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Opinion and analysis

Recommendations for modernizing infant vaccination schedules with combination vaccines in Colombia and Peru

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ABSTRACT The objective of this article was to consider the vaccination challenges in Colombia and Peru and the role of pediatric combination vaccines in overcoming these challenges. Barriers to including new vaccines with more antigens remain apparent in parts of these countries, where vaccine-preventable diseases in infants continue to be a major problem. The challenges include the heterogeneity of vaccine coverage within each country and in neighboring countries, which can contribute to poor rates of vaccination coverage; the adverse impact of the inward migration of unvaccinated individuals, which has favored the re-emergence of vaccine-preventable diseases; vaccine shortages; and the impact of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic and the associated shifts in health care resources. To improve the coverage of pediatric vaccines in Colombia and Peru, it will be necessary to ensure the widespread integration into vaccine schedules of combination vaccines containing diphtheria, tetanus, acellular pertussis, inactivated poliovirus, *Haemophilus influenzae* type b and hepatitis B antigens with a three-dose primary series delivered at 2, 4 and 6 months of age followed by a booster at 18 months of age. Such vaccines play important roles in preventing diphtheria, tetanus and pertussis; eradicating polio; and providing boosting against *H. influenzae* type b.

Keywords Combined vaccines; immunization schedule; vaccines; vaccine-preventable diseases; Colombia; Peru.

Globally, vaccination prevents an estimated 2–3 million deaths per year, contributing significantly to the increase in life expectancy in developed countries in the 20th century (1). Pediatric combination vaccines have been pivotal in achieving and maintaining low global incidence rates of infectious childhood diseases, such as diphtheria, tetanus, pertussis, polio, hepatitis B and *Haemophilus influenzae* type b (2). However, although such vaccines have helped to reduce regional disparities in disease prevalence and are increasingly the standard of care worldwide (2), barriers to use remain in some areas, where vaccine-preventable diseases in infants continue to be a major problem.

The United Nations aims to end deaths from vaccine-preventable diseases in newborns and children aged <5 years

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by 2030 (3); this commitment includes targets to reduce neonatal mortality to ≤12 per 10 000 live births and mortality among children aged <5 years to ≤25 per 1 000 live births by the same year (3). In line with these goals, the World Health Organization (WHO) has an objective of achieving ≥95.0% coverage of all vaccines in the Expanded Programme on Immunization (EPI) to eliminate vaccine-preventable diseases in all WHO regions (4).

Colombia implemented a 4-year development plan (2018–2022) to reduce childhood mortality, and programs in Colombia and Peru are aligned with the EPI goals (5). However, in both countries modernization and simplification of pediatric vaccination practices are needed to achieve these objectives.

Experts in pediatric vaccination from Colombia and Peru (the authors) were convened to discuss the current challenges to achieve the goals for pediatric vaccination and to evaluate the benefit of using combination vaccines to combat the challenges in these countries.

The objective of this article is to consider the challenges to vaccination in Colombia and Peru and the role of pediatric combination vaccines in overcoming these challenges.

VACCINATION CHALLENGES

Vaccination coverage

In a population-based study performed in Colombia in 2012 that included 18 232 children aged <6 years, 51.1% did not receive a pentavalent vaccine (containing diphtheria and tetanus [DT], whole-cell pertussis [wP], hepatitis B vaccine [HepB] and *H. influenzae* type b [Hib]) on time; 55.6% did not receive the 18-month booster on time; and 38.2% did not receive the 5-year booster on time (6). The overall vaccine coverage rate (VCR) was 78.1%, with lower VCRs for vaccines that had been introduced more recently (6).

Heterogeneity in VCRs is seen in both Colombia and Peru, and it favors the re-emergence of vaccine-preventable diseases. In Peru, coverage with three doses of the DTP vaccine (diphtheria–tetanus–pertussis, or DTP3) declined from 90.8% in 2015 to 88.6% in 2016 and to 83.0% in 2017; it then increased to 84.0% in 2018 and to 88.0% in 2019 before declining again to 72.2% in 2020 (7). In Colombia, heterogeneity has been reported between municipalities, with absolute coverage ranging from 46.0% to 90% and timely coverage ranging from 8.0% to 52.0% (6). In some states the situation is critical, with low coverage and high levels of inequity.

An important factor contributing to the low VCR in Peru is the regional decentralization of vaccination activities and challenges to vaccination coverage in general, including difficulties in accessing vaccination services, supply shortages and budgetary constraints. In addition, sociodemographic and economic inequities contribute to low vaccination coverage and delayed vaccination, and particular challenges for Colombia and Peru include the large-scale migration of people from neighboring countries where vaccination coverage may be lower, with the consequent risk of the re-emergence of previously eliminated or well-controlled infectious diseases.

Vaccine shortages

Ambitious vaccination programs require an adequate vaccine supply. The effect of disruptions to vaccine supplies was illustrated in 2016 when countries were required to migrate from the oral poliovirus vaccine to the inactivated poliovirus vaccine (IPV) in the context of the Global Polio Eradication Initiative. The sudden increase in demand for IPV was not matched by an increase in vaccine production and supply, leading to a 49.0% reduction in the projected number of doses so that approximately 42 million children in 36 countries did not receive the planned IPV doses. As a consequence, wild polioviruses and vaccine-related cases persisted (8).

Neighboring countries

The heterogeneity of vaccine coverage in neighboring countries, as well as human migration patterns and humanitarian crises, can have an impact on national VCRs.

Humanitarian crises, such as those that have occurred recently in the Bolivarian Republic of Venezuela, therefore, are likely to affect neighboring Colombia. In the Bolivarian Republic of Venezuela in 2018, coverage for most biologicals was <70.0%, and it was critical for poliovirus vaccine (53.0%) and DTP (60.0%), with measles and diphtheria outbreaks occurring in 2016. This led to an increase in the incidence of confirmed measles and diphtheria cases in Colombia during 2018–2019 (9). In addition to the effects of migration, imported cases from the Bolivarian Republic of Venezuela, Italy and Spain led to a measles outbreak of 38 cases in Peru in 2018, which was controlled by the intensification of vaccination and epidemiological surveillance activities (10).

Impact of the COVID-19 pandemic

The shift in public health resources to control the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has led to disrupted or reduced vaccination schedules, and a diphtheria outbreak occurred in Peru in the middle of the pandemic, highlighting the need to include the maintenance and modernization of national vaccination programs in future pandemic preparedness plans.

Both Colombia and Peru experienced significant drops in vaccination coverage during the pandemic in 2020 of approximately 14.4% and 18.0%, respectively (7, 11). In Colombia, rural areas have been disproportionately affected, with marked differences in VCRs between 2019 and 2020, when comparing the Amazonian and Eastern Plains regions with the predominantly urban Andean region, and these areas must be a focus of vaccination efforts (11). Their respective national ministries of health, as well as WHO and the Pan American Health Organization recognized that the continuity of vaccination programs is critical, and it is necessary to develop catch-up strategies to increase VCRs (11). This continuity can be facilitated by using combination vaccines, which can improve the VCR over time. By December 2020, VCRs had improved in Colombia, with only an approximately 6.0% drop compared with prepandemic levels.

COMBINATION VACCINES AND THEIR ROLE IN VACCINATION COVERAGE

Combination pediatric vaccines based on a DT and acellular pertussis (aP) antigenic backbone are increasingly the standard of care globally (2). The inclusion of IPV, hepatitis B and Hib antigens is commonplace, and the resultant hexavalent

DTaP–IPV–HepB–Hib vaccines are associated with a variety of benefits to social and health systems, including a simplified vaccination schedule that uses the same vaccine for primary and booster vaccinations (2). These vaccines are associated with reduced distress for the child who receives fewer injections, and the delivery of more antigens in a single injection improves adherence to the vaccination schedule.

Such vaccines are essential to successfully implement infant primary and booster vaccinations and are crucial for achieving the target VCRs.

In the context of the COVID-19 pandemic, with the associated reductions in vaccination coverage from a baseline that was already suboptimal, as was the case in Peru, the use of hexavalent vaccines is important to optimize antigenic coverage and avoid the re-emergence of diseases. The safety and immunogenicity of these vaccines have been demonstrated in extensive clinical development programs, and these are not affected by coadministration with other biologicals, making them easy to fit into existing vaccination regimens. However, the economic aftermath of the COVID-19 pandemic may present a challenge to countries that buy their own vaccines in terms of procuring hexavalent vaccines for their pediatric vaccination programs.

Improved VCRs depend on improving access to combination vaccines, and this access should be strengthened to ensure that the benefits of combination vaccines in terms of improving vaccine coverage are fully realized. Measures to improve access to vaccines include extending opening times for vaccination centers, implementing vaccination days in schools, ensuring adequate availability of vaccines and using social media and networks based in the community to mobilize and empower communities by dispelling fears of harmful vaccine-related reactions and a lack of trust based on misinformation, as well as countering the feeling that vaccine-preventable diseases no longer exist. Additionally, it is important that pricing remains sustainable by ensuring access to different vaccines from multiple manufacturers, and mechanisms for approving vaccines by regulatory agencies should be simplified (12).

HEXAVALENT VACCINES CONTAINING INACTIVATED POLIOVIRUS

The cessation of use of the oral poliovirus vaccine, which eliminates the possibility of circulating vaccine-derived polioviruses and vaccine-associated paralytic polio, and the switch to a full IPV schedule in pediatric vaccination programs supports the objectives of the Global Polio Eradication Initiative. Such a strategy is cost effective and is crucial in making progress towards polio eradication rather than control (13).

To achieve high IPV coverage, combination vaccines that contain IPV are recommended. This approach relies on fewer injections and, therefore, ensures better adherence than separate IPV administration. Furthermore, using a combination vaccine reduces the risk of the vaccine shortages that have occurred with the stand-alone IPV and can also reduce the costs associated with adverse events, errors in administration, time spent by health care professionals, and transport and cold chain logistics.

However, any problems in procuring combination vaccines – for example, in the context of the economic conditions after the COVID-19 pandemic – could potentially lead to constraints in the supply of IPV.

THE IMPORTANCE OF A *HAEMOPHILUS INFLUENZAE* TYPE B INFANT BOOSTER

Although cases of invasive *H. influenzae* type b infection significantly reduced globally after the introduction of the Hib vaccine, cases of invasive disease, such as meningitis, still occur in children aged <5 years and particularly in those aged <1 year (14).

In Colombia, the overall incidence of Hib meningitis per 100 000 has increased, being 0.02 in 2015, 0.07 in 2016, 0.1 in 2017, 0.08 in 2018 and 0.46 in 2019. Most cases occurred in children aged <5 years.

In Peru there is underreporting of *H. influenzae* type b cases, despite active surveillance. In a descriptive study of 106 children aged 3 months to 5 years before and after the introduction of the Hib vaccine, most cases occurred in children aged <24 months. However, in the postvaccination period, cases continued to occur: 18.8% of cases occurred after the introduction of the Hib vaccine (15).

In both Colombia and Peru, a three-dose primary series without a booster is used for Hib vaccination. However, since the pathology is common in infants aged >1 year, and in the absence of high-quality surveillance, it may be advisable to introduce a booster dose of Hib vaccine, as recommended by WHO in settings "where the greatest disease morbidity and mortality occur later, or where rate reductions of disease are not fully sustained after the routine use of Hib vaccine" (14).

Using the hexavalent vaccine that includes Hib will facilitate the administration of a Hib booster without the need for an extra injection, and in Colombia the three plus one schedule has been shown to result in protective antibody levels at age 5 years in a clinical trial with follow up to 4.5 years after the primary plus booster series (16). Therefore, adding a booster is considered a practical and necessary solution to reduce residual, persisting Hib disease.

BENEFITS OF INTRODUCING HEXAVALENT ACELLULAR PERTUSSIS–INACTIVATED POLIOVIRUS VACCINES INTO NATIONAL SCHEDULES

Many countries have switched from wP- to aP-containing vaccines due to the lower reactogenicity of the latter (17). Low reactogenicity (i.e. vaccine-related adverse events) is important in vaccine acceptance, and it ultimately improves adherence to vaccination schedules, as well as favoring higher VCRs.

In Colombia in 2019, the wP antigen as part of a DTwP pentavalent vaccine was the second most reactogenic of all antigens (18). Similarly, in Peru, introducing aP through the DTaP hexavalent vaccine is advised due to the reactogenicity of the wP antigen.

Additionally, the manufacturing and production processes for aP vaccines tend to be more consistent than for wP vaccines, resulting in a more reliably protective immune response for aP-containing vaccines (19).

Pertussis is a cyclical disease, with outbreaks occurring every 3–5 years in countries using wP- and aP-containing vaccines. The cause of these outbreaks is multifactorial, involving heterogeneity in case definitions and diagnostic tests, and recognition of the impact on morbidity and mortality (19). Vaccination strategies must focus on providing lifelong protection, for which multiple booster vaccinations (in the second

year of life, at school age, and during adolescence and adulthood) are needed, as well as vaccination of pregnant women and health care workers. In this context, the better acceptance and adherence gained with an aP- versus a wP-containing vaccine is vital to achieving lifelong protection against pertussis and to high population–level vaccination coverage in the long term.

ECONOMIC IMPACT OF INTRODUCING COMBINATION ACELLULAR VACCINES

The economic evaluation of vaccines must include an evaluation of hidden costs, such as savings to health care resources linked to lower vaccine reactogenicity, the loss of work days for parents, out-of-pocket expenses, and costs associated with vaccine preparation and administration (e.g. the time required for reconstitution and the associated error rates compared with the use of a fully liquid vaccine), as well as simple logistics costs (e.g. vaccine transport and documentation) and the cost of the vaccine itself (2). In Peru, and in Latin America in general, factors such as parents' time, lost work days, and costs for health care workers are not routinely analyzed, but they need to be included in any comprehensive economic evaluation. Additionally, the macroeconomic impact on behavior and societal welfare should be considered (20).

Fully liquid, aP-containing, hexavalent vaccines are more expensive than reconstituted wP-containing vaccines, which limits their implementation; however, this difference is largely mitigated by the reduced costs associated with fewer adverse events, due to the better safety profile of the aP-containing vaccine and its lower logistics and social costs (2). The indirect benefits include less time required for vaccination, fewer errors administering the vaccine, simplification of vaccination schedules, simpler supply and storage requirements, and less impact on productivity for parents. Together, these aspects lead to better vaccine acceptance, improved vaccination adherence and timeliness of vaccination, and ultimately to higher vaccine coverage and reduced disease incidence (2).

PROPOSED SCHEDULE FOR THE FULLY LIQUID HEXAVALENT VACCINE

To improve vaccination adherence and coverage, align with the objectives of the Global Polio Eradication Initiative, include a Hib booster and address challenges created by the COVID-19 pandemic, the pediatric vaccination strategies in Colombia and Peru should be modernized and simplified by using the hexavalent vaccine administered in a three plus one schedule, with a three-dose primary series delivered at 2, 4 and 6 months of age, followed by a booster at 18 months of age.

In stable preterm infants, vaccination should be done according to chronological age, so that these infants are vaccinated at the same time as they would be if born at term. It is vital to achieve and maintain high vaccine coverage in this at-risk population. Preterm infants who remain hospitalized at 2 months of chronological age should still receive the first dose at that time, and those with a history of extreme prematurity or apnea or bradycardia, or both, should be monitored for 48 hours after vaccination.

CONCLUSIONS

One of the best strategies for addressing the vaccination challenges faced by Colombia and Peru and achieving the target VCRs is to integrate the combination DT-, aP-, IPV-, Hib- and HepB-containing vaccines into the pediatric schedule. These combination vaccines play important roles in polio eradication, pertussis control and Hib boosting, as well as in reducing the window of risk for any child to contract a vaccine-preventable disease by improving vaccination adherence and timeliness. Such hexavalent vaccines are essential to successfully implement infant primary and booster vaccination programs.

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REFERENCES

1. Rappuoli R. Vaccines: science, health, longevity, and wealth. Proc Natl Acad Sci USA. 2014;111(34):12282.
2. Maman K, Zollner Y, Greco D, Duru G, Sendyona S, Remy V. The value of childhood combination vaccines: from beliefs to evidence. Hum Vaccin Immunother. 2015;11(9):2132-41.
3. United Nations Development Programme. The SDGs in action [Internet]. New York: UNDP; 2022 [cited 2022 August 18]. Available from: https://www.undp.org/content/undp/es/home/sustainable-development-goals.html
4. Pan American Health Organization. Agenda de salud sostenible para las Americas 2018–2030. Objetivo 5: medicamentos esenciales y vacunas [Sustainable health agenda for the Americas 2018–2030. Goal 5: Medicines, vaccines and technologies] [Internet]. Washington (DC): PAHO; 2022 [cited 2022 August 18]. Available from: https://www.paho.org/es/assa2030-objetivo-5
5. Ministerio de Salud y Protección Social, Colombia. Lineamientos para la gestión y adminstración del programa ampliado de immunizaciones - PAI - 2021 [Guidelines for management and administration of the Expanded Programme on Immunization – EPI – 2021] [Internet]. Bogotá: Ministerio de Salud y Protección Social; 2021 [cited 2022 August 18]. Available from: http://www.saludinfantilvalledelcauca.com/uploads/1/3/7/8/13787752/lineamientos_nacionales_pai_2021.pdf
6. Narvaez J, Osorio MB, Castaneda-Orjuela C, Alvis Zakzuk N, Cediel N, Choconta-Piraquive LA, et al. Is Colombia reaching the goals on infant immunization coverage? A quantitative survey from 80 municipalities. Vaccine. 2017;35(11):1501-8.
7. World Health Organization. Diphtheria tetanus toxoid and pertussis (DTP) vaccination coverage [Internet]. Geneva: WHO; 2022 [cited 2022 August 18].Available from: https://immunizationdata.who.int/pages/coverage/dtp.html?GROUP=WHO_REGIONS&ANTIGEN=DTPCV3&YEAR=&CODE=
8. Lewis I, Ottosen A, Rubin J, Blanc DC, Zipursky S, Wootton E. A supply and demand management perspective on the accelerated global introductions of inactivated poliovirus vaccine in a constrained supply market. J Infect Dis. 2017;216 Suppl 1:S33-9.
9. Instituto Nacional de Salud, Colombia. Boletín epidemiológico semanal: semana epidemiológica 49 (1 al 7 de diciembre de 2019) [Weekly Epidemiological Bulletin: epidemiologic week 49 (1 to 7 December 2019)]. Bogotá: Instituto Nacional de Salud; 2019.
10. Pan American Health Organization. Epidemiological update, measles (30 November 2018). Washington (DC): PAHO; 2018. https://iris.paho.org/handle/10665.2/50536?locale-attribute=pt
11. Moreno-Montoya J, Ballesteros SM, Rojas Sotelo JC, Bocanegra Cervera CL, Barrera-Lopez P, et al. Impact of the COVID-19 pandemic on routine childhood immunisation in Colombia. Arch Dis Child. 2022;107:e4.
12. Crager SE. Mejorar el acceso mundial a las nuevas vacunas: propiedad intelectual, transferencia de tecnología y vías de reglamentación [Improving access to new vaccines: intellectual property, technology transfer and regulatory pathways]. Am J Public Health. 2018;108 Suppl 6:S421-9.
13. Falleiros-Arlant LH, Gonzalez Ayala SE, Domingues C, Brea J, De Colsa-Ranero A. Current status of poliomyelitis in Latin America. Rev Chilena Infectol. 2020;37(6):701-9.
14. World Health Organization. *Haemophilus influenzae* type b (Hib) vaccination position paper – July 2013. Wkly Epidemiol Rec. 2013;88(39):413-26. https://apps.who.int/iris/handle/10665/242126
15. Benza N, Aspillaga D, Barrios M, Bueno X, Gustin R. Etiología de la meningitis bacteriana en niños entre los 3 meses y 5 años de edad en el Instituto Nacional de Salud del Niño, Lima – Perú, 2003 – 2008 [Etiology of bacterial meningitis in children between 3 months and 5 years of age in the Children's National Health Institute, Lima – Peru, 2003–2008]. Rev Peru Pediatr. 2012;65(3):144-50.
16. Madhi SA, Lopez P, Zambrano B, Jordanov E, B'Chir S, Noriega F, et al. Antibody persistence in pre-school children after hexavalent vaccine infant primary and booster administration. Hum Vaccin Immunother. 2019;15(3):658-68.
17. Aguirre-Boza F, San Martin PP, Valenzuela BM. How were DTP-related adverse events reduced after the introduction of an acellular pertussis vaccine in Chile? Hum Vaccin Immunother. 2021;17(11):4225-34.
18. Instituto Nacional de Salud, Colombia. Eventos supuestamente atribuidos a la vacunación o inmunización (ESAVI) [Adverse events suposedly attributed to immunization]. Bogotá: Instituto Nacional de Salud; 2019.
19. Cherry JD. The 112-year odyssey of pertussis and pertussis vaccines–mistakes made and implications for the future. J Pediatr Infect Dis Soc. 2019;8(4):334-41.
20. Levine OS, Bloom DE, Cherian T, de Quadros C, Sow S, Wecker J, et al. The future of immunisation policy, implementation, and financing. Lancet. 2011;378:439-48.

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Recomendaciones para modernizar los calendarios de vacunación infantil con vacunas combinadas en Colombia y Perú

RESUMEN El objetivo de este artículo es considerar los desafíos que se enfrentan en Colombia y Perú con respecto a la vacunación y el papel de las vacunas combinadas pediátricas para superar estos desafíos. Los obstáculos para incluir vacunas nuevas con más antígenos siguen siendo evidentes en algunos lugares de estos países, donde las enfermedades prevenibles por vacunación en menores de 1 año continúan siendo un grave problema. Entre los desafíos se incluye la heterogeneidad de la cobertura de vacunación en cada país y en los países vecinos, lo que puede contribuir con que se registren tasas bajas de cobertura de vacunación; el impacto adverso de la migración interna de personas no vacunadas, lo que ha favorecido la reaparición de enfermedades prevenibles por vacunación; la escasez de vacunas, y el impacto de la pandemia del coronavirus de tipo 2 causante del síndrome respiratorio agudo grave (SARS-CoV-2) y los consiguientes cambios en los recursos de atención médica. Para mejorar la cobertura de las vacunas pediátricas en Colombia y Perú será necesario integrar de manera generalizada en los calendarios de vacunación vacunas combinadas con antígenos de difteria, tétanos, tos ferina acelular, poliovirus inactivados, *Haemophilus influenzae* tipo b y hepatitis B con una serie primaria de tres dosis administradas a los 2, 4 y 6 meses de edad, seguida de un refuerzo a los 18 meses de edad. Esas vacunas desempeñan un papel esencial en la prevención de la difteria, el tétanos y la tos ferina; la erradicación de la polio; y el refuerzo contra *H. influenzae* tipo b.

Palabras clave Vacunas combinadas; esquemas de inmunización; vacunas; enfermedades prevenibles por vacunación; Colombia; Perú.

Recomendações para modernizar os esquemas de vacinação infantil com vacinas combinadas na Colômbia e no Peru

RESUMO O objetivo deste artigo foi avaliar os desafios da vacinação na Colômbia e no Peru e o papel das vacinas pediátricas combinadas na superação de tais desafios. Os obstáculos para incluir novas vacinas com mais antígenos permanecem visíveis em partes desses países, onde doenças imunopreveníveis em lactentes continuam a ser um grande problema. Os desafios incluem a heterogeneidade da cobertura vacinal dentro de cada país e nos países vizinhos, o que pode contribuir para baixas taxas de cobertura vacinal; o impacto adverso da migração interna de pessoas não vacinadas, o que favoreceu o ressurgimento de doenças imunopreveníveis; a escassez de vacinas; e o impacto da pandemia de síndrome respiratória aguda grave do coronavírus 2 (SARS-CoV-2) e mudanças relacionadas nos recursos de atenção à saúde. Para melhorar a cobertura das vacinas pediátricas na Colômbia e no Peru, será necessário assegurar sua integração generalizada em esquemas de vacinas combinadas contendo antígenos de difteria, tétano, pertussis acelular, poliovírus inativado, *Haemophilus influenzae* tipo B e hepatite B, com uma série primária de três doses aplicadas aos 2, 4 e 6 meses de idade seguidas de um reforço aos 18 meses de idade. Tais vacinas desempenham papéis importantes na prevenção da difteria, tétano e coqueluche; na erradicação da poliomielite; e no reforço contra *H. influenzae* tipo b.

Palavras-chave Vacinas combinadas; esquemas de imunização; vacinas; doenças preveníveis por vacina Colômbia; Peru.