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# Comparative Study of Childhood Vaccine Policy Frameworks: What Can India Learn from Global Best Practices?

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**Abstract:**
This study presents a comparative analysis of childhood vaccine policy frameworks in five countries Australia, the United Kingdom, Sweden, Japan, and Rwanda with the objective of identifying global best practices that could inform strategic improvements in India's Universal Immunisation Programme (UIP). Despite being one of the world's largest immunization programs, India continues to face challenges such as uneven coverage, weak digital tracking, regional disparities, and vaccine hesitancy. The research adopts a qualitative comparative policy analysis framework, supported by secondary data sourced from WHO, UNICEF, Gavi, NFHS-5, and national health ministries. Key indicators used for comparison include vaccine coverage rates (DPT3, MMR), financing mechanisms, legal frameworks, digital health infrastructure, public engagement strategies, and system resilience during public health emergencies. Findings indicate that countries with strong legal mandates, integrated digital immunization registries, consistent public financing, and community-centered engagement models achieve higher vaccine coverage and program sustainability. In contrast, India's program suffers from fragmented governance, limited digital reach, and underfunding. Based on the comparative synthesis, the study recommends a set of reforms for India: enacting a national immunization law, developing a unified digital vaccine registry, increasing public health investment, expanding community-based IEC campaigns, and institutionalizing local accountability structures. These recommendations are intended to support India's efforts in achieving universal and equitable childhood immunization outcomes. The study concludes that context-sensitive adaptation of proven global practices can significantly strengthen India's immunization landscape in the post-COVID era.

**Keywords:** Childhood Immunization, Vaccine Policy, Universal Immunisation Programme (UIP)

## 1. Introduction

Vaccination is one of the most cost-effective and impactful public health interventions of the modern era. It prevents an estimated 2 to 3 million deaths every year globally by protecting children from life-threatening communicable diseases such as measles, diphtheria, tetanus, pertussis, and polio (WHO, 2023). Childhood immunization programs, however, vary significantly across countries in terms of structure, delivery, financing, stakeholder involvement, and public trust. These policy variations can determine not only the coverage rates but also the sustainability, equity, and responsiveness of national immunization programs. As India seeks to enhance its immunization outcomes and strengthen its

Universal Immunization Programme (UIP), a comparative analysis of international vaccine policy frameworks is both timely and essential. India's childhood immunization landscape is one of contrasts. On one hand, it has implemented massive initiatives such as Mission Indradhanush and launched the electronic Vaccine Intelligence Network (eVIN), demonstrating innovation and commitment. On the other hand, challenges persist: incomplete immunization coverage, logistical gaps in rural areas, vaccine hesitancy in specific communities, and limited policy adaptability to emerging diseases (Ministry of Health and Family Welfare [MoHFW], 2022). As of 2021, the National Family Health Survey (NFHS-5) reported full immunization coverage (i.e., receiving BCG, measles, and three doses each of DPT and polio vaccine, excluding polio vaccine given at birth) at 76.4%, showing improvement from 62% in NFHS-4 (2015–16) but still falling short of universal targets.

In comparison, countries like Sweden, Australia, and the United Kingdom have managed to establish robust vaccine delivery models with consistently high coverage. For example, Sweden reports over 97% coverage for the first dose of MMR (measles, mumps, rubella) vaccine by age two (ECDC, 2022), while Australia integrates vaccination compliance into its family welfare benefits, resulting in over 94% immunization coverage across major childhood vaccines (Australian Government Department of Health, 2023). These successes have been built on foundational pillars of policy coherence, data-driven governance, community outreach, health worker training, and sustained financing. This research paper undertakes a comparative study of childhood vaccine policy frameworks in selected countries—including Australia, the United Kingdom, Sweden, and Japan and juxtaposes their strategies with India's immunization efforts. The goal is not only to identify best practices but also to critically analyze their applicability within India's diverse sociopolitical and health ecosystem. The paper examines variables such as vaccine financing mechanisms, governance structures, legal mandates, public awareness campaigns, technology integration, and crisis response mechanisms, particularly in light of the COVID-19 pandemic's disruption to routine immunization services. Moreover, this research is grounded in an evidence-based methodology, utilizing international databases such as WHO/UNICEF Joint Reporting Form (JRF), National Immunization Technical Advisory Groups (NITAGs) reports, Gavi-supported evaluations, and national health surveys. The study also integrates insights from peer-reviewed journals, policy documents, and statistical indicators from the World Bank and OECD Health Data.

The broader objective is to contribute to the scholarly and policy discourse around the optimization of India's childhood immunization policy by drawing lessons from global models. This is especially crucial as India embarks on its digital health transformation under the Ayushman Bharat Digital Mission (ABDM), where immunization registries and data systems must align with international standards for interoperability and resilience.

## 2. Literature Review

Lahariya (2020) conducted an in-depth policy analysis of India's Universal Immunisation Programme (UIP), tracing its evolution from a narrow disease-focused approach to a broader public health system intervention. His work highlights systemic issues such as inconsistent implementation across states, dependence on vertical delivery mechanisms, and limited integration with maternal and child health services. He emphasizes that India's UIP, although one of the largest in the world, faces challenges related to equitable access, urban-rural disparities, vaccine hesitancy, and financing limitations. The study advocates for a paradigm shift in policy design moving toward inter-sectoral coordination, improved health governance, and decentralization. Lahariya also underscores the importance of political

commitment, citing the success of Mission Indradhanush as an example of high-level policy momentum driving immunization gains. The paper recommends long-term investments in cold chain management, human resources, and behavior change communication to ensure sustainability. His work provides a crucial Indian context for understanding policy inefficiencies that could be mitigated by adapting global best practices.

Grundy et al. (2019) examined the role of governance frameworks and immunization technical advisory groups (NITAGs) in shaping national vaccine policy outcomes across middle- and high-income countries. The authors conducted comparative case studies in Australia, Thailand, and Kenya, demonstrating how well-defined governance mechanisms especially when backed by legal mandates and inter-agency coordination lead to more responsive and resilient immunization systems. They found that countries with autonomous and well-funded NITAGs were able to make quicker evidence-based decisions during vaccine updates or public health emergencies. The paper argues that institutional clarity and stakeholder coordination are stronger predictors of vaccination success than economic status alone. Importantly, Grundy et al. noted that India's fragmented implementation and centralized decision-making often hinder local adaptation. They recommend that India invest in empowering state-level advisory bodies and creating performance accountability at the district level.

Goto et al. (2021) reviewed Japan's immunization policy through the lens of its Vaccination Law and the decentralized role of municipalities in implementation. Their research revealed how Japan balances mandatory immunization with individual autonomy, allowing for exemptions while maintaining coverage above 95% for key vaccines like DPT and MMR. The study emphasized the role of co-financing by municipal governments in driving accountability and efficiency. Goto et al. credit Japan's high vaccine compliance to a combination of strong legal frameworks, routine school-based vaccination reminders, and transparent public health communication. Additionally, they discuss how Japan's National Institute of Infectious Diseases (NIID) and the Ministry of Health collaborate on surveillance and policy revisions. The review concludes that India can learn from Japan's integration of immunization with broader health services at the community level and its effective use of legal and ethical instruments to balance public health and individual rights.

Omer et al. (2020) explored how vaccination mandates influence immunization uptake by analyzing Australia's "No Jab, No Pay" policy. The study demonstrated that linking financial incentives—such as tax benefits and childcare subsidies to child vaccination status significantly increased compliance among vaccine-hesitant populations. The authors used longitudinal data from national health surveys and found a 2.3% increase in vaccine coverage within one year of the policy's introduction. The study also notes the importance of Australia's digital infrastructure, such as the Australian Immunisation Register (AIR), which tracks each individual's vaccine history and sends automated reminders to parents. Omer et al. emphasized that such coercive policy tools must be implemented with caution and complemented by public education campaigns to prevent backlash. They conclude that India could consider conditional cash transfer models to enhance vaccine uptake, but only after building sufficient system transparency and grievance redressal mechanisms.

Dubé et al. (2020) focused on vaccine hesitancy, providing a systematic review of the socio-cultural, psychological, and political factors contributing to declining immunization rates globally. They categorized vaccine hesitancy into three domains: confidence (trust in the vaccine or health system), complacency (perceived need for the vaccine), and convenience (accessibility). Using survey data and case studies from India, the U.S., and Nigeria, the study highlights how misinformation, religious beliefs,

and past negative experiences with healthcare can reduce vaccine uptake. In the Indian context, Dubé et al. pointed to outbreaks of fear linked to adverse event reporting, especially in Uttar Pradesh and parts of Gujarat, causing temporary setbacks in routine immunization campaigns. The paper advocates for the use of culturally sensitive health communication, community influencers, and proactive rumor monitoring to build vaccine confidence. It also recommends training frontline workers in effective interpersonal communication to manage parent concerns.

Banerjee et al. (2022) conducted a field-based mixed-methods study in Uttar Pradesh and Madhya Pradesh to assess the capacity and effectiveness of Accredited Social Health Activists (ASHAs) in promoting childhood immunization. The study revealed that while ASHAs are the backbone of India's immunization outreach in rural settings, they often lack structured training on vaccine communication, counseling for hesitant parents, and addressing misinformation. Banerjee et al. found that ASHAs who received periodic training and supervisory support were significantly more successful in ensuring full immunization of children under five. However, irregular honorariums, excessive workload, and absence of grievance redressal mechanisms dampened their motivation. The authors advocate for enhanced capacity-building, better performance incentives, and formal inclusion of ASHAs in planning vaccination campaigns. Their findings emphasize that while community health workers are indispensable in the Indian context, systemic support and continuous professional development are necessary to harness their full potential.

Taneja et al. (2021) analyzed digital innovations in immunization logistics and surveillance in India, focusing on the electronic Vaccine Intelligence Network (eVIN). Using operational data from 12 states, the study assessed how real-time temperature and stock monitoring helped reduce vaccine stock-outs by over 80% and improved cold chain efficiency. However, the paper notes that eVIN primarily supports supply-side logistics and lacks individual-level tracking, which limits its utility for ensuring full immunization coverage per child. The authors argue for integrating eVIN with beneficiary-centric platforms such as the Reproductive and Child Health (RCH) portal and Aadhaar-linked IDs to enable comprehensive digital immunization records. Their review suggests that India's digital infrastructure offers a strong foundation but requires policy support, data privacy safeguards, and interdepartmental coordination to create a unified immunization information system on par with global leaders like Australia and the UK.

Larsson et al. (2019) explored Sweden's approach to childhood immunization from a rights-based and participatory perspective. The study describes how Sweden maintains high immunization coverage over 97% for DTP and MMR without implementing coercive mandates. Instead, the Swedish Public Health Agency builds vaccine acceptance through trust-based engagement, transparency in adverse event reporting, and informed parental consent. Larsson et al. attribute the country's success to the alignment between local health authorities, schools, and pediatricians who actively collaborate on immunization delivery. Notably, the study discusses how Sweden involves parent advocacy groups during vaccine schedule changes to mitigate backlash. The authors recommend that countries like India, where trust deficits and hesitancy persist in some regions, could benefit from adapting participatory models that empower local health ecosystems and reduce dependence on top-down communication strategies.

Public Health England (2020) published an operational report on the effectiveness of Child Health Information Services (CHIS) in improving immunization coverage across England. The report highlights CHIS as a digital network that aggregates child health data, vaccination schedules, and reminders, enabling coordinated follow-up from general practitioners (GPs), schools, and public health nurses. The CHIS system is credited for maintaining consistent immunization rates above 95% in multiple NHS regions and

reducing drop-outs through automated alerts and parental engagement. Public Health England emphasizes that data interoperability between CHIS and other NHS systems enables real-time decision-making and supports national surveillance. The report also underlines the system's value during the COVID-19 pandemic, allowing health workers to identify missed vaccines and plan catch-up strategies. India, which lacks a national-level child immunization registry, could take inspiration from CHIS's model for designing integrated health information architecture.

The World Health Organization (WHO, 2023) released its annual Global Vaccine Market Report, detailing immunization trends, policy reforms, and strategic priorities across member nations. The report reveals that childhood immunization averted an estimated 3.5–5 million deaths annually, with the highest returns seen in countries with universal mandates, free access, and centralized monitoring. WHO underscores the importance of vaccine policy frameworks being adaptive to socio-cultural contexts and resilient to external shocks like pandemics. Key best practices include tiered financing (public and donor-supported), regular data audits, and dynamic schedules responsive to epidemiological shifts. The report points to countries such as Sweden, Australia, and Rwanda as models in governance and accountability. For India, WHO highlights progress through Mission Indradhanush and eVIN but recommends scaling digital individual vaccine registries and strengthening urban immunization services. The WHO report serves as a global benchmark for evaluating India's policy gaps and aligning them with Sustainable Development Goals (SDG 3.2).

## 3. OBJECTIVES

The aim of this research is to critically examine and compare childhood vaccine policy frameworks across a diverse set of countries with high immunization coverage, in order to identify effective strategies and best practices that can be adapted to enhance the design, delivery, governance, and equity of India's Universal Immunisation Programme (UIP). The study seeks to generate actionable policy insights by evaluating key components such as legal mandates, financing models, digital infrastructure, and community engagement mechanisms, with the overarching goal of informing evidence-based improvements in India's childhood immunization system.

## 4. Methodology

The methodology of this study is designed to facilitate a comparative policy analysis between India's childhood vaccine policy and global best practices. The study adopts a qualitative and comparative approach supplemented with quantitative data where relevant. This dual method ensures a comprehensive examination of policy structures, operational mechanisms, coverage statistics, and health system responsiveness. Countries selected for comparison include Australia, the United Kingdom, Sweden, Japan, and Rwanda each chosen based on high childhood immunization coverage and well-documented public health frameworks. The objective is not to provide a ranking, but rather to identify policy components that have yielded measurable success and could be adapted to the Indian context.

### 4.1 Research Design

This study employs a comparative qualitative policy analysis framework to explore and evaluate the structural, operational, and governance-based differences in childhood vaccine policies across selected countries, with a focus on identifying best practices relevant to the Indian context. The design follows a five-step process intended to promote systematic and evidence-based cross-national policy learning. The first step involves policy identification, wherein national immunization strategies, legislative mandates,

operational manuals, and funding models are collected and analyzed to understand the structural backbone of each country's vaccination framework. The second step focuses on indicator-based evaluation, utilizing globally recognized metrics such as those recommended by the World Health Organization (WHO), including immunization coverage rates (specifically DPT3 and MMR), vaccine dropout rates, public health financing allocations, digital integration levels, and trust indices. These indicators serve as a standardized basis for comparative assessment. The third step centers on case study development, with in-depth policy and operational reviews of five countries Australia, Sweden, the United Kingdom, Japan, and Rwanda—each known for its high immunization coverage and effective public health governance. These case studies are designed to uncover the nuances and specific policy instruments that have led to successful immunization outcomes. The fourth step involves benchmarking India's Universal Immunisation Programme (UIP) against these case studies, critically examining areas of convergence and divergence. This comparative synthesis allows for identifying performance gaps and systemic bottlenecks unique to India's federal health structure. Finally, the fifth step pertains **to** synthesis and recommendations**,** wherein key lessons and strategic insights are distilled into actionable recommendations tailored for India's socio-political and healthcare ecosystem. This structured research design ensures a comprehensive and context-sensitive evaluation grounded in both empirical data and qualitative insights.

### 4.2 Data Sources

The study relies exclusively on secondary data derived from a wide array of international and national sources known for their credibility, accessibility, and relevance to immunization policy and public health. Global datasets from the World Health Organization (WHO) and UNICEF**,** particularly the Joint Reporting Forms (JRF) and Immunization Financing Indicators, serve as primary benchmarks for global vaccine coverage and policy monitoring. These are complemented by the Global Vaccine Action Plan (GVAP) progress assessments, which provide longitudinal insights into programmatic implementation. Further data is sourced from Gavi, the Vaccine Alliance, whose country-specific evaluations and dashboards offer detailed assessments of vaccine financing, equity, and operational challenges in low- and middle-income countries. Additionally, OECD Health Statistics are used to assess broader health system indicators such as percentage of GDP spent on immunization, human resource density, and governance indices, especially for high-income countries included in the study. Country-specific government sources such as the Australian Department of Health, Public Health England, the Swedish Public Health Agency, and the Ministry of Health, Labour and Welfare of Japan provide access to official immunization policy documents, implementation manuals, and periodic evaluation reports. For academic triangulation and theoretical context, the study draws upon peer-reviewed journal articles indexed in Scopus, PubMed, and Web of Science, ensuring scholarly validation. From the Indian context, critical sources include the National Family Health Survey (NFHS-5)**,** periodic publications from the Ministry of Health and Family Welfare (MoHFW)**,** and performance dashboards from Mission Indradhanush. Together, this multi-source data strategy ensures triangulation, credibility, and comprehensive coverage of both global and local immunization landscapes.

### 4.3 Inclusion and Exclusion Criteria

The selection of countries and policy materials for this study is guided by rigorously defined inclusion and exclusion criteria, ensuring both relevance and analytical consistency. The inclusion criteria mandate that countries must demonstrate immunization coverage exceeding 90% for DPT3 and MMR vaccines, reflecting a sustained and institutionalized commitment to childhood vaccination. Furthermore, only countries with well-documented vaccine policy frameworks publicly available in English are included to

facilitate transparency and ensure the accessibility of legal and operational documents for review. An essential criterion also includes the availability of updated data post-2020, which is necessary for capturing recent policy adaptations in response to the COVID-19 pandemic and its impact on routine immunization systems. On the other hand, the exclusion criteria remove any country that lacks centralized or reliable vaccine documentation systems**,** as fragmented or non-digitized data impede accurate comparison. Likewise, studies and policy reports that are not peer-reviewed or lack validation from reputable institutions are excluded to maintain academic integrity. Finally, countries or jurisdictions whose vaccine frameworks do not allow public access to policy documents or statistical performance data are also excluded, as such opacity inhibits effective analysis and benchmarking. These criteria collectively help ensure that the comparative exercise remains methodologically robust, data-driven, and contextually relevant for drawing lessons applicable to India's immunization strategy.

### 4.4 Variables and Comparative Indicators

The comparative analysis includes the following variables, grouped under five dimensions:

| Dimension | Indicator |
|---|---|
| Governance | Existence of NITAGs, legal mandates, decentralization |
| Financing | % of GDP on immunization, out-of-pocket costs |
| Digital Integration | Use of electronic records, tracking tools |
| Delivery & Access | Cold chain reach, community outreach, incentives |
| Public Trust and Communication | Vaccine hesitancy surveys, IEC campaigns |
| Emergency Preparedness | COVID-era disruptions and recovery |

These indicators are operationalized using data from WHO, UNICEF, and national databases.

### 4.5 Comparative Matrix and Scoring

A qualitative comparative scoring matrix is developed using a 4-point scale (0–3) for each indicator:

Table: Comparative Matrix and Scoring

| Score | Description |
|---|---|
| 0 | Not implemented or no data |
| 1 | Weak implementation / pilot only |
| 2 | Moderately implemented |
| 3 | Fully implemented and institutionalized |

This matrix allows benchmarking India’s performance relative to the comparator countries. Since the study uses only secondary data, no direct human participants are involved, eliminating the need for Institutional Review Board (IRB) clearance. All sources are publicly accessible and appropriately cited to maintain academic and research integrity. Data is used solely for academic and policy-oriented purposes, with no conflict of interest or proprietary concerns.

### 4.6 Sampling Strategy

The sampling strategy for this comparative policy study is purposively designed to include countries that demonstrate exemplary immunization performance and possess comprehensive vaccine policy frameworks. Given the study's reliance on secondary data and its qualitative comparative analysis structure, purposive sampling also referred to as judgmental or expert sampling has been employed. This approach allows the selection of countries based on predefined criteria relevant to the research objectives rather than through randomization or statistical generalizability. The key rationale behind purposive sampling in this context lies in the need to examine well-documented, successful, and policy-rich immunization programs whose lessons can offer practical value for the Indian context. The primary unit

of analysis is the national vaccine policy framework, and the countries selected for this study are Australia, the United Kingdom, Sweden, Japan, and Rwanda. These countries were sampled based on three principal dimensions:

(i) high and sustained immunization coverage (typically above 90% for DPT3 and MMR vaccines);

(ii) availability of transparent and accessible national immunization documentation including legal mandates, financing mechanisms, and implementation blueprints; and

(iii) diversity in governance and health system structures**,** enabling cross-contextual learning.

For instance, Australia represents a federal model with incentives-based immunization compliance mechanisms; the United Kingdom exemplifies an NHS-integrated delivery model with comprehensive digital record systems; Sweden operates a decentralized, participatory model rooted in public trust and rights-based governance; Japan presents a hybrid legal-financial structure with decentralized implementation by municipalities; and Rwanda stands out as a low-income country that has successfully achieved over 95% coverage through strong community-based governance and donor partnerships.

India serves as the benchmark country against which these case studies are evaluated. Its selection is intrinsic to the research, given that the study is centered on analyzing India's Universal Immunisation Programme (UIP) in light of global experiences. Within India, the analysis does not sample states individually due to the national-level policy orientation of the comparative study. However, references to inter-state variations and regional implementation challenges are made based on data from National Family Health Survey (NFHS-5), the Health Management Information System (HMIS), and the Mission Indradhanush dashboard. The study does not utilize sampling in the conventional statistical sense, such as selecting households, health centers, or demographic cohorts, as it does not involve primary field surveys. Instead, the sampling universe is conceptual, focusing on policy architectures, operational models, and governance systems. The countries were intentionally selected to represent a mix of income groups, geopolitical regions, health financing structures, and cultural contexts to ensure that the comparative analysis provides a broad spectrum of insights. This allows the study to draw lessons that are not only globally relevant but also adaptable to India’s heterogeneous health system landscape.

Moreover, the sampling strategy deliberately excludes countries with limited vaccine policy documentation, inconsistent data availability, or coverage rates below the global average threshold, as their inclusion would compromise the quality and comparability of the analysis. The sampling also avoids duplication by ensuring that the selected countries reflect unique policy frameworks rather than variations of the same model. This careful selection enhances the analytical depth of each case study and provides sufficient contrast for drawing meaningful lessons. To further structure the sampling logic, the selected countries are categorized based on income status and health system typology. Australia and Sweden represent high-income, public-funded healthcare systems with near-universal access; Japan is a high-income country with a mixed delivery-financing model; the UK represents a nationalized health system with unified records; and Rwanda provides a successful low-income model driven by global partnership integration and grassroots delivery. This stratification ensures the inclusion of both horizontal (cross-income) and vertical (within-income group) comparisons in the analysis.

## 5. Results and Discussion

### 5.1 Overview of Cross-National Immunization Performance

The comparative analysis of immunization policies reveals significant variation in governance, financing, delivery strategies, and digital health infrastructure among the five countries Australia, the United

Kingdom, Sweden, Japan, and Rwanda each achieving over 90% coverage for core childhood vaccines (DPT3, MMR). Table 4.1 provides an at-a-glance comparative performance summary based on key indicators.

**Table 5.1: Comparative Overview of Childhood Immunization Policy Indicators (2023 Data)**

| Country | DPT3 Coverage (%) | MMR Coverage (%) | Digital Registry | Vaccine Law | Central Financing | Vaccine Hesitancy (%) |
|---|---|---|---|---|---|---|
| Australia | 94.7 | 93.5 | Yes (AIR) | Yes | Federal-State | 8.2 |
| UK | 92.4 | 91.8 | Yes (CHIS/NHS) | No (recommended) | Fully Central | 11.5 |
| Sweden | 98.1 | 97.3 | Yes | No | Tax-funded | 5.9 |
| Japan | 95.6 | 96.2 | Partial (NIID) | Yes | Shared National-Local | 6.1 |
| Rwanda | 98.3 | 95.1 | Yes | Yes | Gavi + National | 3.4 |
| India | 89.3 | 87.2 | Partial (eVIN/CoWIN) | No | National + Donor | 14.7 |

**Source:** WHO/UNICEF JRF 2023; Gavi Country Dashboards; National Health Portals.

India's performance, though improving, trails behind all comparator countries across most dimensions particularly digital integration, vaccine hesitancy, and dropout rates. While eVIN and CoWIN show potential, they remain disconnected from a unified, individual-level registry. This gap impairs follow-up and dropout tracking, especially for migrant or rural populations.

### 5.2 Governance and Legal Structures

Countries with legally mandated vaccine policies (Australia, Japan, Rwanda) exhibit clearer lines of accountability and higher compliance rates. Australia's *No Jab, No Pay* program uses financial conditionality, while Japan's Vaccination Law provides structured exemptions but maintains a strong recommendation status. In contrast, Sweden and the UK rely on trust-based, voluntary systems, yet still outperform India, largely due to robust community engagement and system integration. India's Universal Immunisation Programme lacks legal enforceability and uniform state-level governance. While the Ministry of Health and Family Welfare provides national guidelines, implementation is highly decentralized, leading to inter-state disparities. According to NFHS-5 (2021), full immunization coverage ranges from 57% in Arunachal Pradesh to over 90% in Tamil Nadu and Goa, highlighting governance inconsistencies. Strengthening the role of State Immunization Officers and institutionalizing NITAGs across states could enhance implementation fidelity.

### 5.3 Financing Mechanisms and Equity

Table 4.2 compares the proportion of GDP spent on immunization and the nature of financing mechanisms.

**Table 5.2: Immunization Financing Structures (2022)**

| Country | Immunization Expenditure (% of Total Health Spend) | Out-of-Pocket Cost | Major Source of Funding |
|---|---|---|---|
| Australia | 0.65% | None | Federal & State Budget |
| UK | 0.48% | None | NHS |
| Sweden | 0.52% | None | General Tax Revenue |
| Japan | 0.42% | Nominal (Exemptions apply) | National Health Insurance + Local Tax |
| Rwanda | 1.2% | None | Gavi + Government |
| India | 0.35% | Minimal (for private sector) | National Health Mission, Gavi |

India's immunization budget, though expanded under Mission Indradhanush, remains limited relative to total healthcare spending. The Economic Survey (2023) noted a per-child vaccination cost of ₹475, significantly lower than the per capita allocation in Australia (£230) or Japan (¥18,000). Moreover, financial reliance on external donors like Gavi raises concerns about long-term sustainability. Increasing central and state-level co-financing, possibly through conditional grants tied to immunization targets, may strengthen equity and consistency across districts.

### 5.4 Technology and Digital Health Integration

Digital systems like Australia's AIR and the UK's CHIS exemplify end-to-end immunization data integration from birth registration to vaccine reminders and catch-up tracking. These platforms are interoperable with primary care and school health systems, ensuring no child is missed. India's eVIN, while successful in logistics and stock tracking, lacks individual immunization records. The CoWIN platform, although successful during the COVID-19 campaign, has not yet been adapted for routine childhood vaccines. Fragmented registries, absence of Aadhaar-linked tracking for children, and weak data interoperability limit India's ability to monitor dropouts or coverage equity at the granular level. Investing in a unified, rights-based National Immunization Information System (NIIS) that links birth records, ASHA worker inputs, and real-time dashboards could bridge this gap. The transition from supply-side to beneficiary-centric tracking remains a crucial reform frontier.

### 5.5 Public Engagement and Vaccine Hesitancy

Countries like Sweden and Rwanda show how non-coercive communication strategies centered around parental trust, participatory governance, and transparency can achieve high coverage without legal compulsion. Australia uses a hybrid model, combining legal incentives with media campaigns targeting vaccine misinformation. India faces region-specific hesitancy fueled by myths, misinformation, and low health literacy. The Vaccine Confidence Index (2023) ranks India's vaccine trust at 84%, but local-level data (NFHS-5) reveals awareness gaps in several rural districts. For example, only 62% of mothers in Uttar Pradesh could recall the full immunization schedule. Table 4.3 presents public engagement metrics based on WHO SAGE reports and country-level IEC strategies.

**Table 5.3: Community Engagement and Vaccine Awareness**

| Country | Public IEC Campaigns (Per Year) | Parent Involvement Programs | Health Worker Communication Training |
|---|---|---|---|
| Australia | 12+ national + state-specific | Yes | Mandatory for GPs |

| | | | |
|---|---|---|---|
| UK | 15+ via NHS, schools | Yes | Optional |
| Sweden | 8 national + 3 regional | Yes | Integrated into curriculum |
| Japan | 10+ local government led | Yes | Yes |
| Rwanda | 20+ via CHWs and radio | Yes | Yes |
| India | 6–8 (central) + 3–4 (state) | Limited | Variable by state |

To address these gaps, India must invest in localized Information-Education-Communication (IEC) programs delivered through trusted community platforms. Enhancing ASHA workers' capacity with updated training on risk communication and rumor management could improve interpersonal counseling.

### 5.6 Dropout Rates and Continuity of Care

One of the most critical indicators of immunization system performance is the dropout rate between early and later doses, such as between the first and third doses of DPT (DPT1–DPT3). A high dropout rate indicates issues in service delivery continuity, follow-up mechanisms, and caregiver education.

**Table 5.4: DPT1–DPT3 Dropout Rates by Country (2022)**

| Country | DPT1 Coverage (%) | DPT3 Coverage (%) | Dropout Rate (%) |
|---|---|---|---|
| Australia | 95.2 | 94.7 | 0.5 |
| UK | 93.1 | 92.4 | 0.7 |
| Sweden | 98.4 | 98.1 | 0.3 |
| Japan | 96.1 | 95.6 | 0.5 |
| Rwanda | 99.2 | 98.3 | 0.9 |
| India | 91.2 | 89.3 | 2.1 |

**Source**: WHO/UNICEF Joint Reporting Forms, 2023.

India's dropout rate of 2.1% is the highest among the six countries analyzed. This is largely attributed to poor follow-up systems, lack of personalized reminder mechanisms, intermittent supply chain issues**,** and limited parental understanding of the full immunization schedule. In contrast, countries like Sweden and Australia reduce dropouts through automated digital reminders**,** school-based verification systems**,** and strong integration between pediatric care and public health records. India could significantly benefit by digitizing appointment systems and involving frontline workers in personalized follow-up, especially in urban slums and tribal districts.

### 5.7 Cold Chain Infrastructure and Logistics

Effective cold chain infrastructure is essential for vaccine potency and timely delivery. Comparative data shows significant disparities in cold chain adequacy, particularly in rural and hard-to-reach areas.

**Table 5.5: Cold Chain Infrastructure Comparison (2023)**

| Country | Cold Chain Units per 100,000 Children | Real-time Temperature Monitoring | Rural Coverage (%) | Energy Backup Availability (%) |
|---|---|---|---|---|
| Australia | 115 | Yes | 100 | 98 |
| UK | 112 | Yes | 100 | 97 |
| Sweden | 108 | Yes | 100 | 96 |
| Japan | 101 | Yes (select areas) | 100 | 95 |
| Rwanda | 84 | Yes | 95 | 89 |
| India | 72 | Partial (eVIN in 730 districts) | 82 | 74 |

**Source**: Gavi Cold Chain Equipment Optimization Platform Reports, MoHFW eVIN Dashboard (2023).
India's eVIN system has been a significant breakthrough, offering digital temperature monitoring in 29 states. However, over 18% of rural PHCs and SCs lack consistent access to functional cold chain units**,** often due to power outages and equipment breakdowns. In comparison, Rwanda has achieved near-complete coverage through solar-powered units supported by Gavi. India can consider scaling solar cold chain models and deploying mobile vaccine carriers in geographically challenging terrains like the Northeast and Himalayan regions.

### 5.8 Human Resources for Immunization

Health workforce availability and training are foundational to successful immunization programs. This includes not only physicians and nurses but also midwives, community health workers (CHWs), and support staff.

**Table 5.6: Immunization-Specific Human Resources per 10,000 Population (2022)**

| Country | Physicians | Nurses & Midwives | CHWs/Outreach Workers | Dedicated Immunization Staff Training Program |
|---|---|---|---|---|
| Australia | 3.5 | 11.2 | 0.8 | Yes |
| UK | 2.9 | 10.5 | 0.6 | Yes |
| Sweden | 4.1 | 12.4 | 0.7 | Yes |
| Japan | 2.3 | 11.8 | 0.4 | Yes |
| Rwanda | 1.2 | 4.8 | 4.1 | Yes |
| India | 0.9 | 2.3 | 2.9 | Partially |

**Source**: WHO Global Health Workforce Statistics, MoHFW Rural Health Statistics 2023.
India's strength lies in its community health worker network, particularly ASHAs and ANMs. However, the absence of a dedicated immunization cadre, especially at block and district levels, results in task overload, inadequate training refreshers, and inconsistent service quality. Rwanda's investment in CHW-led vaccine tracking and Australia's use of immunization nurses suggest the need for a specialized immunization support workforce in India**,** potentially created through bridge courses and digital certification platforms.

### 5.9 Multi-sectoral Coordination and Delivery Platforms

Countries with strong multi-sectoral collaboration (e.g., health, education, social welfare) have demonstrated improved vaccine uptake. This is especially effective in school-based vaccination programs, birth registration linkages, and conditional cash transfer schemes**.**

**Table 5.7: Multi-sectoral Integration of Immunization Services**

| Country | School-based Vaccination | Birth Registration Integration | Cash Incentives for Immunization | Health-Education Coordination |
|---|---|---|---|---|
| Australia | Yes | Yes | Yes (Family Tax Benefit A) | Yes |
| UK | Yes | Yes | No | Yes |
| Sweden | Yes | Yes | No | Yes |
| Japan | Yes | Yes | No | Yes |
| Rwanda | Yes | Yes | Yes (Performance-based) | Yes |

| | | | | |
|---|---|---|---|---|
| India | Limited (HPV pilots) | Partial | No (except select DBT pilots) | Limited |

**Source**: UNICEF Immunization Landscape Analysis Reports (2022–2023), National Government Dashboards.

India lacks widespread school-based delivery, except for pilot HPV campaigns in a few states. Linking the birth registration system (Civil Registration System) with immunization tracking is inconsistent and often non-digital. Furthermore, Direct Benefit Transfer (DBT) schemes to incentivize full immunization coverage have not been implemented at scale, despite evidence from Latin America and Rwanda supporting their efficacy. Strengthening cross-sector coordination particularly between Ministries of Health, Women and Child Development, and Education could improve immunization reach and retention.

### 5.10 Final Synthesis Table: Mapping Global Best Practices to Indian Reform Areas

This table consolidates the core policy instruments and operational strategies identified from high-performing countries and aligns them with India's current needs and opportunities for reform.

**Table 5.8: Mapping Global Best Practices to India's Immunization Reform Agenda**

| Policy Domain | Global Best Practice | Indian Context | Recommended Adaptation |
|---|---|---|---|
| Legal Framework | Compulsory immunization laws (Japan, Australia) | No national immunization legislation | Draft and enact a National Childhood Immunization Act |
| Digital Tracking | Real-time, unified registries (UK's CHIS, Australia's AIR) | Fragmented (eVIN for logistics only) | Implement NIIS with Aadhaar/Birth registration linkage |
| Cold Chain Management | Solar-powered units with IoT monitoring (Rwanda) | Incomplete rural coverage; power disruptions | Expand solar eVIN and predictive maintenance protocols |
| Financing Mechanism | Fully tax-funded, conditional incentives (Australia) | Low expenditure (~0.35% of total health spend) | Increase budget; tie funds to state performance targets |
| Community Engagement | Participatory platforms and anti-hesitancy campaigns (Sweden, Rwanda) | High hesitancy in some states; generic IEC messages | Hyper-local IEC via ASHAs, faith leaders, mother groups |
| School-Based Delivery | Routine HPV/MMR delivery in schools (UK, Sweden, Japan) | Minimal except in pilot HPV programs | National rollout via School Health Program |
| Human Resource Capacity | Dedicated immunization nurse cadre (Australia, UK) | Overburdened ANMs and ASHAs | Develop trained immunization assistants at block level |
| Pandemic Resilience | Mobile units and backup plans (Rwanda, UK) | Major disruptions during COVID-19 | Add emergency preparedness to UIP operational guidelines |
| Inter-sectoral Coordination | Ministries of Health-Education-Social Welfare integration (Rwanda, UK) | Siloed operations | Establish district convergence committees for UIP |

### 5.11 Regional and District-Level Variation within India

India's internal disparities in vaccine coverage and delivery efficiency significantly affect its national performance average. Data from NFHS-5 (2019–21) reveals considerable heterogeneity at the state and district levels, influenced by literacy, infrastructure, and public health capacity.

**Table 5.9: Immunization Coverage Across Selected Indian States (NFHS-5)**

| State | Full Immunization Coverage (%) | Urban (%) | Rural (%) | Dropout Rate (DPT1–DPT3) (%) |
|---|---|---|---|---|
| Tamil Nadu | 91.3 | 92.7 | 90.6 | 1.1 |
| Kerala | 89.8 | 90.4 | 88.2 | 0.9 |
| Maharashtra | 77.8 | 81.3 | 73.2 | 2.4 |
| Uttar Pradesh | 69.6 | 72.1 | 67.4 | 3.5 |
| Bihar | 62.4 | 66.2 | 58.5 | 4.1 |
| Nagaland | 57.9 | 62.0 | 52.6 | 5.2 |
| National Average | 76.4 | 78.1 | 73.8 | 2.1 |

**Source:** National Family Health Survey (NFHS-5), 2021.

In high-performing states like Tamil Nadu and Kerala, strong health infrastructure, near-universal maternal literacy, and active ASHA networks correlate with high vaccine uptake. Conversely, in states like Bihar and Nagaland, poor transport access, mistrust in government services, and irregular supply chains undermine coverage. This internal diversity suggests that national-level reforms must be state-tailored, with the central government supporting low-performing states through technical missions, incentive grants, and real-time dashboard monitoring.

## 6. Conclusion

This research undertook a comprehensive comparative analysis of childhood vaccine policy frameworks in five countries Australia, the United Kingdom, Sweden, Japan, and Rwanda and evaluated how the insights from these global leaders can be adapted to enhance India's Universal Immunisation Programme (UIP). The study employed a qualitative policy analysis approach supported by WHO-recommended indicators, data from international agencies such as UNICEF and Gavi, and national datasets including NFHS-5 and Ministry of Health reports. The findings point to significant systemic, institutional, and operational gaps in India's immunization ecosystem, many of which are addressable through policy reform inspired by global best practices. India's immunization system, despite being one of the largest in the world, remains limited by its decentralized governance model, fragmented digital health architecture, low per capita vaccine financing, and persistent vaccine hesitancy in underserved communities. While progress has been achieved through Mission Indradhanush and eVIN, these efforts are largely operational rather than structural. In contrast, comparator countries have demonstrated the importance of embedding immunization within comprehensive legal mandates, leveraging integrated digital registries, ensuring equitable financing, and building long-term trust with communities through rights-based approaches and inclusive communication strategies. The global experiences examined in this study offer diverse pathways toward immunization success. For instance, Australia's use of conditional financial incentives, Sweden's trust-based and non-compulsory model, Rwanda's community-driven outreach, the UK's centralized digital integration, and Japan's municipal-led co-financing system each represent viable blueprints tailored to different contexts. These models emphasize that high immunization coverage is not merely a function

of economic strength but of institutional design, public engagement, and cross-sectoral governance. For India, which has both the demographic weight and political will to make systemic improvements, these insights are not only relevant but actionable.

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