World Journal of

Methodology

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META-ANALYSIS

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ABOUT COVER

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AIMS AND SCOPE

The primary aim of *World Journal of Methodology* (*WJM*, *World J Methodol*) is to provide scholars and readers from various fields of methodology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJM mainly publishes articles reporting research results obtained in the field of methodology and covering a wide range of topics including breath tests, cardiac imaging techniques, clinical laboratory techniques, diagnostic self-evaluation, cardiovascular diagnostic techniques, digestive system diagnostic techniques, endocrine diagnostic techniques, neurological diagnostic techniques, obstetrical and gynecological diagnostic techniques, ophthalmological diagnostic techniques, otological diagnostic techniques, radioisotope diagnostic techniques, respiratory system diagnostic techniques, surgical diagnostic techniques, *etc*.

INDEXING/ABSTRACTING

The *WJM* is now abstracted and indexed in PubMed, PubMed Central, China National Knowledge Infrastructure (CNKI), China Science and Technology Journal Database (CSTJ), and Superstar Journals Database.

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Epidemiological burden of parents being the index cases of COVID-19 infected children

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Author contributions: Sumanta Saha prepared the concept and design, performed the data analysis, and drafted the manuscript; Sujata Saha hard edited the manuscript; both authors contributed to the study selection and risk of bias assessment and agree with the content of the final version of the manuscript.

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Abstract

BACKGROUND
In the ongoing coronavirus disease 2019 (COVID-19) pandemic, when children remain home-confined secondary to the closure of schools, little is known of the burden of the parents being their index case.

AIM
To determine the prevalence of parents being the index case of COVID-19 infected children.

METHODS
A database search in PubMed and Scopus ensued to recruit studies reporting the index case information of COVID-19 infected individuals aged ≤ 18. The reviewed articles' quality evaluation included the use of the National Heart, Lung, and Blood Institute's tool. A random-effect meta-analysis ensued to determine the prevalence of the parent being and not-being the index case. Heterogeneity was assessed by I^2 and *Chi*^{2} statistics. The publication bias was evaluated by funnel plots and Egger's test.

RESULTS
Overall, this review included 13 eligible studies sourcing data from 622 children of 33 nations. Study designs were heterogeneous and primarily included descriptive reports (38.4%). The prevalence of parent being the index case was 54% (95%CI: 0.29-0.79; I^2: 62.3%, *Chi*^{2} P < 0.001). In > 70% of children, their index-case parent was symptomatic due to COVID-19 at the time of infection transmitting. Studies for which a risk of bias assessment was possible were of fair quality.

CONCLUSION
There is a substantial global burden of parents being the index case of COVID-19 infected children, and frequently these parents are symptomatic. Therefore, from

a public health perspective, early detection of these parents is crucial.

Key Words: COVID-19 pandemic; COVID-19; Index case epidemiology; Patient zero epidemiology; Pediatrics

Core Tip: During the ongoing coronavirus disease 2019 (COVID-19) pandemic situation, while schools remain closed and children primarily stay at home, the prevalence of parent to child COVID-19 transmissibility remains unknown. Therefore, this meta-analysis chiefly quantifies this epidemiological burden. Globally, this burden was substantial (about 54%) and was highest in Asia. The majority of these parents (> 70%) were symptomatic. This study highlights the public health importance of early detection of COVID-19 infected parent index cases to decrease transmission to their wards.

INTRODUCTION

In March 2020, the World Health Organization declared the coronavirus disease 2019 (COVID-19) epidemic that originated in China as a pandemic[1]. By August 2020, the toll of COVID-19 cases crossed 22 million globally[2]. Our knowledge of COVID-19 has increased at a remarkably fast pace as new research findings became available. Nevertheless, COVID-19 has been less well studied in children, as their reported number of cases, disease severity, and fatality have been less than the adults[3,4]. However, as the testing of the disease increased in different nations and because young children often fail to use face masks effectively[5], the COVID-19 cases in children are rising and it can be severe in children with comorbidities like congenital heart disease and malnutrition[6]. The inability of the children to report their symptoms or contact history is a major challenge in identifying pediatric COVID-19 infection[7]. In the ongoing pandemic scenario, while children often stay at home with parents as schools remain closed in various nations[8], the household transmission risk of the infection from their parents remain high. Moreover, contemporary research[4] has primarily focused on the possibility of children being the index case and not on the other way around when parents can be the index case. Consequently, it's imperative to investigate the vulnerability of children's infectivity from their parents.

Therefore, in this study, we primarily quantified the epidemiologic burden of parents being the index cases of COVID-19 transmission in children.

MATERIALS AND METHODS

This review report adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guideline[9] and is registered in the PROSPERO (CRD 42020209006)[10].

Inclusion criteria

Population: COVID-19 diagnosed children aged ≤ 18.

Study design: Articles reporting the index cases of the above study population was incorporated. Publications of all types including experimental and observational studies, case reports, case series, letters, descriptive reports, and editorials were eligible.

Exclusion criteria
Studies were excluded if its study population included pregnant females.

Search strategy
The search for title and abstract of articles published in the English language took place in the PubMed and Scopus databases irrespective of the publication date and geographical boundary. The last date of the search was Sep 12, 2020. We also searched the Google search engine and the bibliography of the reviewed articles. The search terms used to search the PubMed were: "index case*" OR "index patient*" OR "patient zero" AND child* OR pediatric* OR infant OR toddler OR Adolescent and "Syndrome Coronavirus 2" OR "coronavirus" OR "COVID-19" OR "COVID 19."

Study selection, data abstraction, and risk of bias assessment
Following the uploading of the database search results to the Rayyan systematic review software[11] and successive duplicate elimination, we skimmed the remaining excerpts while matching these against the eligibility criteria. Articles likely to meet these criteria or when decision-making was not possible by reading the title and abstracts only, a full-text reading ensued. Salient features like the study design, inclusion criteria, COVID-19 diagnostic method of children and their index case, relation to the index case, the symptom and death information of the index case, and the number of COVID-19 positive children were abstracted using a pre-piloted form.

The risk of bias assessment (RoB) evaluation categorized each study as good, fair, or poor utilizing the National Heart, Lung, and Blood Institute's tool[12]. For case reports, descriptive reports (not categorizable to any study design), letters, and editorials, we did not perform RoB assessment as validated tools to appraise such articles don't exist. We independently selected studies, abstracted data, and assessed the RoB, and resolved all disagreements by discussion. For experimental studies, the RoB assessment was planned by the Cochrane tool[13]; however, it was not used as the reviewed studies did not include a clinical trial.

Meta-analysis
Using the random-effect (DerSimonian and Laird) meta-analysis (exact binomial method with Freeman-Tukey double arcsine transformation), we estimated the weighted overall and subgroup prevalence of parents being the index case of COVID-19 infected children. Subgrouping was done by continent, country, COVID-19 diagnostic method used in children and their index case, and the index case's symptom status (symptomatic versus asymptomatic) and death. Heterogeneity was assessed by I^2 (catego-rized as low, moderate, or high at values of 25%, 50%, and 75%)[14] and P value of Chi^2 statistics (statistically significant at $P < 0.1$). Exploring the reasons for heterogeneity were not necessary as it was moderate. The publication bias judgment included the use of funnel plots and Egger's test, and sensitivity analysis repeated the meta-analysis while dropping a study each time.

Analytic software Stata (version 16) was used to perform analysis. $P < 0.05$ and 95% confidence interval (CI) estimate the statistical significance.

RESULTS

Scope of the review
The database search retrieved 51 citations. After eliminating the duplicates, out of the 30 articles skimmed, we read 22 manuscripts in full-text and finally reviewed 13 studies[15-27] published in 2020 (Figure 1). These articles chiefly constituted of descriptive reports (38.4%) and case series (23.1%). Other article variants were cross-sectional study (15.4%), research letter (15.4%), and case report (7.7%). Cumulatively, the studies sourced data of 622 children of 33 nations from four continents (Asia, Europe, North America, and South America).

Primarily the COVID-19 infection in the children was diagnosed by reverse transcription polymerase chain reaction (RT-PCR) (99.7%). The index case was mainly an immediate family member or unknown person (96%) for children whose index case was not their parent (n = 276). Table 1 depicts the salient features of the reviewed articles.

Risk of bias assessment
The cross-sectional and case-series studies were of fair quality (Table 2).

Table 1 Salient features of the reviewed studies

Ref.	Country	Continent	Study design	Study period (2020)	Inclusion criteria	COVID-19 diagnosis confirmation in children	Age of COVID-19 infected children with index case	No. of COVID-19 infected children with index case		COVID-19 infected index case/s'			Death due to COVID-19[2]
								Parent	Not-parent[1]	Age	COVID-19 diagnosis Ascertainment	Symptoms around the time of contact with children	
Götzinger *et al*[15], 2020	21 European nations except France[3]	Europe	Case series	1 Apr-24 Apr	≤ 18 yr SARS-CoV-2 infected individuals	RT-PCR	Median age 5 yr (IQR 5–12)	324	24 (sibling); 234 (immediate family member or unknown)	Unclear	History	Unclear	Unclear
Kim *et al*[16], 2020	South Korea	Asia	Cross-sectional	20 Jan- 6 Apr	≤ 18 yr SARS-CoV-2 infected individuals	RT-PCR	15 yr	0	1 (sibling)	16 yr	RT-PCR	Symptomatic	No
								0	1 [unknown (not parent or sibling)]	Unclear	Unclear	Unclear	Unclear
Luo *et al*[20], 2020	China	Asia	Case report	NA	NA	RT-PCR	Average 7 yr	2	0	39 yr	RT-PCR	Symptomatic	No
Merza *et al*[21], 2020	Iraq	Asia	Case series	18 Mar-07 April	Hospitalized conformed COVID-19 cases	RT-PCR	Average 11 yr	3	0	45 yr	RT-PCR	Symptomatic	No
Silva *et al*[22], 2020	Brazil	South America	Descriptive report	NA	NA	Rapid test	Average 10.5 yr	2	0	2 index cases: Male: 51 yr; female: 42 yr	RT-PCR	Symptomatic (both)	No
Song *et al*[23], 2020	China	Asia	Descriptive report	NA	NA	RT-PCR	Average 3.94 yr	5	0	Parents (*n* = 3): Average age 40.33 yr	RT-PCR	Symptomatic	No
								0	2 (grandparent)	Grandparent (*n* = 1): 60 yr		Symptomatic	No
Torres *et al*[24], 2020	Chile	South America	Cross-sectional	NA	All school staff and randomly selected students	RT-PCR	Unclear	0	7 (school staff)	Unclear	RT-PCR	Unclear	Unclear
Yang *et al*[25], 2020	Taiwan	Asia	Descriptive report	NA	NA	RT-PCR	11 yr	0	1 (grandparent)	85 yr	RT-PCR	Symptomatic	Yes
Yung *et al*[26], 2020	Singapore	Asia	Case series	5 Mar–30 Apr	Paediatric household contacts of confirmed COVID-19 cases	RT-PCR	Unclear	7[4]	2 (grandparent or another adult except parent)[5]	Unclear	RT-PCR	Unclear	Unclear

Zhang et al[27], 2020	China	Asia	Research letter	28 Jan–15 Mar	Secondary COVID-19 cases	RT-PCR	Average 3 yr	2	0	Unclear	RT-PCR	One case: Mild symptoms. Other case: Moderate symptom	Unclear
Danis et al[17], 2020	France	Asia	Descriptive report	NA	NA	RT-PCR	9 yr	0	1 (a visitor/tourist)	Unclear	RT-PCR	Yes	No
James et al[18], 2020	United States	North America	Descriptive report	NA	NA	RT-PCR	≤ 18 yr	0	2 (a pastor and his wife)	Two index cases aged 56 and 57 yr	RT-PCR	During contact: Initially asymptomatic, then symptomatic	No
Jung et al[19], 2020	South Korea	Asia	Research letter	NA	NA	RT-PCR	Average 5.5 yr	1	0	The mother: 40 yr	RT-PCR	During contact asymptomatic (symptomatic after RT-PCR diagnosis)	No
								0	1 (another patient who stayed in the same room)	For 9 years old: Unclear	Unclear	Unclear	Unclear

[1]In parenthesis the COVID-19 infected child/children's relation to the index case.

[2]Upto the time period for which index case data reported or at the time of contact–whichever reported in the reviewed studies.

[3]Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

[4]Either mother or father the index case; another non-parent may be an index case for some of the children.

[5]May also have a parent index case. RT-PCR: Reverse transcription polymerase chain reaction; SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2; NA: Not applicable; COVID-19: Coronavirus disease 2019.

Prevalence estimates

The overall weighted prevalence of parents being the index case of COVID-19 in children was 54% (95%CI: 0.29-0.79; I^2: 62.3%, Chi^2 P < 0.001) (Figure 2). Continent-wise this was highest in Asia (75%; 95%CI: 0.45-0.97), followed by Europe (58%; 95%CI: 0.52-0.63). The index cases' RT-PCR-based COVID-19 diagnosis (60%; 95%CI: 0.20-0.94) was four percentage point higher than a history-based diagnosis (56%; 95%CI: 0.52-0.60). The prevalence of parent-index-case being symptomatic or not dying due to COVID-19 was about 73% each at the time of disease transmission to their children (Table 3).

The crude prevalence of parents not being the index case was 46% (95%CI: 0.21-0.71; I^2: 62.3%; Chi^2 P < 0.01) (Figure 3). It was substantial in the North (100%) and South (89%) United States. Only 27.0% (95%CI: 0.00-0.67; I^2: 44.3%) of these cases were symptomatic (Table 4).

Heterogeneity and publication bias

Overall, the heterogeneity was moderate. The funnel plots (Figures 4 and 5) and the Egger's test (index case parent: P = 0.198; index case non-parent: P = 0.488) were not

Table 2 Risk of bias assessment using National Heart, Lung, and Blood Institute's tool[12]

Study design: Case series

Ref.	1. Was the study question or objective clearly stated?	2. Was the study population clearly and fully described, including a case definition?	3. Were the cases consecutive?	4. Were the subjects comparable?	5. Was the intervention clearly described?	6. Were the outcome measures clearly defined, valid, reliable, and implemented consistently across all study participants?	7. Was the length of follow-up adequate?	8. Were the statistical methods well-described?	9. Were the results well-described?	Quality rating (Good, fair, or poor)
Götzinger *et al*[15], 2020	Yes	Yes	CD	Yes	NA	Yes	NA	Yes	Yes	Fair
Merza *et al*[21], 2020	Yes	Yes	CD	Yes	NA	Yes	NA	Yes	Yes	Fair
Yung *et al*[26], 2020	Yes	Yes	Yes	Yes	NA	Yes	NA	Yes	Yes	Fair

Study design: Cross-sectional study

Ref.	1. Was the research question or objective in this paper clearly stated?	2. Was the study population clearly specified and defined?	3. Was the participation rate of eligible persons at least 50%?	4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	5. Was a sample size justification, power description, or variance and effect estimates provided?	6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (*e.g.*, categories of exposure, or exposure measured as continuous variable)?	9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	10. Was the exposure(s) assessed more than once over time?	11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	12. Were the outcome assessors blinded to the exposure status of participants?	13. Was loss to follow-up after baseline 20% or less?	14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	Quality rating (Good, fair, or poor)
Kim *et al*[16], 2020	Yes	Yes	NA	Yes	No	No	No	NA	Yes	NA	CD	NA	NA	No	Fair

Torres *et al* [24], 2020	Yes	Yes	NA	Yes	Yes	No	No	NA	Yes	NA	CD	NA	NA	No	Fair

CD: Can't determine; NA: Not applicable.

suggestive of any small study effect.

Sensitivity analysis

On dropping a study each time and repeating the meta-analysis, the prevalence estimates of the parent being the index case ranged between 49%-65%.

DISCUSSION

Altogether, we reviewed the data of 622 children from four different continents. The parents were the index cases in a substantial proportion of COVID-19 infected children and were highest in Asia. In seven out of ten COVID-19 infected children, the index parent case was symptomatic at the time of disease acquiring.

During this COVID-19 pandemic, schools remain closed in several nations, presuming that it would minimize the risk of transmission of the severe acute respiratory syndrome coronavirus 2 from children to adults[8]. Henceforth, children across the globe primarily remain at home, which increases their odds of getting COVID-19 from their parent/s since the latter are at risk of acquiring the disease from the community due to their required outdoor activities. As our findings suggest that a considerable proportion of the parents were the index cases of COVID-19 transmission to their children, their early detection and isolation is crucial to ensure early intervention. However, as we observed the highest global burden of parents being the index cases of COVID-19 in children in Asian nations, isolation of infected parents may not be unchallenging in these countries since many households lack an adequate number of rooms. Notably, the cities are more population-dense in Asia than those in the rest of the globe[28].

Strengths and limitations

The chief rigor of this study is its novelty to review an unexplored area of COVID-19 literature. Besides, the evidence synthesized in this paper is likely to be comprehensive as the database search criteria did not restrict to any geographic boundary or date range. Additionally, as we did not exclude from meta-analysis the studies with zero numerators, our estimates plausibly did not compromise with the sample size and power of the analysis. However, there are a few weaknesses in our paper. Mostly the

Table 3 Subgroup wise weighted prevalence of parent being the index case in coronavirus disease 2019 infected children

Prevalence of COVID-19 infected children with parents being the index case

Subgroup	Category	Number of studies	Number of COVID-19 positive children	Number of COVID-19 positive children with parent being the index case	Weighted prevalence of COVID-19 positive children with parent being the index case		95% prediction interval	Heterogeneity measures	
					%	95%CI		I^2 (%)	Q (*P* value)
Continent	Asia	8	28	20	75.0	0.45-0.97	0.1-1.0	31.8	0.17
	Europe	2	583	324	58.0	0.52-0.63	Inestimable	-	-
	North America	1	2	0	0.0	0.00-0.84	Inestimable	-	-
	South America	2	9	2	11.0	0.00- 0.47	Inestimable	-	-
Country	21 European nations except France[1]	1	582	324	56.0	0.52-0.60	Inestimable	-	-
	France	1	1	0	0.0	0.00-0.98	Inestimable	-	-
	Brazil	1	2	2	100.0	0.16-1.00	Inestimable	-	-
	Chile	1	7	0	0.0	0.00-0.41	Inestimable	-	-
	China	3	11	9	87.0	0.54-1.00	Inestimable	-	-
	Iraq	1	3	3	100.0	0.29-1.00	Inestimable	-	-
	Singapore	1	9	7	78.0	0.40-0.97	Inestimable	-	-
	South Korea	2	4	1	18.0	0.00-0.77	Inestimable	-	-
	Taiwan	1	1	0	0.0	0.00-0.98	Inestimable	-	-
	United States	1	2	0	0.0	0.00-0.84	Inestimable	-	-
COVID-19 diagnosis in children	RT-PCR	12	620	344	50.0	0.24-0.76	0.0-1.0	63.4	0
	Rapid Method	1	2	2	100.0	0.16-1.00	Inestimable	-	-
COVID-19 diagnosis in the index case	RT-PCR	10	36	21	60.0	0.20-0.94	0.0-1.0	69.0	0.00
	History	1	582	324	56.0	0.52-0.60	Inestimable	-	-
	Unclear	2	4	1	18.0	0.00-0.77	Inestimable	-	-
COVID-19 index patient clinical presentation	Symptomatic	8	20	14	73.0	0.33-1.00	0.0-1.0	44.2	0.08
	Unclear	5	602	332	36.0	0.06-0.72	0.0-1.0	77.2	0.00
COVID-19 index patient mortality	Died	1	1	0	0.0	0.00-0.98	Inestimable	-	-
	Not died	6	17	12	74.0	0.29-1.00	0.0-1.0	48.5	0.08
	Unclear	6	604	334	44.0	0.13-0.78	0.0-1.0	74.1	0.00
Overall	NA	13	622	346	54.0	0.29-0.79	0.0-1.0	62.3	0.00

[1]Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. RT-PCR: Reverse transcription polymerase chain reaction; NA: Not applicable; COVID-19: Coronavirus disease 2019.

reviewed articles were not of any particular study design to allow a proper risk of bias assessment. Furthermore, distinguishing index-parents by gender or biological origin (*i.e.*, blood relation or stepparent) was impossible due to the lack of reporting of this information in the reviewed articles. Finally, for deaths among index cases, as we made estimates depending on the period for which the articles reported their data, we could not account for COVID-19-related deaths in them that might have happened beyond this period.

Table 4 Subgroup wise weighted prevalence of parent not being the index case in coronavirus disease 2019 infected children

Prevalence of COVID-19 infected children with parents not being the index case

Subgroup	Category	Number of studies	Number of COVID-19 positive children	Number of COVID-19 positive children with parent not being the index case	Weighted prevalence of COVID-19 positive children with parent not being the index case		95% prediction interval	Heterogeneity measures	
					%	95% CI		I^2 (%)	Q (P value)
Continent	Asia	8	28	8	25.0	0.03-0.55	0.0-0.9	31.8	0.17
	Europe	2	583	259	42.0	0.37-0.48	Inestimable	-	-
	North America	1	2	2	100.0	0.16-1.00	Inestimable	-	-
	South America	2	9	7	89.0	0.53-1.00	Inestimable	-	-
Country	21 European nations except France[1]	1	582	258	44.0	0.40-0.48	Inestimable	-	-
	France	1	1	1	100.0	0.03-1.00	Inestimable	-	-
	Brazil	1	2	0	0.0	0.00-0.84	Inestimable	-	-
	Chile	1	7	7	100.0	0.59-1.00	Inestimable	-	-
	China	3	11	2	13.0	0.00-0.46	Inestimable	-	-
	Iraq	1	3	0	0.0	0.00-0.71	Inestimable	-	-
	Singapore	1	9	2	22.0	0.03-0.60	Inestimable	-	-
	South Korea	2	4	3	82.0	0.23-1.00	Inestimable	-	-
	Taiwan	1	1	1	100.0	0.03-1.00	Inestimable	-	-
	United States	1	2	2	100.0	0.16-1.00	Inestimable	-	-
COVID-19 diagnosis in children	RT-PCR	12	620	276	50.0	0.24-0.76	0..0-1.0	63.4	0.00
	Rapid method	1	2	0	0.0	0.00-0.84	Inestimable	-	-
COVID-19 diagnosis in the index case	RT-PCR	10	36	15	40.0	0.06-0.80	0.0-1.0	68.9	0.00
	History	1	582	258	44.0	0.40-0.48	Inestimable	-	-
	Unclear	2	4	3	82.0	0.23-1.00	Inestimable	-	-
COVID-19 index patient clinical presentation	Symptomatic	8	20	6	27.0	0.00-0.67	0.0-1.0	44.3	0.08
	Unclear	5	602	270	64.0	0.28-0.94	0.0-1.0	77.2	0.00
Overall	NA	13	622	276	46.0	0.21-0.71	0.0-1.0	62.3	0.00

[1]Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, and the United Kingdom. RT-PCR: Reverse transcription polymerase chain reaction; NA: Not applicable; COVID-19: Coronavirus disease 2019.

Implications

At present, while we are still learning about the transmission dynamics of COVID-19 in children, this study provides a preliminary estimate of the epidemiological burden of the parents being their index case. Our findings emphasize the importance of isolating COVID-19 positive parents when they are living with their children in the same household to break the chain of transmission. Moreover, as most index case parents were symptomatic, early COVID-19 testing in adults, particularly in those residing with their wards is mandated, to ensure early diagnosis and isolation.
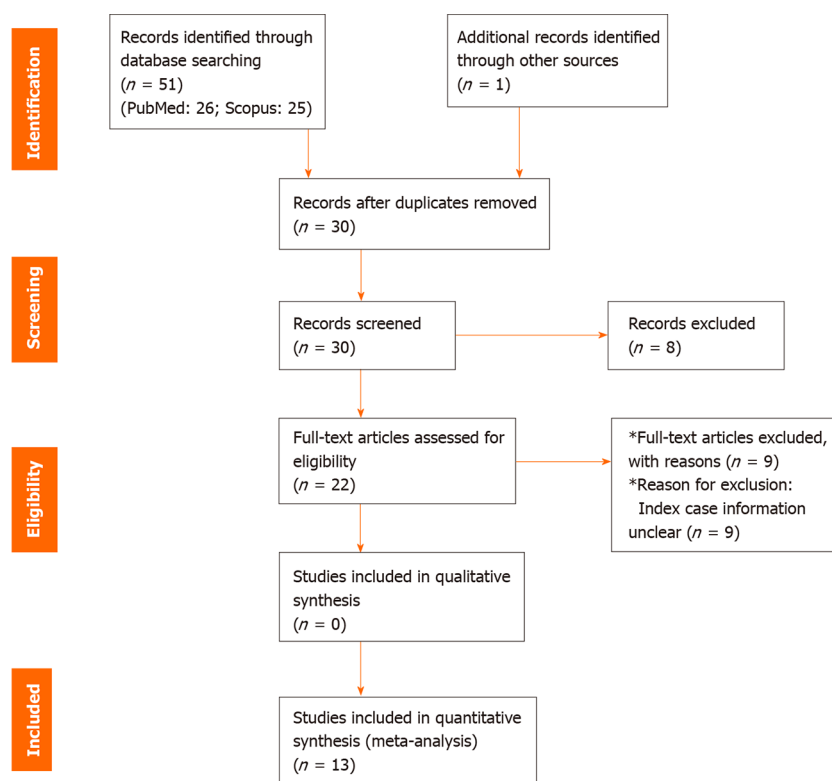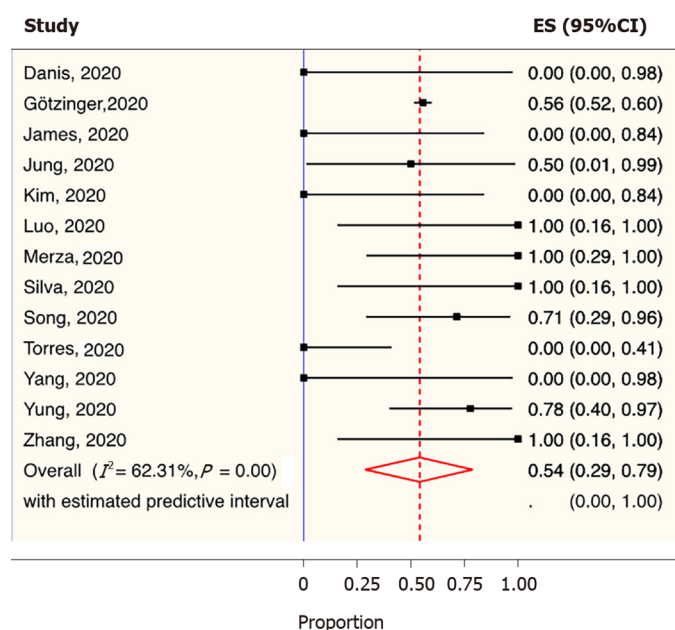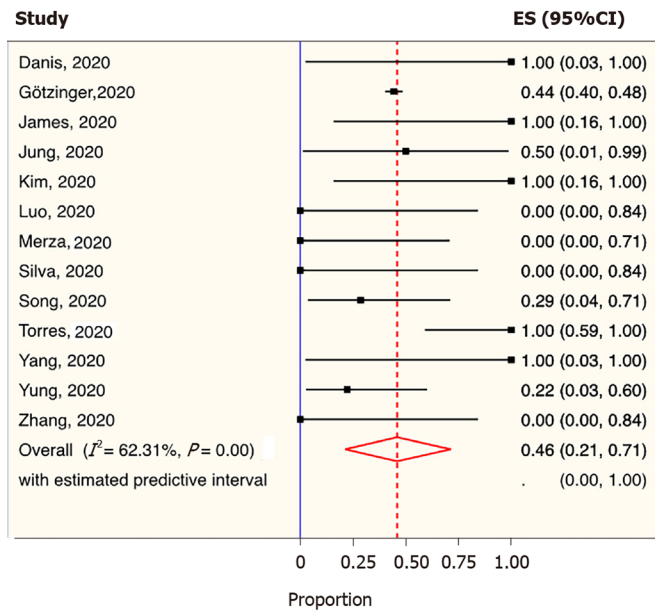
Figure 1 PRISMA diagram[9].

Figure 2 Forest plot depicting the overall weighted prevalence of parent being the index case in coronavirus disease 2019 infected children. The diamond is centred on the summary of the prevalence estimate, and the width indicates the corresponding 95% confidence interval. CI: Confidence interval.

CONCLUSION

In COVID-19 infected children, parents are frequently the index cases than any other individual. A considerable proportion of these parents are expected to be symptomatic when they transmit the disease to their wards. In this context, early detection of COVID-19 infected parents is likely to be a chief public health initiative.

Figure 3 Forest plot depicting the overall weighted prevalence of parent not being the index case in coronavirus disease 2019 infected children. The diamond is centred on the summary of the prevalence estimate, and the width indicates the corresponding 95% confidence interval. CI: Confidence interval.
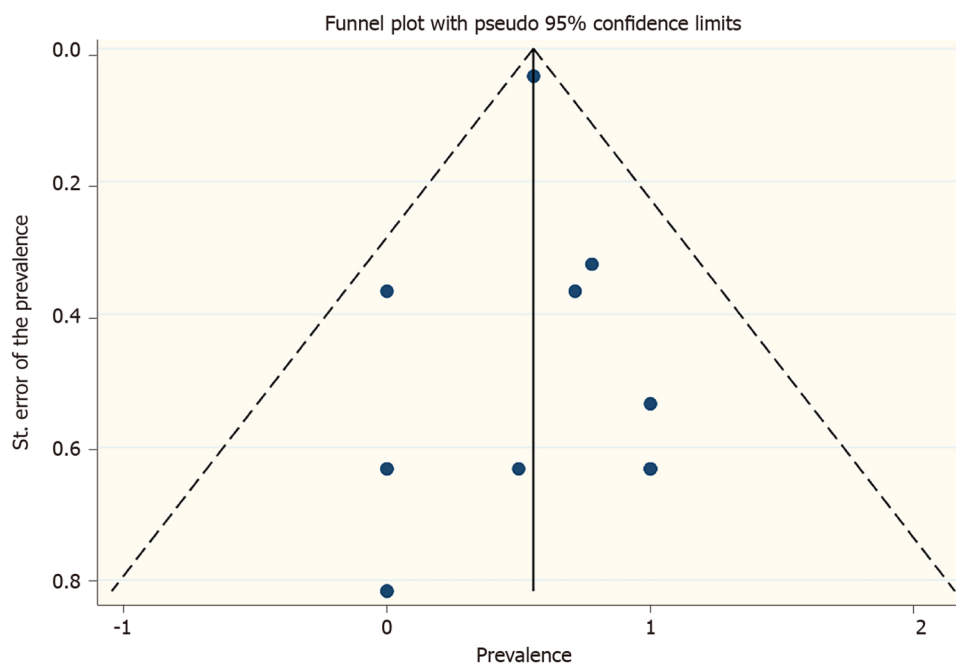
Figure 4 Funnel plot. Outcome: Parent being the index case of COVID-19 infected children.
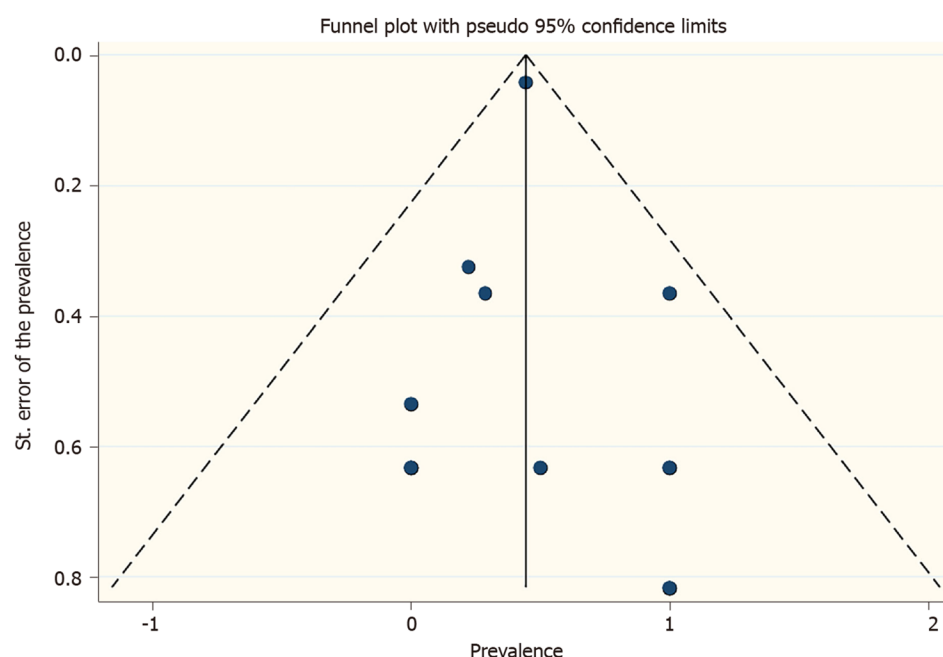
Figure 5 Funnel plot. Outcome: Parent being not being the index case of COVID-19 infected children.

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ARTICLE HIGHLIGHTS

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Research background

Presently little is known about the global epidemiological burden of parent-to-child coronavirus disease 2019 (COVID-19) disease transmissibility.

Research motivation

As children primarily remain at home with their parents due to the closure of schools across the globe (presumably to prevent community transmission of COVID-19 by children), it is crucial to know their domestic vulnerability to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection from their parents.

Research objectives

This study chiefly aimed to determine the pooled weighted prevalence of COVID-19 infection among children when the parent/s were their index cases.

Research methods

This meta-analysis incorporated articles reporting about the index case of COVID-19 infected ≤ 18 years old children by searching electronic databases. Besides data abstraction and critical appraisal of these studies, using random-effects meta-analysis, the weighted pooled prevalence of parents being and not-being the index case of the COVID-19 infected children was estimated.

Research results

This review included 13 studies published in 2020, reporting about 622 children from Asia, Europe, North America, and South America. Appraisable studies were fair in quality. The crude prevalence of parents being and not being the index cases of COVID-19 infected children were 54% (95%CI: 0.29-0.79; I^2: 62.3%, *Chi*^{2} *P* < 0.001) and 46% (95%CI: 0.21-0.71; I^2: 62.3%; *Chi*^{2} *P* < 0.01), respectively. For the former, on subgrouping by continent, the greatest burden was observed in Asia (75%), and most parents were symptomatic (73%).

Research conclusions

During the ongoing COVID-19 pandemic, a substantial proportion of the COVID-19 infected children acquired the disease from their parents, and the majority of these parents were symptomatic from SARS-CoV-2 infection.

Research perspectives

This research depicts a substantial global burden of parents being the index cases of COVID-19 infected children. It highlights the critical importance of early detection of these index cases.

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