



## EDITORIAL

# The importance of immunization as a public health instrument



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Immunization programs are considered one of the most important public health achievements in the world. Together with clean water and improved access to health care, immunizations have contributed in a definitive and relevant way to the increase in life expectancy in most countries, also resulting in reductions in the dramatic infant mortality rates recorded in the not-distant past. According to data from the World Health Organization, vaccination campaigns prevent 4 to 5 million deaths annually worldwide.<sup>1</sup>

Considered one of the most effective mechanisms in the body's defense against infections in general, vaccines, present in the history of humankind for more than two centuries, were essential to achieve the eradication of smallpox in 1980, a disease that was responsible for the death of 300 millions of people in the 20th century alone, in addition to allowing the elimination of poliomyelitis, neonatal tetanus, rubella and congenital rubella in several regions of the world. The immunization programs also contributed to the control of accidental tetanus, pertussis, measles, diphtheria, and several other diseases, once responsible for high rates of hospitalizations, sequelae, and deaths among children and adolescents.<sup>2–5</sup>

Particularly, in the last two decades, several vaccines have been developed and successfully implemented in immunization programs, such as the prevention of diarrhea caused by rotavirus, diseases associated with HPV infection, meningococcal disease, pneumococcal disease, and herpes zoster, among others.<sup>3</sup> In 2019, the implementation of the malaria vaccine was finally introduced in countries in Africa, with the potential to significantly reduce the burden of the most prevalent form of malaria in children for the first time.<sup>1</sup> Vaccine development is not restricted to the prevention of infectious

diseases, as there are several lines of research on therapeutic vaccines against chronic non-communicable diseases, including cancer, hypertension, Alzheimer's disease, amyotrophic lateral sclerosis, type 1 diabetes mellitus, and dyslipidemia.<sup>6</sup>

One of the most remarkable characteristics of certain vaccines is that they elicit such robust protection that they protect those vaccinated not only against symptomatic disease, but also from the infection and, therefore, the risk of transmitting the pathogen when exposed. Thus, when high vaccination coverage is achieved in a population through vaccines with these characteristics, it is possible to observe the presence of collective, herd immunity, causing an interruption in the circulation of the pathogen.<sup>7</sup>

The most recent and representative example of the capacity of a vaccination program to reduce the burden of disease was experienced during the current pandemic caused by COVID-19. Effective vaccines were developed, produced, and distributed with unprecedented speed, some using innovative messenger RNA technology never before incorporated into vaccine production. The COVID-19 vaccines played such a relevant role in mitigating the severe forms of the disease that we can say they changed the natural history of the pandemic. Based on official mortality data, it is conservatively estimated that the vaccines prevented approximately 14.4 million deaths from COVID-19 in 185 countries and territories in just the first year of vaccination worldwide.<sup>8</sup> Despite the substantial increase in the number of COVID-19 cases verified by the emergence of highly transmissible variants and with the capacity to escape the immune protection induced by previous infections or vaccination, we are experiencing a scenario that is completely

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different from that observed in the pre-vaccination period. Currently, lethality is much lower, as well as the risk of hospitalization and severe complications among those affected by the disease. However, we also face difficulties in achieving better coverage with the COVID-19 vaccine, especially in the group of children and adolescents.

As SARS-CoV-2 spread rapidly around the world starting in 2020 and governments sought to contain the transmission, many health services, especially routine immunization, faced severe disruptions. These effects resulted from several factors, including travel restrictions and public policies aimed at reducing opportunities for social contact between people, directing health professionals to work on the front lines of the fight against COVID-19, and the cancellation or postponement of medical visits, for fear of exposure to the virus. As a result of this situation, the demand for vaccination centers decreased in the countries, and vaccination coverage, which was already compromised, became even lower, increasing the risk of new outbreaks of diseases that can be prevented by vaccines.<sup>9</sup>

In many parts of the world, 1 in 5 children is still not vaccinated. Vaccines have, in a sense, become orphans of their own success. The elimination of diseases, or even their control, made the new generations, unaware of them, underestimating their potential severity, questioning the need to keep their children vaccinated against these diseases, with the consequent risk of reintroduction or resurgence of diseases controlled or in the process of elimination in the country. Logistical problems, shortages of vaccines at vaccination centers, and the growing anti-vaccination movement, supported by false information, contributed to the situation of concern we are currently experiencing.<sup>9,10</sup>

Inside this challenging scenario, readers will find in this supplement 10 articles that seek to bring up highly relevant topics for discussion, such as the challenges and proposals for the resumption of vaccination coverage in children during and after the COVID-19 pandemic.<sup>11</sup> In the context of anticipating responses to future pandemics, the reader will find a careful analysis of the main lessons learned from past pandemics with planning suggestions for vaccine development as part of the preparedness for an epi/pandemic in the article “The need and challenges for development of vaccines against emerging infectious diseases”.<sup>12</sup>

The implications of the serotype substitution phenomenon after the implementation of vaccination programs with pneumococcal conjugate vaccines is the subject of detailed analysis in the article “Impact of PCV10 on pediatric pneumococcal disease burden in Brazil: time for new recommendations?”,<sup>13</sup> using the Brazilian model as an example and bringing suggestions on how to continue offering broad protection against invasive pneumococcal disease in this context.

In the article “Implications of the non-specific effect induced by Bacillus Calmette-Guerin (BCG) vaccine on vaccine recommendations”,<sup>14</sup> the reader will find an updated review of the available evidence supporting potential heterologous protection promoted by the BCG vaccine, probably due to the stimulation of innate immunity, in cross-protection against several infections.

The evidence that supports the current recommendations for vaccination in children with immune-mediated disorders was reviewed in details in a comprehensive article entitled

“Vaccination in children with immune-mediated diseases”,<sup>15</sup> allowing the readers to have an updated review of the latest data on the safety, immunogenicity and efficacy/effectiveness of the different vaccines in children that live with these conditions.

The article “Current strategies and perspectives for active and passive immunization against Respiratory Syncytial Virus in childhood”<sup>16</sup> includes a detailed review of passive and active immunization technologies that are in the final stages of development or have just been approved and that anticipate the possibility of finally controlling the most frequent cause of lower respiratory tract infection in infants and young children, responsible for a dramatic burden of morbidity and mortality in childhood, the RSV-associated bronchiolitis.

In the article “HPV vaccination programs in LMIC: is it time to optimize schedules and recommendations?”,<sup>17</sup> the possibility of incorporating optimized vaccination schedules against HPV, with a single vaccine dose, allowing extending the benefit of vaccination to a larger number of individuals, with a substantial reduction in the incidence of cervical cancer and precancerous lesions attributable to HPV is discussed in the light of currently available evidence.

The subject of vaccination against COVID-19 in children is discussed in the article “COVID-19 vaccination in children: a public health priority”,<sup>18</sup> with the authors bringing an in-depth analysis of the potential benefits and challenges of a vaccination program for children in the context of a country with the characteristics of Brazil, where the disease has very relevant mortality and morbidity burden, comparable to or even more impactful than that of several other vaccine-preventable diseases that are part of immunization programs.

An unprecedented discussion related to “Vaccination strategies for people living with inborn errors of metabolism in Brazil”<sup>19</sup> is the subject of an extensive literature review by the authors, with important contributions to vaccination recommendations for individuals living with these conditions. Finally, in the article “An update on vaccination in preterm infants”<sup>20</sup>, the authors update the recommendations for schedules and vaccines for this vulnerable group of infants.

The author hopes, therefore, that the content of this supplement can offer readers an update on the advances in medical science in the field of immunizations and knowledge of the main challenges to be faced so that humankind continues to fully benefit from this important public health instrument.

## Conflicts of interest

The author declares no conflicts of interest.

## References

1. World Health Organization (WHO). Immunization. [cited 2022 December 8]. Available from: <https://www.who.int/news-room/facts-in-pictures/detail/immunization>.
2. Whitney CG, Zhou F, Singleton J, Schuchat A. Centers for disease control and prevention (CDC). Benefits from immunization during

- the vaccines for children program era - United States, 1994–2013. *MMWR Morb Mortal Wkly Rep.* 2014;63:352–5.
3. Modlin JF, Schaffner W, Orenstein W, Bandyopadhyay AS. Triumphs of immunization. *J Infect Dis.* 2021;224:S307–8.
  4. Aylward B, Hennessey KA, Zagaria N, Olivé JM, Cochi S. When is a disease eradicable? 100 years of lessons learned. *Am J Public Health.* 2000;90:1515–20.
  5. Greenwood B. The contribution of vaccination to global health: past, present and future. *Philos Trans R Soc Lond B Biol Sci.* 2014;369:20130433.
  6. Tian Y, Hu D, Li Y, Yang L. Development of therapeutic vaccines for the treatment of diseases. *Mol Biomed.* 2022;3:40.
  7. Scarbrough Lefebvre CD, Terlinden A, Standaert B. Dissecting the indirect effects caused by vaccines into the basic elements. *Hum Vaccin Immunother.* 2015;11:2142–57.
  8. Watson OJ, Barnsley G, Toor J, Hogan AB, Winskill P, et al. Global impact of the first year of COVID-19 vaccination: a mathematical modelling study. *Lancet Infect Dis.* 2022;22:1293–302.
  9. Dinleyici EC, Borrow R, Safadi MA, van Damme P, Munoz FM. Vaccines and routine immunization strategies during the COVID-19 pandemic. *Hum Vaccin Immunother.* 2021;17:400–7.
  10. Olive JK, Hotez PJ, Damania A, Nolan MS. The state of the antivaccine movement in the United States: a focused examination of nonmedical exemptions in states and counties. *PLoS Med.* 2018;15:e1002578. Erratum in: *PLoS Med.* 2018;15:e1002616.
  11. Domingues CM, Teixeira AM, Moraes JC. Vaccination coverage in children in the period before and during the COVID-19 pandemic in Brazil: a time series analysis and literature review. *J Pediatr (Rio J).* 2023;99:S12–21.
  12. Clemens SA, Clemens R. The need and challenges for development of vaccines against emerging infectious diseases. *J Pediatr (Rio J).* 2023;99:S37–45.
  13. Jarovsky D, Berezin EN. Impact of PCV10 on pediatric pneumococcal disease burden in Brazil: time for new recommendations? *J Pediatr (Rio J).* 2023;99:S46–56.
  14. Goudouris E, Aranda CS, Solé D. Implications of the non-specific effect induced by Bacillus Calmette-Guerin (BCG) vaccine on vaccine recommendations. *J Pediatr (Rio J).* 2023;99:S22–7.
  15. Marinho AK. Vaccination in children with immune-mediated diseases. *J Pediatr (Rio J).* 2023;99:S62–9.
  16. Scotta MC, Stein RT. Current strategies and perspectives for active and passive immunization against Respiratory Syncytial Virus in childhood. *J Pediatr (Rio J).* 2023;99:S4–S11.
  17. Villa L, Richtmann R. HPV vaccination programs in LMIC: is it time to optimize schedules and recommendations? *J Pediatr (Rio J).* 2023;99:S57–61.
  18. da Fonseca Lima EJ, Leite RD. COVID-19 vaccination in children: a public health priority. *J Pediatr (Rio J).* 2023;99:S28–36.
  19. Ramos BC, Aranda CS, Cardona RS, Martins AM, Solé D, Clemens SA, et al. Vaccination strategies for people living with inborn errors of metabolism in Brazil. *J Pediatr (Rio J).* 2023;99:S70–80.
  20. Kfourri R, Sadeck LS. An update on vaccination in preterm infants. *J Pediatr (Rio J).* 2023;99:S81–6.