

The impact of COVID-19 and catch-up strategies on routine childhood vaccine coverage trends in Latin America: A systematic literature review and database analysis

María M. Castrejon^a, Ingrid Leal^b, Thatiana de Jesus Pereira Pinto^c, and Adriana Guzmán-Holst^{id}^d

^aScientific and Medical Affairs in Emerging Markets, GSK, Ciudad de Panamá, Panamá; ^bRegional Publications - Global Medical, GSK, Ciudad de Panamá, Panamá; ^cEpidemiology and Health Outcomes, GSK, Rio de Janeiro, Brazil; ^dEpidemiology and Health Outcomes, GSK, Wavre, Belgium

ABSTRACT

Globally, an estimated 23 million children missed vaccination in 2020 due to the coronavirus disease 2019 (COVID-19) pandemic. We analyzed vaccination coverage trends and catch-up strategies/recommendations implemented in Latin America during the pandemic. We performed a national administrative database analysis and a systematic literature review to evaluate vaccination coverage data and identify catch-up strategies for missed vaccinations in selected countries in Latin America (Argentina, Brazil, Chile, Colombia, Mexico and Peru). Data were extracted from national health ministry vaccination coverage and supranational databases to identify coverage of rotavirus (RV), pentavalent/hexavalent, measles, Bacillus Calmette-Guérin (BCG) and pneumococcal conjugate vaccines (PCV) at country level before and during the COVID-19 pandemic. A systematic literature review of published papers was conducted to identify vaccination catch-up strategies published in January 2020–June 2021. National administrative database-reported data showed that vaccination coverage trends were declining prior to 2020. The change in vaccination coverage before and during the COVID-19 pandemic ranged from 2.5% to –11.5% (RV), –3.0% to –11.0% (measles), 1.5% to –7.5% (PCV), 9.0% to –14.0% (pentavalent/hexavalent), and 3.0% to –18.5% (BCG). Among 696 identified studies, 14 studies were included in this review. Catch-up vaccination strategies included prioritizing routine vaccinations as per the national immunization schedule. Overall vaccination coverage declined by varying degrees among the countries investigated. This trend was observed prior to 2020, suggesting multifactorial reasons for declining vaccination rates in Latin America.

PLAIN LANGUAGE SUMMARY

What is the context?

- The coronavirus disease 2019 (COVID-19) led to health immunization disruptions in at least 68 countries, affecting around 80 million children.
- Routine childhood vaccination coverage was already suffering a decline in Latin America in the past decade, this situation could deteriorate further due to COVID-19.
- Consensus is lacking on the use of current guidelines and recommendations for catch-up vaccinations, as these are difficult to implement.

What is new?

- We analyzed national health ministry databases to evaluate vaccination coverage trends in Latin America before and during the COVID-19 pandemic.
- We also conducted a systematic literature review to describe catch-up strategies for missed vaccinations during the pandemic.
- Vaccination coverage declined for the rotavirus, measles and pneumococcal conjugate vaccines at country level from 2017–2020.
- Pentavalent/hexavalent and Bacillus Calmette-Guérin vaccine coverage varied among countries for the same period.
- Catch-up vaccination strategies included prioritizing routine vaccinations as per the national immunization schedule.

What is the impact?

- Continued efforts from healthcare officials and providers could prevent unvaccinated children from severe disease through catch-up vaccinations.

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Coverage; COVID-19; guidelines; Latin America; recommendations; childhood vaccination

Introduction

The coronavirus disease 2019 (COVID-19) pandemic, which began as a localized outbreak in December 2019, has caused nearly 346 million confirmed cases globally and led to almost

5.5 million deaths as of January, 2022.¹ As the outbreak spread rapidly in early 2020, governments around the globe sought to curb transmission through implementing travel bans, social

CONTACT Adriana Guzmán-Holst  adriana.x.guzman@gsk.com  Epidemiology and Health Outcomes, GSK, Building WN23, Avenue Fleming 20, Wavre 1300, Belgium.

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distancing rules, mandated lockdowns, and closure of commercial activities and non-essential services.² In a recent national pulse survey among 135 participating countries conducted by the World Health Organization (WHO), it was reported that 94% of the responding countries experienced a disruption to essential health services between January and March 2021.³ According to data from the WHO, the United Nations Children's Fund (UNICEF), the Global Alliance for Vaccines and Immunizations (GAVI), and the Sabin Vaccine Institute, 68 countries have suspended their immunization services and put at least 80 million children <1 year of age at risk.^{4,5} Furthermore, the WHO reported that an estimated 23 million children missed vaccination in 2020 due to the COVID-19 pandemic.⁶

For Latin America, there is limited information regarding the barriers to achieving high vaccination coverage in the region.⁷ However, the COVID-19 pandemic impacted routine immunization programs in Latin America and other regions.^{8,9} Evidence suggests that this could lead to an increase in mortality from vaccine-preventable diseases (VPDs).^{5,9–12} Consequently, several supranational organizations and experts have issued guidelines for missed vaccinations during the COVID-19 pandemic.^{13–15}

This study aims to assess and describe vaccination coverage trends in selected countries from Latin America before and during the COVID-19 pandemic. Additionally, we aim to systematically review the implemented catch-up strategies and recommendations for vaccinations missed due to the pandemic.

Methods

Six Latin American countries were selected for this study, based on the availability of publicly disclosed vaccine coverage data that are validated by WHO-UNICEF coverage databases. National vaccination coverage data from these countries were extracted from national health ministry databases and the most recent Pan American Health Organization (PAHO) immunization report,¹⁶ to investigate and compare vaccination coverage trends for routine childhood vaccines before and during the pandemic. For each vaccine, the pre-pandemic rate was calculated by subtracting the vaccine coverage rate of 2019 from the average vaccine coverage rate of 2018 and 2017. For a better understanding this may be represented by the equation $x = a - \left(\frac{b+c}{2}\right)$, where x represents the pre-pandemic coverage rate and a , b and c represent the vaccine coverage rate of 2019, 2018 and 2017 respectively. Similarly, the post-pandemic rate was determined by subtracting the coverage rate of 2020 from the average vaccine coverage rate of 2019 and 2018. This may be represented by the equation $y = d - \left(\frac{a+b}{2}\right)$, where y is the post-pandemic coverage rate and d is the vaccine coverage rate of 2020.

We then performed a systematic literature review based on the Preferred Reporting Items for Systematic Literature Reviews and Meta-Analyses (PRISMA) guidelines,¹⁷ to identify catch-up strategies/recommendations in Latin America.

Search sources and strategy

A search strategy was developed in Medline and then adapted to mainstream and regional databases. The following online databases were searched for studies published from January 2020 through May 2021: Medline (via PubMed), Scopus, Scientific Electronic Library Online (SciELO), Google Scholar and online articles. A search of gray literature was performed using national administrative and supranational databases, to extract vaccination coverage information for selected vaccines at country-level before and during the pandemic. We also performed a snowball search by manually reviewing relevant references cited within the screened articles. The search strategy was developed using keywords and related Medical Subject Heading (MeSH) terms to capture as many examples as possible (Table S1). Database searches were performed until 16 June 2021 and retrieved articles were first screened by title and abstract following *a priori* established eligibility criteria (Table S2).

Article selection and data extraction

Identified publications were screened in two phases by three reviewers (AGH, MMC, IL) using the pre-defined inclusion and exclusion criteria (Table S2). The first phase included a screening of titles and abstracts for all publications, while the second phase involved reviewing the full-text of relevant articles. Any discrepancies arising from the search were discussed among all three reviewers; in cases of disagreements about article inclusion, unanimous agreement was sought.

Relevant information about each article was extracted, including title, journal, authorship and year of publication, study setting, study objectives, study design, study period (evaluation period), sample size, study population (age group) and the evaluated vaccine. Lastly, the data extraction was checked and approved by the review team.

Results

Vaccination coverage based on national administrative databases

National health ministry vaccine coverage databases were cross-checked with the latest PAHO immunization reports.¹⁸ Both sources were utilized to identify the vaccination coverage levels of selected vaccines at country level before and during the pandemic.^{16,18} The final analysis was performed using the PAHO database due to its standardized methodology and consistency. Selected vaccines included rotavirus vaccine (RV; two doses), pentavalent/hexavalent (diphtheria, tetanus, pertussis, poliomyelitis, *Haemophilus influenzae* type b and hepatitis B; three doses), measles containing vaccine (MCV; one dose), Bacillus Calmette-Guérin (BCG; one dose) and the pneumococcal conjugate vaccines (PCV; two doses). Data are presented for Argentina, Brazil, Chile, Colombia, Mexico and Peru for the years 2017–2020 (Figure 1a). Overall, the change in vaccination coverage ranged from 2.5% to –11.5% (RV), –11.0% to –3.0% (MCV), 1.5% to –7.5% (PCV), 9.0% to –14.0% (pentavalent/hexavalent), and 3.0% to –18.5% (BCG) (Figure 1b and Table S3).

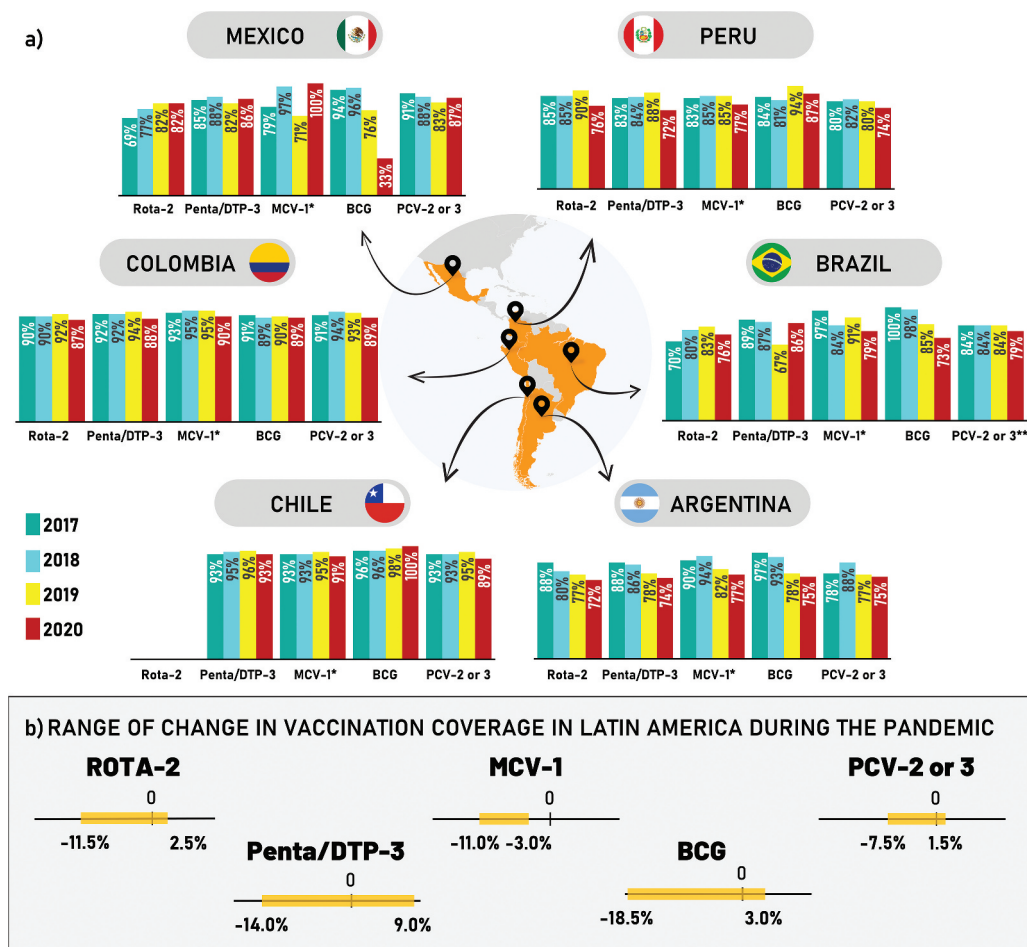


Figure 1. (a) Vaccination coverage rates for selected vaccines among six countries in Latin America, 2017–2020. (b) Annual range of the change in vaccination coverage of selected vaccines among six countries in Latin America, 2020^a. BCG, Bacillus Calmette–Guérin vaccine; DTP-3, diphtheria–tetanus–pertussis, three doses; MCV-1, measles-containing vaccine, one dose; PCV 2 or 3, pneumococcal conjugate vaccine, two or three doses; Penta, pentavalent vaccine; Rota-2, rotavirus vaccine, two doses. *Measles-containing vaccine (measles–mumps–rubella, measles–mumps–rubella–varicella, etc.). **For Brazil, data from WHO/UNICEF Estimates of National Immunization Coverage (WUENIC) (July 2021) were used¹⁹, as there were no 2020 data in the Pan American Health Organization immunization report for PCV. ^aThe negative signs in the presented values refer to a decrease in coverage during/post pandemic. These values are regional ranges – for example, for the rotavirus vaccine there was a change in coverage in the selected countries ranging from 2.5% to -11.5% which comes from Mexico (biggest increase of 2.5%) and Peru (biggest decrease of 11.5%).

Argentina

The average coverage rate for RV declined by 7.0% pre-pandemic and 6.5% during the pandemic. The average coverage rates for pentavalent/hexavalent vaccine declined by 9.0% pre-pandemic and 8.0% during the pandemic. The average MCV coverage rate declined by 10.0% pre-pandemic, and 11.0% during the pandemic. The average BCG coverage rate declined by 17.0% pre-pandemic and 10.5% during the pandemic. The average coverage rate of PCV declined by 6.0% pre-pandemic and 7.5% during the pandemic (Figure 1a,b).

Brazil

The coverage rate of the RV vaccine showed an increasing trend while the remaining vaccines indicated a decreasing trend in Brazil from 2017 to 2020. The pre-pandemic average coverage rate for RV showed an increase of 8.0%, which declined by 5.5% during the pandemic. For the pentavalent/hexavalent vaccine, an average decline of 21.0% and an average increase of 9.0% were observed before and during the

pandemic, respectively. The average MCV coverage rate increased by 0.5% pre-pandemic and decreased by 8.5% during the pandemic. The average decline for BCG vaccine during the pre-pandemic period was 14.0% and this further declined by 18.5% during the pandemic. For PCV, there was no change in the pre-pandemic vaccination coverage rate but it declined by 5.0% during the pandemic (Figure 1a,b).

Chile

Vaccination coverage data for the RV vaccine for Chile were unavailable, as this vaccine is not included in the national immunization programme (NIP). Interestingly, from 2017 to 2020, the BCG vaccine coverage rate increased, while pentavalent/hexavalent vaccine coverage remained stable. Meanwhile, MCV and PCV coverage rates decreased slightly during the pandemic. Average pentavalent/hexavalent coverage increased by 2.0% pre-pandemic and decreased by 2.5% during the pandemic. Similarly, average PCV coverage increased by 2.0% pre-pandemic and then decreased by 5.0% during the pandemic.

Average MCV coverage increased by 2.0% pre-pandemic and decreased by 3.0% during the pandemic. Average BCG coverage increased by 2.0% pre-pandemic and further increased by 3.0% during the pandemic (Figure 1a,b).

Colombia

The average RV vaccine coverage rate increased by 2.0% in the pre-pandemic period and decreased by 4.0% during the pandemic. Average coverage for MCV increased by 1.0% pre-pandemic and decreased by 5.0% during the pandemic. Average pentavalent/hexavalent coverage increased by 2.0% pre-pandemic and decreased by 5.0% during the pandemic. Average BCG vaccine coverage rate remained constant at 0% pre-pandemic and decreased by 0.5% during the pandemic, while the average PCV coverage rate increased by 0.5% pre-pandemic and decreased by 4.5% during the pandemic. (Figure 1a,b).

Mexico

The coverage rate for RV vaccine, pentavalent/hexavalent vaccine and MCV increased, while the coverage for PCV and BCG vaccine decreased from 2017 to 2020. The average coverage rate for RV vaccine increased by 9.0% pre-pandemic and 2.5% during the pandemic. Average pentavalent/hexavalent vaccine coverage declined by 4.5% pre-pandemic and increased by 1.0% during the pandemic. Average MCV coverage declined by 17.0% pre-pandemic and increased by 16.0% during the pandemic. Average coverage for BCG decreased by 19.0% pre-pandemic and further decreased by 53.0% during the pandemic. The average PCV coverage declined by 6.5% pre-pandemic and increased by 1.5% during the pandemic (Figure 1a,b).

Peru

The coverage rates for the RV, pentavalent/hexavalent, MCV and PCV vaccines decreased, whereas BCG coverage rate increased from 2017 to 2020. Average RV coverage increased by 5.0% pre-pandemic and decreased by 11.5% during the pandemic. Average pentavalent/hexavalent coverage increased by 4.5% pre-pandemic and decreased by 14.0% during the pandemic. Average MCV coverage increased by 1.0% pre-pandemic and decreased by 8.0% during the pandemic, while average BCG coverage increased by 11.5% pre-pandemic and decreased by 0.5% during the pandemic. Average PCV coverage rate declined by 1.0% pre-pandemic and further declined by 7.0% during the pandemic (Figure 1a,b).

Systematic literature review study characteristics

The systematic literature review included 14 studies out of 696 publications identified through the five databases (Figure 2).^{13–15,20–30} A description of the main characteristics of the studies follows; further details are presented in Table S4.

Geographically, the included studies presented nationwide (n = 6),^{20–21,26–29} regional (n = 4)^{13,15,24,25} or international (n = 4)^{14,22,23,30} data (Figure S1). Among the studies reporting nationwide data, the highest number reported data from Brazil (n = 3).^{20,27,28} One study each reported nationwide data for Argentina,²⁹ Peru,²⁶ and Chile.²¹ Regional studies that reported data for the Latin American region were also identified (n = 4).^{13,15,24,25} Studies reporting international level data were produced by WHO, Centers for Disease Control and Prevention (CDC), and PAHO (n = 4).^{14,22,23,30}

Most of the included studies were recommendations/guidelines (n = 5)^{15,22–24,30} followed by a narrative or retrospective administrative database analyses (n = 4).^{26–29} The remaining studies were qualitative analyses (n = 2),^{21,25} an interrupted

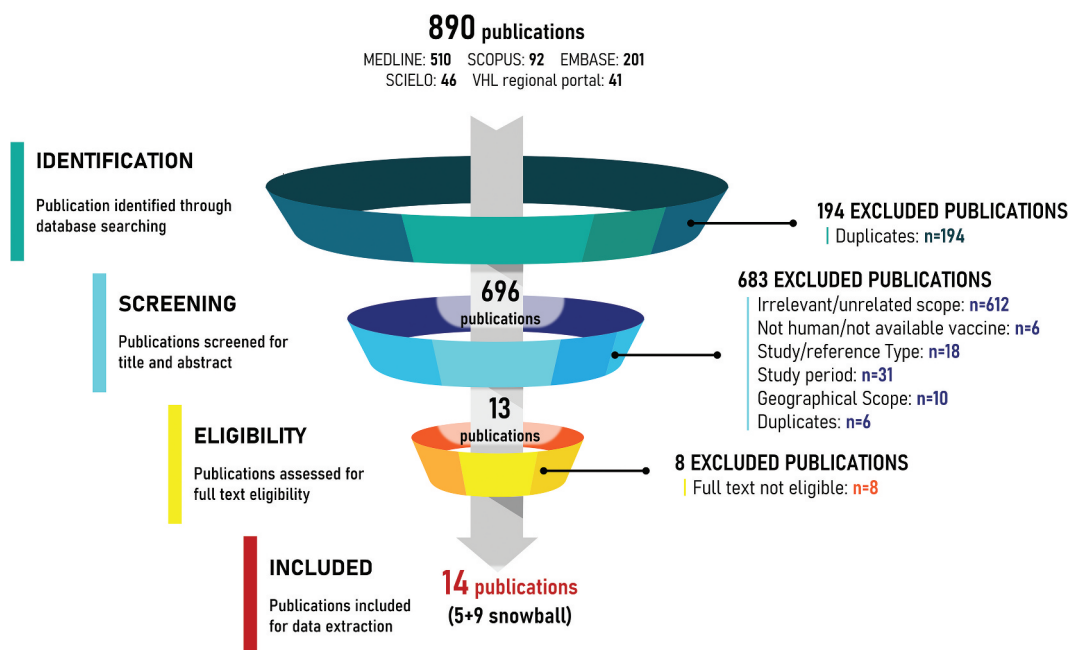


Figure 2. PRISMA diagram. PRISMA, Preferred Reporting Items for Systematic Literature Reviews and Meta-Analyses; n, number of publications.

time series analysis (n = 1),²⁰ expert opinion (n = 1)¹³ and a descriptive review (n = 1).¹⁴

Study populations in the studies were broken down by age groups (Figure S1). Study objectives were reported for all studies, based on either vaccination coverage or catch-up strategies/recommendations (Figure S1). Vaccines evaluated varied based on the study population, with 11 studies reporting the vaccines being evaluated (Figure S1).^{14,20,22–30}

Catch-up strategies/recommendations

One study from Chile reported national level catch-up strategies/recommendations.²¹ The remaining vaccination guidelines were published by supranational and regional organizations.

The recommendations from Chile were provided by the Advisory Committee on Vaccines and Vaccination strategies and aligned with those provided by PAHO and WHO.²¹ It was recommended to maintain the vaccination of newborns in hospital birth-centers as per the vaccination schedule. Primary vaccination series should be prioritized, especially vaccines protective against measles, rubella, poliomyelitis and pneumococcal disease. For influenza, it was recommended to prioritize the most vulnerable groups for vaccination.

For individuals with COVID-19, it was recommended that all vaccinations be deferred until the patient had completely recovered. Similarly, vaccinating a person who was a contact of a COVID-19 case should be deferred for the quarantine period (14 days since their last exposure).²¹

CDC provided similar recommendations regarding COVID-19 patients and those exposed to COVID-19 cases.²² Additional recommendations included the use of reminder and recall systems, immunization information systems and health records to promote vaccine adherence and ensure timely catch-up vaccination.

WHO's Strategic Advisory Group of Experts on Immunization recommended that a clearly defined catch-up vaccination policy and schedule should be in place for all NIPs.¹⁵ All preventive mass vaccination campaigns were to be halted where there are no active VPD outbreaks while simultaneously assessing the risk-benefit of continuing vaccination programs during outbreaks/endemic situations.¹³ Catch-up vaccination strategies should be based on the epidemiology of VPDs in the region and include outreach programs, mobile immunization sessions or intensified routine immunization services for a given period.

Guidance from PAHO, in the context of the COVID-19 pandemic,²⁴ recommended similar strategies to those from Chile, i.e., vaccination against influenza and measles should be prioritized and vaccination of newborns must remain a priority in all settings, especially against hepatitis B. It was also recommended that countries with pneumococcal vaccination programs for older adults and individuals in risk groups should maintain such programs whenever possible. Maintaining a periodic and systematic registry of the population including newborns pending vaccination was also recommended. Additionally, it was recommended to temporarily suspend mass vaccination campaigns due to the risk of increasing COVID-19 transmission in the community and in health establishments. A risk-benefit analysis of conducting outbreak response vaccination was recommended in the case of a VPD outbreak, to safely implement this decision in the context of the COVID-19 pandemic. Guidance also recommended to prioritize vaccination of newborns according to the national immunization calendar.²³ School-based vaccination programs should be maintained only if they can be implemented safely. Individuals infected with COVID-19 or those exposed to COVID-19 cases should be vaccinated following recovery or after completion of quarantine, respectively.

A study that provided recommendations based on expert opinion¹³ stated that VPD surveillance should be continued, and health services should be adapted to sustain vaccinations during the pandemic. Experts also recommended the prioritization of catch-up vaccinations if the situation was safe to do so. One study recommended the vaccination schedule be updated as soon as the pandemic situation allowed the immunization program to be implemented safely.¹⁴ A summary of these recommendations is shown in Table 1.

PAHO provided guidance regarding vaccination of newborns²³ and recommended that the vaccination of newborns with hepatitis B (HepB) and BCG vaccines (as per the national immunization schedule) should be prioritized. For mothers who tested positive for COVID-19, but whose newborn may or may not be COVID-19 positive, it was recommended to postpone the BCG vaccine until both mother and child were discharged from hospital or until 14 days after symptoms had subsided in the newborn. The HepB vaccine should be prioritized for all births within 24 hours of life or as soon as possible, regardless of COVID-19 symptoms.

Table 1. Summary of strategies and recommendations.^{13–15,21–25,30.}

Guidance	<ul style="list-style-type: none"> • WHO recommends all mass vaccination campaigns be temporarily halted with exception of a VPD outbreak • Vaccination of newborns and primary vaccination series were prioritized
Observations	<ul style="list-style-type: none"> • All Latin American countries reported a decline in childhood vaccination coverage • The decline in vaccination coverage was prevalent prior to the COVID-19 pandemic, suggesting the influence of multiple factors
Strategy/Recommendations	<ul style="list-style-type: none"> • Prioritize primary vaccination series, vaccination of COVID-19 cases and individuals suspected of COVID-19 infection • Controlled surveillance of VPD outbreaks • Standardize catch-up strategies for missed vaccinations for the entire region

Discussion

All six studies that reported data on vaccination coverage in Latin America reported an overall decrease in coverage from March 2020.^{20–21,26–29} Several studies in this review also reported regional variations in the decline of vaccination coverage.^{13,15,24,25} These variations could be due to regional/cultural differences affecting compliance with health guidelines, level of concern regarding infection, and differences in socioeconomic status.^{31,32} Additionally, our results suggest that vaccination coverage for some vaccines in various countries was declining even prior to the pandemic. Hence, some reasons for the declining vaccination coverage post-pandemic could be assumed to be outside the direct effects of the pandemic. These reasons could include declining birth rates, inaccessibility to health centers due to shortage of healthcare resources or parents canceling scheduled vaccination appointments due to fear of COVID-19 infection. However, diphtheria – tetanus – pertussis (DTP) vaccine coverage rates increased slightly in Brazil during the pandemic. Mexico also reported a higher vaccine coverage rate for most vaccines, except for the BCG vaccine. This may have been influenced by the stringent vaccine policy introduced following the 2019 measles outbreak in Mexico.³³ Further evidence on this subject may help to improve vaccination coverage in the region.

The decline in vaccination coverage in Latin America in 2020 was similar to declines reported for the South-East Asia

and Western Pacific regions, where 18 of the 19 (95%) countries included in the study reported disruptions to vaccination, especially infancy and school-entry age vaccinations.³⁴ The study reported that DTP vaccine coverage decreased by 42.0%, oral polio vaccine coverage decreased by 79.0%, and measles vaccine coverage decreased by 9.0% among the school-entry age group.³⁴ Similar findings were reported in Pakistan, where a 52.5% decrease was observed in the daily average total number of vaccinations administered from September 2019 to March 2020.³⁴ The largest decline was 40.6%, for the BCG vaccine.³⁵ The Spanish Association of Pediatrics also recorded a decline in vaccination coverage (range: 5.0%–60.0%) in March 2020 compared with the monthly average from January 2019 to February 2020.³⁶ However, while the above-mentioned studies reported declining vaccination coverage, not all countries reported such declines in 2020. Brazil recorded a 5.79-fold increase in MCV coverage, from 0.86% to 4.98%, following a vaccination campaign in 2020.³⁷ Australia reported a 17.0% absolute increase in coverage for influenza vaccination (adults/elderly), and South Korea reported a 1.0% increase in coverage for HepB, BCG (early infancy), measles, and pneumococcus (infancy) vaccines.³⁴ Best practices developed by these countries could be utilized to improve vaccination coverage within Latin America.

Studies describing vaccination catch-up strategies/recommendations were aligned in their recommendations for prioritizing primary vaccination series, vaccination of

Plain Language Summary

What is the context?

- The coronavirus disease 2019 (COVID-19) led to health immunization disruptions in at least 68 countries, affecting around 80 million children.
- Routine childhood vaccination coverage was already suffering a decline in Latin America in the past decade, this situation could deteriorate further due to COVID-19.
- Consensus is lacking on the use of current guidelines and recommendations for catch-up vaccinations, as these are difficult to implement.

What is new?

- We analyzed national health ministry databases to evaluate vaccination coverage trends in Latin America before and during the COVID-19 pandemic.
- We also conducted a systematic literature review to describe catch-up strategies for missed vaccinations during the pandemic.
- Vaccination coverage declined for the rotavirus, measles and pneumococcal conjugate vaccines at country level from 2017-2020.
- Pentavalent/hexavalent and Bacillus Calmette-Guérin vaccine coverage varied among countries for the same period.
- Catch-up vaccination strategies included prioritizing routine vaccinations as per the national immunization schedule.

What is the impact?

- Continued efforts from healthcare officials and providers could prevent unvaccinated children from severe disease through catch-up vaccinations.

Figure 3. Plain language summary (PLS).

COVID-19 cases and individuals suspected of COVID-19 infection, continued surveillance of VPD outbreaks, and catch-up strategies for missed vaccinations. We found that while vaccination strategies exist during times of service disruptions, a lack of standardization remains that hinders the successful implementation of these strategies within the Latin American region.

The disruption of essential services due to COVID-19 also impacted the supply chains of healthcare systems. In France, during the lockdown, routine vaccination saw the greatest decrease during the week of May 30 to 5 April 2020. Penta/hexavalent vaccination coverage fell by 28.9%, and deliveries of measles, mumps and rubella (MMR) and human papillomavirus (HPV) vaccines decreased by more than half (50.8% and 78.1%, respectively).³⁸ In the United States, two studies highlighted a notable decline (approximately 75.0%) in vaccines ordered by doctors since January 2020.^{8,39} This decline in vaccine orders and deliveries could lead to an increased risk of VPD outbreaks in communities with low vaccine coverage.

Study limitations included inconsistencies in vaccination coverage registration and estimation methods in each country, which makes cross-country comparisons difficult. Therefore, we utilized the WHO/UNICEF Estimates of National Immunization Coverage (WUENIC) database, which simplifies comparisons between countries due to standardized coverage estimates. Additionally, this study does not analyze specific risk factors that affected the change in vaccination coverage, considering these are multi-factorial and some related or unrelated to our main effect variable (the COVID-19 pandemic). These unrelated risk factors affecting vaccination coverage could be a subject of future research.

The disruption of essential health services due to the COVID-19 pandemic greatly impacted routine childhood vaccination in the Latin American region. Studies also reported declining coverage prior to the pandemic, suggesting multifactorial reasons for lagging vaccine coverage in the region. Recommendations to prioritize routine vaccination, continue surveillance of VPDs within communities, and develop vaccination campaigns with strategic intervention plans and catch-up strategies based on outreach programs could reverse this declining coverage.³⁷

A plain language summary of this article's context and findings can be found in Figure 3.

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Disclosure statement

MMC, IL, TP and AGH are employed by the GSK group of companies. MMC, IL and AGH hold shares in the GSK group of companies. All authors declare no other financial and non-financial relationships and activities.

Contributorship

Maria Mercedes Castrejon: Conceptualization (lead); data collection and analysis (supporting); interpretations (supporting); manuscript – review and editing (equal).

Ingrid Leal: Conceptualization (supporting); data collection and analysis (supporting); interpretations (supporting); manuscript – review and editing (equal).

Thatiana Pinto: Data collection and analysis (supporting); interpretations (supporting); manuscript – review and editing (equal).

Adriana Guzmán-Holst: Conceptualization (supporting); methodology (lead); data collection and analysis (lead); interpretations (supporting); manuscript – review and editing (equal).

All authors had full access to the data and gave final approval before submission.

Previous congress activities

The results of this manuscript were previously presented at the SLIPE 2021 congress held in Buenos Aires, Argentina and virtually, from 13–15 October 2021.

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ORCID

Adriana Guzmán-Holst  <http://orcid.org/0000-0002-6753-2541>

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