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Promoting immunization equity in Latin America and the Caribbean: Case studies, lessons learned, and their implication for COVID-19 vaccine equity



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ARTICLE INFO

Article history:

Received 15 April 2021

Received in revised form 11 December 2021

Accepted 9 February 2022

Available online 14 February 2022

Keywords:

Vaccine promotion

Vaccine equity

National Immunization Programs

Immunization Agenda 2030

Latin America and the Caribbean

Lessons learned

ABSTRACT

In 2020, the World Health Organization launched the Immunization Agenda 2030: A Global Strategy to Leave No One Behind, which prioritizes high equitable immunization coverage at the national level and in all districts. Achieving high and homogenous immunization coverage, which is all the more important within the current context of the COVID-19 pandemic and vaccine rollout, requires the strengthening of existing immunization activities and innovative approach to immunization promotion. This research applied a descriptive case study methodology to document the implementation of strategic multi-level alliances to promote equitable immunization access and demand in Colombia, Guyana, and Sucre, Bolivia. Data collection, carried out between September 2019 and March 2020, included documentary reviews, semi-structured interviews, focus groups, and site visits accompanied by discussions with relevant stakeholders. Case studies provide valuable examples of people-centered, partnership-based, country-owned, and data-guided approaches to promoting equitable immunization coverage, including multi-level partnerships to build technical capacity for the identification and measurement of social inequalities impacting immunization in Colombia; intersectoral and community collaboration for pro-equity emergency response to regional vaccine preventable disease outbreaks in Guyana; and strategic alliances with the education sector and civil society organizations for the introduction of the human papilloma virus (HPV) vaccine in Sucre, Bolivia. Lessons learned highlight avenues for improving the impact of multi-level, equity-focused capacity building, particularly at the local level; optimizing the use of data and resources, partnerships, and community and stakeholder education and empowerment. While impact studies are needed to better understand the quantitative contributions of such strategic alliances, these case studies illustrate their practical significance and reinforce the value of multi-level, intersectoral collaboration for enhancing equitable immunization access and demand. The experiences of Colombia, Guyana, and Sucre, Bolivia provide evidence-based insight to support pro-equity immunization program planning to ensure that no one is left behind and that everyone, everywhere receives the benefits of vaccines, both routine and for COVID-19.

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1. Introduction

In 2020, the World Health Organization (WHO) launched the Immunization Agenda 2030: A Global Strategy to Leave No One Behind (IA2030), which established strategic priority objectives specific to immunization coverage and equity, including achiev-

ing high equitable coverage at the national level and in all subnational divisions¹, with a focus on increasing coverage among the

¹ Throughout this article we refer to four administrative levels, which are defined using varying terms in different countries. For clarity, the regional level refers to Latin American and the Caribbean (LAC) and the Pan American Health Organization (PAHO). The national level refers to the country-level, such as Colombia and the Ministry of Health and Social Protection. The subnational level refers to first-level, in-country divisions, such as departments, regions, and provinces, and corresponding health authorities. Finally, the local level refers to second-level divisions, which include districts, cities, and municipalities, and associated health facilities.

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most disadvantaged populations [1–3]. Over the last 40 years of the Expanded Program on Immunization (EPI) in Latin American and the Caribbean (LAC), countries and territories have made extraordinary progress in providing their populations with an umbrella of protection against vaccine preventable diseases (VPDs) and promoting a culture of immunization in which vaccines are viewed as an essential service, a public good, and a right of every citizen [4–6]. However, high national coverage rates often mask the reality of subnational inequalities and coverage gaps within and across cities, districts, and municipalities. From 2013 to 2016, regional LAC coverage for third dose of diphtheria and tetanus toxoids and pertussis-containing vaccine (DTP3) remained around 90%, though it has been declining for the past several years. Over this same period, an estimated 50% of municipalities in LAC did not achieve at least 95% DTP3 coverage, which increased to 66% of municipalities in 2019 [7]. While it is widely acknowledged that district and municipal-level immunization data can present some data quality challenges that may not fully reflect the magnitude of inequalities [8], such data do demonstrate the existence of subnational inequalities in routine immunization coverage throughout LAC.

Existing inequalities in routine immunizations and subnational coverage gaps in LAC have been deepened by the COVID-19 pandemic, particularly in light of the disproportionate impact of COVID-19 on vulnerable populations in the region as well as the long-standing inequalities in health service access and utilization [9–11]. The Access to COVID-19 Tools (ACT) Accelerator, a global collaboration launched by the WHO, provides leadership and integrated guidance in partnership with governments, private sector organizations, civil society, and philanthropic entities around the world to strengthen health systems and support the development, production, and equitable access to COVID-19 testing, treatment, and vaccines. Within the ACT Accelerator, COVAX is spearheading pro-equity planning for the global distribution of COVID-19 vaccines based on a unified approach of shared risks and benefits and the understanding that “no one is safe until everyone is safe” [12]. The IA2030 identifies challenges to achieving high and homogenous vaccination coverage, including issues of immunization service quality and accessibility, particularly in zones of conflict, underserved areas, and with continued urbanization and cross-border migration, as well as the spread of misinformation eroding trust and confidence in vaccines [1,13].

The case studies presented in this article were guided by PAHO’s Regional Immunization Action Plan, Global Vaccine Action Plan’s strategic objective 2.1 to ensure that “immunization benefits extend equitably to all people and social groups” [1,14]. PAHO is an international public health agency that serves as the WHO Regional Office for the Americas and has over 100 years of experience providing technical assistance to all countries and territories in the Western Hemisphere, with a particular focus on poorer regions of the LAC [15]. Their Regional Plan calls for multi-faceted approaches to strengthening existing immunization activities as well as innovative strategies for promoting immunization equity, reflecting the IA2030 core principles: people-centered, partnership-based, country-owned, and data-guided [1–3,14,16]. In this article, we present the experiences of Colombia, Guyana, and Sucre, Bolivia in leveraging strategic multi-level, intersectoral and civil society alliances to promote immunization equity with respect to access and demand. We describe each country’s strategic approach and discuss challenges and lessons learned regarding the implementation of these strategies in their unique contexts. Findings from these case studies add to the toolkit of strategies shown to effectively improve immunization access and equity in low- and middle-income countries [17].

2. Methodology

In these cases studies, we applied a descriptive approach to documenting innovative strategies for promoting immunization equity among underserved and under-vaccinated populations in LAC, specifically Colombia, Guyana, and Sucre, Bolivia, which were selected based on their distinct experiences with addressing immunization inequities and the potential value to other countries. Colombia was chosen to document their multi-level approach to subnational capacity building for the identification and monitoring of social inequalities impacting immunization as well as to share lessons learned from these on-going efforts.

Colombia was chosen to illustrate efforts for monitoring social inequalities at national and subnational levels in immunization coverage with the adoption of PAHO initiatives for capacity building. We selected Guyana to document their equity-focused emergency response to measles, diphtheria, and yellow fever outbreaks in LAC, including neighboring Venezuela and Brazil, and the prioritization of migrant populations and border communities. Bolivia was chosen for its unique approach to participatory management of the public health system, the Family, Community, and Intercultural Health Model [18], effectively applied to promoting equity during the introduction of the Human Papilloma Virus (HPV) vaccine through intersectoral and civil society alliances. Case studies are used to generate an in-depth understanding of a specific event or phenomenon within its real-world context, allowing for a detailed consideration of a broad range of influential variables through multiple data collection methods, different stakeholder levels, and triangulation of findings across data sources [19–21]. In-country data collection, conducted by an external PAHO team, with support from Ministry of Health and/or PAHO-country office personnel, took place between September 2019 and March 2020 and included documentary reviews, face-to-face, semi-structured interviews, in-person focus group discussions, and site visits and observations accompanied by informal discussions with relevant stakeholders. The external PAHO team defined participant profiles (i.e., those with in-depth knowledge of the targeted interventions such as Ministry of Health officials and subnational EPI officers) for interviews and focus groups with input from PAHO country offices and national EPI units. This purposive, information-oriented sampling strategy focused on the collection of useful data from a small sample of knowledgeable participants and is appropriate for descriptive case studies about a particular phenomenon not well-known to the general public [22,23].

In Colombia, we conducted interviews with 18 participants, including national Ministry of Health and Social Protection (MSPS, acronym in Spanish) officials, subnational EPI directors, and regional PAHO representatives, and observed a 3-day training workshop on measuring social inequalities in immunization. In Guyana, we completed 13 interviews with national EPI officials, subnational EPI supervisors, and local-level healthcare providers, and held two focus groups with nurses, community health workers (CHWs), and medexes². We also visited eight health facilities near migrant entry points and/or border communities, where we met with health officials, discussed migration trends and procedures, and reviewed immunization data. In Sucre, Bolivia, we conducted interviews with 24 participants, including subnational and local health officials, civil society organization representatives, and education and social service-sector personnel. These data were complemented by three focus group discussions: one with parents of a local school board, one with social workers and educators, and one with personnel from the health information and epidemiological surveillance unit. All

² Guyana Medex Program, designed to increase capacity for primary healthcare delivery, particularly in the country’s interior, provides training equivalent to that of a Physician’s Assistant.

Table 1
Summary of Strategic Approaches, Challenges, and Lessons Learned.

	Alliances	Contributions	Challenges Encountered	Lessons Learned
<i>Colombia: Multi-level Partnerships for Pro-Equity Capacity Building</i>	PAHO (regional), MOH and EPI (national), and Departmental EPI Directors (subnational)	-Capacity building and technical training for the measurement, analysis, and monitoring social inequalities impacting immunization -Innovative equity tools and resources -Collaborative planning of vaccination activities and outreach brigades -Improved community vaccine sensitization and acceptance	-Scarcity of adequately trained local-level personnel -Insufficient political commitment at the municipal and district-levels -Insufficient vaccination capacity in some areas, including inadequate provider networks, poor compliance, and a shortage of vaccinators	-Need for ensuring technical capacity and data use at the district and municipal levels through training activities and steady multi-level support -Importance of sensitizing subnational decision-makers and funders to the value of monitoring immunization inequalities to secure political commitment
	Departmental EPIs and community leaders and stakeholders			
<i>Guyana: Intersectoral Collaboration and Community Partnerships to Strengthen Emergency Response</i>	Inter-Agency Coordinating Committee on Immunization and Multi-Agency Coordinating Committee for Addressing the Influx of Migrants	-Integrated approach and coordinated response to addressing VPD risks and migrant needs -Intersectoral data sharing and streamlined knowledge database -Multi-level engagement with key stakeholders and potential collaborators	-Access and outreach to border communities and migrant points of entry as well as cold-chain maintenance were challenged by time-consuming travel, difficult-to-navigate terrain, and weather-related complications -Competing demands on limited healthcare personnel -Linguistic barriers associated with migrants and Amerindian populations	-Optimizing limited resources and effectively targeting vulnerable areas and high-risk populations requires data-driven decision-making, for which intersectoral data sharing is crucial -Integrating emergency response activities with the existing EPI structure leverages established data practices, distribution networks, outreach programming, and health care personnel -Intersectoral collaboration and community partnerships is crucial for comprehensive emergency response as public health impacts all sectors
	Border Personnel, including immigration officers, local law enforcement, army personnel, and port authority	-Standardization of migrant registration and immunization verification procedures -Establishment of migrant health referral practices -Verification of immunization status of high-risk border personnel		
	Amerindian Village Councils and <i>toshaos</i>	-Data sharing, including local documentation of VPD-related symptoms and migrant entry patterns in their communities -Stakeholder-led vaccination promotion and sensitization -Collaborative coordination of mop-up visits, linguistic support, and help with vaccination follow-up		
<i>Bolivia: Promoting Vaccine Access and Uptake through Intersectoral Collaboration and Civil Society Participation</i>	Education sector, including individual schools and personnel	-Survey of all active educational units -School-based student census data -Collaborative campaign planning, including coordination of parental orientation sessions -Identification and outreach to vaccine-eligible students absent on campaign days	-Determination of denominators for school-based vaccination with outdated, national census data -Growing misinformation about vaccine safety and effectiveness, especially on social media, generating confusion and vaccine hesitancy	-School-based campaigns reduce barriers to vaccination access and decrease vaccinator burden -Multi-level, intersectoral data sharing supports more accurate campaign planning and monitoring -Educating and empowering community leaders and stakeholders reinforce EPI efforts to inform the public, counter misinformation, and alleviate vaccine hesitancy
	School Board Association and other civil society organizations	-Collaborative campaign planning, including coordination of parental orientation sessions and social mobilization strategies -Peer-to-peer and community-based vaccine promotion and sensitization -Identification and outreach to vaccine-eligible individuals absent on campaign days and/or not enrolled in school		
	Local media	-Expanded reach of EPI messaging -Publicization of immunization experts to notify the public regarding ESAVIs		

interviews and focus groups were audio-recorded with verbal participant permission.

Audio recordings were transcribed verbatim, and transcripts were reviewed alongside recordings to ensure accuracy prior to coding and analysis in Atlas.ti.8. Analysis was guided by Kuckartz's iterative, seven-step thematic analysis process [24]. Given the targeted focus of each case study, *a priori* codebooks were developed based on each study's objectives and preliminary thematic findings [21,25]. To assess coding concordance, reconcile discrepancies, and validate codebooks, two researchers independently coded 30% of transcripts from each case study. Inter-coder agreement (ICA) was assessed with Cohen's Kappa, with a Kappa greater than or equal to 0.80 widely accepted as demonstrating high coding concordance and semantic reliability [11]. The average Kappa was 0.91 (range: 0.81–1.00) for the Colombia case study; 0.88 (range: 0.82–0.91) for Guyana; and 0.84 (range: 0.81–0.90) for Bolivia. Given these high ICAs, remaining transcripts were coded by a single researcher. Category-based analysis of the thematic codes was conducted to assess saturation across participants and data sources, triangulate findings, and identify associations between themes [24]. Major findings presented here are organized into strategic approaches, challenges encountered, and lessons learned.

All participants were provided a verbal statement of informed consent prior to participation. The protocol for these case studies was reviewed by the Ethics Review Committee at PAHO and determined to be exempt from full review (#PAHO-2019-05-0039); given the PAHO exemption, case studies were exempted from in-country ethical review by national ministries of health. No names were included in data collection and all presented quotes are identified only by administrative level and/or general occupation of the participant.

3. Findings

(see Table 1 for case study summaries)

3.1. Colombia

The case of Colombia illustrated the country's leadership to achieving immunization equity through multi-level partnerships and technical capacity building.

3.1.1. Multi-level partnerships for pro-equity capacity building

In Colombia, equity is a national priority and guiding health policy value [26,27]. The country has established important initiatives for public health planning based on the monitoring of health inequalities, including the 2018–2022 *National Development Plan: A Pact for Colombia, a Pact for Equity* and the Ministry of Health's (MOH) recently launched Observatory for Health Inequality Measurement and Equity Analysis [26,27]. This Observatory is responsible for monitoring, measuring, and explaining observable, unjust, and avoidable differences in health resulting from social disadvantages [26,27]. Colombia's EPI employs a variety of strategies for identifying coverage gaps, such as health situation analyses and rapid coverage monitoring. Additionally, the MSPS and EPI cooperate closely with PAHO for multi-level capacity building activities. Recent cooperative engagements include the 2020 "First National Workshop for Strengthening Capacities for Measuring, Analyzing and Monitoring Social Inequalities in Immunization" and the development of Colombia's *National Immunization Equity Booklet* [28]. The objectives of these national and multi-level initiatives are to develop equity-focused tools and resources and increase technical capacity for the identification, measurement, and monitoring of social inequalities impacting immunization to support the achievement of universal immunization coverage.

Workshop Monitoring Equity

The March 2020 Workshop, attended by national officials from the EPI, Epidemiology, Health Promotion and Prevention, the National Department of Planning, and subnational EPI directors from each of Colombia's 32 departments, focused on strengthening analytical capabilities to generate evidence on the presence, magnitude, and impact of social inequalities on immunization coverage. The workshop provided conceptual and methodological training on the analysis of social inequalities in health through theoretical presentations, live demonstrations of innovative tools and technical procedures, and hands-on, team-based exercises with subnational immunization data. Subnationally, departmental EPI directors discussed engaging with community leaders and stakeholders of underserved populations, particularly in difficult to access areas and with indigenous populations, to strengthen immunization sensitization and outreach efforts to bolster vaccine demand and uptake. Nationally, such efforts are supported by the "Vaccination Without Barriers" campaign, which aims to ensure vaccine access to any citizen, regardless of their insurance status, through data-informed outreach activities. As participants explained, vaccination opportunities for underserved populations in hard-to-reach parts of the country often only arise through extramural vaccination taking place outside the clinic setting, such as on-site vaccination and community outreach brigades. In indigenous communities, departmental EPI directors described planning these actions with local leaders to ensure community access and acceptance and underscored the multi-level, inter-institutional nature of such collaboration, engaging sectors such as education and indigenous affairs to increase the pro-equity impact of EPI outreach efforts.

National Immunization Equity Booklet

The *National Immunization Equity Booklet* was jointly designed by Colombia's MSPS and PAHO to provide an innovative tool to inform equity-focused immunization program planning based on the identification of social inequalities in subnational coverage of routine vaccines based on the Sustainable Development Index (SDI). SDI is a synthetic index constructed by integrating three proxy indicators of the three dimensions of sustainable development: the municipal per capita economic importance index (economic dimension), school survival rate (social dimension), and drinking water coverage (environmental dimension). SDI computation is based on calculating a normalized index for each dimension of sustainable development, with a range 0 to 1, the higher the index, the higher the degree of sustainable development [28]. Alongside providing a panorama of SDI-stratified immunization coverage across 1,122 municipalities, special districts, and township, the collaborative development of the Booklet also served as practical training and capacity-building for MSPS personnel. A departmental EPI director reflected on the value of the Booklet and its innovative methodology,

It's a great tool. It's vital because, in a way, it helps us explain why, for example, in my case [department], why some municipalities meet their targets and others don't. I have very extreme coverage. In some places it's very high and in others, it's very low. Usually when you try to find a subjective explanation, it's very difficult, but if we incorporate this [SDI], it is easier to understand why these coverages behave the way they do.

3.1.2. Challenges encountered

Participants acknowledged challenges to implementing the monitoring of social inequalities impacting immunization at the

local level (i.e., municipalities and districts). One of the main challenges was a scarcity of adequately trained personnel at the local level, as heavy workloads in routine tasks and considerable staff turnover complicate the sustainability of such capacity building. Another challenge was the necessary political support from local decision-makers for the execution of immunization activities based on inequality monitoring, particularly as accessing remote areas where transportation demands increased investment. Inade-

quate provider networks in some jurisdictions, poor compliance of some health service providers, and a shortage of vaccinators were also discussed as hampering local-level capacity for identifying and addressing social inequalities in immunization.

3.1.3. Lessons learned

As a result of these challenges, local-level implementation of these techniques is on-going and technical capacity remains tenu-



Fig. 1. Map of Guyana, including Regional Divisions [32].

ous. Accordingly, participants at all administrative levels noted the need for consistent, multi-level actions and commitments to support local implementation and sustainability. Ensuring technical capacity and data use at the district and municipal levels was an important lesson learned. Due to the complexity and novelty of the techniques for identifying and monitoring social inequalities in immunization, training activities and steady multi-level support were indicated as important for effective local-level implementation. Continuing the flow of technical cooperation to municipal and district actors was highlighted as an ideal solution, given PAHO's commitment to capacity building, close cooperation between regional and national levels, and the engagement with departmental EPI directors. Additionally, participants underscored the need to sensitize subnational and local-level decision-makers and funders to the value of monitoring these inequalities to guarantee local prioritization and political commitment. Vaccinators are targeting underserved and under-vaccinated populations through immunization outreach and extramural vaccination in collaboration with community leaders and local stakeholders but challenges persist. Reinforcement from municipal and district-level decision-makers and funders, such as ensuring trained personnel and transportation resources, would help advance health equity on the ground by strengthening data-driven outreach and pro-equity EPI programs.

3.2. Guyana

The case study documented the equity-focused response to concurrent diphtheria, measles, and yellow fever outbreaks, beginning in 2016, 2017, and 2018, respectively, in LAC, including the neighboring countries of Venezuela, Brazil. Following the declaration of an emergency situation on March 22nd, 2018, Guyana began strategic emergency response planning targeted at ensuring immunization equity among high-risk border communities and migrant populations to prevent the importation of cases. As of December 2020, the country had not reported a single confirmed case of measles, diphtheria, nor yellow fever.

3.2.1. Intersectoral collaboration and community partnerships to strengthen emergency response

Multi-level, intersectoral collaboration and community partnerships were key to the success of Guyana's Emergency Response Plan (ERP). Planning began with the establishment of the Inter-Agency Coordinating Committee on Immunization (ICC), composed of the MOH's Chief Medical Officer and key personnel from the EPI, the Ministry of Indigenous People's Affairs (MIPA), and the PAHO country office, among others. ICC organized rapid assessments in four of the country's 10 Regions, specifically the Regions of Barima-Waini, Potaro-Siparuni, Cuyuni-Mazaruni, and Upper Takutu-Upper Essequibo, which border Venezuela and Brazil (see Fig. 1 for details).

Rapid Assessments

Conducted in collaboration with subnational and local authorities, including Amerindian Village Councils and *toshaos* (community leaders), border personnel, such as local law enforcement, army, and immigration officers, and CHWs, rapid assessments involved visits to health facilities, migrant points of entry (POEs), and border communities to assess VPD risks, evaluate emergency response capacity, and mobilize community partnerships. During assessments, intersectoral collaboration facilitated data sharing, access to POEs, verification of immunization status of high-risk border personnel, and engagement with local stakeholders and potential collaborators. For example, border personnel accompa-

nied ICC assessment teams to POEs to ensure access to migrant registration records for analysis of entry patterns and registration procedures as well as triangulation with health facility data. Border personnel and *toshaos* also identified unofficial POEs for evaluation of additional points of VPD vulnerability. Community partnerships also provided valuable local insights alongside access to Amerindian communities. Village Council members were invited to rapid assessment briefings to ensure the inclusion of their perspectives and foster engagement with assessment activities, including sharing local documentation of VPD-related symptoms and migrant entry patterns in their communities. Following rapid assessments, findings were presented to intersectoral and community partners to collaboratively interpret findings and discuss plans of action.

National-Level Informed Decision-Making

At the national level, findings informed MOH decision-making regarding the focus of ERP activities, including high priority areas, vaccination strategies, human resource needs, vaccine requirements, and cooperative partnerships. Intersectoral collaboration was formalized through the establishment of the Multi-Agency Coordinating Committee for Addressing the Influx of Migrants into Guyana (MACC), which included representatives from the EPI, the Department of Citizenship and Immigration (DCI), Port Authority, and the MIPA, among others, as well as external agencies, like Unicef and the International Organization for Migration. Meeting bi-weekly, the MACC provided an inter-agency platform for coordinating ERP activities, consolidating resources, and sharing data to ensure an integrated approach to addressing VPD risks and migrant needs. For example, it was agreed that the DCI and MOH would provide official data on incoming migrants for the MACC to streamline the development of a shared data repository. An MOH representative explained, "With that committee, we were able to identify as a *team*, as a country team, how it is that we will reprogram our pathways so that we can benefit each other in our responses."

Strategies for the Emergency Response Plan

Three strategic areas were identified for the ERP: 1) enhancing surveillance capacity and practices, 2) improving diphtheria, measles, and yellow fever vaccination coverage among at-risk populations, and 3) expanding EPI services to reach migrant populations. Successful implementation of these strategies relied heavily on the participation of intersectoral and community partners. The first strategy, enhancing surveillance capacity, included daily disease surveillance reporting and the standardization of POEs migrant registration procedures, and involved VPD sensitization and training on surveillance practices, reporting systems, and emergency response procedures with existing healthcare personnel alongside border personnel, port authority officers, and Village Council members. Public health training at POEs focused on recognizing VPD risks and symptoms of concern, immunization status verification procedures, and instituting migrant health referral practices.

The second strategy, improving coverage among at-risk populations, required widespread immunization promotion, mop-up activities in border communities, and vaccination campaigns among first-contact individuals, such as border personnel and tourism and transportation workers. National authorities acquired vaccine supplies, equipment, and funding for additional healthcare workers, while subnational and local public health personnel coordinated the implementation of ERP activities with *toshaos*, border personnel, and other collaborators. Critical to the effective execution of vaccination mop-ups in border communities was the sup-

port of Village Councils who promoted vaccine awareness in their communities based on their sensitization and training experiences and aided in the coordination and local notification of upcoming visits.

The third strategy sought to expand EPI services along the border through health facility improvements, integration of vaccination services with maternal and child health outreach activities, and intersectoral collaboration for migrant outreach and referral. Fixed-term healthcare personnel, including many recently retired nurses, were hired to support ERP outreach and heightened surveillance. In border health facilities experiencing heavy migrant influxes, permanent staff were hired and cold chain capacity was strengthened, including installation of solar fridges for on-site vaccination storage in facilities that previously had to rely on air, river, and land transport of vaccines from the capital. Such improvements were crucial to effectively accommodate the increased demand for immunization services along Guyana's borders, especially following the establishment of referral procedures with border personnel to facilitate migrant use of health services. Healthcare workers also described coordinating with border personnel, port authorities, and Village Councils for immunization outreach upon the arrival of migrant groups, reducing the burden on migrants and facilitating vaccinator contact. Additionally, Village Councils were described as supporting migrant tracking for vaccination follow-up in their communities through responsive, informal data sharing of movement in and out of these closed communities as well as providing linguistic support, particularly for Warao-speaking migrants.

3.2.2. Challenges encountered

Access and outreach to border communities and POEs were challenged by time-consuming travel and difficult-to-navigate terrain as well as weather-related complications washing out roads and overflowing and/or drying out waterways. These issues also complicated cold-chain maintenance, strained limited transportation, and increased competing demands on healthcare personnel, which were further exacerbated by linguistic barriers associated with caring for the migrants, as Guyana is the sole English-speaking country in South America surrounded by Spanish, Portuguese, and Dutch-speaking nations.

3.2.3. Lessons learned

Intersectoral collaboration and community partnerships were crucial to addressing these challenges as well as the overall success of the ERP, leading to several lessons learned. First, optimizing limited resources and effectively targeting vulnerable areas and high-risk populations require data-driven decision-making, for which intersectoral data sharing is crucial. Participants throughout this case study highlighted the value of the collaborative rapid assessments in providing critical data for the establishment of ERP priorities and strategic responses to local-level challenges, like cold chain improvements and additional healthcare personnel. Moreover, the integration of ERP activities with the existing EPI structure was described as an important and cost-effective benefit, leveraging established data practices, distribution networks, outreach programming, and healthcare personnel. The EPI Manager who oversaw the ERP explained,

“The good thing is that we did not really go outside of the normal EPI program for this emergency response plan. The distribution and logistics are done through the normal system that we have. ... The reporting format remains the same, it's just that it's being done on a more regular basis, and the active surveillance, that was just heightened. ... It was a strength because the costs were drastically reduced by utilizing the same systems and personnel that we have.”

Lastly, participants consistently explained that public health and immunization equity are not isolated to the health-sector and highlighted the value of intersectoral collaboration and community partnerships for enhancing emergency response capacity and expanding data availability at all levels. Indeed, such partnerships helped address initial challenges of limited data on border communities and migrant populations through informal data sharing of unofficial migrant POEs, notification of newly arriving migrants to Amerindian villages and border towns, and movement out of these communities, which also aided patient tracking of migrants and Amerindian populations. Similarly, the collaborative establishment of migrant health referral practices and outreach coordination with border personnel and Village Councils amplified immunization promotion efforts among migrants.

3.3. Sucre, Bolivia

In 2008, Bolivia implemented the Family, Community, and Intercultural Health Model (*Salud Familiar Comunitaria Intercultural*—SAFCI, acronym in Spanish), providing a framework for public participation in the management and monitoring of the public health system. The case study in Bolivia documented the city of Sucre's application of the SAFCI model to promote equity during the introduction of the HPV vaccine.

3.3.1. Promoting vaccine access and uptake through intersectoral collaboration and civil society participation

In 2017, Bolivia began nationwide introduction of the quadrivalent HPV vaccine, targeted at girls 10–12 years of age, through school-based vaccination campaigns supplemented by on-demand health center vaccination and outreach brigades. In the city of Sucre, located in the department of Chuquisaca, effective intersectoral collaboration and civil society participation at all administrative levels were critical to promoting equitable access to and uptake of the HPV vaccine. While agreements between the MOH and Ministry of Education were nationally established, inter-institutional collaboration and joint operational planning for school-based vaccination campaigns were carried out by health and education authorities at the subnational and local levels.

Planning and Data Sharing

Data sharing for health center micro-planning was supported by Sucre's municipal government and District Office of Education (DOE), which provided a survey of all active educational units, including contact information, enrollment data, and estimated time and human resource requirements. Such information allowed for the assignment of educational units to nearby health centers to facilitate joint campaign planning and data sharing, which included student census by school. Health center staff, school faculty, and SAFCI-based local health committees (CLS, acronym in Spanish) jointly organized parental HPV orientation sessions; prepared campaign supplies and data recording materials; coordinated vaccination visits; and planned social mobilization strategies — a critical aspect of which was engagement with Sucre's School Board Association to foster peer-to-peer vaccine promotion and public sensitization. The Association's president recalled meeting with EPI representatives,

“They explained to me the scope of the vaccine, its characteristics, and then workshops were conducted. ... And then we authorized them to enter, one, the educational units, and two, the different training workshops. ... In parallel to the explanations given to me by the vaccination officials, we had to do outreach as parents, and mostly top-down. ... We had to explain

why the vaccine was being given, we tried to conduct wide-spread socialization.”

Other civil society allies, including the Chuquisaca chapter of the Confederation of Indigenous Peasant Women of Bolivia “Bar-tolina Sisa” and the Chuquisaca Pediatric Society, also participated in HPV vaccine orientations and led community-based immuniza-tion promotion within their areas of influence. Complementing these efforts, the EPI collaborated with local media to further expand the reach of HPV vaccine messaging.

School-Based Campaigns

School-based vaccination campaigns, which included detailed data recording and campaign monitoring, were collaboratively executed by health center personnel and their education counter-parts, while CLS, school boards, and other civil society allies contin-ued parental sensitization to promote equitable vaccine demand and uptake. To further ensure access equity, school faculty and civil society groups assisted health center personnel with identifying and contacting vaccine-eligible students who had missed cam-paign days as well as non-enrolled individuals. Health sector par-ticipants also described triangulating intersectoral data sources to verify coverage accuracy and identify unimmunized girls for tar-geted outreach with civil society partners.

Partnerships for the Dissemination of Information

Intersectoral and civil society partnerships also helped sustain the dissemination of clear and accurate information about the bur-den of cervical cancer and the benefits of the HPV vaccine. Health, education, and civil society participants consistently referenced the importance of such widespread and persistent messaging to alleviate hesitancy and promote informed decision-making in the face of growing disinformation and anti-vaccination propaga-nda, particularly on social media platforms. Collaborations with the Chuquisaca Pediatric Society, the Regional Immunization Commit-tee, and local media were also crucial for investigating events sup-posedly attributable to vaccination or immunization (ESAVIs) and notifying the public with accurate, evidence-based information through official press releases and news media interviews. Such strategic alliances reinforced peer-to-peer information sharing and community-based immunization promotion, resulting in con-sistent, unified messaging about the HPV vaccine, which helped ease public concerns and vaccine hesitancy. Sucre’s collaborative approach to promoting the HPV vaccine undoubtedly played a sig-nificant role in the department of Chuquisaca’s high coverage and low dropout during the 2017 introduction (HPV-1 at 89.5% and HPV-2 at 86.5%, compared to nationwide HPV-1 at 82.4% and HPV-2 at 69.8%).

3.3.2. Challenges encountered

Initially, the establishment of denominators for school-based HPV vaccination visits presented challenges as the EPI typically uses national census data to establish target populations for rou-tine immunizations. Health-sector personnel alluded to national census data quality concerns due to high internal migration and decennial data collection, further complicating the use of these data for school-based vaccination planning. Additionally, although the EPI was successful in effectively establishing a variety of strate-gic alliances, participants from the education sector and civil soci-ety organizations mentioned the potential for improving the provision of immunization information to the general public. Non-health sector case study participants acknowledged sufficient immunization knowledge personally but noted the challenge of ensuring adequate and accurate information at the individual level

in the face of growing misinformation about vaccines that gener-ates confusion and vaccination hesitancy. During a focus group, a school board parent explained,

“I think that they [vaccine hesitant parents] get upset because they don’t have *adequate* information about vaccines, and by coming here, to the assemblies, the meetings, they are better informed, and that when parents become more flexible and agree to vaccinate their children.”

3.3.3. Lessons learned

The introduction of the HPV vaccine in Sucre was among the most successful in the country, and intersectoral collaboration and civil society engagement were vital to supporting equitable vaccine access and demand to achieve high and homogenous cov-erage across the health districts of Sucre. Based on this experience, three key lessons learned emerge. First, parents, educators, and healthcare workers alike emphasized the benefits of school-based vaccination both for parents and vaccinators, by reducing the bur-den associated with individual vaccination visits and outreach activities. In fact, following the 2017 HPV vaccine introduction, Sucre’s EPI leveraged the newly established strategic alliances to strengthen the practice of verifying vaccination status at school enrollment and promote equity in routine vaccinations, including through school-based vaccination. A health sector representative reflected on the effectiveness of school-based vaccination campaigns,

“We get to the school, and of course the principal *knows* that we’re coming in. The teacher *knows*. The school board *knows*. The parents *know*. . . . In the end, everyone has consented to have their children vaccinated So, it [school-based vaccina-tion] has definitely served us well as something very, very, very effective.”

Secondly, as the initial denominator challenge showed, the intersectoral collaboration involved in school-based vaccination facilitates multi-level data sharing for improved data accuracy in campaign planning and coverage monitoring. Lastly, participants highlighted the importance of educating and empowering commu-nity leaders and stakeholders, including teachers, civil society organizations, and parents. Doing so expands the reach and influ-ence of immunization promotion and sensitization efforts by lever-aging the trust and respect of allies to broadly and effectively inform the public, counter misinformation, and alleviate vaccina-tion hesitancy. Indeed, such continued community-based and peer-to-peer immunization information sharing reinforced the information provided by the health sector and contributed to the promotion of a culture of vaccination uptake and VPD prevention.

4. Discussion

Findings provide first-hand insight to support the planning, development, and implementation of equity-focused COVID-19 vaccine policies and practices in LAC, where vaccine rollout is still in the early stages, with two-thirds of countries reporting less than 10 cumulative doses administered per 100 people [16]. These case studies are valuable examples of people-centered, partnership-based, country-owned, and data-guided approaches to promoting vaccine equity, particularly in underserved areas, reflecting the core principles of the IA2030 [1].

Colombia’s national leadership and commitment to achieving immunization equity through multi-level partnerships and techni-cal capacity building for monitoring social inequalities impacting immunization is commendable. However, municipal and district-level challenges have impeded comprehensive implementation

and sustainability of such equity monitoring, resulting in collaborative, inter-institutional extramural vaccination efforts falling short of their full potential in achieving immunization equity. In contrast, Guyana's equity-focused ERP strengthened local-level EPI capacity based on data-driven decision-making to promote immunization equity among border communities and migrant populations. Intersectoral and community collaboration were fundamental to Guyana's comprehensive approach to protecting its populations and borders against neighboring measles, diphtheria, and yellow fever outbreaks through widespread and streamlined data sharing, integrated migrant and health surveillance efforts, and the overall coordination and consolidation of personnel and resources. Similarly, in Sucre, Bolivia, intersectoral collaboration and civil society engagement contributed to the high coverage and low dropout achieved during the 2017 introduction of the HPV vaccine. Such strategic alliances provided a multi-pronged approach to promoting equitable vaccine access and demand through school-based vaccination, formal and informal vaccination sensitization and information sharing, and intersectoral data sharing.

Implications for COVID-19 vaccine equity

Indeed, multi-level, intersectoral strategic alliances with education, indigenous affairs, civil society organizations, and community leaders, among others, are shared across Colombia, Guyana, and Bolivia's strategic approaches to promoting immunization equity. The value of such strategic alliances become all the more important within the current context of the COVID-19 pandemic and vaccine rollout. Global distribution of COVID-19 vaccines must be equitable within and across nations in order to effectively protect the global population [1,12]. The jointly developed Vaccine Introduction Readiness Assessment Tool (VIRAT), which has been translated to Spanish, Portuguese, and French, facilitates the self-assessment of country readiness and provides a roadmap to guide the planning and preparation of COVID-19 vaccine introduction, including considerations of equity and targeting of high-risk populations [29]. To monitor VIRAT implementation, PAHO has developed a Regional Dashboard that is updated weekly to help identify and address multi-level technical cooperation needs in LAC regarding the preparation for and distribution of COVID-19 vaccines [30]. Reflecting the issues addressed in the case studies presented in this article, self-identified areas for additional strengthening include human resources, generating vaccine demand, and community engagement and communication. Moreover, as the Colombia case study underscores, coverage monitoring is crucial for identifying and reducing immunization inequalities. Accordingly, PAHO is monitoring COVID-19 vaccine rollout in member countries through weekly analysis of reported data, which are uploaded to a publicly available database to support data transparency and multi-level cooperation [16].

The lessons learned are relevant to promoting COVID-19 vaccine equity. First, addressing equity requires relevant data to identify, measure, and monitor coverage inequalities in order to target underserved populations, funnel resources towards addressing these gaps (e.g., health facility strengthening, increased extramural vaccination activities, etc.), and evaluate progress. Intersectoral data sharing strengthens such data-driven decision making by expanding data availability and facilitating data triangulation, as illustrated by Guyana's experience analyzing POE migrant flows alongside health facility immunization capacity and Sucre's use of school census data for vaccine forecasting as well as data quality verification. Similarly, multi-level partnerships can strengthen technical capacity for measuring and monitoring immunization inequalities, as illustrated by Colombia's regional, national, and

subnational coordination. However, as Colombia's experience shows, capacity building must continue to the local level to support vaccinators on the ground, requiring not only multi-level coordination, but also political commitment at all levels.

Second, improving equitable immunization access should move beyond facility-based services to involve intersectoral, extramural group-focused immunization services where vaccine recipients commonly gather. Bolivia's school-based vaccination campaigns highlight the value of such extramural efforts in an urban environment, while Guyana's coordination with border personnel to meet arriving migrants and with Village Councils for mop-up campaigns show innovative approaches to improving immunization access in rural and remote areas and among underserved and hard-to-reach populations. The extramural immunization services discussed also illustrate the importance of adapting such outreach strategies to the needs and contexts of the communities they seek to serve. Moreover, as participants in Guyana's case study emphasized, integration of emergency response with the existing EPI structure leverages existing systems, practices, and personnel and reduces additional costs and redundancies.

Finally, strategic alliances with intersectoral and civil society partners are effective, multi-pronged methods for promoting immunization awareness, sensitizing the public to routine and novel vaccines, and countering misinformation about vaccine safety and effectiveness [31]. In the case of Sucre, the collaboration involving the education sector, the School Board Association, local media, and other civil society organizations for the introduction of the HPV vaccine exemplifies the contributions of such strategic alliances, though their value is evident across all case study countries. Community-engaged strategies like these also expanded the nature and reach of immunization promotion and sensitization messaging to include social and peer-to-peer communications, which are crucial for ensuring all stakeholders are informed. Moreover, such strategic alliances are grounded in the understanding that it is the responsibility of public health institutions and their allies to build and sustain confidence and understanding in health interventions, including immunizations, in order to alleviate vaccine hesitancy and facilitate informed decision-making to increase equitable vaccine uptake and demand.

Limitations

Several limitations to this research must be acknowledged. While these case studies collected rich, in-depth qualitative data on strategies for promoting immunization equity, they were not meant to measure the impacts of these approaches. A lack of quantitative data as well as the on-going and diffuse nature of the strategies made it difficult to isolate their specific impacts for measurement and/or comparison. Impact studies are needed to understand the quantitative contributions of such strategic multi-level, intersectoral and civil society alliances to immunization equity. Nonetheless, the qualitative insights documented by these case studies show the practical significance of such approaches as well as their public acceptability. Additionally, it is important to note the scarcity of COVID-19 vaccination data, particularly in low and middle-income developing nations, at the time of this paper's writing, which makes evidence-base decision-making and evaluation of interventions difficult without comprehensive, reliable data.

5. Conclusion

Achieving high and homogenous national and subnational immunization coverage requires the strengthening of existing immunization activities as well as innovative immunization pro-

motion strategies [1–3,14,16]. To ensure that no one is left behind and that everyone, everywhere benefits from vaccines, both routine and for COVID-19, countries must ensure high and homogeneous coverage across nations and in all communities. Reflecting the IA2030 principles of people-centered, partnership-based, country-owned, and data-guided strategies, Colombia, Guyana, and Bolivia's experiences with promoting immunization equity through strategic multi-level, intersectoral and civil society alliances should be helpful to other countries as they plan, develop, and implement equity-focused vaccine policies and practices.

Funding

This research was made possible thanks to funding provided by Gavi, the Vaccine Alliance (#OPP1159427).

CRediT authorship contribution statement

MVG, MC, and RM conceptualized the study and ILC designed the study and its methodology. ILC led the investigation, including in-country data collection and data analysis. RM, JR, and JPA supported the investigation's data collection and analysis. ILC conceptualized, wrote, and revised the paper with support from RM, JR, and JPA. MVG and MC edited and provided feedback. All authors have reviewed and approved the final version of the manuscript. All authors attest they meet the ICMJE criteria for authorship.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank the national officials, subnational authorities, and local health workers in Colombia, Guyana, and Bolivia for their participation in these case studies as well as Sucre's social structure actors, education sector participants, and civil society representatives from the Bolivian Pediatric Society, Chuquisaca's Confederation of Indigenous Peasant Women of Bolivia "Bartolina Sisa," and Sucre's School Board Association. We would also like to express our gratitude to Dr. Oscar Mujica, Regional Advisor for Social Epidemiology and Health Equity, and to Claudia Moreno, consultant for the Department of Evidence and Intelligence for Action in Health of the Pan American Health Organization, for their joint work in carrying out the workshop on Measurement, Analysis, and Monitoring of Inequalities in Immunization in Colombia. Likewise, for the intellectual production of the National Immunization Equity Booklet, which uses the Sustainable Development Index to measure equity in the country. Without the cooperation and collaboration of all partners, including members of the Pan American Health Organization and Gavi, the Vaccine Alliance (#OPP1159427), these case studies would not have been successfully completed.

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