

PERSPECTIVE

Why India Needs to Change the Architecture of its Public Health Information Systems

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ABSTRACT

In this commentary on public health information system (s) (HIS) in India, authors highlight gaps in India's HIS. It contains specific examples of two national-level HIS in order to identify their underlying Health Information Architecture (HIA). Knowledge of this underlying HIA is critical for the creation of an enabling HIS that allows healthcare providers and policy makers to use routine data for decision-making and hence contribute to improved health outcomes.

Key Words: Health Information Systems, Health Information Architecture, Enabling Health Care Providers, Data-based Decision-making

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Introduction

Design and implementation of dynamic healthcare services and public health programs and policies demand access to and use of timely and accurate data. The new national health policy in India underlines the importance of creating a health information system (HIS) that can serve the diverse health information needs of the range of health system stakeholders: providers, payers, patients, public health professionals, policy and program administrators, and health information technology users. This implies that India's national HIS must provide timely and accurate data and enable healthcare providers, public health leaders, and policymakers to use data on a routine basis to enhance program performance. Over the years, HIS such as health management information system (HMIS) have provided information and strengthened public health program development, implementation, and the monitoring and assessment of service delivery to an extent. However, despite significant investments in their development, public HIS at national and subnational levels have failed to enable policymakers and healthcare providers in India to ensure universal healthcare services

of good quality to the population. Moreover, there is limited research on health information issues and its effect on health system performance.¹

Growing health disparity and the slow pace of progress among the most populated and less developed states such as Bihar, Jharkhand, Madhya Pradesh, Rajasthan, and Uttar Pradesh continue to hamper India's performance on overall health indicators.² Acknowledging the challenges confronting the country's health systems, the proposed national health policy outlines strategies to accomplish its objective of assuring universal availability of free, comprehensive primary healthcare services, as an entitlement, for all aspects of reproductive, maternal, child, and adolescent health and for the most prevalent communicable and noncommunicable diseases.³

India has improved its HIS, and these systems have undoubtedly helped to improve, in turn, the coverage, quality, and use of healthcare services among the country's populations under the national health mission program. India has also made progress in improving its health infrastructure, human resources for health, health financing, regulation, and medical technologies and supplies. Even so, significant gaps persist in the national and state health systems.^{4,5}

India has many "silo" HIS to monitor programs such as those addressing reproductive health; maternal, newborn, and child health and nutrition; HIV; malaria; tuberculosis; leprosy; and blindness control.⁶ These independent HIS developed and maintained by public (e.g., the National Informatics Center, Government of India) and private (e.g.,

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Vyapam Technologies Ltd., for the HMIS portal of the government) information technology agencies fragment health data and lock them in discrete systems, making it difficult for governmental departments within and outside of the health ministry to extract, analyze, and use them. Additionally, continued reliance on large periodic surveys to gather data for policy and program formulation and assessment has been a bottleneck in the development of a dynamic health system that could respond to the population's diverse healthcare needs.

For India to achieve its proposed objective of universal primary healthcare effectively and efficiently, a robust national HIS to monitor, review, and evaluate access to and the impact of good quality care is necessary. This system must cater to the specific information needs of state- and national-level public health leaders. It must also enable providers to use data to inform their healthcare decisions so that their clients receive appropriate, good-quality care. Two key HIS that have been implemented at the health subcenter level are the Mother and Child Tracking System (MCTS)⁷ and the HMIS portal.⁸

The Mother and Child Tracking System collects individual patient data and seems to operate like a mini electronic health record. This system tracks antenatal care, pregnancy outcomes, and postnatal care services for women of reproductive age. It also tracks immunization services provided to children under five years of age. This system collects data on more than 100 data elements. The national HMIS portal is designed to aggregate data based on health indicators compiled by rural healthcare workers. At the system's core are approximately 200 indicators related to the areas of child and maternal health and infectious diseases. The data are collected at the facility level and fed progressively up to block, district, state, and national levels, where they can be analyzed and used to make decisions. The national rural health mission funds both of these systems, but they use different technologies and standards. Where as MCTS was adapted from the e-mamta system of Gujarat state, which was developed by the national informatics center, a government agency, the HMIS portal receives technical support from Vyapam Technologies Limited, a private information technology company. Both systems rely on thousands of health workers for data collection, and hundreds of data entry operators to capture data online. Though the data captured and reported are similar, these two systems are meant to serve different informational needs. The MCTS collects data only at the health subcenter level; the HMIS portal collects data not only at that level but also from all the other health facilities in a district. Additionally, MCTS focuses on the services provided by the frontline health workers of the health subcenters, including those provided during home visits. In contrast, the HMIS portal reports data only on healthcare services offered at the health facilities.

The above description of the two national HIS provides insight into the reasons why India's HIS is fragmented and weak.

Health Information Architecture of an Enabling HIS

Design and development of an enabling HIS is guided by a health information architecture (HIA) that builds on the current systems, processes, and data. Furthermore, such an HIA offers flexibility to add functionalities in an incremental way. To meet the diverse information needs of public health policymakers and program leaders, and of providers, who function at different levels of the health system, the HIA of a national HIS must align with the goals of these two key types of users. The most important attributes of an enabling HIA are discussed below, and these attributes are well-defined in the related concepts of the theory of information infrastructure.⁹

Enabling providers and public health leaders: Ideally, an HIS system should support a wide range of activities carried out by various health system stakeholders and not cater just to the needs either of healthcare providers or public health policymakers. Unfortunately, HIS in India are aimed at addressing public health program monitoring and assessment information needs. Moreover, these information systems are plagued by numerous information systems issues such as poor data quality, data demand and use, data sharing, data standards, and data governance among others.

The process of enabling providers would not only help to generate good quality data, but it would also increase the use of good quality data in healthcare decision making. Most importantly, this process allows providers to share patient data with different providers to enable patients to access healthcare services at the patient's chosen point of care. This architecture can reduce duplication of resources and prevent creation of parallel HIS to meet program-specific data needs. It can also permit extraction, transformation, and aggregation of individual patient data for public health decision making. Enabling HIA must support activities conducted by healthcare providers¹⁰ as well as by those who formulate public health policy and develop public health programs.

Federated and distributed: The HIS in India are distributed in terms of physical location, administrative and political management, funding resources, and human resource and technology infrastructure. They are heterogeneous in terms of technology components, organizational entities, people involved, and institutional associations. The health system comprises state, provincial, district, subdistrict, and community subhealth systems, which also have their own HIS. These layers of health systems involve different types of healthcare providers both public and private (including nonprofit), who vary in their roles, skill sets, functions, and associations of facility type. The heterogeneity of subhealth systems demands HIS to provide contextualized information services. These subhealth systems have varied data needs and use different tools, processes, and systems to collect, report, and access data

for use. These data categories may include antenatal care, pregnancy outcomes, postnatal care, disease outcomes, laboratory test results, immunization history, inpatients and outpatients, and surgical procedures. A federated HIA enables providers and public health leaders at each level of the health system to perform optimally and thus maximize both patient- and population-level healthcare outcomes.

Shared: All the health systems stakeholders can share one HIA. In other words, a provider can use the clinical information system to provide healthcare services and administrative users can analyze information for costing and reimbursement purposes while being part of the same HIA. A shared HIA can be split into different units for analytical, decision-making, and design purposes but the different elements must be integrated by means of standardized interfaces. Such an architecture can use available standards (data representation, semantics, data interchange, communication, and security standards) to realize the goal of health information exchange among diverse and distributed HIS.

Conclusion

While routine healthcare service data pertaining to reproductive, maternal, newborn, child health and nutrition, and adolescents is captured at the facility level, the aggregated data is primarily used for macro level planning. Healthcare providers ability to use data for provision of continuity of care is restricted by lack of data related to clinical, laboratory, diagnostic and pharmacy services. The issue is further aggravated by the fact that HIS landscape in India is fragmented and patient data is partially captured and locked in multiple discrete HIS. As a result clinical procedures are repeated and patient's out-of-pocket expense further increases. In the absence of an enabling HIA that can reduce data division and serve data needs of both policy makers and healthcare providers, HIS strengthening efforts will fail to bear fruits. Since research on health information issues in India is limited, there is an urgent need to prioritize research on HIS issues. In particular, studies are needed on the design and implementation of HIA that can enable both policymakers and healthcare providers to use data for decision making, and thus improve health outcomes.

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