



## Ayushman Bharat Digital Mission and Public Health Transformation in India: Trends, Challenges, and Future Directions

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### Abstract

The Ayushman Bharat Digital Mission (ABDM) is a transformative initiative aimed at modernizing India's healthcare system through integrated digital health technologies. By promoting the adoption of electronic health records (EHRs), enabling real-time data interoperability, and supporting telemedicine services, by connecting fragmented health services into a unified digital ecosystem, ABDM seeks to streamline healthcare delivery by integrating digital tools that reduce costs, expand reach, and improve coordination of services for both providers and patients.

This paper examines the evolving role of ABDM in shaping India's public health infrastructure. It draws upon national implementation data from 2021 to 2025, including ABHA-linked EHR trends and the Digital Health Incentive Scheme (DHIS), while incorporating global best practices from the UK, Australia, and Estonia to contextualize India's digital health journey. A mixed-methods approach is adopted, combining secondary analysis of government dashboards and policy documents with comparative case studies to assess the infrastructural, policy, and technological drivers of digital health transformation.

Special focus is given to Bihar's BHAVYA initiative, highlighting scalable, state-led models of EHR adoption in low-resource settings. The study identifies implementation challenges such as digital infrastructure gaps, health workforce capacity, privacy concerns under the Digital Personal Data Protection Act (DPDP) 2023, and limited interoperability across digital health systems.

Policy recommendations include strengthening public-private partnerships, enhancing digital health literacy, and integrating AI-powered clinical intelligence into ABDM's roadmap. The paper concludes that ABDM represents more than a technology platform - it is a national blueprint for digital health transformation aligned with the National Digital Health Blueprint (NDHB) 2019, offering replicable lessons for other low- and middle-income countries.

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**Keywords:** Ayushman Bharat Digital Mission (ABDM); Electronic Health Records (EHR); Digital Health Infrastructure; Public Health Policy; India; Digital Personal Data Protection Act (DPDPA); National Digital Health Blueprint (NDHB); BHAVYA Bihar; Health IT Interoperability; DHIS

## 1. Introduction

India's public health system is undergoing a major transformation with the incorporation of digital health technologies to address long existing challenges such as fragmentation of services, inefficiencies of care delivery and limited access. While plans such as Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PM-JAY) have come a long way, the lack of a standard electronic health record (EHR) system has been a major barrier to seamless health care delivery.

In response, the Government of India created Ayushman Bharat Digital Mission (ABDM) in September 2021 to build a

comprehensive digital health ecosystem. ABDM integrates key components of digital health like Electronic Health Records (EHRs), telemedicine services and real-time data interchange to facilitate continuity of care and evidence-based decision making.

The NHP 2017 said that health reforms in India are grounded on equity with focus on removing the financial obstacles to obtain excellent treatments by the population. (MoHFW, 2017) ABDM is a derivative of the suggestions of the National Digital Health Blueprint (NDHB). NDHB initiated the process of implementation of National Health Stack under the leadership of Shri J. Satyanarayana – fostering interoperability, citizen centricity and digital equality.

The ABDM ecosystem consists of core building blocks such as:

- **ABHA (Ayushman Bharat Health Account)** for lifelong health record ownership,
- **Health Facility Registry (HFR)** and **Healthcare Professionals Registry (HPR)** for authenticated provider networks, and
- **Unified Health Interface (UHI)** for seamless telemedicine and digital service access.

**Table 1. Core Components of ABDM**

| <b>ABDM Component</b>                     | <b>Description</b>                                                                                                               | <b>Primary Public Health Function</b>                                           | <b>Relevance to Health System Strengthening</b>                                                               |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Ayushman Bharat Health Account (ABHA)     | Unique, lifelong digital health identity for individuals that enables linkage of electronic health records across providers      | Ensures unique patient identification and longitudinal health record continuity | Reduces duplication of records, improves continuity of care, and supports patient-centric healthcare delivery |
| Health Facility Registry (HFR)            | National repository of digitally verified public and private healthcare facilities                                               | Standardizes facility identification and service availability mapping           | Improves health system planning, transparency, and facility-level governance                                  |
| Healthcare Professionals Registry (HPR)   | Centralized digital registry of verified healthcare professionals                                                                | Enables authentication and digital credentialing of providers                   | Enhances accountability, workforce visibility, and trust in digital health services                           |
| Unified Health Interface (UHI)            | An open network protocol enabling interoperability across telemedicine, diagnostics, pharmacy, and other digital health services | Facilitates seamless digital service delivery across platforms                  | Expands access to care, promotes competition, and supports digital health innovation                          |
| Consent Manager                           | Consent-based framework that allows individuals to control access to their health data                                           | Ensures secure and patient-controlled data sharing                              | Builds trust, ensures compliance with DPDP Act 2023, and protects patient privacy                             |
| Electronic Health Records (EHR) Framework | Standardized framework for generation, storage, and exchange of clinical data                                                    | Enables interoperable digital clinical documentation                            | Supports evidence-based care, clinical decision-making, and public health analytics                           |

**Table 1 illustrates how ABDM's modular digital architecture links technical building blocks with specific public health functions, enabling system-wide interoperability and patient-centric service delivery.**

As of February 2025, over **750 million ABHA IDs** have been generated, with **5 lakh+ healthcare providers** and **3 lakh+ health facilities** enrolled in the system.

This paper examines the impact of ABDM on public health outcomes in India, evaluates implementation challenges, and proposes policy frameworks for sustainable digital health transformation.

## 2. Literature Review: Global and National Perspectives on Digital Health

### 2.1. Global Experiences in Digital Health Integration

Several countries have successfully implemented nationwide digital health frameworks, offering insights into ABDM's trajectory:

- **United Kingdom (NHS Digital):** Established a centralized EHR system but faced data privacy concerns and implementation bottlenecks (BMJ, 2022).
- While Australia achieved high public participation in its My Health Record programme, technical challenges - particularly interoperability - restricted its broader utility, a concern India seeks to avoid through ABDM's federated model.
- **Estonia (e-Health System):** Globally recognized for 100% digital health coverage, demonstrating successful data portability and interoperability.

### 2.2. India's Digital Health Initiatives: The Road to ABDM

India has implemented state-led digital health projects, which laid the groundwork for ABDM:

- **eSanjeevani (National Telemedicine Service):** India's flagship telemedicine platform, eSanjeevani, has facilitated over 140 million teleconsultations across states, demonstrating the scalability and accessibility of digital healthcare services, especially in remote and underserved areas. While developed independently, eSanjeevani aligns with ABDM's vision and is progressively being integrated with its ecosystem to support continuum of care through ABHA-linked health records.
- **The Integrated Health Information Platform (IHIP),** developed under the Integrated Disease Surveillance Programme (IDSP), serves as India's centralized platform for real-time disease surveillance. Though not part of ABDM, it complements the national digital health strategy by enabling timely epidemiological insights, which may be interoperable with ABDM building blocks in future phases of integration.
- **BHAVYA (Bihar Health Application Visionary Yojana for All)** is a state-specific HMIS initiative aligned with ABDM standards and implemented in Bihar. Alongside BHAVYA, several other ABDM-compliant HMIS platforms—including e-Sushrut, e-Hospital, and private digital health solutions - are being adopted across multiple states to facilitate seamless EHR integration and improve health service delivery.

This section positions ABDM within both global and national digital health advancements, reinforcing its significance in modernizing India's healthcare infrastructure.

## 3. ABDM's Role in Digital Transformation of Public Health

### 3.1. ABDM Core Components

- **ABHA (Ayushman Bharat Health Account):** Enables creation of a unique, lifelong digital identity of individuals to allow secure exchange and keeping of electronic health data (EHRs) between healthcare providers with consent of the user.
- **Health Facility Registry (HFR):** A national repository of digitally validated public and commercial healthcare institutions, providing standardized and transparent listings of healthcare infrastructure.
- **Healthcare Professionals Registry (HPR):** Digital repository of registered healthcare professionals throughout the country, ensuring transparency of credentials and digital access to verified practitioners.
- **Unified Health Interface (UHI):** An open network protocol that allows plug-and-play integration of telemedicine, diagnostics, pharmacy and other digital health services across platforms.

### 3.2. Benefits of ABDM for Public Health

- **Disease surveillance in real-time** Enables the fast collecting and analysis of health data for early epidemic identification and public health response using data driven models.
- **Telemedicine & remote Healthcare:** Connects urban medical experts with rural and distant areas to provide healthcare access, removing geographical barriers in healthcare provision.
- **Health Financing & Insurance Efficiency:** Ensures transparency and speed in PM-JAY claim process via Direct Benefit Transfer (DBT) hence eliminating delays and leakages.

### 3.3 Evidences from ABDM National Dashboard:

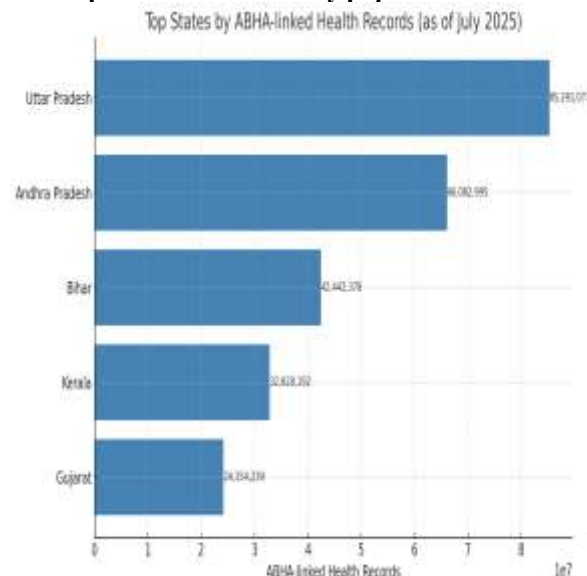
Public and commercial healthcare providers have been participating in the countrywide roll-out of the Ayushman Bharat Digital Mission (ABDM) which has led to the generation of over 548 million health data associated with ABHA. Bihar is one of the major contributor states in this respect with more than 42.4 million linked health records. This extraordinary adoption is a testament to Bihar's expanding integration into India's digital health ecosystem, and is indicative of the success of several initiatives to improve the state's electronic health record

(EHR) usage. Uttar Pradesh, Andhra Pradesh and Bihar are the top three states in the country in terms of number of ABHA-linked health records indicating wide uptake of digital health platforms under ABDM (Figure 1).

**Table 2. Top States by ABHA-Linked Electronic Health Records (EHRs)**

| Rank | State          | ABHA-Linked EHR Contribution               | Key Interpretation                                           |
|------|----------------|--------------------------------------------|--------------------------------------------------------------|
| 1    | Uttar Pradesh  | Among the highest nationally               | Large population base and early large-scale ABDM adoption    |
| 2    | Andhra Pradesh | High contribution                          | Strong digital health readiness and public-sector EHR usage  |
| 3    | Bihar          | <b>42.4 million+ linked health records</b> | Effective state-led adoption despite resource constraints    |
| 4    | Kerala         | Moderate to high                           | Mature health IT ecosystem with quality-focused EHR adoption |
| 5    | Gujarat        | Moderate                                   | Steady ABDM integration across public and private facilities |

Table 2 illustrates that ABDM adoption is driven both by population scale and by systemic digital maturity.



**Fig 1: Top EHR Contributors State by ABHA-linked Health Records**  
Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

#### 4. Year-Wise Data Insights from ABDM Trends

The Ayushman Bharat Digital Mission (ABDM) has been rolled out in stages from 2021 to 2025, including fundamental development, fast scale, and most recently consolidation. This section presents a trend of some key indicators of ABDM such as ABHA ID generation, electronic health record (EHR) linking, Health Facility Registry (HFR) and Healthcare Professionals Registry (HPR) verification, and Digital Health Incentive Scheme (DHIS) enrolment on an annual basis, based on the official data available in the ABDM Dashboard. This section presents a trend of some key indicators of ABDM such as ABHA ID generation, electronic health record (EHR) linking, Health Facility Registry (HFR) and Healthcare Professionals Registry (HPR) verification, and Digital Health Incentive Scheme (DHIS) enrolment on an annual basis, based on the official data available in the ABDM Dashboard. “The trends reported underscore the growing maturity of India’s digital health ecosystem and offer valuable insights into adoption trends, implementation challenges, and system readiness across public and private healthcare sectors.

#### 4.1 Summary of Improvements Made During the Year

##### 2021-22: Initial Phase

- **ABHA Creation:** ABHA first attempts building up. Absorption slow.
- **Health Records Linked:** Poor connectivity, preparedness & understanding of the system.
- **Verified Facilities & Professionals (HFR / HPR):** New environment with very little onboarding difficulties.
- **DHIS (Digital Health Incentive Scheme):** Not applicable; it was yet supposed to be started.

**2022-23: Growth year**

- **ABHA Creation:** It has shown three times growth, lesser focused marketing to drive registrations.
- **Health Records Linked:** HMIS integrations and NHA incentives a huge leap forward
- **Verified Facilities & Professionals:** ABDM Onboarding for Private Sector with Trusted Professionals & Facilities.
- **DHIS Registration:** Some providers are starting to register, have some sense of the incentive packages but limited acceptance.

**2023-24: Accumulation Period**

- **ABHA Creation:** Best Ever Production Year Level Record of ABHA Creation
- **Health Records Linked:** EHR Adoption Exceeded Natural Adoption Norms in One Year, Reflecting Policy Incentives Driving Uptake Incentive oriented campaigns and HMIS installations were very appreciably associated to the growth, showing that policy nudges were a motivating factor more than the endogenous preparedness of providers.
- **Verified Facilities & Professionals:** Large public sector verification initiatives Some measurements of saturation Compliance varies a little per state (Figure 4). The number of health facilities accredited under HFR grew greatly in 2022-23, decreased in 2023-24 and climbed fast in 2024-25. Figure 5 shows that there was year-on-year rise in the verification of HPR and the number of healthcare professionals enrolling under ABDM also increased.
- **DHIS Registration:** Awareness of incentives and digitization push lead to over 49,000% rise.

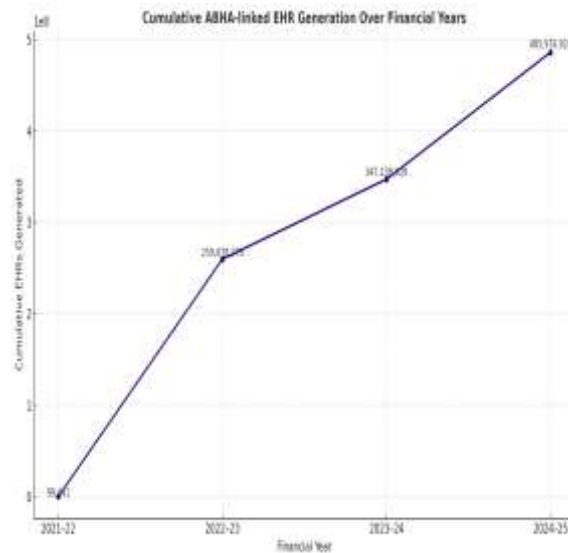
**2024-25: Consolidation ear**

- **ABHA Creation:** More than 750 million ABHA IDs have been established around the country.
- **Health Records Linked:** Quality, re-use key to linked health records increase The number of ABHA EHRs connected has expanded from <0.1 million in 2021-22 to ~486 million in 2024-25 (Figure 2). This is an evidence of the growing adoption of digital health recording by ABDM.
- **Verified Facilities & Professionals:** Trusted centres & specialists More private sector participation. Improved compliance monitoring
- **DHIS Registration:** Same trend, most eligible providers registered. Membership of DHIS has grown rapidly during 2022-23 (Figure 6). More awareness and incentives has got 15,000+ suppliers active in 2024-25.

**Table 3. Phase-Wise Progress of ABDM Implementation in India (2021–2025)**

| Phase / Year                                | ABHA                       | EHR                                    | HFR & HPR                                           | DHIS                         | Key Interpretation                                                                 |
|---------------------------------------------|----------------------------|----------------------------------------|-----------------------------------------------------|------------------------------|------------------------------------------------------------------------------------|
| <b>2021-22</b><br>(Initial Phase)           | Low, pilot-driven          | Minimal                                | Very limited onboarding                             | Not applicable               | Foundational phase focused on system setup, standards, and awareness               |
| <b>2022-23</b><br>(Expansion Phase)         | Rapid increase (3× growth) | Significant rise                       | Surge in private facility & professional onboarding | Initial uptake               | Transition from pilots to early-scale implementation                               |
| <b>2023-24</b><br>(Acceleration Phase)      | Peak generation            | Exponential growth (~25,000% increase) | Large-scale verification drives                     | Massive increase (49,000%+)  | Strong policy push leading to rapid ecosystem expansion                            |
| <b>2024-25</b><br>(Advanced Adoption Phase) | 750 million+ cumulative    | Continued growth with focus on reuse   | Expanded coverage, especially private sector        | Broad provider participation | Shift from volume-driven onboarding to <b>depth, quality, and functional usage</b> |

Table 3 illustrates that while ABDM has achieved large-scale adoption in terms of digital identities and infrastructure, the current phase is characterized by an increasing emphasis on depth of use, data quality, interoperability, and integration of advanced digital health services.



**Fig 2: Health Records Linked Trend (2021- 25)**

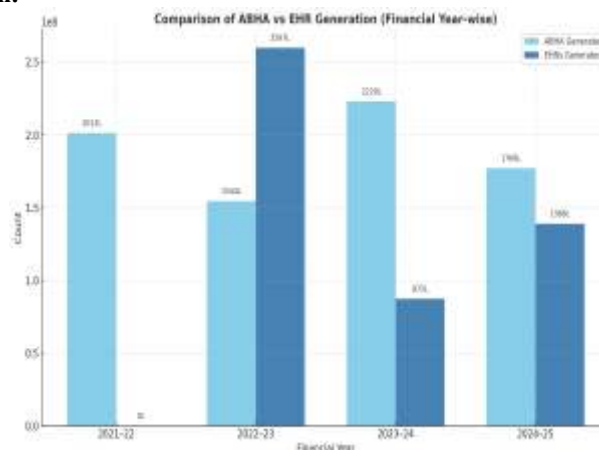
Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

As shown in **Fig 3**, while ABHA ID creation remained consistently high across financial years, EHR generation witnessed greater fluctuations - peaking in 2022–23 and stabilizing thereafter - highlighting evolving provider readiness and system maturity under ABDM.

**Table 4. Comparison of ABHA ID Creation and EHR Linkage under ABDM (2021–2025)**

| Financial Year | ABHA ID Creation               | EHR Linkage              | Observed Gap              | Interpretation                                                               |
|----------------|--------------------------------|--------------------------|---------------------------|------------------------------------------------------------------------------|
| 2021-22        | Limited, pilot-stage           | Minimal                  | Very high                 | Infrastructure and provider readiness were still nascent                     |
| 2022-23        | Rapid increase                 | Sharp rise               | High but narrowing        | Initial HMIS integration enabled early EHR generation                        |
| 2023-24        | Sustained high growth          | Exponential increase     | Reduced significantly     | Policy push and DHIS accelerated provider-side adoption                      |
| 2024-25        | Continued large-scale creation | Growing with reuse focus | Persisting functional gap | Indicates need for workflow integration, repeat usage, and clinical adoption |

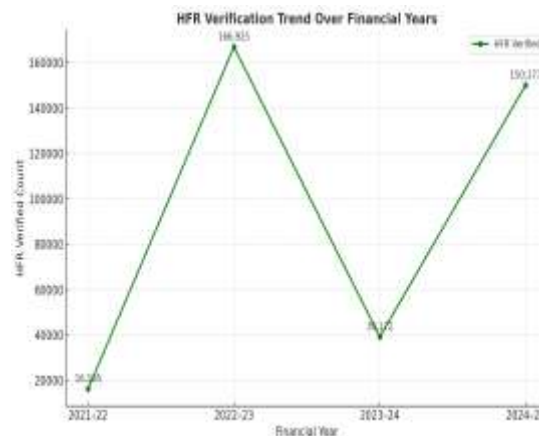
Table 4 highlights the persistent gap between digital identity creation and meaningful clinical data generation, underscoring the need to shift policy focus from enrolment-driven metrics to functional EHR usage and care integration.



**Fig 3: Comparison of ABHA ID Creation vs EHR Linkage (2021- 25)**

Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

Figure 4 illustrates the year-wise trend in Health Facility Registry (HFR) verification under ABDM. The sharp increase during the expansion phase reflects large-scale onboarding drives, while subsequent fluctuations indicate data validation and compliance-led rationalization rather than a decline in adoption.



**Fig 4: Verified Health Facilities Trend (2021-25)**

Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

Figure 5 presents the growth pattern of Healthcare Professionals Registry (HPR) verification from 2021 to 2025. The steady upward trend suggests increasing professional participation in ABDM, though variations across cadres and regions highlight the need for continued capacity building and workflow integration.



**Fig 5: Verified Healthcare Professionals Trend (2021-25)**

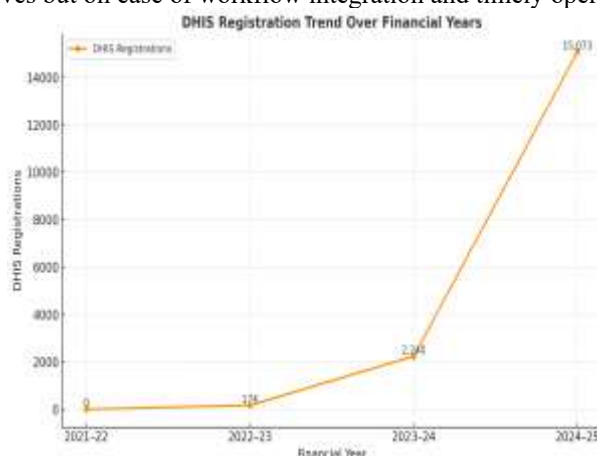
Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

**Table 5. Health Facility Registry (HFR) and Health Professional Registry (HPR) Trends under ABDM (2021–2025)**

| Year / Phase                                | HFR - Facility Verification Trend                                   | HPR - Professional Verification Trend           | System Readiness Interpretation                                                         |
|---------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------|
| <b>2021-22</b><br>(Initial Phase)           | Very limited onboarding of facilities                               | Very low professional registration              | Digital ecosystem in formative stage; awareness and system familiarity low              |
| <b>2022-23</b><br>(Expansion Phase)         | Sharp increase, especially private facilities                       | Moderate rise in doctor and nurse registrations | Infrastructure readiness begins to improve                                              |
| <b>2023-24</b><br>(Acceleration Phase)      | Large-scale verification drives; temporary dip due to data cleaning | Steady year-on-year growth                      | Shift from quantity to verification quality and compliance                              |
| <b>2024-25</b><br>(Advanced Adoption Phase) | Expanded coverage across public and private sectors                 | Broader participation across cadres             | Improved digital readiness, but functional usage and workflow integration remain uneven |

Table 5 indicates that while registry coverage of health facilities and professionals has expanded significantly, variations in digital workflow adoption and EHR generation capacity continue to influence effective utilization of ABDM across states.

Figure 6 illustrates the year-wise trend of provider registrations under the Digital Health Incentive Scheme (DHIS). The sharp increase observed after 2022–23 reflects the role of financial incentives in accelerating ABDM adoption, particularly among private healthcare facilities. However, the trend also indicates that sustained participation depends not only on incentives but on ease of workflow integration and timely operational support.

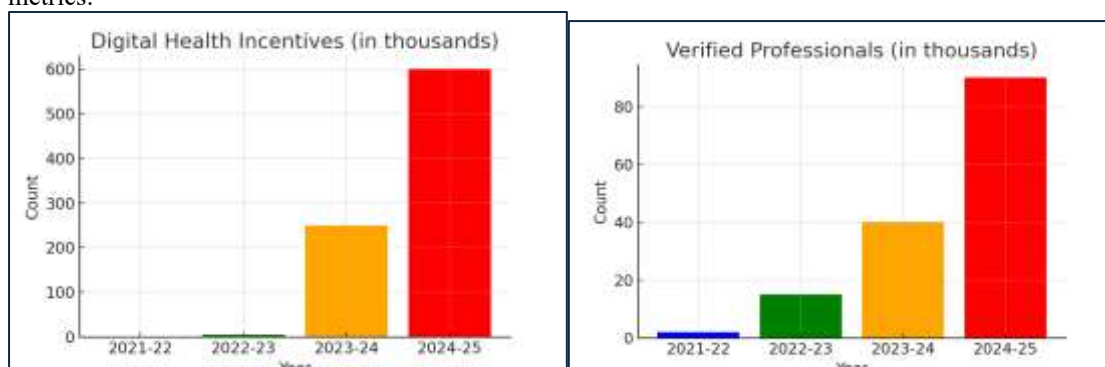


**Fig 6: Digital Health Incentive Scheme Registration Trend (2021-25)**

Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

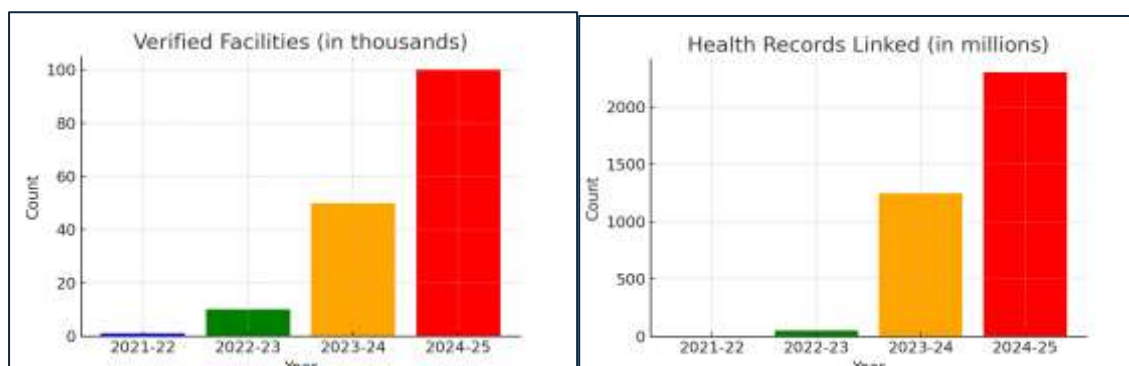
#### 4.2 Visual Representation of ABDM Trends

As shown in Fig 7, both DHIS registrations and verified healthcare professionals increased sharply over the years, indicating strong provider-side integration and responsiveness to ABDM incentives. Fig 8 demonstrates parallel growth in verified health facilities and ABHA-linked health records, underscoring the infrastructural depth achieved during ABDM scale-up. The following graphs illustrate the year-wise progression of key ABDM metrics:



**Fig 7: DHIS Registration & Verified Professionals (2021-25)**

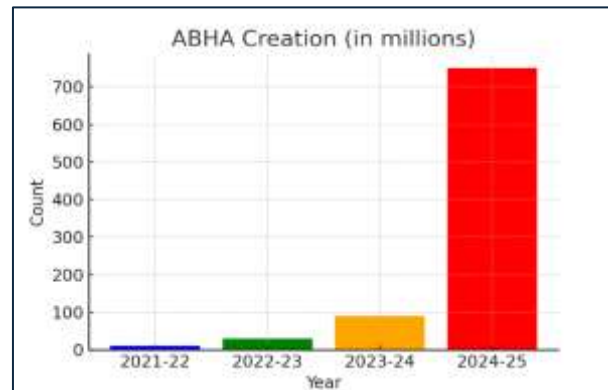
Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)



**Fig 8: Verified Facilities & Health Records Linked (2021-25)**

Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)





**Fig 9: ABHA Creation (2021-25)**

Source: ABDM Dashboard (<https://dashboard.abdm.gov.in/abdm/>)

As illustrated in **Fig 9**, ABHA ID creation expanded rapidly from 2021–22 to 2024–25, reflecting a strong uptake among citizens driven by national campaigns and digital health awareness.

## 5. Global Contextualization: Learning from International Digital Health Frameworks

The implementation of ABDM can be better contextualized by examining global experiences with national digital health frameworks. Countries like the United Kingdom, Australia, and Estonia offer useful contrasts in design philosophy, implementation scale, and citizen engagement.

### 5.1. United Kingdom – NHS Digital

**Strengths:** The UK's NHS Digital is known for its centralized EHR system that offers a longitudinal view of patient histories across NHS trusts.

**Challenges:** Despite early promise, the system faced criticism over patient data privacy concerns, high costs of implementation, and lack of interoperability among legacy systems (NHS Digital, 2022).

**Comparison with ABDM:** Comparison with ABDM: Unlike the current effort, ABDM employs federated architecture where the data is at the source and accessible via consent-based protocols. This citizen-first strategy minimises the likelihood of large breaches and is in line with India's Digital Personal Data Protection Act, 2023.

### 5.2. Australia – My Health Record

**Strengths:** Effective government lobbying resulted in national coverage of EHR and high levels of patient involvement with the My Health Record platform.

**Challenges:** The initial distribution's automatic opt-in methods and data sharing difficulties resulted in public outcry and a considerable number of data removal requests (Journal of Medical Internet Research, 2021).

**Comparison with ABDM:** Concerns are minimal and acceptable in a privacy sensitive setting like India via voluntary method for installation of ABHA, granular authorization levels and federated data governance of ABDM.

### 5.3. e-health system of Estonia

**Strengths:** Estonia's extensive statewide deployment of EHR coverage with blockchain-based audit trails shows how investments in IT infrastructure and solid legislative frameworks may allow seamless interoperability early on. This may inform India's ABDM as it transitions to a federated, consent-driven architecture.

**Challenges:** The success of the approach required initial investments in IT infrastructure, digital literacy, and good regulatory frameworks (e-Estonia, 2023).

**Comparison with ABDM:** While ABDM is still in its scaling phase, learnings from Estonia - particularly blockchain-based audit trails - can inform enhancements in ABDM's data integrity and traceability protocols.

## 6. Challenges in Implementing ABDM

Ayushman Bharat Digital Mission (ABDM) has revolutionary potential but faces many institutional, technological and operational hurdles in its implementation throughout India's broad and diversified healthcare sector.

### 6.1. Digital Infrastructure Shortcomings

PHCs in rural India are still battling inconsistent internet and frequent power disruptions, despite the fast advancements in digitalization, thereby limiting the scope for real time record production. While microsites in Bihar, this was considered a major difficulty. This greatly restricts the real-time data sharing and EHR development. Furthermore, a lot of private clinics (especially small and medium-sized ones) do not have any computerized systems or skilled digital people, which is a big impediment to ABHA-linked digital processes.

**Suggested Solution:** Experiences of private sector adoption in Bihar indicate that PPPs may help bridge significant digital divides, such as internet access and hardware support, especially at the PHCs, and can spread important IT gear and training in underserved regions.

## 6.2. Risks of Data Privacy & Cybersecurity

With the increased digitization of personal health information worries about data breaches, illegal access to and abuse of health data has increased. “Building citizen trust in the digital health ecosystem is critical and ensuring compliance with the Digital Personal Data Protection Act (DPDPA), 2023 is imperative.

Proposed Solution: Use of blockchain based audit trail, multi-tiered end-to-end encryption and access control using federated consent frameworks to increase the security of the system.

## 6.3. Interoperability and Standardization Problems

The Indian healthcare system is beleaguered by fragmented Hospital Information Systems (HIS) and non-standard EMR installations, mostly in the private sector. The absence of standardized interfaces impedes smooth data interchange and undermines longitudinal patient care. Further, there is no government requirement that hospitals install EHRs.

We should prioritize the implementation nationwide of open standards like Fast Healthcare Interoperability Resources (FHIR) and SNOMED-CT. Technical help for integration with ABDM, including incentives and regulatory nudges to HIS/EMR providers to achieve ABDM compliance should be provided.

## 6.4. Operational Challenges in DHIS Implementation

The **Digital Health Incentive Scheme (DHIS)** - intended to promote ABDM adoption among private providers - faces several on-ground execution hurdles:

- **Manual Invoicing Requirements:** Private facilities must log in monthly and manually raise invoices to claim incentives, which is burdensome and unfamiliar to many small providers.
- **Follow-up Burden:** In many cases, claims processing requires ongoing hand-holding and follow-up, which reduces scalability.
- **Awareness Gaps:** Facilities are often unaware of the monthly transaction requirements (e.g. minimum 100), incentive rates and the documentation necessary to submit successful claims.

Proposed solution: Automated reminder for monthly invoicing of DHIS portal Organize DHIS training seminars at district level Technical facilitation cells for debugging claims and timely delivery of payment.

## 7. ABDM Sustainability Policy Suggestions

The policy proposals provided below aim to ensure the long term sustainability and inclusivity of ABDM: infrastructure, stakeholder capacity, technological innovation and sustainable incentives.

### 7.1. Enhancement of public-private collaboration

- **Incentivise Innovation:** Health-Tech businesses and AI based healthcare analytics platforms should be offered innovation funding, incubator programmes and fast track ABDM compliance certification.
- **Digital Infrastructure PPPs:** Use public-private partnerships (PPP) to enhance access to broadband, cloud hosting infrastructure and IT equipment supply, especially in rural and underserved areas.
- **Private Sector Incentives:** Create a tiered incentive structure to enable small and medium private clinics, pharmacies and diagnostic labs to onboard and use EHRs under ABDM.

### 7.2. Building literacy and capability of the digital workforce

- **Stages of Digital Health Training:** We need a tiered training paradigm -- starting with ASHAs and ANMs who are the first point of contact in rural healthcare. The Bihar experience has proven that early training of frontline workers is the key to scale-up of ABHA adoption.
- **Digital Health Fellows & Mentors:** To create a pool of Digital Health Fellows at the district level to provide technical support, problem solving and capacity building in local languages.
- **Accredited Certification Programs:** Partner with National Agencies (NHA, IGNOU, ICMR etc.) to provide short term credentials in ABDM systems, cyber security & digital prescribing.

### 7.3. The Future of Digital Health: Integration of AI and Big Data

- **Predictive Health Intelligence:** Utilize AI models to predict disease outbreaks (dengue, TB, NCDs), diagnose diseases in the early stages, and develop regional risk maps using real-time ABDM data.
- **Personalized Healthcare Delivery:** Apply machine learning algorithms to offer risk-based personalized treatment strategies in chronic diseases and maternal-child health.
- **Data Governance Framework:** Establish strong data governance policies under DPDPA 2023 to promote ethical use of anonymised ABDM datasets for research and policy-making in public health.

#### Future directions for research

- Impact of AI assisted diagnostics in ABDM -- e.g. efficacy of automated screening for TB, diabetic retinopathy and risk stratification for non-communicable illnesses (NCDs)
- Evaluation of Digital Prescription Systems Connected with ABDM – To prevent prescription fraud, improve adherence and allow connection with e-pharmacy.
- Effectiveness of Digital Health Incentives (DHIs) on the patterns of developing Electronic Health Records (EHRs) across private sector sectors.

## 8. Conclusion: ABDM for the Future of Public Health in India

The Ayushman Bharat Digital Mission (ABDM) marks a watershed point in the growth of India's health system, transitioning the country from fragmented, paper-based care to an integrated, data-driven ecosystem. By coupling

- digital health records owned by the citizen
- interoperability nationwide based on open standards, and
- new AI-powered analytics,

ABDM is in line with NDHB 2019, and creates the groundwork for universal digital health coverage. But its actual effect will rely on how many people experience genuine gains in trust, access and continuity of treatment via digital channels. But its real-world success will hinge on how well states like Bihar and Assam can translate digital access into meaningful gains in patient trust and health outcomes.

Three remaining criteria are necessary to transfer this potential into sustained impact:

1. **Digital Infrastructure Equity** - Closing the final mile connection and power gaps in rural PHCs and small private facilities.
2. **Robust Trust Architecture** - delivering privacy protections and cyber-resilience mechanisms (e.g. blockchain audit trails, end-to-end encryption) consistent with DPDP Act.
3. **Human-Capital Readiness** - Scaling up digital literacy and change management programs across all cadres, from ASHAs to experts.

Addressing the above points, may make ABDM a worldwide model of patient-centric, technology enabled and future ready public health for India.

### Statements

**Conflict of Interest:** The author declares no conflict of interest for the publication of this paper.

**Funding:** No fund received for this work by the authors.

**Ethics Approval:** The study is based on secondary data only which is accessible in public domain and does not include human subjects and so, ethical approval was not necessary.

**Contributorship:** Author wrote and evaluated the text referring to publicly available digital health data sources and relevant literature for analysis.

**Acknowledgements:** The author wishes to thank their colleagues and the reviewers for their important comments and direction in the production of this article.

## References

1. Ministry of Health & Family Welfare. National Health Policy 2017. <https://www.nhp.gov.in>
2. Ministry of Health & Family Welfare. National Digital Health Blueprint (2019). <https://ndhm.gov.in/blueprint>
3. National Health Authority. ABDM Dashboard. <https://abdm.gov.in>
4. World Health Organization. Global Strategy on Digital Health 2020-2025 (2022). <https://www.who.int/publications/i/item/9789240020924>
5. NHS Digital. *The Future of Healthcare: Digital Transformation in NHS* (2022). <https://digital.nhs.uk/>
6. e-Estonia. *Digital Health Records* (2023). <https://e-estonia.com/solutions/healthcare/>
7. Journal of Medical Internet Research. *Australia's My Health Record System and Interoperability Challenges* (2021). <https://www.jmir.org/>
8. HL7 International. FHIR & SNOMED-CT Standards (2023). <https://hl7.org/fhir/>
9. Government of India. Digital Personal Data Protection Act (2023). <https://www.meity.gov.in/digital-personal-data-protection-bill-2023>
10. Journal of Artificial Intelligence in Healthcare. *Predictive Analytics and Future Healthcare Outcomes* (2024). <https://doi.org/10.1016/j.aihc.2024.02.015>