



NITI Aayog
National Institute for
Transforming India

Government of India

National Health Stack

STRATEGY AND APPROACH

July 2018



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FOR CONSULTATION

Message from Member (Health), NITI Aayog



Dr Vinod K Paul

Member (Health),
NITI Aayog

In today's time, a strong health system is inconceivable without a strong and resilient digital backbone. The National Health Policy 2017 envisages creation of a digital health technology eco-system aiming at developing an integrated health information system that serves the needs of all stakeholders and improves efficiency, transparency and citizens' experience with linkage across public and private healthcare.

The need for a future-ready digital health system has become even more urgent with the announcement of *Ayushman Bharat*, Hon'ble Prime Minister's flagship program, that would herald a system level transformation of nation's health system. This historic initiative is designed with a powerful yet simple objective in mind: to scale up a wellness-oriented rather than illness-focused approach and to ensure cost-effective healthcare without financial hardship for all.

Ayushman Bharat comprises twin missions:

- i. Operationalizing 1.5 lac health and wellness centers offering preventive and primary care, on the supply side;
- ii. Financial protection of up to 5 lacs per year per family for the deprived 10 crores plus households towards secondary and tertiary care, on the demand side.

The National Health Stack (NHS) is a visionary digital framework usable by centre and state across public and private sectors. It represents a holistic platform that supports a multitude of health verticals and their disparate branches, and is capable of integrating future IT solutions for a sector that is poised for rapid, disruptive changes and unforeseen twists. It is now conceivable to aim for digital health records for all citizens by the year 2022.

The innovativeness of the proposed National Health Stack design lies in its ability to leverage a shared public good—a strong IT spine built with a deep understanding of the complex structures of the system. Various layers of the National Health Stack will seamlessly link to support national health electronic registries, a coverage and claims platform, a federated personal health records framework, a national health analytics platform as well as other horizontal components. The stack will embrace health management systems of public health programs and socio-demographic data systems. The population level base of such an IT system would be individual health record logged through the Health and Wellness Centres in rural areas and corresponding primary health care in urban areas.

The Strategy and Approach paper on the National Health Stack is a blueprint for India's futuristic digital health system that would undoubtedly be the very best in the world.

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Message from CEO, NITI Aayog



Mr Amitabh Kant

CEO,
NITI Aayog

What will it take to Transform India?

This is the fundamental question that we at NITI Aayog ask ourselves: we seek to bring together states and the center to shape strategic policy actions that will accelerate India's progress towards becoming a global digital and economic powerhouse.

Universal health coverage is undoubtedly a key lever to achieving this goal. Not only does improved health security have the potential to transform individual well-being, it would also allow our nation to fully leverage our strongest asset: human capital. Recognising the significance of this agenda, the ambitiously designed Ayushman Bharat Programme (earmarked in Budget 2018) will work in Mission Mode to ensure healthcare for all—and particularly for the poorest and most vulnerable. Through both a rapid scale up of primary healthcare facilities and a comprehensive insurance plan allowing 50 crore individuals to access secondary and tertiary care, it would create the largest government-funded healthcare program in the world.

Achieving such scale requires us to rethink the core technology backbone of our system and leverage cutting edge digital solutions to tackle the challenge. The proposed National Health Stack (NHS) will thus deploy a powerful technology arsenal, from Big Data Analytics and Machine Learning all the way to Artificial Intelligence and a state of the art Policy Markup Language. The result? A complete redesign of the flow of people, money, and information, as well as a layered approach to providing comprehensive foundational health functions for all states and programs—grounded in an inclusive and interoperable technology strategy. Once implemented, the National Health Stack will significantly bring down the costs of health protection, converge disparate systems to ensure a cashless and seamlessly integrated experience for the poorest beneficiaries, and promote wellness across the population.

We hope that you will join us on this journey to developing a best-in-class healthcare information technology approach across the nation—one that the world would seek to emulate, and one which would become the cornerstone of India's public health system for years to come.

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Table of Contents

Executive Summary	11	Guiding Principles for the Overall Design of the National Health Stack	34
Acronyms	13		
Introduction	14	Benefits of the National Health Stack	37
National Health Stack (NHS) Overview	17	—Benefits to Public	37
		—Benefits to the Central Government	38
		—Benefits to the States	39
Components of the National Health Stack	18	Well-functioning and Accountable Private Sector Participation	40
—India Stack	18	—Service Providers	40
—Electronic Health Registries	19	—Health Insurance Providers	40
—Coverage and Claims Platform	23		
—Digital Health ID	28	Conclusion	41
—Federated Personal Health Records (PHR) Framework	29		
—National Health Analytics Framework	32		

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Executive Summary

The Union Budget of the fiscal year 2018–19 laid the foundation for the **Ayushman Bharat Yojana**, a program designed to address health holistically through a two-pronged approach—

- Set up of 1.5 L Health and Wellness Centres for comprehensive primary healthcare offering preventive and promotive healthcare accessible to all.
- A flagship scheme **Pradhan Mantri-Rashtriya Swasthya Suraksha Mission (PM-RSSM)** which will cover 10 Cr+ poor and vulnerable families providing coverage up to 5 L per family per year for secondary and tertiary care hospitalization.

The **PM-RSS Mission**, which is expected to be rolled out by states themselves, seeks to converge multiple health protection schemes across states into one universal health protection scheme over time. This will be a key step towards achieving **Universal Health Coverage (UHC)** and **Portability**—which essentially translates into an environment where **All** people can obtain health services **Anywhere** in the country without suffering financial hardship or excessive indirect costs.

Through Ayushman Bharat, the Indian government has significantly stepped up its financial commitment in public healthcare. And while financing on demand side is critical, it is equally important to build a national digital infrastructure as an integral part of the program design to enable supply-side readiness. The PM-RSS Mission provides the right opportunity to build such an infrastructure.

In this document, we present the idea of a **National Health Stack (NHS)**—a digital infrastructure built with a deep understanding of the incentive structures prevalent in the Indian healthcare ecosystem. The NHS, a set of building blocks which are essential in implementing digital health initiatives, would be “**built as a Common Public Good**” to avoid duplication of efforts and successfully achieve convergence. Also, the NHS will be “**built for NHPS but designed beyond NHPS**” as an enabler for rapid development of diverse solutions in health and their adoption by states.

The key components of the National Health Stack are—

- National Health Electronic Registries:** to create a single source of truth for and manage master health data of the nation;
- A Coverage and Claims platform:** building blocks to support large health protection schemes, enable horizontal and vertical expansion of RSSM by states and robust fraud detection;

- C. **A Federated Personal Health Records (PHR) Framework:** to solve twin challenges of access to their own health data by patients and availability of health data for medical research, critical for advancing our understanding of human health;
- D. **A National Health Analytics Platform:** to bring a holistic view combining information on multiple health initiatives and feed into smart policy making, for instance, through improved predictive analytics;
- E. **Other horizontal Components:** including, and not restricted to, unique Digital Health ID, Health Data Dictionaries and Supply Chain Management for Drugs, payment gateways etc shared across all health programs.

The National Health Stack will facilitate collection of comprehensive healthcare data across the country. Designed to leverage India Stack, subsequent data analysis on NHS will not only allow policy makers to experiment with policies, detect fraud in health insurance, measure outcomes and move towards smart policy making, it will also engage market players (NGOs, researchers, watchdog organizations) to innovate and build relevant services on top of the platform and fill the gaps.

The design is geared to generate vast amounts of data resulting in some of the largest health databases with secured aggregated data that will put India at the forefront of medical research in the world.

We believe that with the adoption of this technology approach, the government's policies on health and health protection can achieve:

- **Continuum of Care** as the Stack supports information flow across primary, secondary and tertiary healthcare
- **Shift focus from Illness to Wellness** to drive down future cost of health protection
- **Cashless Care** to ensure financial protection to the poor
- **Timely Payments on Scientific Package Rates** to service providers, a strong lever to participate in government-funded healthcare programs
- **Robust Fraud Detection** to prevent funds leakage
- **Improved Policy Making** through access to timely reporting on utilization and measurement of impact across health initiatives and
- **Enhanced Trust and Accountability** through non-repudiable transaction audit trails.

Acronyms

AEPS	Aadhaar Enabled Payment System
APB	Aadhaar Payment Bridge
API	Application Programming Interface
BPL	Below Poverty Line
FMS	Fraud Management Service
KYC	Know Your Customer
NGO	Non-Governmental Organization
NHP 2017	National Health Policy 2017
NHS	National Health Stack
PHR	Personal/Patient Health Records
RSBY	Rashtriya Swasthya Bima Yojana
RSSM	Rashtriya Swasthya Suraksha Mission
SECC	Socio-Economic Caste Census
TPA	Third Party Administrator
UHC	Universal Health Coverage
UPI	Unified Payments Interface

Introduction

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi in its meeting on 15th March, 2017 had approved the National Health Policy 2017 (NHP 2017) which states as its goal—

...The attainment of the highest possible level of health and wellbeing for all at all ages, through a preventive and promotive health care orientation in all developmental policies, and universal access to good quality health care services without anyone having to face financial hardship as a consequence.....

To this effect, The Union Minister for Finance and Corporate Affairs, Shri Arun Jaitley, while presenting the General Budget 2018–19, has announced two major initiatives in health sector, as part of Ayushman Bharat Yojana.

- (i) **Health and Wellness Centre:** 1.5 L Health and Wellness Centres will be set up across the nation to bring healthcare system closer to the homes of people. These centres will provide comprehensive **Primary Health Care**, including for non-communicable diseases and maternal and child health services. These centres will also provide free essential drugs and diagnostic services. The Budget has allocated Rs.1200 crore for this flagship programme.
- (ii) **Pradhan Mantri-Rashtriya Swasthya Suraksha Mission:** This second flagship programme under Ayushman Bharat will cover over 10.74 crore poor and vulnerable families (approximately 50 crore beneficiaries) providing coverage upto 5 lakh rupees per family per year for **Secondary and Tertiary Care** hospitalization.

For the first time, the policy positions health as a major national agenda linking outcomes to the economic development of the nation. These two health sector initiatives under Ayushman Bharat Programme, if delivered successfully, will realize its dream of New India 2022 and ensure enhanced productivity and wellbeing, avert wage loss and arrest impoverishment.

This document will introduce the concept of a shared digital infrastructure called the **National Health Stack (NHS)** to help achieve the desired **Continuum of Care** across primary, secondary and tertiary care.

The Rashtriya Swasthya Suraksha Mission has been identified for rapid rollout across states. Therefore, while the **National Health Stack** will be built in the context of RSSM, it will be designed for 'beyond RSSM' to support existing and future health initiatives, both public and private.

In the past there have been several health insurance initiatives by the central and state governments. Examples include the Rashtriya Swasthya Bima Yojana (RSBY), Rajiv Arogyasri in Telangana, Yeshasvini in Karnataka, etc. Each government-funded healthcare scheme has historically aimed to cover a section of the society that requires essential protection from sudden, large expenditures for treatment.

However, despite the right intent, government-funded healthcare schemes have faced several challenges in implementation, major ones listed below:

1. **Low enrolment of entitled beneficiaries**— The significant on-the-ground challenges of enrolling beneficiaries covered under various health schemes are a result of both poor process implementation and adverse incentives. As per National Sample Survey (NSS) 71st round (2014) only 11.3% of the bottom 40% population has any insurance coverage.
2. **Low participation by service providers**— Many hospitals and nursing homes decide not to participate or refuse to offer services post empanelment. The main reasons cited are low package rates compared to market, long payment times and lack of transparency in claims process. According to NSS only 4.5% of total hospitalization expenses are reimbursed to the bottom 40%. This results in high Out-of-Pocket Expenses (OOPE).
3. **Poor fraud detection**— The lack of robust systems makes it difficult to quickly identify and prevent health insurance fraud. This leads to funds leakage, long claims cycle time and increase in rejected claims owing to a conservative approach adopted by insurance providers. This creates a vicious cycle of disillusioned service provider who refuses to participate in such schemes which in turn pushes up the Out-of-Pocket Expenses (OOPE).
4. **Lack of reliable and timely data & analytics**— There are significant gaps in data availability and data quality across the system as of now. The absence of reliable and timely data aggregated at the patient level reduces quality of care, and at a systemic level puts significant constraints on policy makers to evaluate the performance of various players or measure outcomes in a consistent manner to make evidence-based decisions.

We are convinced that to address the above challenges, in addition to the issue of Portability of health services (in a country like India where health is a state subject), the **National Health Stack (NHS)** will prove to be the ultimate **Game Changer**. Built as a **Common Public Good** by the Centre for adoption by all states, it will eliminate any repetitive efforts on part of, yet retain autonomy for, the states—paving way for rapid rollout of various health initiatives, achieve convergence and accelerate the momentum to achieve the goal of **Universal Health Coverage** well ahead of time.

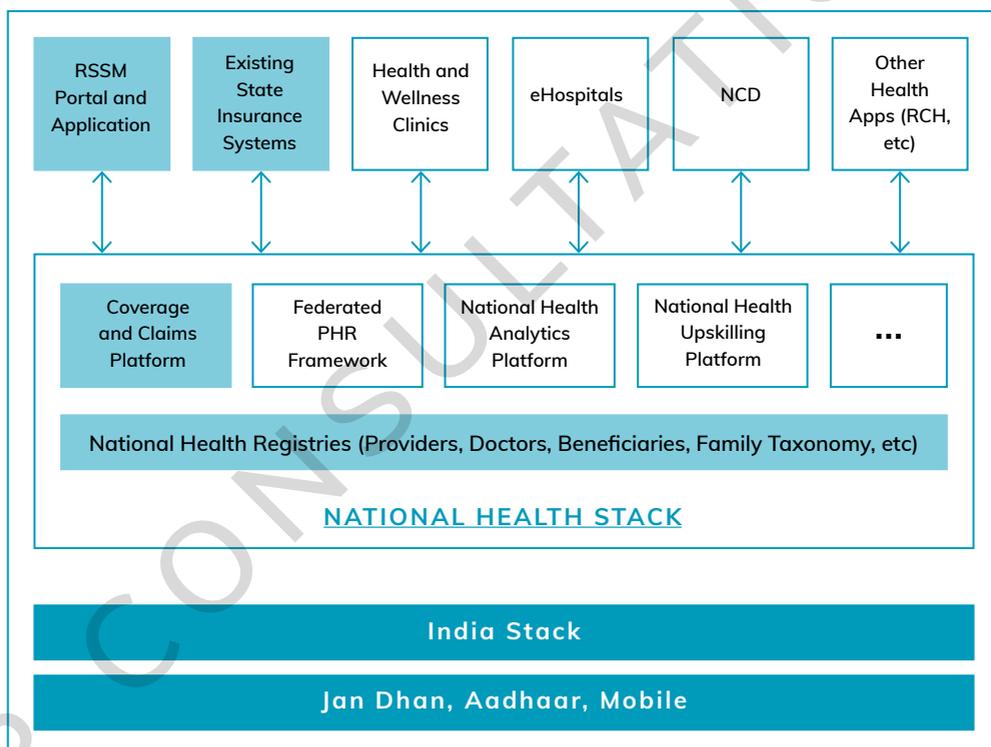
The scope of this document is limited to stating the vision, strategy and approach for the development of the National Health Stack. The document also contains an overview of the principles guiding the design and architecture of the National Health Stack and illustrates the two-track implementation approach of the NHS through the Rashtriya Swasthya Suraksha Mission. The operational details of building and rolling out the Stack including the delivery mechanisms and other related matters are beyond the scope of this document.

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National Health Stack (NHS) Overview

The National Health Stack is designed to provide the *foundational components* that will be required across Ayushman Bharat and other health programs in India. The Health Stack is a nationally **shared digital infrastructure** usable by both Centre and State across public and private sectors. The Stack is designed to bring a holistic view across multiple health verticals and enable rapid creation of diverse solutions in health.

Exhibit 1:
The National Health Stack—
High Level Architecture



The National Health Stack is a collection of *cloud-based services*. Each service provides just one capability across multiple health services, accessible via *simple open APIs* compatible with global standards. Together they create a powerful framework to bring convergence and faster go-to market for any health initiative.

The scope of the National Health Stack includes (and is not restricted) to the following subjects: Induction of Private Hospitals and Private Practitioners into the Primary and Secondary healthcare ecosystem; Focus on Non-Communicable Diseases (NCD); Disease Surveillance; Health Schemes Management Systems; Nutrition Management; School Health Schemes; Emergency Management; e-Learning Platform for health, LMS, Telehealth, Tele-radiology; Diagnostic Equipment; Health Call Centre(s) etc.

Components of the National Health Stack

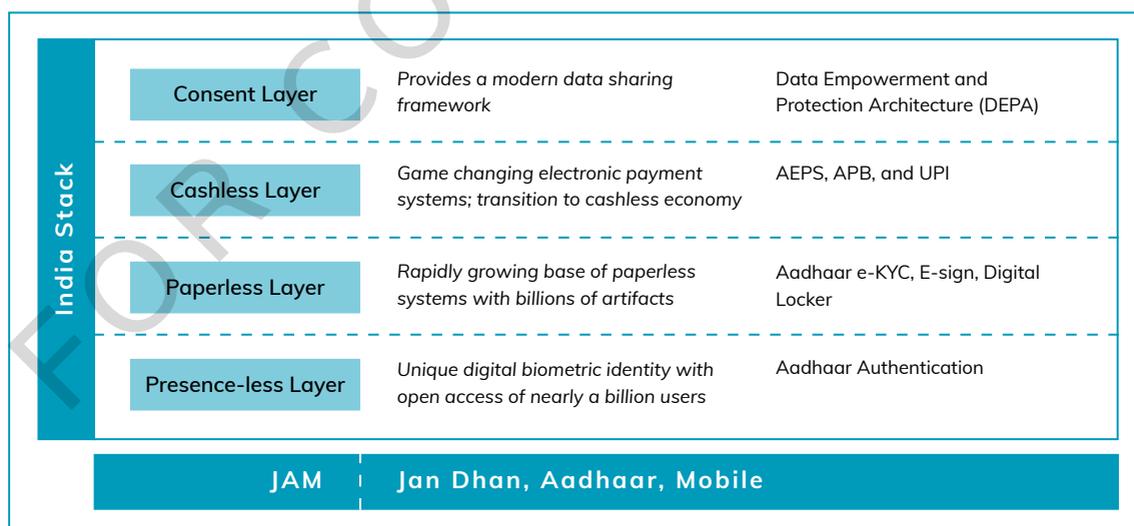
At a high level, the components of National Health Stack are organized in two layers. There is a *National Health Registries* layer, which forms the base of the Stack and houses the services required to manage the master data for all health programs. Above it, there is a layer of software services and platforms which encapsulate additional building blocks required for operationalizing programs. This includes a *Coverage and Claims Platform*, a *Federated Personal Health Records (PHR) Framework* and a *National Health Analytics Framework (NHAF)* amongst others. In the design of these components, the Health Stack utilizes various components of the *India Stack*, which we briefly describe below.

INDIA STACK

India Stack is a set of digital public goods which collectively make it easier for innovators to introduce digital services in India across a range of sectors.

Exhibit 2:
The India Stack

LAYERS OF INDIA STACK



India Stack has four essential layers:

1. **Presence-less layer**, which enables removal of barriers to people's participation in formal services through digital identities and remote authentication mechanisms;
2. **Paper-less layer**, which enables digital records to be moved with an individual's digital identity;
3. **Cashless layer**, which includes a set of payments services to ease monetary transactions; and
4. **Consent layer**, which empowers individuals to share their data in a safe and secure manner, thus enabling access to better financial, healthcare, and other services.

The widespread rapid adoption of basic bank accounts under the Prime Minister's financial inclusion scheme, the Jan Dhan Yojna (JDY); the digital identity called Aadhaar; and mobile phones, especially smartphones, has created a foundation (JAM) in India on which the India Stack operates.

More information about India Stack is available from <http://www.indiastack.org/>

ELECTRONIC REGISTRIES—MANAGING THE HEALTH MASTER DATA OF THE NATION

A lack of reliable and easily accessible master data is a core problem that affects current health systems: each vertical program in the government tends to maintain its own copy of data that is difficult to keep updated and restricts data sharing across programs. This, in turn, makes it difficult to get a holistic picture of care across programs. To overcome these challenges, the National Health Stack will incorporate a layer of electronic registries that will form the base layer of the Stack. This layer will be utilized by all programs which are built on top of the National Health Stack.

Registries will include data for various health-sector stakeholders, in particular (but not restricted to) healthcare providers (hospitals, clinics, labs etc), beneficiaries, doctors, insurers and ASHAs, and they may also contain data about other aspects of health programs like information on drugs and interventions. All registries will have open APIs for publishing and consent-based access by authorised entities.

Principles of well-designed registries

The registries in NHS will be developed with the following design principles in mind:

Self-Maintainability

Entities listed in the registry should be able to view their information and through appropriate workflows be able to update their information in a verifiable and trusted manner.

Non-Repudiable Data

The source for each attribute in the registry should be visible: viewers should be able to tell who added which information and when. All attributes should be digitally signed by the authorized updater. This leads to greater trust in the data and stronger accountability.

Incentive-aligned Design

Registry owners must attempt to enact mandates that require the entities listed by the registry to register and to keep their data up to date. Where mandates are not possible, suitable incentives need to be provided as part of the implementation process. For

example, empanelment of hospitals for health insurance must encourage the insurer or third-party administrator (TPA) to always obtain the information from the provider registry and not collect it directly from the provider. This ensures that the provider has an incentive to keep its registry entry up to date.

Extensibility and Flexible Schemas

Registry owners will have to set up a process to accept feedback and to update registry schemas. Health applications built on top of the Health Stack should be able to extend the base registries and use derived versions of them.

Open APIs

Creation, updation and retrieval of data must be possible using open APIs. For some APIs, entity authentication mechanisms must be implemented in order to ensure data security.

Controlled Data Visibility and Consented Data Sharing

Registries will offer fine-grained control and visibility over each attribute of an entity. Attributes can be public or private, masked or encrypted. Sharing of private attributes to a data requestor will require consented access.

Data Provenance

A non-repudiable audit trail must exist for all changes made to entries in the registry. In general, it should not be possible to delete data from registries, though it may be possible for the registry owner to mark certain entries as obsolete.

Approach and Considerations for designing Electronic Registries

While we do not present the detailed design of the registry layer in this document, we point out a few essential elements of the approach that will be taken to design two important registries: the *provider registry* and the *beneficiary registry*.

Provider Registry

The provider registry will be the one which will manage master data for all healthcare providers in the country. This will include hospitals (both government and private), clinics, diagnostic labs and other clinical establishments. Building a provider registry along the above design principles is essential for running any insurance scheme effectively and in running other programs which rely on ensuring veracity of provider data.

Multiple efforts are currently underway to build provider registries in India. This includes the National Health Resource Repository (NHRR) being managed by the Central Bureau of Health Intelligence (CBHI),¹ the NIN database² implemented by Ministry of Health and Family Welfare (MoHFW) and NIC and the Registry of Hospitals in Network of Insurance (ROHINI)³ developed by the Insurance Information Bureau of India (IIB). These efforts have thus far been disconnected from each other and are resulting in redundancy in datasets. The NHS provider registry will not only provide features like self-maintainability, non-repudiability and consented access of data, it will also attempt to **unify existing efforts on provider registries** and reduce the redundancy in these efforts. All existing registry implementations will be able to publish provider information securely to the NHS registry, on a per-provider basis or in bulk, and extract information from it for their respective programs. (These implementations will operate as applications on top of the Health Stack.) There will also be the flexibility to extend provider schemas defined in the NHS registry for individual use cases. In this manner, both

1 http://dghs.gov.in/content/1370_1_CBHI.aspx

2 <https://nin.nhp.gov.in/login.php>

3 <https://rohini.iib.gov.in/>

existing and future programs reliant on provider registries will be benefitted.

An important element of maintaining provider registries will be the role of a surveyor who will be tasked with physically visiting providers and validating registry data. The interfaces for surveyors and data validators will be defined and their role scoped out in detail.

Provider registries, as other registries like doctor registries and insurer registries, will have attributes for grading and scoring providers on different metrics; some of these grading mechanisms could be crowdsourced. Such information about providers will have a different approach for data update and access. There will be a facility to allow some entities in the healthcare ecosystem to create, update and access data about others in/from the latter's registries (e.g., beneficiaries will have the authority to grade providers and submit these grades to the provider registry). Such cross-entity access of information will also need to be scoped out.

Beneficiary Registry

Health programs are likely to use a variety of identifiers to identify the individual and family on the ground, and so the beneficiary registry in the NHS is designed to offer flexibility. The base entry in the beneficiary registry will be created with a link to a strong foundational ID such as the beneficiary's Aadhaar number. The registry would allow any number of other identifiers being used in the health system to be linked to the Health ID. This will not only enable a holistic view of the different programs that beneficiaries participate in, it will also enable efficient search and recovery of beneficiary details given program-specific identifiers.

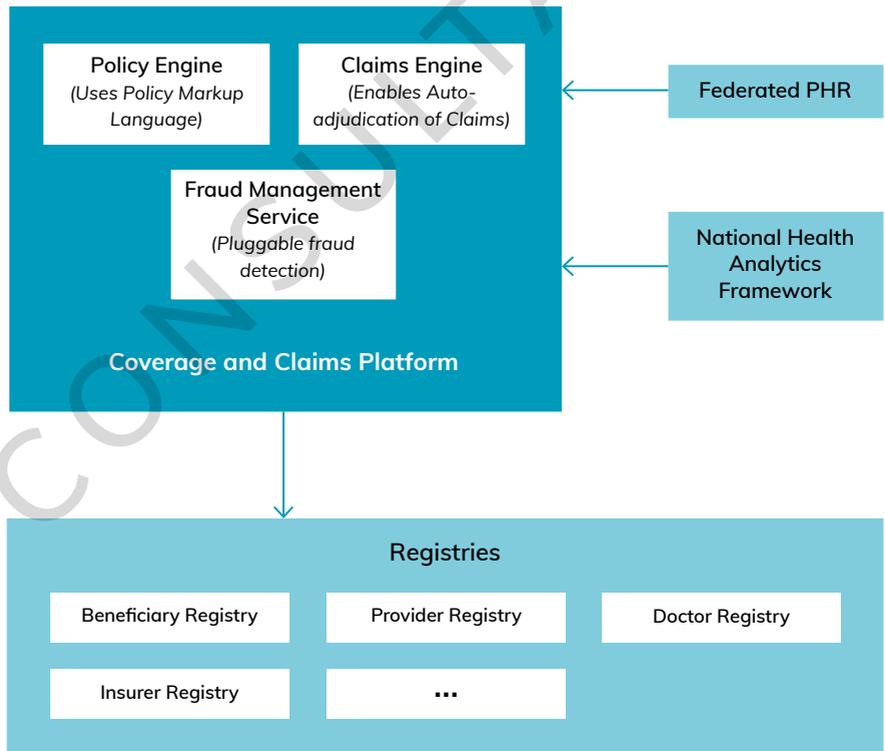
Beneficiary registries will also capture and store important beneficiary-to-beneficiary linkages e.g, information about a beneficiary's family will be available from the record corresponding to that beneficiary. The NHS registry will not assign any group IDs (e.g., family IDs) to beneficiaries although such attributes may be added by individual NHS applications.

COVERAGE AND CLAIMS PLATFORM

The coverage and claims platform provides the building blocks required to implement any large-scale health insurance program, in particular, any government-funded healthcare programs. This platform has the transformative vision of enabling both public and private actors to implement insurance schemes in an automated, data-driven manner through open APIs.

There will be three primary sub-components of this platform: a *policy engine*, a *claims engine*, and a *fraud management service*.

Exhibit 3:
Coverage and Claims Platform and linkages with the National Health Stack



Policy Engine

The Policy Engine is a service that allows defining and storing of insurance policies for individuals and families in a machine-readable format, and provides APIs to consume and update these policies. Two key components of this engine are a **Unified Multi-Policy View** per beneficiary and a new **Policy Markup Language (PML)**.

Unified Multi-Policy View

The Policy Engine, through its APIs, will empower beneficiaries to get a unified view of all their health insurance policies in a convenient and user-friendly manner. This will cover both government-funded healthcare policies as well as private insurance policies that the beneficiary may have purchased.

Policy Markup Language (PML)

A key innovation in the NHS would be the idea of Policy Markup Language (PML), which would be a machine-readable language designed for describing, updating, accessing and communicating policies between software programs. The PML will enable health insurance policies to be written to cover their various attributes, including:

- The list of empaneled providers linked to the policy
- The coverage amount
- The coverage period
- List of procedures that are covered
- Pre-authorization requirements for procedures
- Pre-authorization approver details
- Hospitalization costs payable for each procedure
- Exclusion criteria for any procedures

To start using the coverage and claims platform, health insurance schemes will need to define a set of health insurance policies in the Policy Markup Language. The policy is uploaded and validated to be syntactically correct in the policy repository. Each policy will need to be accompanied with a digital signature, linked to the entity that is providing the coverage (e.g., insurance company or a health trust set up by the state). Only when the signature has been generated will the policy become active. The Policy Engine will allow policies to be activated at different times for each beneficiary. Activation requires that premiums that cover the beneficiary be transferred to the insurance company or

health trust. It is the responsibility of the Centre and State to ensure the the funding cycle for any government-funded healthcare programs is correctly managed so that policies do not expire and the poor and vulnerable do not suffer due to policy expiry.

Subject to the approval and successful demonstration of the technology, there could be a possibility for policies to be developed based on **Smart Contracts**, a derivative of **Blockchain Technology**. Smart contracts will enable policies to have intelligence embedded in them, which will allow each policy to directly interact with the Claims Engine (or other parts of the Stack). So, for example, policies would automatically be able to trigger insurance payments once certain conditions in the claims process are met.

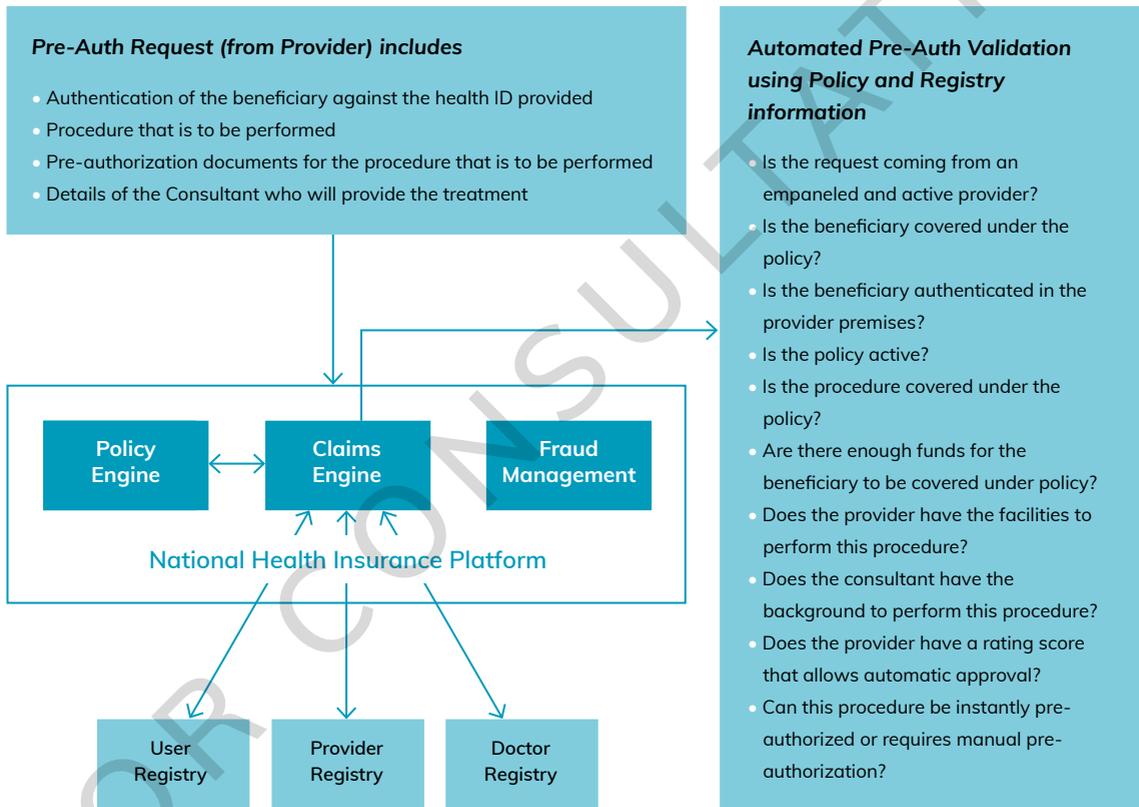
Claims Engine

Claims processing is the most vital component in the coverage and claims platform. The Claims Engine will manage the way claims flow in health insurance schemes and ensure ease of filing and settling claims. This engine will:

1. **Ensure auto-adjudication of claims:** A large part of the claims process (covering both pre-authorization and post-treatment claims processing) can be automated given machine-readable description of policies, as in the Policy Markup Language. The claims engine will accomplish this automation, which in turn will help insurers and third-party administrators (TPAs) in making faster decisions.
2. **Orchestrate the payment flow:** The claims engine will also send payment triggers and notifications to designated entities which will help ensure that insurance Service Level Agreements (SLAs) are adhered to and claims processing times are accurately reported to the authorities.
3. **Provide data points:** The claims engine will generate a rich data trail on the history of claims processed by the NHS, which will serve as the key input to the Fraud Management Service (FMS).
4. **Receive requests for audit:** The claims engine may also receive requests for audit on past claims from the FMS. In such situations, claims would be re-assessed and the resulting analyses provided back to the FMS. With better data, suspicious claims can be detected and analysed in this manner.

Claims in coverage and claims platform are settled within the time defined by the SLA of the insurance policy. The engine is responsible for ensuring that claims originating

in the system are adjudicated at the earliest. In order to do so, this component takes into account inputs from the external Fraud Management System (FMS) which recommends an action to be taken on the claim. For example, the FMS may recommend acceptance or advise TPA intervention for a newly filed and documented claim. If FMS recommends acceptance, the platform will auto-adjudicate the claim in accordance with rules specified in the policy.

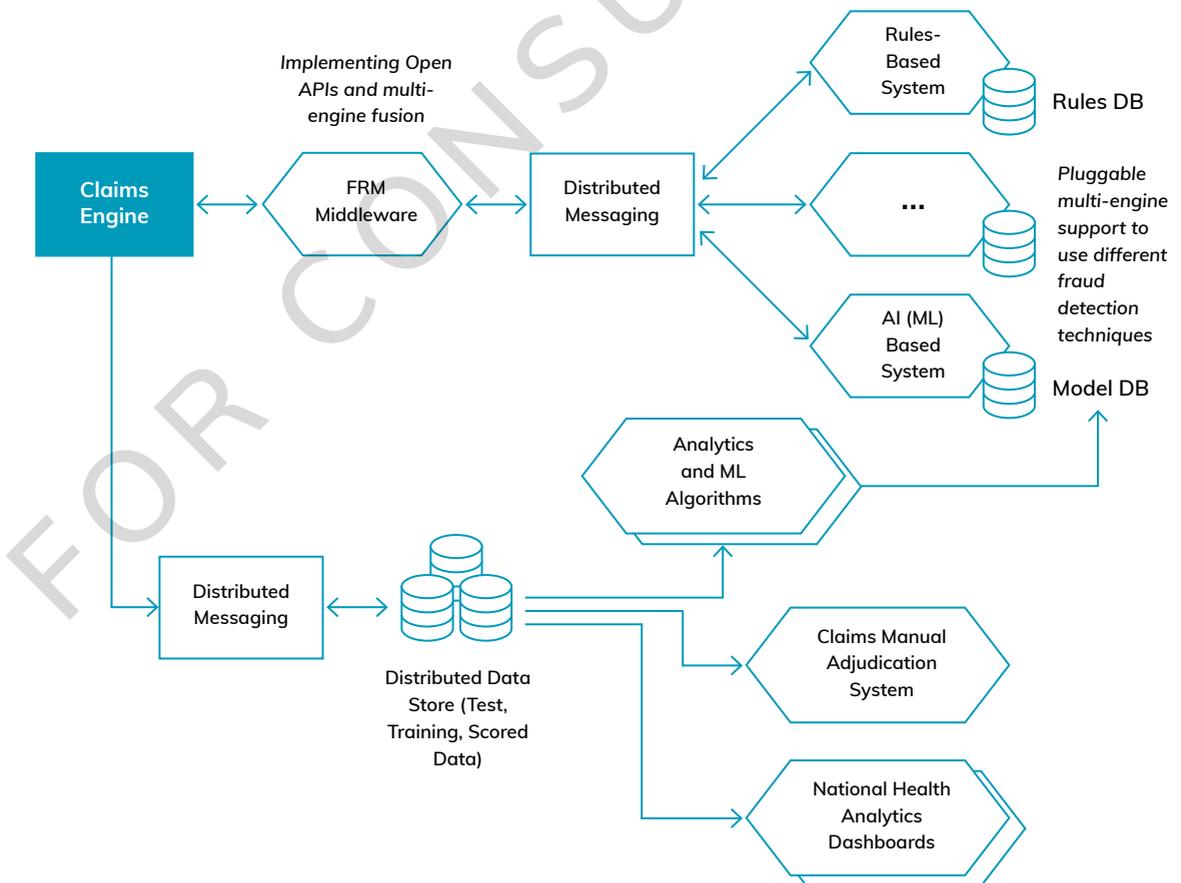


When resolving such re-assessed cases, detailed analyses is provided to the FMS as feedback, along with the case resolution.

Fraud Management Service

Fraud management processes are improved dramatically when its analysis is based on national scale data; this is possibly the greatest impetus for a shared digital infrastructure. The fraud management component is responsible for ensuring that the number of fraudulent claims settled by coverage and claims platform is minimized. The component aims to reduce losses due to dishonest claims and ensure that the healthcare system covers the people who need it the most.

Fraud Detection using big data analytics and machine intelligence is improving at a rapid pace. Thus, the fraud management service will be implemented leveraging multiple engines in an effort to encourage innovation. In order to maximize fraud detection rates and accuracy, the engines will be incentivized to report fraud events and will compete with each other in the process. This approach will boost the rates of true positives as well as the rate of true negatives in fraud detection. The data feed into the fraud management system will be anonymized to protect patient and provider privacy.



When a fraud is reported, all pending claim settlements and any new claim settlements for a hospital are placed on hold until the fraud raised can be investigated. Governments, insurance companies and TPAs are expected to have vigilance teams that investigate the fraud scenarios suggested by the fraud management service. The teams would need to decide as to whether it is a truly fraudulent scenario or an item incorrectly flagged as fraud. The FMS service gets the feedback from the same process.

Personal Health Records (PHR) are a core requirement to avoid fraud and bring greater trust into the claim handling process, as most fraud is based upon either unwanted or redundant tests and procedures, or claims made by patients/providers on false procedures.

DIGITAL HEALTH ID

The NHS will provide for a mechanism through which every user participating in the system can be uniquely identified. Accurate identification will greatly reduce the risk of preventable medical errors and significantly increase quality of care. It will enable users to obtain a longitudinal view of their healthcare records. Also, it will also drive out unnecessary costs by reducing inefficiency.

Upon successful registration of the user, a Digital Health ID (unique, system-wide identifier) will be created and provided to the registrant. The registrant may create a Virtual Health ID to preserve their privacy when interacting with other users or stakeholders in the system.

When enrolling into any Scheme, users will be able to provide one of many national identifiers (like Aadhaar, PAN card, Election ID, etc) to identify themselves as specified by the National Health Policy.⁴ Upon successfully completing KYC, these users will be registered by the system. The NHS Health ID is generated for each user upon successful registration in the system.

When a registered beneficiary approaches a service provider for Scheme-related facilities, she is expected to only provide her Health ID. This federated identification

⁴ The NHP Document (https://www.nhp.gov.in/categories-for-adoption-of-standards_mtl) from 2016 states the following: "A health record system must have provision to include patient identifiers of following types: (1) UIDAI Aadhaar Number (preferred where available), (2) Both of the following in case Aadhaar is not available: 2.1 Local Identifier (as per scheme used by HSP), 2.2 Any Central or State Government issued Photo Identity Card Number.

system ensures that a user is identified uniquely in the NHS without requiring additional national identities to be produced for each transaction. The user or stakeholder is securely verified via authentication provided by the NHS.

The Health ID may also be looked up in a secure manner if the beneficiary does not have her identifier handy. For example—a beneficiary visiting a provider, in the absence of NHS Health ID, may authenticate against Aadhaar. A secure verification process will ensure that the beneficiary is validated. The provider will then be able to look up this beneficiary's relevant information using this reverse lookup.

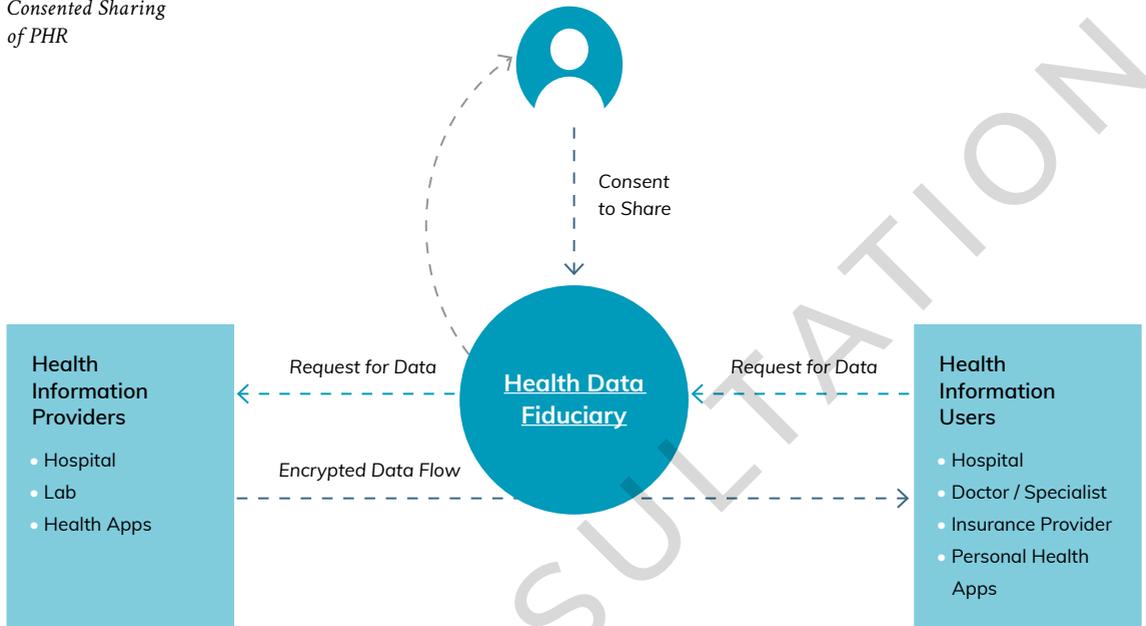
Like the Health ID, similar Digital IDs will be provided by the system to stakeholders like Government departments, insurers, TPAs and providers. Just as in the case of individual clients, identifiers will be assigned to these institutions only upon successful KYC for the institution. This KYC could be performed using a unique national ID already assigned to the institution (e.g., the institution's TAN number).

FEDERATED PERSONAL HEALTH RECORDS (PHR) FRAMEWORK

This component of the Health Stack enables the management and aggregation of user health data, as well as the consent-based flow of such data across different stakeholders who require access in order to deliver value-added services to the user.

Personal Health Records (PHR) refers to the integrated view of all data related to an individual across various health providers, comprising of medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal stats such as age and weight, demographics and billing information, and multiple health apps. Because health data is sensitive, the design and implementation must ensure the right level of privacy and security for health data; thus, **the PHR is maintained in a secure and private environment, with the individual determining rights of access**. This will be made possible through **Health Data Fiduciaries (trustees)** that shall facilitate consent-driven interaction between entities that generate the health data and entities that want to consume the PHR for delivering better services to the individual.

Exhibit 4:
 Health Data
 Fiduciaries for
 Consented Sharing
 of PHR



A meaningful patient-controlled health-record infrastructure, made possible via Health Data Fiduciaries, will support the development of highly desirable health system qualities. First, it allows a patient to effectively become a health information exchange of one: as meaningful data accumulate in a patient-controlled repository, a complete picture of the patient emerges, resulting in an improved quality of care across a range of providers. Secondly, the federated structure of PHRs (with pre-authorizations built in) can facilitate the access to this valuable data in a consented manner for the purposes of medical research (which in turn results in reduced cost and better health outcomes).

The key guiding principles for this framework are listed below:

1. The Patient is the Controller of her data:

True empowerment occurs when the patient is the controller of data rather than just the owner. Incentivised mandates for healthcare organizations to provide data to patients after an encounter through a standardized electronic mechanism (automated updates, for instance) has the potential to achieve a patient driven information economy in addition to inculcating a stronger partnership between patients and clinicians.

2. Leveraging a Federated, rather than a Centralised Approach:

A key aspect of the PHR framework is that it enables meaningful health data to be stored and managed in a *federated* manner: i.e. multiple entities (e.g., hospital systems, health-technology companies, etc.) will manage health data about users. User will be able to share their data via Health Data Fiduciaries (that will generate and manage consent) with data requestors. This will be achieved using standardized and open APIs through which these entities will be able to communicate with each other and with stakeholder systems. Such an approach to managing and sharing data has many advantages from a scalability and flexibility perspective over a centralized solution for managing health data.

3. Privacy by Design:

User data needs to be protected from abuse and compromise. The PHR framework will define data sharing mechanisms, using the MeitY Electronic Consent Framework,⁵ that gives the user control of their data and ensures privacy of user data ground-up. Tools to protect privacy of data must be in-built in the framework and best-practice guidelines should be in place for the framework users (hospitals, insurers, and other stakeholders) to ensure privacy of data.

⁵ Reference to *MeitY Electronic Consent Framework* (<http://dla.gov.in/sites/default/files/pdf/MeitY-Consent-Tech-Framework%20v1.1.pdf>)

4. Minimal changes to existing health record formats:

The diverse IT products used by healthcare providers in India do not follow a common standard for data storage and do not communicate with each other. Therefore, the framework must require minimal to no changes to existing IT products and must be designed to work with the existing IT infrastructure as-is.

5. A clear incentive for providers to participate:

Almost 80% of Indians seek private healthcare and pay out of pocket. In order to ensure the private healthcare providers participate, the framework should support built-in incentive structures to ensure rapid and universal adoption. Incentives and regulatory control need to be suitably balanced, in order to ensure maximum participation and innovation, and still ensuring user privacy and control.

6. Open APIs:

The framework should provide an *open* and *standard* set of application programming interfaces (APIs) for creating, accessing and updating records in EHRs, as proposed in the Policy for Open APIs by MeitY.⁶ The API definitions should be simple and follow the principles of minimalism and privacy by design. Some parts of the framework could be publicly available (as public goods) for any framework user to utilize.

NATIONAL HEALTH ANALYTICS FRAMEWORK

The National Health Analytics Framework will enable the creation of anonymised and aggregated datasets that assist in the creation of dashboards, reports, and other types of statistics. These aggregated datasets will present the overall direction of health of the country/state/district leading to data-driven decisions and targeted policymaking in the health sector.

In alignment with the National Data Sharing & Accessibility Policy (NDSAP),⁷ open datasets shall be published as part of this framework to increase transparency, accountability, civil society engagement, and innovations in service delivery.

A few examples of data which could be obtained through this framework are listed below:

- Average number of patients treated in a day
- Most commonly occurring diseases in India (Epidemiology)

⁶ http://meity.gov.in/sites/upload_files/dit/files/Open_APIs_19May2015.pdf

⁷ Reference to MeitY's National Data Sharing & Accessibility Policy (NDSAP) (<http://meity.gov.in/open-data>)

- Percentage of claims filed by the entities (Healthcare Provider, Doctor, or Beneficiaries) that are accepted/rejected (Resource Utilisation)
- Average billed amount / billed amount for a particular medical procedure
- Average time of settlement
- Treatment characteristics and procedures
- Years of experience of doctors across state/district/country.

While the National Health Analytics Framework will initially focus on Health Insurance, it will provide for “horizontal expansibility”—enabling the potential to cover, at a later point in time, important areas including (and not limited to) disease surveillance, predicting epidemics, classifying and clustering population segments for proactive care, nutrition, health schemes, and national health infrastructure such as telemedicine, teleradiology, and the enhancement of process controls.

Moreover, the treatment and patient care data in PM-RSSM can provide critical insights into the healthcare skill shortage at various governance levels (e.g. both the villager and block levels) and enable the implementation of skill development initiatives at a very granular level (for instance, through ASHA workers).

The National Health Analytics Framework will also help develop newly benchmarked standards in areas such as data formats, pricing, standard operating procedures in daily operations, and standard treatment procedures with optimal cost—whilst also providing the opportunity for continuous evaluation of National Health Policy. This will help shift evaluation away from an annual exercise towards a real-time approach, to help rapidly curate data collected through the insurance schemes and feed into agile smart policy decisions.

Guiding Principles for the Overall Design of the National Health Stack

1. Mandated PHR

Every citizen has a right to not just her/his health data but also right to access to structured data. All service provider EHRs and stand alone PHRs which include wearables, mHealth devices and health apps etc should have APIs compatible to NHS PHR.

2. Separating the Consent Layer from Data Flow is Key

It has been successfully implemented by India Stack while building the Universal Payment Interface. Patients may opt to (consent to) archive their data in one or more types of meta-directories that will then allow (or restrict) automated access for clinical, research, quality improvement, or marketing purposes.

3. Interoperability through Open APIs and Open Standards

Interoperability is essential for our solution to be able to support a large number of applications. NHS must be built using open standards, absent dependence on specific platforms or software frameworks. In addition, the components of the Stack should be loosely coupled using open interfaces (APIs).⁸ Adoption of open APIs and open standards and, where prudent, choosing open source frameworks and components over proprietary ones, creating vendor-neutral API's, will help achieve the goal of interoperability.

4. Privacy and Security by Design

Managing security and privacy of data is important in healthcare technology and thus will be a critical part of the design of the Stack. All data access must be through API calls to ensure centralised management of security controls. Direct access will be prohibited for internal modules and use of APIs will be mandated. NHS will ensure privacy and data integrity and will disseminate data to authenticated and authorised stakeholders only (both internal and external). Sensitive health data about individuals will be encrypted at rest. Mechanisms for user consent, using the MeitY Electronic Consent Framework,⁹ will be implemented to enable applications to share data about users in a safe manner. Finally, tools to enable audit and breach investigations will be present.

⁸ Reference to *MeitY Open API Policy 2015* (<http://meity.gov.in/content/policy-open-application-programming-interfaces-government-india>)

⁹ Reference to *MeitY Electronic Consent Framework* (<http://dla.gov.in/sites/default/files/pdf/MeitY-Consent-Tech-Framework%20v1.1.pdf>)

5. Strong Data Governance

NHS will follow principles of strong data governance. Data about any individual (patient, doctor, etc) in the system must be under the control of that individual, using the MeitY Electronic Consent Framework,¹⁰ and any entity holding that data must first obtain legitimate consent from that individual before sharing the data or processing it in other ways. Strong mechanisms for anonymization must be in place to enable data to be efficiently aggregated and analyzed for purposes where aggregate data is desirable (e.g. fraud detection, medical research).

6. Ensuring Extensibility through the use of Layered Design

The design of NHS will be modular: there will be a clear separation of concerns for data storage, software services

and APIs. Components will be minimalistic and independently replaceable and extensible. This will allow different components to be loosely coupled when building applications which will enable application diversity. State governments will be able to customise at a sub-stack level and create contextual solutions to serve their specific purpose, make changes to them with appropriate permission control and audit trace.

7. Granular Control

The modular design of NHS will enable governments (both center and state) to configure it easily and to use its components depending on their needs. A configurable plug-n-play model will also ensure simplicity and governments will be able to implement their own applications rapidly, allowing the Stack to scale nationally with ease.

8. Designing for Evolvability and Scale

The Stack must be able to scale horizontally to hundreds of millions of users in the healthcare ecosystem and to handle trillions of data records. All components including computer, network and storage resources must be capable of scaling horizontally: it should be possible to add new resources as and when needed to achieve required scale. Being cloud-ready and using commodity hardware will ensure that capital investments on the Stack will be minimal. This will also give a choice of infrastructure to the implementers and enable systems to evolve heterogeneously. Finally, the scale of use of the Stack should be measurable and demonstrable.

¹⁰ Reference to MeitY Electronic Consent Framework (<http://dla.gov.in/sites/default/files/pdf/MeitY-Consent-Tech-Framework%20v1.1.pdf>)

9. Based on Common Open-Source to create Public Goods

NHS will be built using available open-source frameworks. This approach will ensure full flexibility in feature enhancements, give full code control to program implementers, avoid vendor lock-in, and allow any third party to build solutions on top of the platform. These features, in turn, will help ensure agility of the Stack and its applications, build trust among consumers and enable scalability.

10. Transparency and Accountability through Data

The verified registry of all the entities and the non-repudiable transaction trails shall lead to higher trust and stronger accountability. NHS will be data-driven and will use data generated through transactions for reporting and analysis. Public Open Data shall be made available via APIs for transparency. The access to open data will ensure high-quality analytics, accurate fraud detection, shorter cycles for system improvement (e.g., updates to health policies can be made efficiently) and, most importantly, high responsiveness to user needs.

Benefits of the National Health Stack

There are numerous benefits to this approach—expected to accrue to individual beneficiaries, the central and state governments, the private sector; nudge healthcare service and insurance providers towards efficiency and accountability. These are outlined below.

BENEFITS TO PUBLIC

The greatest impact of the National Health Stack on the lives of people in the country will be, for the first time ever, the shift towards **Citizen and Wellness Centric** policy making.

As NHS matures with data over time, it will be well equipped to deliver solutions (in phases) to the four big challenges of healthcare faced by the people of India—availability, accessibility, affordability and acceptability.

Phase 1—Improving Affordability

Technology in Healthcare will provide affordability.

Increased participation of service providers and availability of healthcare services due to **justified pricing, instant adjudication and On Time payment of claims** will result in more widespread cashless care. This will result in significant improvement in:

- Financial protection (reduced out-of-pocket payments)
- Improved overall health and reduction of wage loss through individuals seeking more preventative care, and accessing medical assistance in earlier stages of illness

Over time as data is collated on the platform and a modern schema-less federated PHR is adopted, we foresee doing away with the need to conduct unnecessary tests as all records will be linked.

Phase 2—Improving Accessibility & Availability

National Health Stack will:

- Allow beneficiaries to avail the policy at any point in time of the year

- Increase access and availability of service providers for the beneficiaries through the **Faster Adjudication of claims** feature for service providers, making the program more attractive to them
- Incentivize service providers, via a scorecard mechanism, to set up facilities closer to the beneficiaries (e.g. tier 3 towns)—thus empowering the beneficiaries with choice

Instant adjudication, payment and claims closure will incentivise the service providers to participate in government-financed health insurance schemes with tremendous energy—increasing access and availability of service providers for the beneficiaries.

Phase 3—Improve Acceptability

A **Value-based Purchasing** feature can now be introduced as the Stack collates enough data to initiate a reward-based program based on incentivized payments and public reporting for the quality of care they give to patients, productivity and cost control.

The Hospital Value-based Purchasing Program encourages hospitals to improve the quality and safety of acute inpatient care for health protection beneficiaries and all patients by:

- Eliminating or reducing adverse events (healthcare errors resulting in patient harm)
- Adopting evidence-based care standards and protocols that make the best outcomes for the most patients
- Changing hospital processes to make patients' care experiences better
- Increasing care transparency for consumers
- Recognizing hospitals that give high-quality care at a lower cost to government-funded healthcare program beneficiaries

BENEFITS TO THE CENTRAL GOVERNMENT

India's is a federal government and health is a state subject. The National Health Stack will allow the Government of India to:

- Build in the feature of **Portability** for migrants, thus allowing it to fulfil its promise of healthcare and health protection anywhere in the country
- Achieve portability not just for the beneficiaries but also for practitioners

- Potentially place India at the forefront of medical research in the world. The design is geared to generate vast amounts of data resulting in some of the largest health databases with secured anonymised aggregated data
- Get a holistic view across health verticals through integrated national dashboards
- Adopt data-driven policy making through real-time reports and analytics
- Reduce the cost of healthcare through improved fraud detection, and
- Enable effective management of schemes and mission to achieve the goals of NHM

BENEFITS TO THE STATES

The National Health Stack will allow States to:

- Incorporate horizontal and vertical expansion of scheme and facilitate co-branding
- Leverage RSSM funds yet configure and customize based on their needs (items like eligibility, coverage of procedures etc), as well as maintain control over data.
- Avoid duplication of efforts and enable ease of adoption for those without systems or with dysfunctional systems in place
- Continue using their own state system while integrating with RSSM via APIs, making migration simple in case of states with more advanced systems.

Well-functioning and Accountable Private Sector Participation

SERVICE PROVIDERS

The core intent of the National Health Stack is to enable **On Time Payments** for the Service Providers. The technology stack will enable the distinction between good and bad service providers, as dictated by data, and subsequent recognition/treatment to create a self-sustaining win-win ecosystem in healthcare where better service providers will bubble to the top.

- **Digitization of policies, user registries, provider registries** will standardize empanelment, pre-authorization, claims processes and streamline operations resulting in administration ease for those participating in multiple government-financed health protection schemes
- **Combination of Instant Adjudication and Fraud Detection** tools will ensure the service provider is rewarded immediately for making honest claims and has no incentives to make fraudulent claims
- **Analytics** on data reported by service providers on actual cost for a procedure will result in establishing scientific packages and pricing of procedures

HEALTH INSURANCE PROVIDERS

Historically, insurance providers have been plagued with adverse incentives to reduce the claims ratio and avoid enrolling vulnerable, high risk populations which tend to have the greatest need for health protection.

The National Health Stack will benefit insurance providers while simultaneously bringing in efficiencies and enforcing accountability through:

- **A dramatic reduction in fraud** due to network scale data collated as a result of shared digital infrastructure
- **Reduced cost of operations**, as most processes will be streamlined on the claims engine
- **Access to data on performance of service providers** to help fine tune their sourcing mix
- **Reduction in claims ratio**, as the whole ecosystem will work towards management of health rather than management of disease
- **Market expansion and targeted product offering** with availability of supply side data

Conclusion

In India, 6 Cr individuals move Below the Poverty Line (BPL) every year because of expenses related to unforeseen illnesses, placing substantial constraints on the individual welfare and the nation's economic growth. Our Out-of-Pocket Expense rate stands currently at 70%, while the government's health budget is a mere 1.3% of its GDP (which remains largely unspent). Providing health coverage to the more vulnerable sections of society is a large and complex problem which needs to be tackled on a war footing. With Ayushman Bharat, the Government of India has indicated its desire to take healthcare protection to a new aspirational level.

The most critical lever in the ecosystem which can bring about a shift is the Service Provider. Participation of the currently disillusioned service provider in turn can be secured only through timely payments. This requires auto-adjudication of pre-authorizations and claims possible through world-class fraud detection system and hence the need for a claims engine.

Past experience and success with UPI, GSTN and other national platforms suggests that a platform approach could benefit the healthcare sector in improving the process flows for service providers. With building blocks in the form of policy repositories and various national level registries, workflows and PHR, incentivised access to stakeholders through open APIs, and consolidation of all insurance and assurance claims for health care at all levels (primary and preventive, secondary and tertiary) through a Claims Engine, the quality and accessibility of care could be dramatically improved.

We believe that this modular and open-source design will help cater to the current and growing needs of over a billion people and navigate the complexities of governance structures, multiple health systems and a combination of public and private providers. The concept of National Health Stack will significantly accelerate the participation of various stakeholders of the healthcare ecosystem and ensure deployment of patient-centric policies—resulting in **Cashless Care with Improved Access** to ensure protection for the poor.

Given its federal structure and limited resources, India demands agility, flexibility and evidence based smart policy making for implementation of healthcare initiatives, driving all stakeholders towards **health-seeking behaviours** with renewed energy. The adoption of the National Health Stack will provide a stimulus not only to act in conformity with a globally progressive commitment to health equity, but also enable India to become a leader of the movement by creating one of the best contemporary technology-informed models for universal health coverage.



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