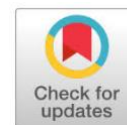


Impact of the COVID-19 pandemic on routine immunization coverage of children under 2 years in Asia: a systematic review



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ABSTRACT

The COVID-19 pandemic has caused a disruption in essential health services which also has an impact on reducing the coverage of routine immunizations for children. A decrease in immunization coverage will increase the incidence of vaccine-preventable diseases. This study aimed to determine the coverage of routine immunization in children under 2 years of age during the COVID-19 pandemic in Asia. A systematic search was conducted to find relevant studies using keywords in 3 databases like Scopus, PubMed, and EMBASE, on October 24, 2022. The article's identification used the PRISMA method. Articles used were limited to 2020-2022. The reduction in immunization coverage or delays in immunization in children ranges from 16-71%. The most decrease in immunization coverage occurred in March-April 2020. Immunization coverage increased again in May 2020 and decreased back in September-October 2020. An overview of the decline in immunization is an evidence base for policy practitioners to carry out mitigation immediately. Continuation of the immunization program is very important for children's health and must remain a priority despite the ongoing pandemic.

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INTRODUCTION

The COVID-19 pandemic has been declared worldwide since March 2020 which impacted 629 million morbidities and more than 6.5 million mortality until November 1st, 2022. (1) The direct impact of the pandemic on children's health is probably underreported while cases of COVID-19 were reported in children aged 0-4 years until 2022 at 3.2%. (2) The Covid-19 pandemic has had an indirect impact on children's health status due to the pandemic policy that affects their daily life. To prevent transmission of Covid-19, WHO recommends physical and social distancing implemented in countries worldwide like travel bans, regulating distances, lockdowns, and closing commercial activities and non-essential services. (3)

A survey conducted by WHO in 2021 reported that 94% of responding countries experienced disruption of essential services in January-March 2021 due to the pandemic. About 34% of countries report more than half of service interruptions (9% of countries report

75-100% service interruptions and 25% of them report disruptions at 50-74%). Health care was reported to be the most affected service (48%). One of the disrupted service programs is immunization (37%). (4) According to research by Catherine Ji et al (2022), the policies implemented during a pandemic were the most significant impact on a decrease in immunization coverage. (5)

Immunization is an essential health service for child health interventions. (6) More than 1/3 of countries (37%) report disruption of immunization services to immunization outreach and services in health facilities. (4) Research in Canada showed a significant decrease in immunization coverage for children under 2 years old in the early months of the pandemic, especially those aged 15-18 months. (5) Other countries have also reported a decrease in children's immunization coverage. In 2021, WHO estimated 25 million children under 1 year of age did not receive basic vaccines due to the COVID-19 pandemic. (7)

Immunization has been known as effective in reducing infant morbidity and mortality from vaccine-preventable diseases. (8) WHO stated around 80 million children in 68 countries could be at risk of infection with the vaccine-preventable disease. (9) Immunization coverage is necessary to be maintained even during a pandemic to prevent outbreaks of highly communicable diseases such as measles. (10) Outbreaks of measles have occurred in developed countries in recent years due to immunization coverage declining. (11)

WHO and several studies have estimates of routine immunization coverage during a pandemic. However, it is necessary to provide data from various regions for mitigation. Previous routine immunization coverage studies during the COVID-19 pandemic were highly conducted in Europe and America,(12,13) probably there is a decline in routine immunization coverage in Asia. As known, the first two years of life are a critical period to fulfill basic needs for optimal growth and development. (14) Therefore, this study used a systematic review approach to identify the impact of the COVID-19 pandemic on routine immunization coverage in children aged 0-24 months in Asia.

METHOD

General description

A systematic review was conducted according to PRISMA guidelines (Preferred Reporting Item for Systematic Review and Meta-Analysis) in identifying articles using the PECO method which consists of population, exposure, comparison, and outcome. Search for relevant articles using keywords in the Scopus, EMBASE, and PubMed databases on October 24, 2022. The article screening was done using Mendeley. The screening process consisted of 2 stages. In the first stage, studies identification of articles that met the requirements based on the title and abstract. In the second stage, identification of the full text and assessed the article based on the inclusion criteria of this systematic review. The summary of the included studies was presented in a table.

Study Selection

The population studied was children under 2 years. The exposure was the COVID-19 pandemic since late 2019. Comparison is immunization coverage before the pandemic compared to during the pandemic. The health problem was the change in routine immunization coverage that has been affected by the COVID-19 pandemic. The identified articles were in English and open access, full text available, studies conducted in 2020-2022, and a cross-sectional or survey study design. The article was excluded if review method, abstracts, the adult population, not in Asian continent countries, and articles that are not related to routine immunization, for example, related to the COVID-19 vaccination.

Search Strategy

The data sources for this systematic review were obtained from PubMed, Scopus, and EMBASE on October 24, 2022. For the included studies, a comprehensive search strategy using medical terms (MesH) was used in the text, title, abstract, and synonyms. Search title/abstract using a combination of relevant keywords such as routine immunization (OR routine immunization OR immunization coverage OR vaccination coverage), impact, COVID-19 (OR Sars-cov-2 OR Sars-cov2 OR Severe acute respiratory syndrome coronavirus 2 OR 2019 ncov OR ncov) and children (OR childhood OR child OR Pediatric).

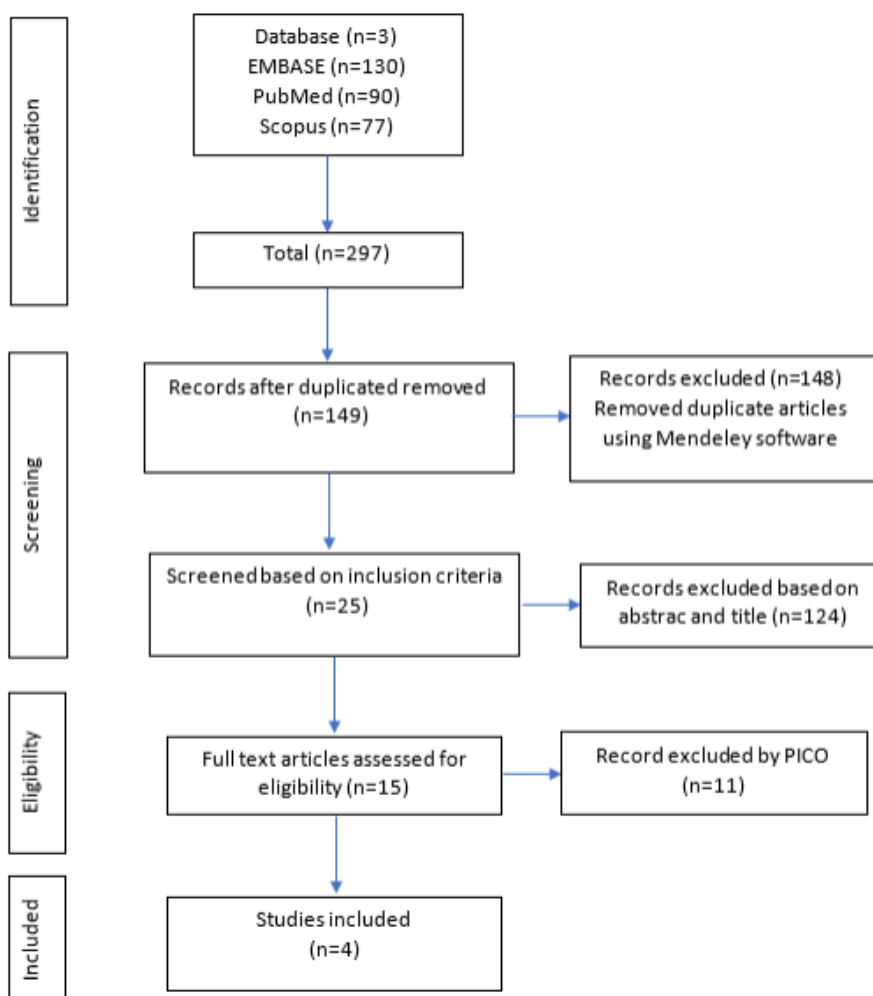


Figure 1. PRISMA Diagram of Study Selection Flow

Data Extraction

The study selection was carried out by 3 researchers independently. The initial selection was based on the abstract and title of the article. In the second step, relevant studies were downloaded for further selection based on inclusion criteria. Irrelevant studies were excluded. If there were differences of opinion between researchers, discussions were held until an agreement was reached. If an agreement was difficult to reach, then the highest vote was taken to get the final decision. The stages of study selection were presented in the PRISMA chart (Figure 1). Researchers extracted and summarized the following information into tables: author's name, year of study, study design, country of study, study population, immunization coverage, and summary of main findings.

Risk of bias assessment

To evaluate the risk of bias, all selected studies were evaluated according to the New Castle Ottawa Scale (NOS). Cross-sectional study quality was assessed using the adjusted NOS version. Studies were categorized as strong if the points were >7, 5-6 for moderate, and weak if <5. This systematic review prioritized studies with >7 rating points and considered studies with 5–6 points. The researchers evaluated each study independently. If there was a difference of opinion between researchers, the highest vote will be taken for the final decision.

The results of the risk assessment of bias for the two cross-sectional studies were categorized as high (Table 2). In the retrospective cohort study, the results were in the moderate category (Table 3). Although the results were moderate, they were still included in this systematic review because they were considered representative.

Table 1. Risk of Bias Assessment for Cross-sectional Studies

Author(s) / Year	Study Design	Selection			Comparability		Outcome		Total
		Representativeness of the sample	Sample Size	Non-response rate	Ascertainment of exposure	Based on design and analysis	Assessment of outcome	Statistical test	
Chandir et al, 2020	Cross sectional	*	*	*	**	*	**	*	9
Abu-Rish, Bustanji and Abusal, 2021	Cross-sectional	*	*	*	*	*	*	*	7

Table 2. Risk of Bias Assessment for Retrospective Cohort Studies

Author(s) / Year	Study Design	Selection			Compa rability	Outcome			Total	
		Representati veness of the sample	Select- ion of non- expose d	Ascertain ment of exposure		The outcome of interest was not present at the start of the study	Assess ment of outcom e	follow- up long enough		Adequac y of follow-up test
Alrabiaah et al., 2020	Retrospective cohort	*	-	*	*	-	*	*	-	5
Zhong et al, 2021	Retrospective cohort	*	-	*	*	-	*	*	*	6

RESULTS

Search results with keywords obtained 77 articles from the Scopus database, 130 articles from the EMBASE database, and 90 articles from the PubMed database, with a total of 297 articles. There were 148 duplicates and 15 articles conducted in Asia. Finally, there were 4 included articles in this systematic review.

The included studies were exploring the impact of the COVID-19 pandemic on coverage of routine immunization in children, conducted in Pakistan (n=1), Saudi Arabia (n=1), Singapore (n=1), and Jordan (n=1). Two articles were cross-sectional studies and two articles were retrospective cohort study designs. Those studies showed immunization declining due to the COVID-19 pandemic.

Table 3. The included studies were exploring the impact of the COVID-19 pandemic on coverage of routine immunization in children.

Author	Years	Location	Design	Population	Decreased Immunization Coverage (The year 2020)	Finding Summary
Y. Zhong, et al	2021	Singapura	Retrospective cohort	0-23 months	Jan-Mar: MMR/MMRV Polyclinic: 5,5% hospital: 5,5% Private clinic: 52,2% DTP3 Polyclinic: 2,3% hospital: +22% Private clinic: 15,5% PCV Polyclinic: 2,2% hospital: +8,8% Private clinic: 27,9% Apr: MMR/MMRV Polyclinic: 25,6% hospital: 57,3% Private clinic: 73,6% DTP3 Polyclinic: 10,3% hospital: 0,4% Private clinic: 47,8% PCV Polyclinic: 8% hospital: 12,9%	The decline in immunization coverage, both in polyclinics, hospitals, and private clinics, has decreased in various ways, but the lowest decline was in hospitals.

Author	Years	Location	Design	Population	Decreased Immunization Coverage (The year 2020)	Finding Summary
					Private clinic: 67,8%	
S. Chandir, et al	2020	Sindh, Pakistan	Cross-sectional	0-23 months	Mar-Apr: 51% Mei- Aug: 42%	The impact of restrictions during the COVID-19 pandemic has greatly impacted immunization coverage in large populations. The decline occurred due to a decrease in demand and supply.
A. Alrabiaah, et al	2020	Saudi Arabia	Retrospective cohort	0-12 months	Mar: 49,9% Apr: 71,9% May: 68,5%	The social distancing strategy has proven to have an impact on decreasing immunization coverage. Immunization in children under 12 months decreased by more than 72.9%
Abu-Rish, Bustanji and Abusal	2022	Jordanian	Cross-sectional	0-23 months	Mar: 48,3% Apr: 32,4% Sep: 76,5% Oct: 73,4%	The decline in immunization coverage occurred at the start of the lockdown, namely March-April 2020. In May, coverage began to increase again and was relatively stable from June-August. Immunization coverage dropped significantly again during the first wave of the pandemic, namely September-October 2020

DISCUSSION

The COVID-19 pandemic has confirmed disrupted essential health services, such as immunization services.(4,15,16) Immunization coverage decline or delays in children under 2 years in Asia were found about 16-72%. (17–20) The greatest immunization coverage decline occurred in March-April 2020 when the lockdown policy was enforced.(18,19,21) It is consistent with the finding in Canada where a significant decline occurred early in the pandemic. (5) This is similar to what has occurred in Latin America. (22)

In May 2020, immunization coverage decline began to increase again from the previous month. (17) The coverage increased in May after the opening of primary health care for child vaccination and the easing of the lockdown. Coverage from June-August 2020 was relatively stable.(17) However, during the first wave of COVID-19 in September-October 2020 immunization coverage decreased again.(17–19)

The coverage of various types of immunization declined in polyclinics, hospitals, and private clinics. It reported diverse, but the lowest decline was in hospitals. (20) In Singapore,

immunization against MMR/MMRV has decreased by more than 50% in both hospitals and private clinics. DTP3 immunization has decreased by more than 40%. Furthermore, for this type of PCV, the decrease is about 12-67%. (10) Immunization coverage of DTP3 (third dose diphtheria, tetanus toxoid, and pertussis-containing vaccine) in one-year-old children worldwide has decreased from 86% in 2019 to 81% in 2021. (4) The decline in BCG immunization in Pakistan reached 40%, while for measles it was 20%. (19) In contrast to Jordan, BCG, MMR, and DTP types decreased by 14%, 6-8%, and 7%, respectively, compared to before the pandemic. (17)

The immunization coverage decline partly can be explained by a decrease in immunization services and demand for services by users. It is simply due to a decrease in the supply and demand of immunization. (21) Even though healthcare services in developed countries are better, pandemic-impacted immunization services apply throughout the world. (20) It is because most health facilities during the COVID-19 pandemic were more optimized for pandemic control. (8)

On the supply side, the provision of services was disrupted because it depended on strict restrictions of vaccination officers to carry out outreach. (19) A WHO survey reported more than one-third of countries reported disruption of immunization services in immunization outreach and immunization services in health facilities. (4) Immunization coverage services in Pakistan, both in Karachi, and Sindh, were two-fold more affected by the pandemic than immunization services in health facilities. (19,21) About 18% of immunization services were closed in Karachi. (21) A study conducted by the Indonesian Ministry of Health and UNICEF reported 84% of health facilities had disrupted immunization services. Immunization coverage in Indonesia was reported to have decreased in 2020 (83.3% of 92.9% target) and 2021 (84.2% of 93.6% target). (8) Those show a linearity between the decline of health services and immunization coverage.

In addition, the decline in demand occurred due to anxiety about being infected with COVID-19 which contributed to a decrease in immunization. (21) People are reluctant to come to health service facilities during the pandemic. Hence, parents tend to postpone their child immunizations. (17,20) Therefore many immunization schedules are missed. Those facts illustrate in immunization coverage decline occurs on the demand side. (21)

Discipline in immunization is key to preventing outbreaks of vaccine-preventable diseases. Outbreaks of diseases such as Tetanus Neonatorum, measles, and diphtheria are a threat in the future. The disease outbreak could have an even higher impact if immunization coverage continues to decline. (11,20) This outbreak will certainly increase the burden on the health system which was quite overwhelmed during the COVID-19 pandemic. It shows an urgent need to maintain routine immunization coverage in children despite a pandemic. (19,20)

Several strategies that can be implemented include immediately resuming immunization services at basic health services both fixed locations and outreach locations with clear standard operating procedures (SOPs) including social distancing, use of PPE, and other pandemic health protocols. (19) It includes campaigns about safe immunization during a pandemic. (17,20) Implementation of interventions in basic health services is necessary to catch up on delayed or missed immunizations to prevent potential outbreaks. (5) Community-based basic health services can also be optimized it. (6)

Furthermore, this systematic review only included articles from three databases. Several articles may not generalize the study population. The included studies were conducted for a short duration, but probably the observation need a longer period. This study also cannot distinguish vaccinations that were postponed due to being canceled by the provider and user. Mitigation measures to increase immunization coverage cannot be conveyed in depth.

CONCLUSION

This systematic review provides an overview of the impact of the COVID-19 pandemic on declining routine immunization coverage in children under 2 years of age in several countries in Asia, especially during the lockdown. Immunization trends in children and their movements have differed during several periods of the pandemic. The highest immunization coverage decline occurred in March-April 2020. Immunization coverage increased again in May 2020 and decline again in September-October 2020. This systematic review found the decline occurred due to both supply and demand. It provides an evidence base for policy practitioners and the government for mitigation. The continuation of the immunization program is very important and urgent for children's health and should prioritize even in a pandemic situation. In the supply problem, we suggest facilitating the mobile immunization process through door-to-door visits and increasing vaccine availability. For demand issues, it is advisable to provide information and encouragement to overcome the concerns and fears of parents.

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