Moreover, the cited sources from these papers were used as a resource for finding other related studies.

Duplicates were removed, and four independent reviewers (AG, HB, MT, MF) continued to screen the title and abstract of all potentially eligible studies. Then, the full text of potentially eligible studies that reported the prevalence of the SARS-CoV-2 infection was added to the collections for extraction. Disagreements among authors during data extraction were resolved through discussions.

2.3. Eligibility Criteria

Original articles that reported the seroprevalence of SARS-CoV-2 infection among the Ethiopian population were included. All observational studies carried out by serological tests as well as by PCR tests and reported only in English were included. However, non-English articles that had an abstract in English containing the required data for extraction were also included. On the other hand, studies reporting the seroprevalence of SARS-CoV-2 infection among non-human subjects (animals, rodents) were excluded. Furthermore, review articles, case reports, and letters to the editor were also excluded.

2.4. Outcome Variables

The outcome variable for this study is the national pooled prevalence of SARS-CoV-2 infection among the Ethiopian population.

2.5. Data Extraction and Quality Assessment

Data from the eligible studies were extracted by four reviewers (AG, HB, MF, and HD) independently in Microsoft Excel sheets. The information extracted from each study includes the name of the first author, publication year, region, study subjects, study design, sample size, number of male and female participants, diagnostic methods, and the prevalence of SARS-CoV-2 among males and females. Study qualities were assessed using the Newcastle-Ottawa Quality scale for cross-sectional studies [22,23]. Using the critical appraisal checklists, studies were reviewed, and articles with an average score of 50% to 75% were considered as good quality, while those greater than a 75% score were defined as high quality.

2.6. Statistical Analysis

Data extraction was done using a Microsoft Excel worksheet, and the meta-analysis was done using STATA version 12 with metan commands. The point estimate and the 95% confidence interval of the prevalence of SARS-CoV-2 infection for the included studies were calculated. Due to the high heterogeneity reported, the national pooled prevalence of the SARS-CoV-2 infection was calculated using a random-effects model. The DerSimonian

Laird method was used to estimate the between-study variance. The Cochrane's Q test and I^2 statistics, providing an estimate of the percentage of variability in effect estimates that is due to heterogeneity rather than chance alone, were used to assess the heterogeneity [24]. Subgroup analysis for the primary outcome was performed by sex, year of publication, and laboratory diagnostic methods. Moreover, publication bias was assessed by visual observation of the symmetry of the funnel plot and Egger's test statistic [25,26]. A sensitivity analysis was done to assess the impact of a single study on the overall pooled effect size.

3. Result

3.1. Selection and Identification of Studies

There were 488 records found after a systematic search of studies on the prevalence of SARS-CoV-2 Infection. Following a regress screening for duplication and eligibility, 11 studies were found to be eligible for inclusion in this systematic review and meta-analysis (Figure 1). The preferred reporting items for Systematic Review and Meta-analysis (PRISMA checklist 2009) were followed [27].

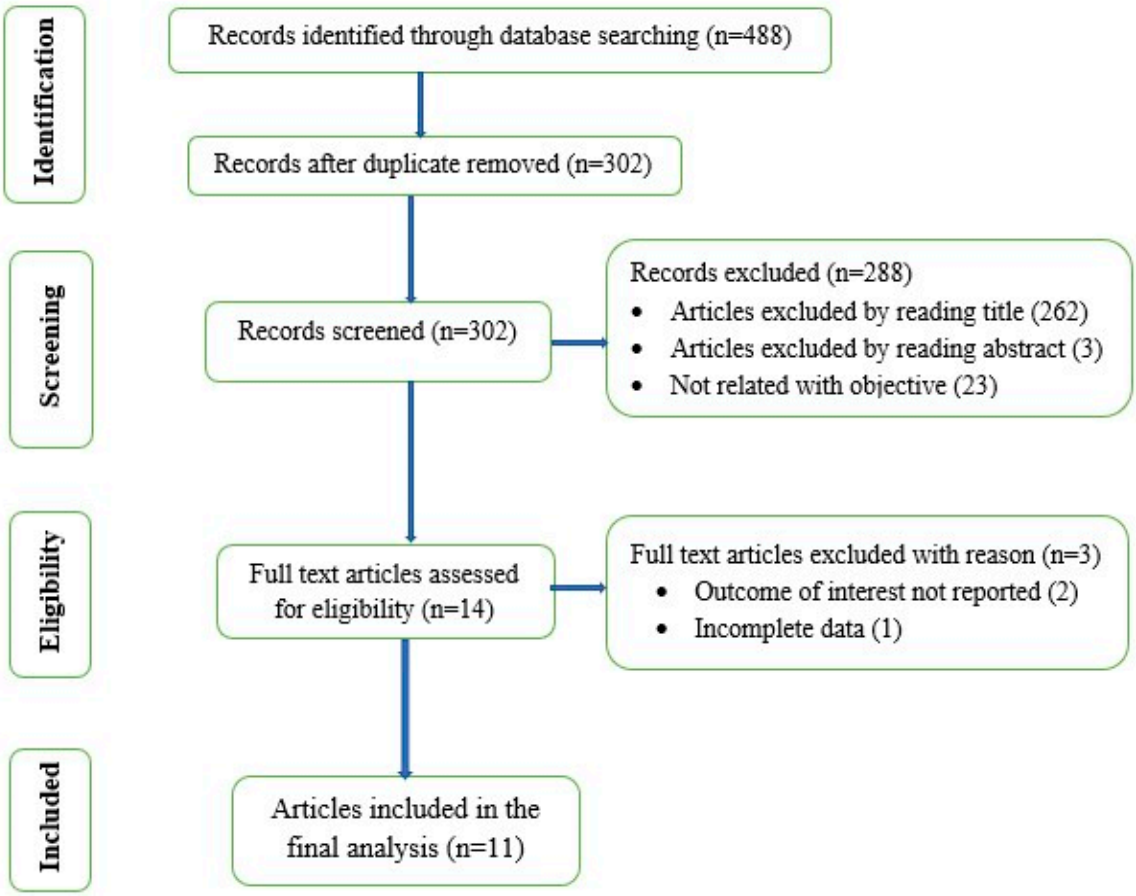

Figure 1. Flow diagram for the selection of eligible studies.

3.2. Study Characteristics

In this systematic review and meta-analysis, a total of 11 published articles were included. The studies involved 35,376 (15,759 male and 19,838 female) study participants. The sample size of the studies ranged from 301 to 16,932. The studies were conducted in two city administrations and all national and regional states of Ethiopia. All the included studies employed a cross-sectional study design. Of the 11 studies included in this systematic review and meta-analysis, 8 studies were conducted in all age groups and the general population. Four studies were conducted using molecular diagnostic techniques, while the rest were conducted using serological diagnostic techniques (Table 1).

Table 1. Characteristics of the included studies.

Author/Year/Reference	Region	Study Design	Age of Participant	Study Population	Diagnostic Methods	Sample Size			Number of Cases			Prevalence, (%)
						M	F	Total	M	F	Total	
Alemu et al. (2020) [28]	Addis Ababa	Cross-sectional	All age	General population	IgG/IgM Rapid Test Cassette	188	113	301	17	10	27	8.8
Assefa et al. (2021) [29]	Harar	Cross-sectional	>15 years	Pregnant women	WANTAI® SARS-CoV-2 Rapid Test	NA	1447	1447	NA	83	83	5.7
Gelanew et al. (2021) [30]	All region	Cross-sectional	All age	Healthcare workers	ELISA using in-house IgG assay	980	1017	1997	389	432	821	39.6
Shaweno et al. (2021) [31]	Dire Dawa	Cross-sectional	>15 years	General population	Abbott SARS-CoV-2 IgG assay	307	377	684	11	10	21	3.2
Kebede et al. (2022) [32]	Benishangul-Gumuz	Cross-sectional	All age	Quarantined individuals	Elecsys Anti-SARS-CoV-2 assay	292	154	446	9	12	21	4.7
Abdella et al. (2021) [33]	Addis Ababa & Oromia	Cross-sectional	All age	General population	IgG/IgM Rapid Test Cassette	799	1057	1856	20	25	45	2.42
Tadesse et al. (2020) [34]	All region	Cross-sectional	>15 years	General population	Abbott™ ARCHITECT™ assay	5829	11102	16,932	221	371	593	3.5
Gebretsadik et al. (2020) [35]	Amhara	Cross-sectional	All age	General population	RT-PCR	374	139	513	13	4	17	3.3
Geto et al. (2020) [36]	Amhara	Cross-sectional	All age	General population	RT-PCR	5568	3184	8752	194	97	291	3.3
Birhanu et al. (2020) [37]	Harari	Cross-sectional	All age	Patients with ARTI	RT-PCR	816	876	1692	183	205	388	22.9
Adane et al. (2022) [38]	Amhara, West Gondar	Cross-sectional	All age	General population	RT-PCR	794	372	1166	7	9	16	1.37

3.3. Prevalence of SARS-CoV-2 Infection

In this systematic review and meta-analysis, the national prevalence of the SARS-CoV-2 Infection in Ethiopia was 8.83% (95% CI = 6.06–11.6%). Overall, the prevalence of the SARS-CoV-2 Infection among the Ethiopian population was variable, ranging from 1.37% reported in West Gondar to 39.6% reported in all the regions of Ethiopia. There was substantial heterogeneity, with an I^2 of 99.3% (Figure 2).

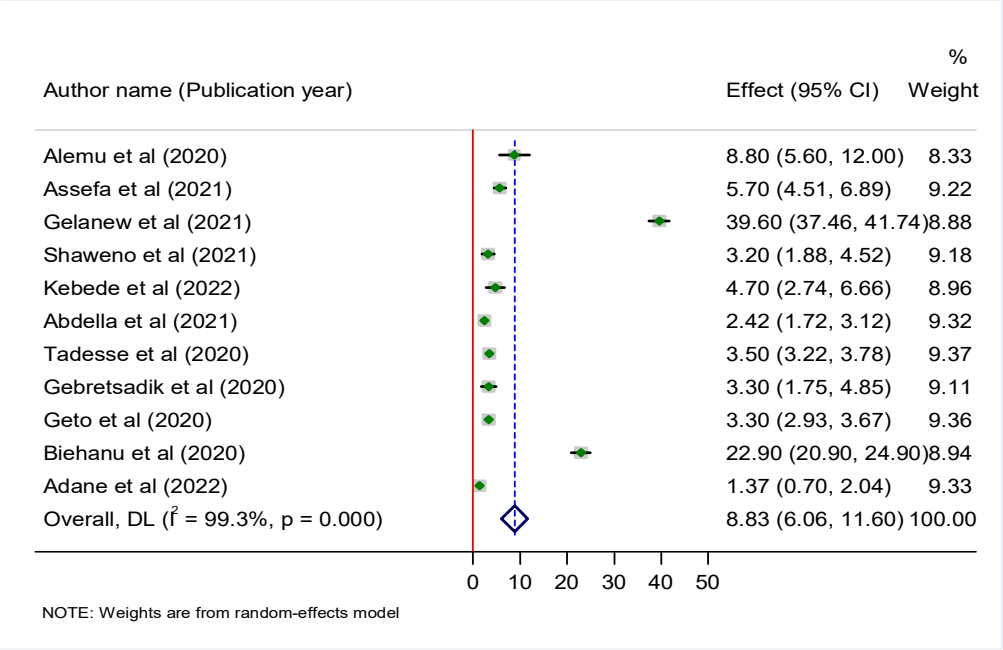

Figure 2. Forest plot showing the prevalence of SARS-CoV-2 infection [28–38].

3.4. Subgroup Analysis

Subgroup analysis for sex, age of the study subjects, population type, diagnostic methods, and publication year. Regarding the sex of the study participants, 10 and 11 studies reported the prevalence of SARS-CoV-2 infection among male and female patients, respectively. The prevalence of SARS-CoV-2 infection was higher among females, 9.27% (95% CI: 6.24–12.3), than in males, 8.8% (95% CI: 5.88–11.72). In both males and females, high heterogeneity was reported, with an equal value of I^2 of 98.8% (Table 2). Five, four, and three studies, respectively, were reported according to the publication years 2020, 2021, and 2022. In this concern, the prevalence was 12.69% (95% CI: 1.49–23.88) in 2021, followed by 8.09% (95% CI: 5.33–10.86) in 2020 (Table 2). Moreover, the prevalence of SARS-CoV-2 infection among participants of all ages and above 15 years of age was 10.73% (95% CI: 5.82–15.63) and 4.09% (95% CI: 2.74–5.44), respectively (Table 2). Likewise, the pooled prevalence of SARS-CoV-2 infection among the general population and specific groups were 5.75 and 16.65%, respectively (Table 2). Another subgroup analysis was done for the types of laboratory diagnostic methods. The pooled prevalence of SARS-CoV-2 infection reported using serological tests (enzyme-linked immunosorbent assay and rapid immunochromatographic tests) and Molecular techniques (RT-PCR) were 9.72% and 7.59%, as indicated in Table 2.

Table 2. Subgroup analysis by different categories of studies included in the systematic review and meta-analysis.

Subgroup	Category	Number of Studies	Prevalence (95% CI)	*p*-Value	I^2	Heterogeneity between Groups (*p*-Value)
Sex	Male	10	8.8 (5.88–11.72)	<0.0001	98.8%	0.827
	Female	11 *	9.27 (6.24–12.3)	<0.0001	98.8%	
Publication year	2020	5	8.09 (5.33–10.8)	<0.0001	98.9%	0.030
	2021	4	12.68 (1.49–23.88)	<0.0001	99.7%	
	2022	2	2.9 (0.35–6.15)	<0.0001	89.9%	
Ages of study subject	All age	8	10.73 (5.82–15.63)	<0.0001	99.5%	0.011
	>15 years	3	4.09 (2.74–5.44)	<0.020	84.3%	
Population type	General population	8	5.75 (3.93–7.58)	<0.0001	98.3%	0.287
	Specific group	3	16.65 (3.35–36.66)	<0.0001	99.7%	
Diagnostics method	Serological test	7	9.72 (4.6–14.84)	<0.0001	99.5%	0.550
	Molecular technique (PCR)	4	7.59 (2.83–12.35)	<0.0001	99.3%	

* One study was done on women only for publication bias and sensitivity analysis.

In this study, the symmetry of the funnel plot indicated the absence of publication bias (Figure 3). Furthermore, Egger's test statistics confirmed the absence of publication bias, with a *p*-value of 0.242 (Table 3). According to the sensitivity analysis, the pooled effect size when the individual studies were omitted lay within the 95% confidence interval of the overall pooled effect size. This confirmed the absence of a single study impact on the overall pooled prevalence of SARS-CoV-2 infection (Table 4).

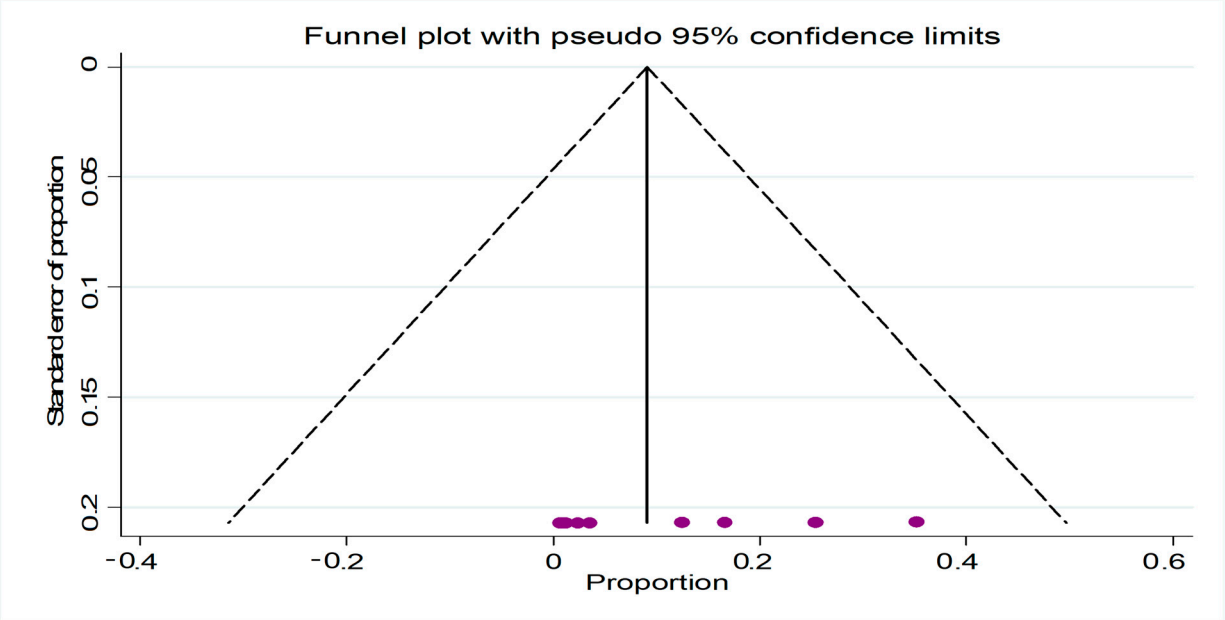

Figure 3. Funnel plot showing the absence of publication bias.

Table 3. Eggers test statistics.

Std-Eff	Coef.	Std.Err.	t	P	95% Conf. Interval
Slope	3.56	1.56	2.28	0.049	0.0248167–7.096408
Bias	7.19	5.75	1.25	0.242	5.809789–20.20058

Std Eff: Standard Effect; Coef: Coefficient; t: test Statistics; Std. Err: Standard Error; P: *p*-value of significance by assuming null zero value; Conf. Interval: Confidence Interval.

Table 4. Sensitivity analysis of the included studies [28–38].

S.No	Authors' Name	Publication Year	Estimate	95% Confidence Interval
1	Alemu et al.	2020	0.09897935	−0.02924858–0.22720729
2	Assefa et al.	2021	0.0965836	−0.03164587–0.22481307
3	Gelanew et al.	2021	0.0648924	−0.06335741–0.19314221
4	Shaweno et al.	2021	0.09923597	−0.0289918–0.22746374
5	Kebede et al.	2022	0.09923597	−0.0289918–0.22746374
6	Abdella et al.	2021	0.09773885	−0.03048987–0.22596759
7	Tadesse et al.	2020	0.07470677	−0.05353674–0.20295028
8	Gebretsadik et al.	2020	0.09940703	−0.02882062–0.22763468
9	Geto et al.	2020	0.087674	−0.04056118–0.21590918
10	Birhanu et al.	2020	0.08351306	−0.0447248–0.21175091
11	Adane et al.	2022	0.0994498	−0.02877783–0.22767743
	Combined *		0.09103919	−0.0312262–0.21330459

NB. * Computed from proportion.

4. Discussion

The purpose of this systematic review and meta-analysis was to determine the national prevalence of SARS-CoV-2 infection in the Ethiopian population. Our review represents the largest systematic review and meta-analysis of the national pooled prevalence of SARS-CoV-2 infection in Ethiopia, including 35,376 study participants with 15,759 males

and 19,838 females. The present study revealed that the pooled prevalence of SARS-CoV-2 infection was 8.83% (95% CI = 6.06–11.6%), with high heterogeneity (I^2 value of 99.3%). This finding was in line with the global pooled prevalence of SARS-CoV-2 among healthcare workers, identified using PCR (11%; 95% CI = 7–16%) [25]. On the contrary, the finding of the present systematic review and meta-analysis was higher than the finding reported from SARS-CoV-2 among the HCWs using antibody tests, which was 5% (95% CI = 2–9%) [39], 0.68% among HIV patients (95% CI = 0.34–1.34) [40], and the worldwide SARS-CoV-2 seroprevalence (3.38%; 95% CI = 3.05–3.72) [41]. This lower finding might be due to the exclusion of studies of high-risk patient groups so as to avoid an overestimation of seroprevalence in previous studies [41], as well as variations in the test method employed, which was supported by findings reported from HCWs, where the higher finding was reported using RT-PCR but lower using seroprevalence study methods [39]. Moreover, the finding of the current study was higher than those reported as asymptomatic SARS-CoV-2 infection (35.1%; 95% CI = 30.7 to 39.9%) [42] and asymptomatic carriers (48.2%; 95% CI = 30–67%) [43].

The present study had substantial heterogeneity with an I^2 of 99.3%. The possible reasons for heterogeneity could be due to differences in methodological issues, such as differences in the study designs, data analysis methods, study population characteristics, as well as seasonal variations related to the wave of SARS-CoV-2 spreading.

According to the subgroup analysis, the pooled prevalence of SARS-CoV-2 infection is higher in females (9.7%) than in males (8.8%). This finding was contradicted by a slightly higher prevalence in males [41], but it was also consistent with the findings of a meta-analysis study that looked at asymptomatic SARS-CoV-2 infection [43]. Previous research has found that gender has a greater impact on SARS-CoV-2 spread and/or viral infections in females [44,45]. Furthermore, it may be related to the level of knowledge about the transmission, prevention, and control of the SARS-CoV-2 pandemic, where females were significantly associated with a low level of knowledge in previous findings from Ethiopia [35]. In Ethiopia, female educational support is still in its early stages. As a result, the SARS-understanding of SARS-CoV-2 in women is limited. Along with literacy rates, social norms and caregiving exposing them to potential risks, as well as greater care and frontline work of females, such as cashiers, cleaners, and nurses, can be potential factors for increasing the positivity rate of the SARS-CoV-2 infection in females over males.

In this study, the pooled prevalence of the SARS-CoV-2 infection was highest in 2021 (12.69 percent; 95% CI: 1.49–23.88) followed by 2020. (8.09%; 95% CI: 5.33–10.86). This could be due to variations in the prevalence rates between the studies. In support of this, higher prevalence rates of the SARS-CoV-2 infection, such as 39.6% [30,33] and 22.9% [37], were reported in 2021, followed by 2020. Furthermore, differences in the study group and exposure status may be another factor contributing to the observed seasonal differences. Furthermore, the pooled prevalence of SARS-CoV-2 infection among specific study groups was higher than the general population (16.65% vs. 5.75%), which could be attributed to the fact that specific study groups, such as healthcare workers, pregnant women, and quarantined individuals may have had a higher rate of exposure and infection.

Another subgroup analysis using laboratory diagnostic methods revealed that serological tests (9.72 percent) had a higher pooled prevalence of SARS-CoV-2 infection than molecular techniques or rRT-PCR (7.59%). This could be due to false-negative rRT-PCR results, which may underestimate the prevalence of SARS-CoV-2 when compared to the serological tests. This is supported by previous research indicating that rRT-PCR does not provide 100% accuracy for detecting viral RNA. Thus, Zhang et al. reported a 20% false-negative rate of rRT-PCR [46]. This means that two of every ten patients who tested negative for COVID-19 tested positive for rRT-PCR. Furthermore, poor specimen quality, such as a swab sample taken from the upper respiratory tract (URT), may be associated with a lower likelihood of detecting SARS-CoV-2 RNA. Furthermore, the sample was obtained at an incorrect time. For example, collecting specimens from URT secretions after the first week of symptoms will result in a decrease in rRT-PCR positivity rates because viral load decreases

after the first week of symptoms. As a result, it falls below the detection limit; however, patients may exhibit later symptoms [46–48].

The higher pooled prevalence of SARS-CoV-2 infection among participants of all ages (10.73%) compared to participants above 15 years of age (4.09%) was observed in this study. This difference could be due to differences in the study population, the participants' immunological status, or their exposure status. Furthermore, the pooled prevalence of SARS-CoV-2 infection in specific groups (16.65%) was higher than in the general population (5.75%). This could be due to the differences in participant exposure status, such as direct care healthcare workers being much more exposed than the general population. As a result, the overall prevalence of SARS-CoV-2 infection may be exaggerated. Furthermore, the specific groups included in this study were individuals who were more likely to have SARS-CoV-2 infection than the general population who were not suspected of having SARS-CoV-2. Therefore, the higher risk exposure can be the plausible reason for the higher prevalence of SARS-CoV-2 infection compared to those who have an unknown or least exposure status.

In this systematic review and meta-analysis, the symmetry of the funnel plot and the Egger test statistics (p-value of 0.242) revealed that there was no publication bias. Furthermore, the sensitivity analysis results demonstrated that no single study affected the pooled effect size. The pooled prevalence of SARS-CoV-2 infection was calculated by excluding each study in turn, and the computed pooled prevalence was within 95% confidence intervals of the overall pooled prevalence.

The results of this systematic review and meta-analysis have several implications, such as establishing national and subnational actions in response to the COVID-19 problem, managing the crisis across levels of government, and applying a place-based approach to policy responses. These actions include reallocating public funds to crisis-related objectives, assisting vulnerable populations, regions, and healthcare, loosening fiscal regulations, and building up sizable investment reserves. These findings suggest that these sociodemographic, economic, and political risk factors, as well as their root causes, must be addressed in order to address the disparities in the burden of the COVID-19 pandemic in a conflict of priorities, particularly in low- and middle-income countries where resources are limited [49–51]. The finding of the present study suggests that different therapeutic approaches may still be required for the best management of SARS-CoV-2 infected patients and the availability of expendable and non-expendable healthcare materials for the timely identification and diagnosis of cases. Additionally, availing and administering vaccines in clinical practice and in policy issues, such as evidence-based medicine and evidence based public health practices, might be an important concern. Therefore, public health preparedness should be strengthened to tackle the existing problem. Moreover, the findings of the present study imply that further large-scale studies are required, and there exists a need for special concerns for high-risk groups to minimize the risk of disease transmission. There are some limitations to this study. First, all included studies were conducted in Ethiopia. Following that, there was significant heterogeneity among the studies, which may have affected the interpretation of the results.

5. Conclusions

According to this systematic review and meta-analysis, the national pooled prevalence of SARS-CoV-2 infection in the Ethiopian population was 8.83%. This encourages clinicians to consider the SARS-CoV-2 infection, request appropriate routine testing to confirm the infection, vaccinate individuals, and treat those infected. Furthermore, it serves as a wake-up call to international, continental, and national health bureaus, as well as other stakeholders, to develop targeted prevention and control strategies for SARS-CoV-2 infection. This review also provides useful information to policymakers and other stakeholders. Furthermore, the data could be used for future complementary research and evidence-based decision-making.

Author Contributions: A.G. conceived and designed the study. A.G., H.B., M.T. (Mihret Tilahun) and M.F. participated in article search and data extraction. A.G., H.B., M.F. and H.D. conducted a quality assessment of the included studies and performed the statistical analysis and interpretation of the data. A.G. drafted the manuscript. E.A., A.S. (Abdurahaman Seid), Y.K., A.A. and A.S. (Agumas Shibabaw) checked the validity and monitored the overall process. A.G., M.T. (Melkam Tesfaye), O.M. and B.K. critically reviewed the manuscript. All the authors read and approved the final manuscript. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Not applicable.

Data Availability Statement: All data required for this research are available within the manuscript. If additional data are needed, they can be obtained from the corresponding authors upon request.

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Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

COVID-19	Coronavirus disease 2019
rRT-PCR	Real-Time Reverse-Transcriptase Polymerase-Chain-Reaction
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
URT	Upper Respiratory Tract
WHO	World health organization

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