
50 Years of Immunisation: Global Vaccine Impact and Future Challenges



The Expanded Programme on Immunization (EPI), established by the World Health Assembly in May 1974, aimed to extend vaccination benefits globally, initially focusing on smallpox, tuberculosis, diphtheria, tetanus, pertussis, poliomyelitis, and measles by 1990. Motivated by the successful eradication of smallpox in 1980, the program has since expanded to include vaccines against other pathogens based on country-specific decisions, covering all age groups. This expansion, supported by global collaboration and strategic initiatives, has significantly increased vaccine coverage. Notably, global coverage for the third dose of the diphtheria-tetanus-pertussis (DTP3) vaccine rose from under 5% in 1974 to 86% in 2019, slightly dropping to 84% post-COVID-19 pandemic.

How to quantify the impact of the Expanded Programme on Immunization

In this modelling study published in the Lancet, the impact of the Expanded Programme on Immunization (EPI) was quantified by estimating the number of deaths averted, life-years gained, and disability-adjusted life-years averted (full health years gained) through vaccination against 14 pathogens across 194 WHO member states from June 1, 1974, to May 31, 2024. These pathogens include diphtheria, Haemophilus influenzae type B, hepatitis B, Japanese encephalitis, measles, meningitis A, pertussis, invasive pneumococcal disease, poliomyelitis, rotavirus, rubella, tetanus, tuberculosis, and yellow fever. Using a standardised analytical framework and synthesising results from 22 models, the study estimated the vaccine impact per fully vaccinated person over time. It also assessed the contribution of vaccination to reducing infant mortality and regional variations in vaccination impact. The primary outcome measured the overall impact on deaths averted, life-years gained, and full health years gained from 1974 to 2024, while the secondary outcome evaluated these impacts by WHO region and World Bank income stratum.

Multi-Source Vaccine Coverage Data and Advanced Modelling Approaches

This study synthesised age-specific vaccine coverage estimates from four data sources to quantify the impact of the Expanded Programme on Immunization (EPI) from 1974 to 2024. The sources included the WHO Immunization Dashboard, WHO Supplementary Immunization Activities Database, WHO Polio Information System, and Vaccine Impact Modelling Consortium (VIMC). For countries lacking data from 1974-1979, estimates were extrapolated from 1980 data. The study evaluated 24 vaccine activities across different diseases, doses, and types of immunisation (routine or supplementary), using population estimates from World Population Prospects. Three modelling approaches were used:

- Direct Simulation: Impact estimates for measles and poliomyelitis in all 194 WHO member states over 50 years, using dynamic models.
- Extended Transmission Models: For six diseases in 110 countries (fewer for meningitis A and yellow fever), using geographical imputation and temporal extrapolation.
- Upgraded Static Models: For diphtheria, tetanus, pertussis, and tuberculosis, incorporating data from the 2021 Global Burden of Disease study on country-specific and age-specific disease-attributable mortality and morbidity, vaccine efficacy, and vaccine coverage.

These models captured both individual and population-level vaccine effects, comparing results with previous analyses to ensure accuracy.

The Lifesaving Impact of Vaccination Programs: 50 Years of Global Health Improvements

Between June 1, 1974, and May 31, 2024, vaccination programs targeting 14 pathogens are estimated to have averted 154 million deaths, with 146 million of these in children under five years old, including 101 million infants under one year. These programs have gained 9 billion life-years and 10.2 billion disability-adjusted life-years (years of full health), averaging over 200 million healthy life-years gained annually. For each life saved, an average of 58 years of life and 66 years of full health were gained, with 7.8% of the full health years attributed to averted poliomyelitis cases. Measles vaccination accounted for the majority of lives saved, with 93.7 million lives (60.8% of the total).

Global infant mortality has significantly declined since 1974, with vaccination directly responsible for 40% of this decline, varying from 21% in the Western Pacific to 52% in Africa. During the 1980s, a period of rapid vaccine coverage expansion, vaccination had a particularly high impact on reducing infant mortality. By 2024, children aged ten are estimated to be 44% more likely to survive to their next birthday due to vaccinations since 1974. The Eastern Mediterranean and African regions saw the largest absolute gains in life course survival probability, while the Western Pacific and European regions saw the largest relative gains.

Models used in this study generally fit local data better when accounting for community effects, with results falling within published error margins. The risk of double counting was minimal, affecting overall estimates by only 0.01%.

EPI Extends Health and Ensures Future Impact

On the 50th anniversary of the Expanded Programme on Immunization (EPI), this comprehensive assessment estimates that vaccination programs have saved 154 million lives since 1974, with 95% of these lives being children under five years old. This equates to 9 billion life-years saved and 10.2 billion healthy life-years gained due to reduced morbidity. Measles vaccination was the most significant contributor, accounting for the majority of lives saved and remains crucial for future impact. Vaccination has contributed to nearly half of the global reduction in infant mortality, with higher impacts in regions like Africa. A child born today has a 40% increased survival rate in infancy and childhood due to vaccination, extending benefits beyond 50 years of age. The study highlights the dual protection of vaccines: direct individual protection and community transmission reduction. However, reduced community transmission may lessen the apparent individual benefit due to lower disease prevalence.

Still a need for equity, innovation and engagement

Despite significant contributions from non-vaccine factors in recent years, measles vaccination remains a primary intervention for saving lives. While not breaking community transmission chains, Tetanus vaccination remains highly impactful per dose. Pertussis vaccination also significantly contributes to lives saved, especially in pregnant women. The study underscores the importance of integrating vaccination with primary healthcare and highlights the need for continued investment in immunisation programs, especially for pregnant women. New-generation vaccines for diseases like tuberculosis are in development, which could further improve outcomes. The analysis, focusing on historical data and excluding some recent vaccines (e.g., HPV, influenza, COVID-19), suggests that vaccination has increased survival rates across all ages. The study also emphasises the need for improved targeting and community engagement to sustain and build on these gains, particularly in regions with high infectious disease burdens.

Overall, the findings call for sustained efforts to maintain high vaccine coverage and the integration of immunisation programs into broader health systems to prepare for future pandemics and improve global health outcomes.

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