Indian J Med Res 160, September & October 2024, pp **-**
DOI: 10.25259/IJMR_1677_2024

Perspectives

50th anniversary of expanded programme on immunization: Shaping the next 50 years in the WHO South-East Asia region

The world is celebrating the 50th anniversary of the Expanded Programme on Immunization (EPI) (now the Essential Programme on Immunization). Over these five decades, an estimated 154 million lives have been saved worldwide, with children born today having a 40 per cent greater chance of reaching their first birthday than 50 years ago[1].

The first significant milestone for the EPI was eradicating smallpox in 1980, followed by numerous other successes, such as the near-eradication of polio, with only Afghanistan and Pakistan remaining endemic. By the end of 2022, maternal and neonatal tetanus were eliminated in all but ten countries, and measles was eliminated in 83 nations[2]. However, despite these significant achievements, immunization coverage disparities have reached alarming levels, particularly disrupted by the COVID-19 pandemic's impact on health systems. Globally in 2023, there were 14.5 million children missing out on any vaccination–so-called zero-dose children[3].

The EPI faces several new challenges that necessitate adaptive strategies. Climate change has catalyzed the emergence and re-emergence of diseases, leading to outbreaks of vaccine-preventable diseases (VPDs) and increasing the risk of antimicrobial resistance. Inundations and landslides across the region have elevated the incidence of waterborne diseases, such as cholera and typhoid[4]. Additionally, changing climate patterns have pushed disease vectors like mosquitoes to higher altitudes, escalating the risk of dengue, malaria, yellow fever, and chikungunya infections[5]. Demographic shifts, including geographic location, gender, and socio-economic factors, complicate equitable access to immunization services. Intersectoral approaches must be strengthened to bridge these gaps, cultivating partnerships among vaccine manufacturers, regulatory authorities, and public health organizations. Growing vaccine hesitancy remains another pressing challenge, requiring proactive measures to identify barriers and devise strategies to enhance acceptance. Misinformation exacerbates hesitancy, emphasizing the need for proactive risk communication and community engagement to counter false narratives[6].

Shifting global and national priorities call for innovative distribution and for administration methods to align with the Immunization Agenda 2030, tailored to regional contexts through the Regional Strategic Framework 2022-2026[7]. Lastly, routine immunization programmes suffer significantly in politically unstable environments, where morbidity and mortality from VPDs are higher, especially in impoverished communities. Developing conflict-sensitive immunization strategies within national plans is essential to protect vulnerable populations and ensure effective immunization coverage amid instability[8].

The next 50 years of EPI will require improvements in targeting and reaching unvaccinated and under-vaccinated children and communities. Continuous community engagement in vaccination uptake is critical, as hard-won gains can be easily lost. The next 50 years hold great promise, but need collective and sustained determination to deliver. By continuing to invest in EPI, we can help create a world where everyone, everywhere and at every age fully benefits from vaccines for good health and well-being.

EPI in the WHO South-East Asia Region (WHO SEAR) is poised to introduce several new vaccines to tackle a growing list of VPDs. With a global vaccine pipeline of 68 per cent prophylactic and 32 per cent therapeutic, the region targets the introduction of 52 vaccines in countries by 2030[9]. Priority vaccines for the Region include pneumococcal conjugate vaccine (PCV), rotavirus vaccine (RVV), Human Papilloma virus (HPV) vaccine, Japanese encephalitis vaccine (JEV), typhoid conjugate vaccine (TCV), dengue vaccine, Respiratory Syncytial Virus (RSV) vaccine, TB, malaria vaccine and COVID-19 vaccines[7]. Additionally, important existing vaccines like the

inactivated polio second dose (IPV2), diphtheria, pertussis and tetanus (DPT) booster, and hepatitis birth dose remain essential. Achieving this goal requires robust health systems, immunization infrastructure, and strong partnerships to ensure successful introduction and equitable access, sustaining the region's immunization achievements.

The WHO SEAR must also prepare for the adoption of advanced vaccine technologies, building on innovations like mRNA vaccines, which transformed immunization during the COVID-19 pandemic. Other cutting-edge approaches include antigen-presenting cells, bacterial and viral-vectored vaccines, nanotechnology, and gene-based diagnostics. Cold chain management remains a significant challenge, especially for vaccines requiring ultra-low temperatures, like mRNA vaccines[10]. As only a few countries in the region possess ultracold chain facilities, investment in infrastructure is crucial. Research into vaccine materials that can be stored at higher temperatures and technologies for delivering multiple antigens in a single dose could simplify the required logistics. With 46 per cent of global vaccine production concentrated in the region[11], its manufacturers are well-positioned to drive advanced research and innovation in immunization.

In addition to introducing new vaccines, the SEAR must focus on integrating emerging vaccine delivery technologies[12]. New techniques like nasal spray and needleless or needle-free jet injectors are being developed for intradermal, subcutaneous, and intramuscular injections, making vaccine administration more efficient[13]. The microarray patch (MAP) offers a groundbreaking solution for painless intradermal vaccine delivery without requiring a cold chain or trained manpower, significantly improving community accessibility[14]. With two MAPs for measles and rubella in development, further research is essential to address challenges, scale production, and revolutionize vaccine delivery. All these newer technologies could be 'game-changers' in addressing VPDs.

Advancements in technology offer transformative opportunities to improve vaccine equity. Artificial intelligence (AI), machine learning (ML), and data analytics can be critical in identifying and reaching zero-dose children, particularly in underserved communities[15]. Training health workers in digital tools is essential to enhance these efforts. Universal digital personal health records and biometric tools like iris and fingerprint scanning can also help identify patients, create efficient vaccination plans, and ensure 'no one is left behind'[16]. These technologies will help ensure equitable access to vaccines across the region.

Building a resilient immunization system is essential for our region, especially in resource-constrained settings where cold chain management poses a significant challenge due to unreliable power supply. One promising solution is the environment-friendly, battery-free refrigeration system, such as the Solar Direct Drive, which WHO prequalified in 2010[17]. This solar-powered cold chain system offers a sustainable and affordable option to ensure vaccines are kept at the required temperatures. Another innovative approach could be use of controlled temperature chain (CTC). Further research and investment is needed to develop more resilient solutions to ensure that vaccines remain accessible and effective, even in remote areas with infrastructural constraints.

A robust immunization programme requires a single integrated network that combines surveillance and immunization activities. This includes human resources, laboratory infrastructure, and equipment for tracking VPDs, monitoring adverse events, and responding to health emergencies. The polio transition network in the WHO SEAR is considered one of the best examples of such integration[18]. Adopting this network to include surveillance for other VPDs will strengthen the region's ability to tackle a broader range of public health challenges.

Rapid vaccine development is essential to address future pandemic threats. The Coalition for Epidemic Preparedness Innovations (CEPI) aims to have a safe and effective vaccine ready for use within 100 days of identifying a pathogen[19]. The success of such initiatives will depend on engaging stakeholders to enable faster development, effective responses, and equitable access to these vaccines, ensuring the region is prepared to respond emerging pandemics.

The future of the EPI lies in its integration with primary health care (PHC) systems. The polio transition plan is a prime example of how critical functions and infrastructure established through disease-specific programmes can be incorporated into national health systems. Strengthening PHC systems will ensure improved outreach, especially to zero-dose children, and will provide a sustainable, community-based approach to immunization in South-East Asia.

Finally, vaccine safety is crucial for reducing hesitancy and increasing public confidence. Phase IV trials and post-marketing surveillance allow

policymakers to monitor rare side effects after vaccines are approved and brought into large-scale use. Vaccine Adverse Events Reporting Systems are instrumental in tracking the negative impacts of immunization. Four out of eleven countries in our region currently report vaccine safety data to the Uppsala Monitoring Centre. The priority now is to ensure all countries in our region update vaccine safety data consistently, enhancing regional accountability and trust in immunization efforts.

As we mark the 50th anniversary of the EPI, WHO remains committed to strengthen immunization programme in the WHO SEAR. Combined efforts would help shape the next 50 years, ensuring that every individual, everywhere, benefits from the life-saving power of vaccines.

***Financial support & sponsorship*:** None.

***Conflicts of Interest*:** None.

***Use of Artificial Intelligence (AI)-Assisted Technology for manuscript preparation*:** The authors confirm that there was no use of AI-assisted technology for assisting in the writing of the manuscript and no images were manipulated using AI.

Saima Wazed
Regional Director,
WHO South-East Asia,
New Delhi 110 001,
India
serdo@who.int

Received October 22, 2024; Accepted November 07, 2024; Ahead of print November 16, 2024, 2024; Published *** *, 2024

References

1. Shattock AJ, Johnson HC, Sim SY, Carter A, Lambach P, Hutubessy RCW, *et al*. Contribution of vaccination to improved survival and health: Modelling 50 years of the Expanded Programme on Immunization. Lancet 2024; *403* : 2307-16.
2. Minta AA. Progress toward measles elimination – worldwide, 2000-2022. *MMWR Morb Mortal Wkly Rep* 2023;72. Available from: *https://www.cdc.gov/mmwr/volumes/72/wr/mm7246a3.htm*, accessed on July 19, 2024.
3. World Health Organization. *Immunization coverage: Key facts*. Available from: *https://www.who.int/news-room/fact-sheets/detail/immunization-coverage*, accessed on September 3, 2024.
4. Liao H, Lyon CJ, Ying B, Hu T. Climate change, its impact on emerging infectious diseases and new technologies to combat the challenge. *Emerg Microbes Infect* 2024; *13* : 2356143.
5. Climate, health and immunisation. 2024. Available from: *https://www.gavi.org/our-alliance/global-health-and-development/climate-health-and-immunisation*, accessed on October 11, 2024.
6. Recommendations. In: *Communicating risk in public health emergencies: A WHO guideline for emergency risk communication (ERC) policy and practice*. World Health Organization; 2017. Available from: *https://www.ncbi.nlm.nih.gov/books/NBK540733/*, accessed on October 26, 2024.
7. Regional Vaccine Implementation Plan 2022–2026, WHO South-East Asia Region. Available from: *https://www.who.int/publications/i/item/9789290210542*, accessed on October 11, 2024.
8. Nnadi C, Etsano A, Uba B, Ohuabunwo C, Melton M, Wa Nganda G, *et al*. Approaches to vaccination among populations in areas of conflict. *J Infect Dis* 2017; *216* : S368-72.
9. *Advances in Vaccine Technology*. Available from: *https://www.iqvia.com/blogs/2024/04/advances-in-vaccine-technology*, accessed on September 4, 2024.
10. Uddin MN, Roni MA. Challenges of storage and stability of mRNA-based COVID-19 vaccines. *Vaccines (Basel)* 2021; *9* : 1033.
11. Global vaccine market report 2023 Update: *World Health Organization. December 2023*. Available from: *https://cdn.who.int/media/docs/default-source/immunization/mi4a/who_gat_008_global_vaccine_market_report_march_12.pdf?sfvrsn=a61f4733_1&download=true*, accessed on September 4, 2024.
12. Mutasa R, Gandham R, Newmarch G, Seiter A, Schaeferhoff M, Sowers E. ASEAN regional vaccine manufacturing and development regional synthesis report. *The World Bank* 2023.
13. Trimzi MA, Ham YB. A needle-free jet injection system for controlled release and repeated biopharmaceutical delivery. *Pharmaceutics* 2021; *13* : 1770.
14. Zehrung D, Innis BL, Suwantika AA, Ameri M, Biellik R, Birchall JC, *et al*. Measles–Rubella microarray patches phase III clinical trial framework: Proposal and considerations. *Vaccines* 2024; *12* : 1258.
15. UNICEF. *Digital for zero-dose: Harnessing AI for global health equity*. Available from: *https://www.unicef.org/blog/digital-zero-dose-harnessing-ai-global-health-equity*, accessed on September 4, 2024.
16. Moore S. The future of vaccines. *News-Medical*. 2021. Available from: *https://www.news-medical.net/health/The-Future-of-Vaccines.aspx*, accessed on September 3, 2024.
17. Elliott K. Sun's warmth may keep vaccines cool. *Trop Doct* 1983; *13* : 90-1.
18. Polio Transition Programme. Available from: *https://www.who.int/teams/polio-transition-programme*, accessed on July 17, 2024.
19. CEPI. *CEPI 2.0 and the 100 days mission*. Available from: *https://cepi.net/cepi-20-and-100-days-mission*, accessed on September 4, 2024.