NARRATIVE REVIEW

The Last Mile: Addressing India's Immunization Gap with Zero-Dose Insights from WUENIC Estimates

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DOI: 10.55489/njcm.160920255861

ABSTRACT

The global Immunization Agenda 2030, endorsed by the World Health Assembly in 2020, calls for a concentrated push to reach zero-dose children in all countries. The increase in the number of zero-dose children illustrates how layered vulnerabilities originating from social, environmental, workforce-related, and digital systems can interact to undermine even well-established immunization programs. In 2023, 14.5 million children globally missed out on basic vaccines, wherein India contributed nearly 1.6 million to this total. The objective of this narrative review is to synthesize WUENIC and NFHS data to explore trends, factors, and interventions to inform policy. Results shows that India has already reduced its zero-dose children by 27% from 1992 to 2021, however WUENIC estimates reported a 2% increase in the number of zero-dose children in 2023 from 2022. Factors such as socioeconomic and environmental determinants, workforce fatigue lead to negative impact on Immunization programme. Recent WUENIC 2024 estimates reported a coverage recovery with 43% reduction in the number of zero-dose children from 2023 which offers vital insights about India's resilient health care system. Interventions beyond traditional catch-up drives such as equity-focused micro-planning, climate-resilient infrastructure, empowered frontline workers, interoperable digital health systems are having an ability to further address a zero-dose children burden in India. Identifying and vaccinating zero-dose children is crucial not just for lowering under-five mortality, as this group accounts for approximately half of all vaccine-preventable mortality in low- and middle-income countries.

Keywords: Zero-Dose, Immunization, WUENIC, Vaccination

ARTICLE INFO

Financial Support: None declared
Conflict of Interest: The authors have declared that no conflict of interests exists.
Received: 30-06-2025, **Accepted**: 21-07-2025, **Published**: 01-09-2025
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How to cite this article: Badhwar P, Khanuja BS, Singh K, Verma A. The Last Mile: Addressing India's Immunization Gap with Zero-Dose Insights from WUENIC Estimates. Natl J Community Med 2025;16(9):925-933.
DOI: 10.55489/njcm.160920255861

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

With the endorsement of Immunization Agenda 2030 (IA 2030) by World Health Assembly in August 2020, the global public health community has set an ambitious task of leaving no one behind and reaching out to Zero dose communities- communities with cluster of unvaccinated or under-vaccinated children.[1] Immunization plays a critical role in achieving the SDGs, specifically SDG3, "Ensure healthy lives and promote well-being for all at all ages", and also contributes directly or indirectly to 13 other SDGs. IA 2030 aims to reduce zero-dose children by 50% by 2030. Zero-dose children are defined as those that lack access to or are never reached by Routine Immunization services. For operational purposes, Gavi defines zero-dose children as infants who have not received the first dose of diphtheria, tetanus, and pertussis-containing vaccine (DTP1) by the end of their first year of life.[1,2] This indicator of zero-dose children serves as a crucial indicator of a country's immunization program, reflecting its reach, sustainability, and equity. Compared to vaccinated children, zero-dose children are acutely vulnerable as they are predisposed to several vaccine preventable diseases.[3] Globally in 2023, there were 14.5 million children who missed out on any vaccination and among the countries with highest number of children are Nigeria- 2.1 million, India ranks second globally with 1.6 million zero-dose children in 2023 and Ethiopia-917K children followed by Congo, Sudan and Indonesia.[4,5]

Global efforts have been directed toward reaching zero-dose communities, with investments being made in key health system components to address barriers to child vaccination. Notably, expecting mothers with partial or no ANC visits and Td vaccination, a cross-cutting public health area, were found to be at a significantly higher risk of being mothers of zero-dose children.[6] Evidently, zero-dose children highlight missed communities who belongs to communities with several inequalities in socio-economic, political and geographical factors thus preventing them from leading healthy lives.[7] Connecting these families to the health system for early childhood immunization can unlock a range of health and socio-economic benefits including achievements of Sustainable Development Goals. Therefore, zero-dose children present a key opportunity to design and strengthen the public health programs in a holistic manner. This not only will help in achieving immunization goals under the IA 2030 but also result in fulfilling the broader SDG commitment. Therefore, this narrative review aims to summarize trends, determinants, and interventions for zero-dose children in India using WUENIC and NFHS data.

METHODOLOGY

We conducted a narrative review by synthesizing data from WUENIC 2019–2024, NFHS and peer-reviewed studies, focusing on zero-dose trends and interventions in India. WUENIC and NFHS were chosen for their comprehensive immunization coverage data. We analyzed WUENIC data from 2019–2024 and NFHS data from 1992–2021. Relevant studies from 2019 to 2024 were identified through PubMed for contextual factors. Multiple indicators such as immunization coverage, zero-dose children, antigen wise coverage such as DPT, Measles- and Rubella-containing vaccine, BCG etc, breath of protection (BOP) have been assessed. Additionally, this paper also aims to understand the various plausible factors contributing towards shaping the burden of Zero-Dose Children in India across the recent years i.e. 2023 and 2024 and review the efforts made by the Government of India to address this challenge.

Eligibility criteria

In this review, WUENIC 2019-2024 reports, and NHFS data which estimated zero-dose burden has been included. Articles focused on factors associated with zero-dose burden were also included. Articles, reviews, grey literature which are not based on zero-dose children estimates were excluded. Articles other than English language has been excluded.

Data Extraction: Relevant data on zero dose estimates (global and India) through WUENIC estimates and NFHS data, BOP and antigen wise coverage were extracted in MS-Excel by two independent authors (PB and BSK).

RESULTS

All Figures and Tables were generated using WUENIC 2019 to 2024 estimate data. A summary of qualitative factors such as socially disadvantaged groups, gender, ANC status, pregnant women education, Covid-19 pandemic, impact of climate etc was conducted to balance the narrative review's interpretive nature.

India's vaccination progress and zero-dose children landscape: India has made significant strides to ensure every child receives essential, age-appropriate vaccines through its Universal Immunization Programme (UIP).[8] At present, UIP delivers 11 vaccines against 12 vaccine-preventable diseases (VPDs) to children, as well as Td vaccination to pregnant women. From 1992-93 (NFHS-1) to 2019-2021 (NFHS-5), the proportion of zero-dose children in India dropped by 27%, from 33.4% to 6.4%.[7] However, a geospatial analysis of data from four NFHS (1992-2016) by M Johri et al spanning over 24 years shows that zero-dose children continue to be concentrated in socially disadvantaged groups, including rural areas, less-educated mothers, and lower wealth quintiles.[3]

Table 1 summarize the burden of zero-dose children as per WUENIC estimates from 2019 to 2024. In 2023, an estimated 1.592 million zero-dose children were recorded in India, marking an increase of 0.452

million children as compared to 1.139 million children representing a 39.7% rise in zero-dose children compared to 2022. During India's journey of continued immunization efforts achieving several historical landmarks, the years 2020 and 2023 witnessed an increase in India's zero-dose children and its contribution to their global burden. Due to disruptions caused by the pandemic in 2020 in terms of strained health manpower, shifted focus to covid-19 management and stringent containment and transmission control measures[9], there was a sharp dip in the number of children vaccinated in the country[8]. In 2023, India faced significant challenges such as strikes by ASHAs and other frontline health workers, as well as extreme weather events including cyclones and landslides. These disruptions strained the healthcare delivery system and may have contributed to the rise in the number of zero-dose children. Additionally, Zero-dose children in India witnessed a fall in the year 2024 which is 0.908 million- a 43% reduction from 1.592 million in 2023 (Table 2). While the year 2020 showed a marked increase in India's zero-dose children count due to the disruptions brought by the Covid-19 pandemic.

The magnitude of this disruption on routine vaccination is evident from the WUENIC estimates in Table 2. The coverage of DTP 1 in India dropped from 94% in 2019 to 87% in 2020 and DTP 3 coverage dropped from 91% to 85% in 2020 and 2021. MCV1 coverage dropped from 95% to 89% in 2020 and 2021 and MCV2 coverage dropped from 84% to 81%.

Globally, the impact of pandemic on vaccination was seen as an estimated 22.3 million children and 24.5 million children in 2020 and 2021 were left unvaccinated with basic vaccines[4]. Out of these, an estimated 16.1 million and 18.1 million children were zero-dose children, respectively. India ranks second among the number of zero-dose children for the countries with the greatest number of zero-dose children in absolute numbers. This has given rise to both drop out and missed out children. Globally, the coverage of antigens as given in Table 3 shows a reduction from 2019 to 2021; however, an improvement in coverage is evident from 2022 to 2024.

Geographically, the distribution of zero-dose children in India has been found to be highly uneven, with higher concentrations in areas facing large-scale development challenges, particularly in States such as Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, and Assam.[3,5] Additionally, urban areas with significant migrant or informal sector populations, such as Maharashtra, Karnataka, and Gujarat, also see a higher prevalence of zero-dose children.[3]

As per the latest WUENIC report 2024 for 194 countries released on 15th July 2025, India has significantly overturned the zero-dose landscape of the previous year. The number of zero-dose children in the country have reduced from approximately 2.6 million in 2013 to 1.6 million in 2023 and further 0.9 million in 2024.[10]

Table 1: Number of zero-dose children in India as per WUENIC 2019-2024 estimates

Year	No. of Zero-dose children in India*	No. of Zero-dose children in the World*	India as a proportion to the estimated global Zero Dose burden
2019	14,11,904	1,34,77,302	10%
2020	29,81,541	1,57,25,802	19%
2021	27,36,114	1,81,79,505	15%
2022	11,39,518	1,41,84,589	8%
2023	15,92,409	1,41,54,775	11%
2024	9,08,667	1,41,91,633	6%

*Source: WUENIC estimates 2024 report; zero-dose children- Children not received DPT-1 within 1st year of their life.

Table 2: Antigen wise year wise WUENIC coverage estimates (%) in India

Antigen\Year	2019	2020	2021	2022	2023	2024
DTP 1	94	87	88	95	93	96
DTP 3	91	85	85	93	91	94
MCV 1	95	89	89	95	93	97
MCV 2	84	81	82	90	90	92
BCG	92	85	84	91	89	91

*Source: WUENIC estimates 2024 report; DTP1- First dose of diphtheria, tetanus, and pertussis-containing vaccine; DTP3- third dose of diphtheria, tetanus, and pertussis-containing vaccine; MCV 1- Measles-containing-vaccine first-dose; MCV 2- Measles-containing-vaccine second-dose; BCG- Bacillus Calmette–Guérin vaccine

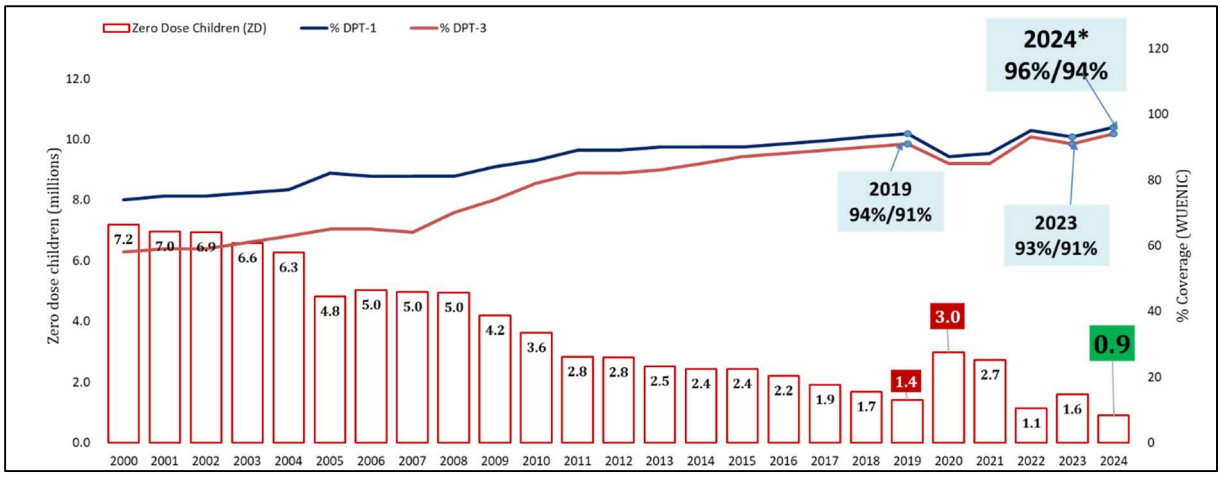
Table 3: Global antigen wise year wise WUENIC coverage estimates (%)

Antigen\Year	2019	2020	2021	2022	2023	2024
DTP 1	90	88	86	89	89	89
DTP 3	86	83	81	84	84	85
MCV 1	86	83	81	83	83	84
MCV 2	71	71	71	73	74	76
BCG	89	86	85	88	87	88

*Source: WUENIC estimates 2024 report

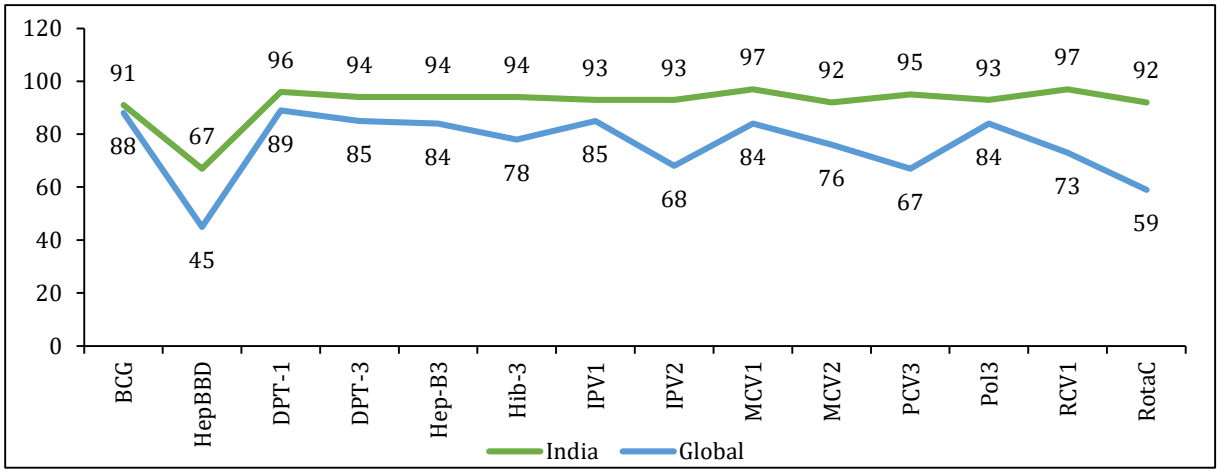
India's staggering reduction of approximately 0.7 million zero-dose children speaks volumes about the country's immunization efforts. In just one year, India's coverage of DTP 1 has increased from 93% to 96% (Table 2), while the global average remains stagnant at 89% since the last 3 years (Table 3). Out of total 194 countries, only 93 countries including India have DTP-1 coverage of 96% or above. Thereby reducing the zero-dose children by 43% from 2023.[10] Figure 1 depicts the immunization coverage of DTP-1 and 3 antigens with number of zero-dose children as per WUENIC 2024.

Figure 2 compares the antigen wise coverage among Indian and Global context in 2024. As evident in the WUENIC 2024 report, India has shown its commitment to vaccinate all eligible children for age-appropriate vaccination and staying way ahead than the global immunization coverage. In comparison to global average coverage of all antigens, India's antigen wise coverage, mostly above 90%, is far above the global trends, including DPT coverage at 96%.



*Source: WUENIC estimates 2024 report

Figure 1: DTP-1 and DTP-3 coverage, 2019–2024 & number of Zero-dose children



*Source: WUENIC estimates 2024 report; Antigen wise coverage includes DTP, MCV, BCG etc as shown in figure above.

Figure 2: Antigen Wise Coverage: India vs Global (WUENIC 2024)

Table 4: Interventions to reach out to every child as per Zero Dose Implementation plan (ZIP)

Sr. No.	Intervention
1	U-WIN, a digital platform for improved name-wise immunization tracking
2	Data analytics for routine immunization review
3	Community of Practice on Demand for building a community to support demand creation
4	Mobilizer incentivization for encouraging mobilization efforts by ASHAs
5	Improved and inclusive microplanning to reach the underserved areas
6	Monitoring and Mentorship for strengthening supportive oversight
7	CSO engagement for effective outreach
8	Rapid Immunization Skill Enhancement and Institutionalized training for capacity building of health workers
9	Program Monitoring and Action
10	Behavioural and Social Drivers for identifying and addressing social factors influencing vaccination uptake.
11	Establish participatory and data-driven review mechanisms

India's continued efforts to reach out to Zero-dose children and recent achievements: India has adapted a "Guidance Document on Strategic Approach for Reaching Zero-dose children in India"[11] with an aim to vaccinate all children and leaving no one behind. The guidance document aims to define a Zero Dose Implementation plan (ZIP) through a Health system strengthening approach. The Government of India has prioritized 143 districts across eleven high-burden and vulnerable States accountable for an estimated 60% of zero-dose children through its ZIP, a targeted strategy aimed at identifying and vaccinating zero-dose children in these communities. The ZIP identifies 11 interventions to reach out to every child (table 4).

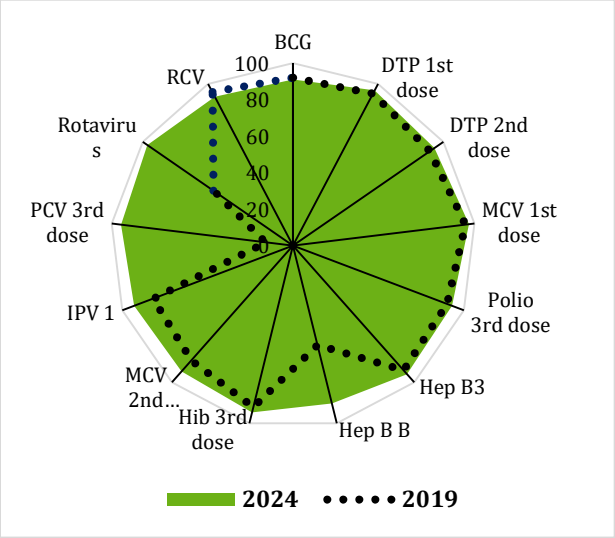
U-WIN tracked 27.77 crore vaccine doses administered to 7.43 crore beneficiaries through 1.26 crore vaccination sessions held up till 25th November 2024[12]. Successful implementation of these efforts will further strengthen the reach of immunization in country. The immediate impact of this holistic approach in reaching zero-dose children along with emphasized coverage of eligible children with all due

vaccines is reflected in the gains, as mentioned in the WUENIC 2024 report.

Breadth of Protection: Indian and Global scenario: The Breadth of Protection (BOP) is an index that represents the average coverage attainment across all globally recommended vaccines, regardless of introduction status in the country[13]. BOP is calculated based on the below formula:

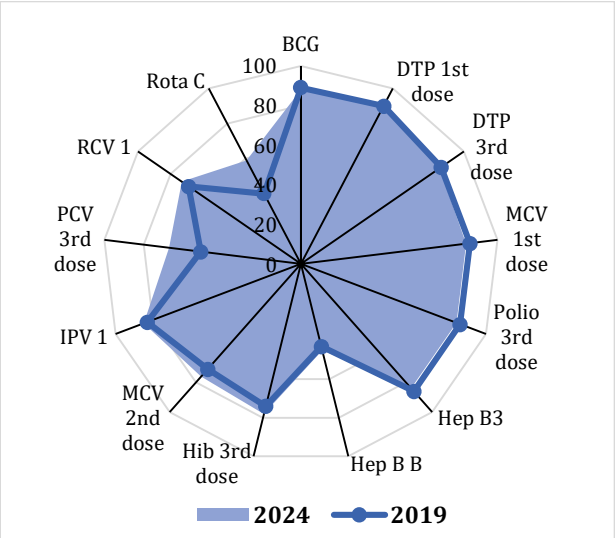
BOP= ((DTP3 x 3) + HepB3 + Hib3 + IPV1 + MCV1 + MCV2 + PCV3 + POL3 + RCV1 + RotaC + HPV)/13.

We have extracted the BOP calculation from WUENIC from 2019 and 2024. BOP in India has continued to improve because of the continued implementation of newer vaccines and has shown significant progress as compared to the global progress (Figure 3 and 4).



*Source: WUENIC estimates 2024 report

Figure 3: Breadth of Protection: India (2019 and 2024)



*Source: WUENIC estimates 2024 report

Figure 4: Breadth of Protection: Global (2019 and 2024)

Comparing on the BOP indicator, India has made exceptional progress by increasing BOP from 83.66% in 2023 to 86.85% in 2024, which is a 3.4 percentage point increase, whereas Global increase is only 2 percentage points from 72.77% in 2023 to 74.85% in 2024 (Figure 5 and 6). With every New Vaccine introduction in India, the immunization system got strengthened and resulted in the improvement of converges of existing vaccines under UIP.

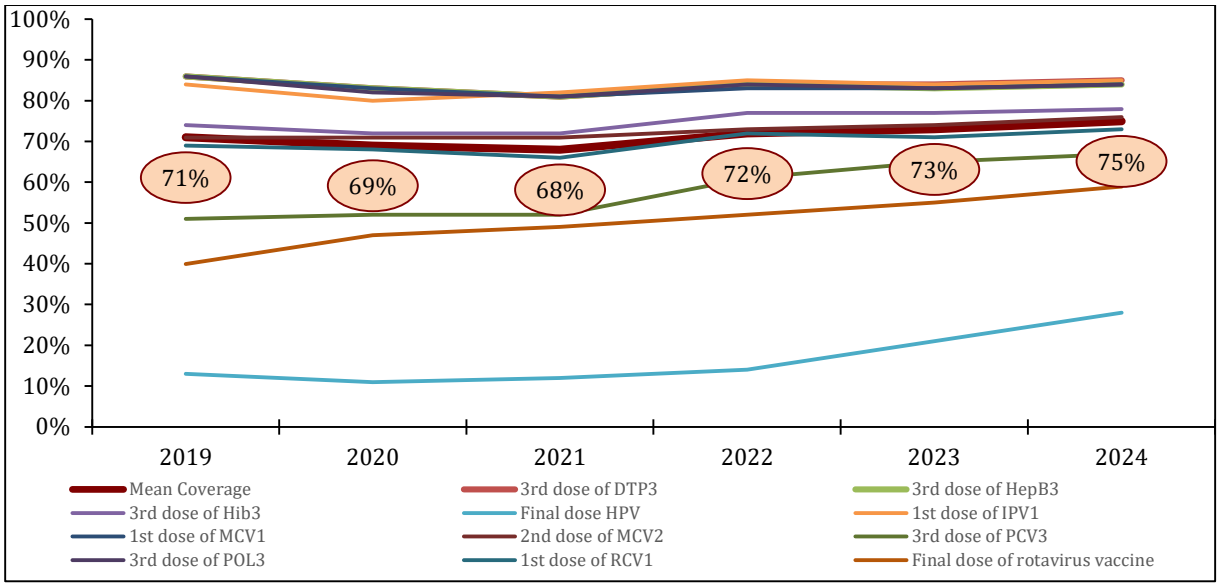
With each year the scope of Intensified Mission Indradhanush (IMI) catchup round was increased, IMI 5.0 in 2023 was conducted across the all districts with an aim to reach out to zero-dose children, complete vaccination of children up to 5 years of age, and special focus on Measles-Rubella (MR) vaccination in view of MR elimination targets of the country. IMI allows identification and inclusion of catchment areas, nomadic settlements and other vulnerable population groups missed in the routine microplanning and has resulted in a 34% decline in the zero-dose children since its inception up till 2023[14] and strengthening of routine immunization hence improved Full Immunization Coverage (Figure 7).

National Immunization Days (NIDs) and Sub-National Immunization Days (SNIDs) for polio-free status, Village Health and Sanitation Days (VHNDs) and outreach activities at the community level have contributed to reaching missed communities and ensuring vaccination of zero-dose children.[15] Innovative IEC (Information, Education and Communication) campaigns have addressed the vaccine avoidance behaviour and helped generate awareness on the safety, efficacy and importance of vaccines, thereby leading to vaccine demand generation.

Discussion

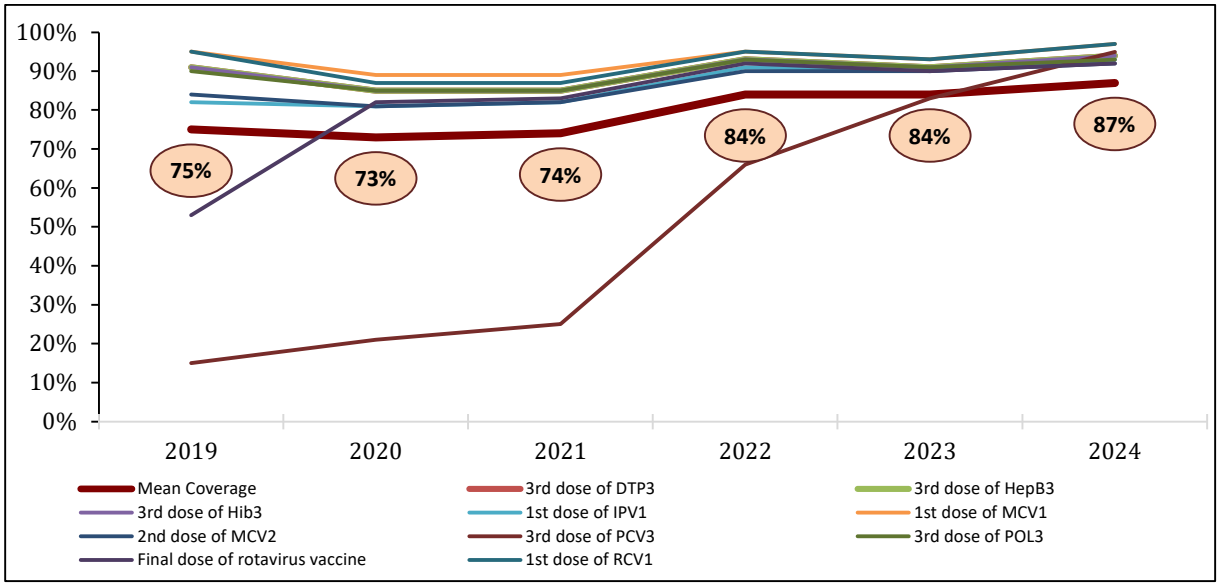
The State of the World's Children 2023 by Unicef reported that 1 out of every 5 children are zero-dose who are un-vaccinated or under-vaccinated, thereby making them vulnerable to wide array of vaccine preventable diseases.[16] The resurgence of zero-dose children in India in 2023, despite post-pandemic recovery efforts and long-term system strengthening, suggests persistent vulnerabilities in the health ecosystem. This is evident by increase probability and number of measles outbreak reported globally as well as in India.[17]

A study conducted by Causey et al. in 2021 estimated that routine immunization coverage dropped by 7.7% globally in 2020, leaving 30 million children under-vaccinated, of whom nearly 17 million received no vaccines at all.[18] The findings of study are aligned with India's surge in zero-dose children in both 2020 and 2023, suggesting that recovery was neither uniform nor sustained. A study by Feikin et al. in 2022 showed that political instability, healthcare worker strikes, and natural disasters are among the most significant contributors to service delivery gaps in immunization.[19,20,21,22]



*Source: WUENIC estimates 2024 report

Figure 5: Breadth of Protection (Mean Coverage across 12 antigens, %): Global



*Source: WUENIC estimates 2024 report

Figure 6: Breadth of Protection (Mean Coverage across 12 antigens, %): India

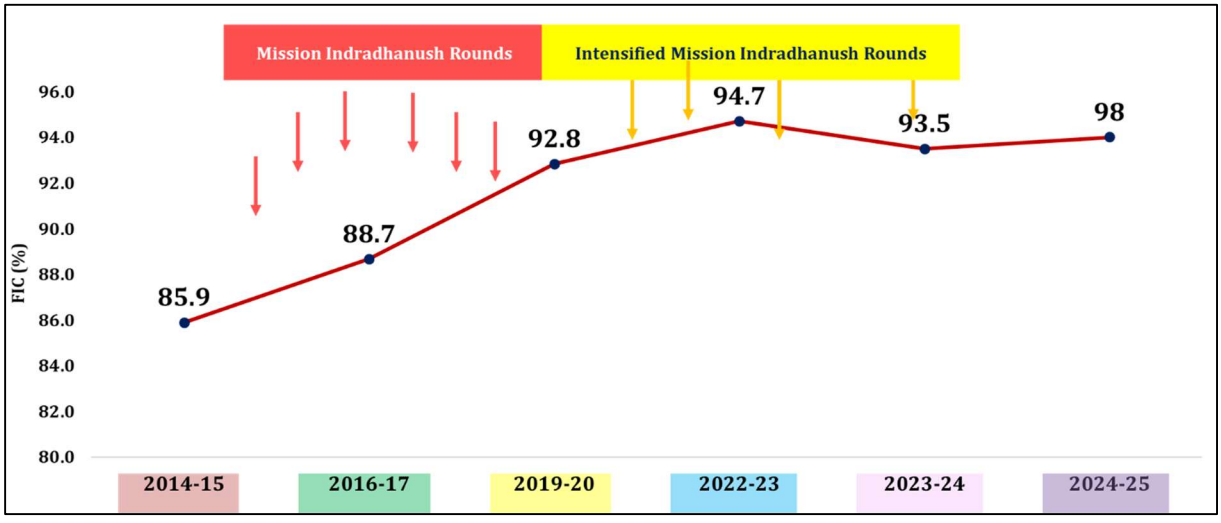


Figure 7: Full Immunization Coverage: India (HMIS)

One of the most pressing challenges was the nationwide strike by frontline workers, especially ASHAs, across several States such as Bihar[23], Haryana[24], Uttar Pradesh[25], and Madhya Pradesh[26,27], Maharashtra[28] which echoes the findings from African countries[29]. According to the Center for Science and Environment and Indian Meteorological Department[30], India faced extreme weather events such as heatwaves, cyclones, snowfall, cloudbursts, floods, landslides, and cold waves on 235 out of 273 days until September 30, 2023[31] which not only lead to loss of life and infrastructure but also strained health systems affecting the delivery of health services including immunization. Climate change affect the accessibility, vaccine stability, and pathogen variation.[32] According to the WHO, the direct damage costs to health from climate change are estimated to be between US$ 2–4 billion per year by 2030.[33] Climate change significantly impacts health by increasing outbreaks of infectious diseases, driving displacement and disrupting health systems. The impacts of climate change on health disproportionately affect vulnerable groups such as children, women and displaced people, with health workers facing increased risks, especially during extreme climate events.

These reasons can fairly be assumed to significantly affect the prevalence of Zero-dose children. A multi-country analysis by Arsenault et al. in 2022 found that zero-dose children disproportionately belong to families in the poorest quintile, with limited maternal education and minimal antenatal care exposure. In India, data from NFHS and WUENIC corroborate this, with disadvantaged geographies and social groups bearing the highest zero-dose burden.[7] Encouragingly, India's efforts through ZIP intervention tries to bring a cohesive approach of digitalisation of immunization records, tracking of beneficiaries, mitigating immunization coverage challenges due to migration through U-WIN portal. U-WIN and microplanning directly address barriers such as socioeconomic disparities and digital divides by enabling real-time name-based tracking of due beneficiaries, targeted outreach, and equitable service delivery. U-WIN enhances beneficiary visibility and continuity of care, especially for migratory and underserved populations, while microplanning ensures tailored, community-based strategies to reach zero-dose children in hard-to-reach areas. ZIP also envisaged strengthening of programme review at all levels through data analytics and strengthening review mechanism, demand generation in the society for vaccination by establishing a community of practice on demand which would guide approaches to improve vaccine confidence and burst myths and hesitancy associated with vaccines and vaccination. CSO engagement, improved microplanning and strengthened monitoring and mentoring of the program are targeted towards continuous improvement in the programme focusing on zero-dose children. These interventions are well thought and are consistent with global recommendations from the IA2030. The ZIP's multi-pronged approach is aligned with strategic interventions in countries like Cambodia, Nigeria, Uganda, Bangladesh and Rwanda, where community engagement, digital tools, and targeted microplanning significantly improved vaccine uptake among the hardest-to-reach.[34,35] Observing the increased DPT1 coverage by 3 percentage-points, India's immunization programme has shown a resilient recovery towards reducing zero-dose children in 2024. The mean immunization coverage for India is 83.4%, which is more than 10 percentage point of the global coverage.[14] India, through proactive strategies and continued measures such as the recently launched National Zero Measles-Rubella Elimination Campaign 2025-26 under the "Act Now" and approach[36] is consistently striving for strengthening their Routine Immunization. However, the overall impact of such interventions on the public health outcomes would be known in the coming years.

LIMITATIONS

This narrative review is limited to a desk review of secondary data such as WUENIC and NFHS data, with no primary data collection conducted to understand ground-level realities. Consequently, several local factors and context-specific variables that may have contributed to the increase or decrease in the number of Zero-dose children could not be taken into consideration. WUENIC use reported administrative data and survey data to bring the WUENIC estimates yearly hence is dependent upon the quality of reported data by the countries. WUENIC uses UN population estimates as a denominator for coverage calculations, which may differ from country-reported population data. NFHS data relies on recall of the respondents. It is a survey of limited households which has been extrapolated to give the national figures.

CONCLUSION

Despite signs of recovery and stabilization in routine immunization services, India witnessed a concerning 2% increase in the number of Zero-dose children in 2023. Health systems can be considered truly resilient only when they are equipped to absorb unexpected shocks that disrupt health outcomes. India reduced zero-dose children by 43% in 2024 through ZIP and digital interventions, despite a 2023 setback. Addressing the zero-dose challenge will require not only targeted outreach and catch-up drives but also increased funding for mobile vaccination units and digital training for ASHAs in equity-based planning, digital interoperability, and frontline workforce empowerment. Further, climate proof solutions like Nepal's solar-powered cold chain systems, India's use of solar-powered ice-lined refrigerator (ILR) in difficult topographies and Madagascar's cyclone-resistant solar refrigeration units can be utilized to keep vaccines safe and ensure uninterrupted services during extreme weather events.[37,38,39] Identifying the zero-dose children and ensuring their complete vaccination, has the potential to reduce the mortality among

infants, children. These measures will not only help achieve the IA 2030 goals but also contribute meaningfully to the broader SDGs particularly those related to SDG-3 (Health), SDG-4 (Education), and SDG-10 (Inequality). Vaccinating zero-dose children reduces under-five mortality, supporting SDG 3.2 which focuses on ending preventable deaths of newborns, to reduce neonatal mortality to at least 12 deaths per 1,000 live births and children under 5 years of age to at least 25 deaths per 1,000 live births by 2030. Moving further, future studies should explore primary data collection in high-burden districts to estimate the zero-dose children burden. Strengthen supply chains, disease surveillance, early warning systems and health workers' capacity as part of the broader effort to build climate-resilient health systems and prioritise the identification of vulnerable groups facing climate-related health threats in national Vulnerability and Adaptation (V&A) assessments, including children, women and displaced populations, as well as community health workers. Develop risk models that reconcile health sector information, such as immunisation coverage and presence of 'zero-dose' children, with climate data to anticipate the impacts of extreme weather events on health, particularly on this population and their communities.

Acknowledgment: The authors would like to thank Dr. Shipra Verma, Immunization Technical Support Unit for her support to conduct this review.

Individual author contribution: PB contributed to the conceptualization of the design, data extraction, method definition, and writing of the original draft. **BSK** was involved in the conceptualization of the design, data extraction, and writing of the original draft. **KS** contributed to the conceptualization of the design, data extraction, and was responsible for reviewing and editing the manuscript. **AV** played a key role in the conceptualization of the design, performed data analysis, provided supervision, and finalized the manuscript.

Availability of Data: This narrative review is conducted based on the publicly available evidence however the extracted data is available on request to the corresponding author.

No use of generative AI tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

Abbreviation

IA 2030- Immunization Agenda 2030
SDG- Sustainable Development Goals
DTP1- First dose of Diphtheria, Tetanus, and Pertussis-containing Vaccine
ANC- Ante Natal Checkup
WUENIC- WHO/UNICEF estimates of National Immunization Coverage
NFHS- National Family Health Survey
BOP- Breath of Protection
UIP- Universal Immunization Programme
VPDs- Vaccine Preventable Diseases
ASHA- Accredited Social Health Activist
DTP3- Third dose of Diphtheria, Tetanus, and Pertussis-containing Vaccine
MCV 1- Measles-containing-vaccine first-dose
MCV 2- Measles-containing-vaccine second dose
BCG- Bacillus Calmette–Guérin vaccine
ZIP- Zero Dose Implementation plan
U-WIN- Universal Immunization Programme WIN
MR- Measles-Rubella
HepB- Hepatitis B
Hib- Haemophilus Influenza B
IPV- Inactivated poliovirus vaccine
PCV- Pneumococcal Conjugate Vaccine
POL- Poliovirus Vaccine
RCV- Rubella-containing vaccine
RotaC- Rotavirus Vaccines Completed dose

References

1. World Health Organization. Immunization Agenda 2030: a global strategy to leave no one behind. Geneva: WHO; 2020. Available from: https://www.who.int/publications/m/item/immunization-agenda-2030-a-global-strategy-to-leave-no-one-behind [Accessed on July 26, 2025]
2. Gavi, the Vaccine Alliance. Reaching zero-dose children. Geneva: Gavi; 2025. Available from: https://www.gavi.org/our-alliance/strategy/phase-5-2021-2025/equity-goal/zero-dose-children-missed-communities. [Accessed on July 26, 2025]
3. Johri M, Rajpal S, Subramanian SV. Progress in reaching unvaccinated (zero-dose) children in India, 1992-2016: a multilevel, geospatial analysis of repeated cross-sectional surveys. Lancet Glob Health. 2021 Dec;9(12):e1697-e1706. DOI: https://doi.org/10.1016/S2214-109X(21)00349-1
4. World Health Organization. COVID-19 pandemic leads to major backsliding on childhood vaccinations, new WHO, UNICEF data shows. Geneva: WHO; 2021 Jul 15. Available from: https://www.who.int/news/item/15-07-2021-covid-19-pandemic-leads-to-major-backsliding-on-childhood-vaccinations-new-who-unicef-data-shows. [Accessed on July 28, 2025]
5. Hogan D, Gupta A. Why Reaching Zero-Dose Children Holds the Key to Achieving the Sustainable Development Goals. Vaccines. 2023 Mar 31;11(4):781. DOI: https://doi.org/10.3390/vaccines11040781 PMid:37112693 PMCid:PMC10142906
6. Farrenkopf BA, Zhou X, Shet A, Olayinka F, Carr K, Patenaude B, et al. Understanding household-level risk factors for zero dose immunization in 82 low- and middle-income countries. Harapan H, editor. PLOS ONE. 2023 Dec 7;18(12):e0287459. DOI: https://doi.org/10.1371/journal.pone.0287459
7. Taneja G, Datta E, Sapru M, et al. An equity analysis of zero-dose children in India using the National Family Health Survey data: status, challenges, and next steps. Cureus. 2023;15(2): e35376. DOI: https://doi.org/10.7759/cureus.35376
8. Kumar P, Chakraborty AB, Dhandore S, Dhalaria P, Singh AK, Agarwal D, et al. Balancing Routine and Pandemic: The Synergy of India's Universal Immunization Program and COVID-19 Vaccination Program. Vaccines. 2023 Nov 28;11(12):1776. DOI: https://doi.org/10.3390/vaccines11121776
9. Singh K, Verma A, Lakshminarayan M. India's efforts to achieve 1.5 billion COVID-19 vaccinations: a narrative review. Osong Public Health Res Perspect. 2022 Oct 31;13(5):316-327. DOI: https://doi.org/10.24171/j.phrp.2022.0104
10. World Health Organization, UNICEF. WHO/UNICEF estimates of national immunization coverage. Geneva: WHO; 2025 Jul 15. Available from: https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/global-monitoring/immunization-coverage/who-unicef-estimates-of-national-immunization-coverage. [Accessed on July 26, 2025]

11. Ministry of Health and Family Welfare, Government of India. Guidance document on strategic approach for reaching zero-dose children in India [Internet]. New Delhi: MoHFW; 2024. Available from: https://itsu.org.in/wp-content/uploads/2024/05/Zero-Dose-Document-Small-ViewOnly.pdf. [Accessed on July 26, 2025]
12. Ministry of Health and Family Welfare. Update on U WIN Portal. New Delhi: Press Information Bureau; 2024 [cited 2025 Aug 5]. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2079025
13. World Health Organization. IA2030 SP 4.1: breadth of protection (mean coverage for all WHO-recommended vaccine antigens, by country). Geneva: WHO; 2025. Available from: https://www.who.int/data/gho/indicator-metadata-registry/imr-details/7771. [Accessed on July 27, 2025]
14. Ministry of Health and Family Welfare. Myth vs. facts on immunization. New Delhi: Press Information Bureau; 2024. Available from: https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2034080. [Accessed on July 27, 2025]
15. Ministry of Health and Family Welfare. India's zero-dose children decline from 0.11% in 2023 to 0.06% in 2024. New Delhi: Press Information Bureau; 2025. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2140343. [Accessed on July 27, 2025]
16. United Nations Children's Fund. The state of the world's children 2023: for every child, vaccination]. Florence: UNICEF Innocenti - Global Office of Research and Foresight; 2023 Apr [cited 2025 Jul 27]. Available from: https://www.unicef.org/media/108161/file/SOWC-2023-full-report-English.pdf.
17. CDC. Global Measles Outbreaks. United States: 2025. Available from: https://www.cdc.gov/global-measles-vaccination/data-research/global-measles-outbreaks/index.html [Accessed on May 8, 2025]
18. Causey K, Fullman N, Sorensen RJD, Galles NC, Zheng P, Aravkin A, et al. Estimating global and regional disruptions to routine childhood vaccine coverage during the COVID-19 pandemic in 2020: a modelling study. The Lancet. 2021 Aug; 398(10299):522-534. DOI: https://doi.org/10.1016/ S0140-6736(21)01337-4 PMid:34273292
19. Center for Strategic and International Studies. Reaching people in fragile and conflict-affected settings with immunization services. Washington, DC: CSIS; 2023. Available from: https://www.csis.org/analysis/reaching-people-fragile-and-conflict-affected-settings-immunization-services. [Accessed on July 28, 2025]
20. World Health Organization. Accessing essential health services in fragile, conflict-affected and vulnerable settings. Geneva: WHO; 2025. Available from: https://www.who.int/activities/accessing-essential-health-services-in-fragile-conflict-affected-and-vulnerable-settings. [Accessed on July 28, 2025]
21. Craveiro I, Choudhury PK, de OLiveira APC, Pereira A, Fronteira I, Chança R, et al. Impacts of industrial actions, protests, strikes and lockouts by health and care workers during COVID-19 and other pandemic contexts: a systematic review. Hum Resour Health. 2024 July 2;22(1):47. DOI: https://doi.org/10.1186/s12960-024-00923-y PMid:38956631.
22. Essex R, Ahmed S, Elliott H, Lakika D, Mackenzie L, Weldon SM. The impact of strike action on healthcare delivery: A scoping review. Int J Health Plann Manage. 2023 May;38(3):599-627. DOI: https://doi.org/10.1002/hpm.3610 PMid:36576087
23. Newsclick. Bihar: 32-day ASHA workers' strike ends after talks with health minister. New Delhi: Newsclick; 2023 Aug 14. Available from: https://www.newsclick.in/bihar-32-day-asha-workers-strike-ends-after-talks-health-minister [Accessed on July 27, 2025]
24. Pati I. ASHA workers to hold statewide strike over wages. Times India. 2022 Jun 29. Available from: https://timesofindia.indiatimes.com/city/gurgaon/asha-workers-to-hold-statewide-strike-over-wages/articleshow/92532319.cms. [Accessed on July 27, 2025]
25. Jafri AA. UP: ASHA workers protest again, not paid salaries for six months. NewsClick. 2022 Sep 20. Available from: https://www.newsclick.in/UP-ASHA-workers-protest-paid-salaries-six-months [Accessed on July 27, 2025]
26. Dwary A. Thousands of ASHA workers on strike in Madhya Pradesh, demand salary hike. NDTV. 2023 Dec 4. Available from: https://www.ndtv.com/india-news/thousands-of-asha-workers-on-strike-in-madhya-pradesh-demand-salary-hike-3943374. [Accessed on July 27, 2025]
27. Gupta S. ASHAs in Madhya Pradesh on indefinite strike; 29 arrested, released, but refuse to call off protest. Gaon Connection. 2021. Available from: https://en.gaonconnection.com/reportage/asha-workers-madhya-pradesh-strike-arrests-salary-compensation-insurance-garib-kalyan-shivraj-singh-chouhan/. [Accessed on July 27, 2025]
28. Mascarenhas A. Day 14 of strike: 200 ASHA workers demonstrate at PMC main building. The Indian Express. 2023 Oct 30; Available from: https://indianexpress.com/article/cities/pune/day-14-of-strike-asha-workers-demonstrate-pmc-main-building-9006390/ [Accessed on Aug 1st, 2025]
29. Manguele ALJ, Sidat M, Ferrinho P, Cabral AJR, Craveiro I. Strikes of physicians and other health care workers in sub-Saharan African countries: a systematic review. Front Public Health. 2024 May 30;12:1209201. DOI: https://doi.org/10.3389/fpubh.2024.1209201 PMid:38873309
30. Pandey K, Sengupta R. Climate India 2024: an assessment of extreme weather events. New Delhi: Centre for Science and Environment; 2024. Report No.: 33. Available from: https://www.cseindia.org/climate-india-2024-an-assessment-of-extreme-weather-events-12460 [Accessed on Aug 1st, 2025]
31. Center for Strategic & International Studies. India has faced more extreme weather events and higher damages in 2024 compared to last year, says CSE and Down To Earth's annual state of extreme weather report. 2024. Available from: https://www.cseindia.org/india-has-faced-more-extreme-weather-events-and-higher-damages-in-2024-compared-to-last-year-says-cse-and-down-to-earth-s-annual-state-of-extreme-weather-report-12462 [Accessed on Aug 6th, 2025]
32. Zhang K, Dang Y, Li Y, Tao C, Hur J, He Y. Impact of climate change on vaccine responses and inequity. Nat Clim Change. 2024 Dec;14(12):1216-1218. DOI: https://doi.org/10.1038/s41558-024-02192-y PMid:40276125 PMCid:PMC12021441
33. World Health Organization. Climate change. Geneva. Available from: https://www.who.int/health-topics/climate-change#tab=tab_1 [Accessed on May 8, 2025]
34. Gavi, the Vaccine Alliance. Unlocking Tailored Solutions: Understanding Root Causes and Barriers to Reaching Zero-Dose Children and Missed Communities. Geneva: Gavi; 2025. Available from: https://zdlh.gavi.org/events/unlocking-tailored-solutions-understanding-root-causes-and-barriers-reaching-zero-dose [Accessed on Aug 5, 2025]
35. Gavi, the Vaccine Alliance. Reaching zero-dose children: local challenges, global lessons. Geneva: Gavi; 2025. Available from: https://www.gavi.org/vaccineswork/reaching-zero-dose-children-local-challenges-global-lessons. [Accessed on July 27, 2025]
36. Ministry of Health and Family Welfare. Union Health Minister launches National Zero Measles-Rubella Elimination Campaign. New Delhi: Press Information Bureau; 2025. Available from: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2124032 [Accessed on July 27, 2025]
37. United Nations Children's Fund. Securing the cold chain. Nepal: 2025. Available from: https://www.unicef.org/nepal/stories/securing-cold-chain [Accessed on Aug 5, 2025]
38. Gavi, the Vaccine Alliance. In Madagascar, an unstable climate is putting the vaccine cold chain to the test. Geneva: Gavi; 2025. Available from: https://www.gavi.org/vaccineswork/in-madagascar-unstable-climate-putting-vaccine-cold-chain-to-test [Accessed on Aug 5, 2025]
39. Gavi, the Vaccine Alliance. An extremely important fridge: Keeping vaccines cool in remote Kashmir. Geneva: Gavi; 2025. Available from: https://www.gavi.org/vaccineswork/extremely-important-fridge-keeping-vaccines-cool-remote-kashmir [Accessed on Aug 6, 2025]