Integration of Health Care Modules in Current Health Care Management Systems in India

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1. Introduction

Health care beyond worldwide boundaries is a critical problem, particularly when the population differs in terms of geographic position, culture, habits, socioeconomic background, medical strategy, and variations in disease burden over time. For countries like India, with a significant percentage of high-end medical experts as well as support and other health care systems, the development and integration of comprehensive and functionally versatile health care management systems are among the most important clinical problems addressed.

The central dogma of a country that facilitates adopting a conglomeration will create a dedicated population to provide tailor-made health care in health shield, health protection, and health care delivery; a nation that takes care of a nation. Until now, it has given us E-Health, and offerings have been fine-tuned in research literature. In India, the health care domain is currently breaking the boundaries of knowledge workers in clinical and research domains working with the help of these workhorses **(Fletcher-Brown *et al.* 2021).** Many e-governance and public health reform programs in India are under consideration, and many of them are under implementation. This research focuses more on the integration of health care technology relevant to the paper topic within clinical setups, passive provision, and utilization of services for administrative purposes technologically implemented **(Das *et al.* 2023).**

1.1. Background of Health Care Management Systems in India

India has a chequered history of public policies in health, which is a varied mix of health and development, neglect, deprivations, a large presence of private providers, a delicate mix of law, communities, and negotiations, and a stretched-out overlay of the present and the bygones. In the changing epidemiological scenarios widely distinguished for persistence, demand, quality, and equity issues, the delivery of health services in real-time settings has to balance all these and emerge with effective outcomes for the betterment of the well-being of the people. The developmental scenario of the health delivery systems and management issues has traveled an epoch-making transition starting from broad-band intervention strategies to targeted and integrated vertical and horizontal modes of health care delivery systems.

The overarching framework of the district primary health system model in earlier days has evolved over decades. It catered to first contact points of health care services up to the distal level covering populations of 0.35 million (**Mustafa and Shekhar, 2021**)(**Chowdhury *et al.*2023**). Over the years, it was federated into a network with community health care supported by preventive and curative outreach services. These systems were resource-starved and criticized in no mean terms. They failed to achieve health in an overall sense but emerged with improved maternal, neonatal, and child health outcomes: reducing mortality and morbidity over time. It established a three-tiered system of community involvement and cross-sectoral linkages of the services and remains the bedrock to this day, even in the management of existing system structures **(Nordlund, 2024).** Major policy reforms followed,

which led the country to have a mixed assemblage of centrally funded priorities, as per operational issues. Despite the rhetoric and threshold changes, these models of health care delivery systems have stood the test of time and have been instrumental in providing a better return on investment over a specific period. The track record of various systemic changes suggests that the range and sets of management practices and functional and structural changes are influenced by both trajectories and path dependency. With the above perspectives and background, health systems in India hold profound potential and untold challenges in delivering health care. The emerging needs and requirements in this health system have been individually evolving in a cottage industry way, designing interventions and strategies on their global relevance and will have to provide effective and cost-effective remedies for the coexistence of polities and the political consciousness of a growing population of 1.36 billion and a lethal association with a triple burden in the health system (**Ramasubramani *et al.* 2024).** Scientists have to promise to deliver a supplementary health system rather than overtaking their mainstay medical models and cushions.

2. Concept of Integrated Health Care Modules

Advances in information technology over the years have resulted in the development of various hospital management information systems and health management information systems. But none of these systems allow easy exchange of data between them. To meet this requirement, various integrated health care modules are being developed and integrated with the existing systems. Interoperability is the capability of different information technology systems and software applications to communicate, exchange data, and use the information that has not been lost. It is the capability to connect existing health care information systems within and across organizational boundaries without replacing them **(Dwivedi et al. 2022).** These integrated health care models allow seamless data exchange between these different systems, and that too enables end users to access the data from these connected systems.

Integration of these modules with the existing HMIS has numerous advantages such as improved patient care, better decision support, improved patient education, efficiency improvement, better clinical outcomes, better data management, improved follow-up, and better preventive care, improved workflow, improved access to health care, and utilization of medicine. We have used the top-down approach for the development of the conceptual model, which provides a foundation for the direction of the integration system development and promulgation of the integrated care model. The rationale for this approach is grounded in clarity of focus and direction. Moreover, the approach aids in model development to be context-driven. A result of the assessment provides a perspective of attention to potential outcomes from the experience, observation, and insight which resulted from the health care services interaction with the model. Integrated health care models present a unique approach to addressing a need in the existing health care environment. For example, the Integrated Medical Model could be used in the heart of a city, located amongst embassies, surrounded by private schools and businesses, to get rid of medical aid and provide patients with 'world-class' treatment for a flat rate above a certain level of care **(Kelkar and Kelkar 2021).** It enables an approach, within the financial affordability context in which management, practitioners, community, and patients operate, to improve patient access, streamline patient workflow, and at the same time cut out physician 'frustrations' and reduce healthcare costs in an informed way. In short, integrated health care models strive to address the plan, organize, lead, and control needs in their own environment. It focuses on efficient workflow, good record keeping, the health of the patients, and the financial needs of the system. In the process, managed care is applied, and disease management is undertaken effectively using the referral to the most efficient, effective person who is located at the back of the system **(Health Organization, 2020).** Integrated health care models are developed in order to address the numerous needs faced in a rural area and highlight the building of system pillars. Investigating integrated health care models has broad application and implications for the environment and for people responsible for health management such as the relevant ministries and medical professionals.

2.1. Definition and Benefits

Integrated care, health management, systems, stakeholders, and policymakers.

Integration of health care modules in current health care management systems in India - more than a desideratum. Unique and important, health care is a multiple services provider activity, which is driven by both tangible technologies and intangible forces. It is mainly centered on maintaining, aiding, or regaining the health status of both individuals and society. To measure management effectiveness, we have to be effective firstly in health management. The hallmark of effectiveness in health management is the improved patient health outcomes measured vis-à-vis the cost and service delivery for prevention, cure, and care of diseases. There could be various modes to measure the quality of health care services. Some researchers are emphasizing integrated health services delivery models through controlled trials and filters, and the health performance spectrum model, where the positive side of IT will help in the integration of all the players, be they primary, secondary, or tertiary. The integrated health care modules are the training and research tools for larger integration of health care management **(Health Organization, 2020**).

Integration can be vertical (range of health services), horizontal, or a combination of vertical and horizontal (all the ranges of health care facilities with public and private stakeholders). Initialization of care through the integrated health management process can help in improving coverage of EMoC at suitable level health facilities, thus leading to an increase in institutional delivery and reduction in MMR/NMR, where necessary **(Sony and Naik, 2020).** The integrated health care referral module can also show pathways or chains for better health care and for spreading awareness of quality health care among potential beneficiaries. It will reduce the cost of care for the community as excellent and quality services are being provided in the vicinity of the patient at primary health care institutions. Integrative consultation or referral modules will improve the availability of information and the engagement of people in the health system. Thus, there are numerous grants to open the area of integrated health care management and types of training, research, and manpower training. Integrated health care management parameters defined for the effectiveness of health care consider the patient-centered module, with the current delivery structure providing extra benefits. Integrated health care operates on a process of improvement and refinement of different areas of interaction based on a few core principles. Integrated care does not have to be solely for patients with long-term conditions; in principle, it should be available to anyone who needs care from multiple systems. Integrated care can manifest itself in many different forms. In practice, integration exists in different degrees, depending on the people involved and the processes undertaken. **(Sheikh et al. 2021)**

3. Current Health Care Management System in India

3.1. Overview of the System

The Health Care Management (HCM) system architecture presented contains five modules, namely, the Staff Module, the Manager Module, the Financial Module, the Research Module, and the Patient Module. Among these, the Staff Module, the Manager Module, and the Financial Module communicate with the Data Module. This module contains details regarding the management, infrastructure, staff, and patients. The communication of a patient's personal and health details can be made possible only from within the Research Module.

There are separate screens and control over access for the doctors and the nurses under the Staff Module. Access to any of these is on a need-to-know basis. Typically, a doctor will be interested in a patient's personal as well as health details. On the other hand, a nurse will be more concerned with the patient's health details. At the same time, an IT assistant might be needed in all sections of the module. Systems administration, however, has access to some portions of all modules. Information of a highly sensitive nature, such as a patient's personal or health details, is permitted only from within the module to which they belong. All verified requests for medical data must be

introduced via the module's user interface, which acts as the communication tool to get to the Data Module containing a patient's personal and health details. As a result, a secure worldwide HCM system architecture is sought.

4. Challenges and Opportunities in Integrating Health Care Modules

Challenges

Do we have sufficient CAD? A large variation still exists across countries for health care facilities. While we have several hospitals and health care centers present in towns and rural areas where telemedicine and tele-radiology can be useful, this setup is fundamentally different from that in high-income countries and hence, it may not be possible to implement technologies suitable for high-income countries. The pathway for health care for these two setups, particularly the referral system, differs. There is resistance to change and adoption of new technology that has already been developed and validated. There is inadequate technology management support in health care practice. Inappropriate data collection and recording in health care setups using smart cards are not so popular in rural primary health care. A blend of technological infrastructure and ICT facilities in health care, administrative, as well as central reporting setups, has yet to be created in the country. A matrix of technological backup for health care support facilities needs to be developed across the country. The adequate level of manpower needed to support the ICT and BT-infused health care facilities is significant. There is significant variation across the country in the socio-economic, literacy, and educational status of the participants. Inadequate policy, legal, and regulatory environments need to foster the integration of health care, ICT, and BT **(Health Organization, 2020) (Balasubramanian *et al.*2021) (Sawan *et al.*2020).**

Opportunities

India has the institutional infrastructure for conducting vital research in the health care management system. A high level of expertise exists among several of our engineers in the field of information technology and biotechnology. Hence, creating skilled knowledge in this area will not be tough once adequate infrastructures are created. Policymakers must foster appropriate policy support to propel the vision forward and should make a huge investment in BT coupled with IT, including telemedicine and tele-radiology for patient-specific point of care applications. In the initial stage, the urban and rural divide should be bridged by custom-made solutions, showcasing an impact to the local people, masses, and the administrators. Once people believe in the concept, all infrastructures need to be created. Integrated health care research will provide innovative solutions to improve health and the quality of life of people in all walks of life, everywhere. In order to realize this potential for India, similar is the case in several countries, and numerous advanced health technologies are emerging trends. Smart health seems to discuss such potential with one set of dominant components of artificial intelligence. Naturally, it benefits health care, creating a unified data collection, an “always-connected patient,” and employment in innovative solutions starting from diagnosis, prescription, and health management. Given the strength and relevance of these trends, and the broad opportunities available and in the offing, there is potential in the development of integrated health care software as well as integrated health care personalized solutions.

4.1. Technological and Infrastructural Challenges

Data on health care services flow from different centers, both in the public and private sectors, that use diverse modules and systems. An efficient and affordable use of ICT to combine health care modules is currently not feasible for several health care centers. Moreover, in most of the centers, the system is administered through manual entries, which are prone to the risk of manipulation, hence decreasing the trustworthiness of data. Currently, there are digital gaps in the basic health care infrastructure, which should be addressed for affordable and efficient

operation of health care management systems. The requirements of connecting all the centers digitally are a challenging task, which will need enormous effort as most of the data generated by each center is managed in standalone mode with poor interoperability among the centers. Lack of a common standardized protocol for inter-hospital data exchange restricts the interconnectivity of modules. **(Li *et al*.2023) (Thakral, 2023)**

Resistance towards adapting information system usage still exists at the clinical level due to the non-availability of a proper training plan and usage of tools among health care professionals. There is a non-uniform allocation of ICT resources among countries at a global level, especially in developing nations. Sufficient technological systems are not available in hospitals in rural or remote areas, where the patient load is usually immense. The non-availability of ICT resources such as internet bandwidth, connectivity, and information technology personnel is a major challenge. Ensuring the security of the system in terms of unauthorized access, misuse of data, and cyber attacks is a requirement. The confidentiality of data about patients' identity, medical records, etc., should be protected under regulations. Data security and patient privacy are major concerns in cloud computing. If this concern is addressed properly, it is easy to implement a decentralized cloud model, which is more cost-effective when compared to existing centralized database models. Cloud computing facilities offered by corporates and public sector agencies need to be implemented effectively at the hospital level, and the creation of a central data repository is required to build interoperability among different systems used in different centers. Policies for cloud computing will facilitate search, access, and sharing of data between different healthcare systems. Mobile health care applications can be built effectively if the cloud infrastructure is in place, as the required data will be available in a cloud; it can be on a private cloud or on a public cloud. In a mobile cloud architecture, the security and privacy of the data are still challenging tasks that need proper attention. A mobile device in possession of medical information about patients is a potential risk, as unauthorized personnel can have access to this information.

5. Case Studies and Best Practices

This section presents various case studies and other best practices discovered during the literature review about integration and health care. The relevant case studies and evidence on best practices were examined for insights and lessons learned in a global context to suggest how they can be adapted to the Indian health care system. The situation in many of these case studies and evidence suggests that hospital systems and health care services are similar to those available to the general public in India and highlight good strategic planning. These case studies range from primary to quaternary care but are all from a high-income country setting. Case studies have been sought beyond high-income countries, specifically from countries with a nominated primary health care system or at a similar level of health care development to the situation in India, where primary, secondary, and tertiary health care coexist but are not so regimented or well-defined. In the cases presented, recommendations focus on how the programs implemented can promote strategies based on best practice and comparability to unique local conditions to address the socioeconomic situation and communication challenges in India. Insights into the rural–urban interface are also offered, which, in conjunction with the primary theme of this chapter, can guide strategies in overcoming inequalities in service quality between rural and urban populations. While some convergent themes emerge across cases and best practice examples, it is emphasized that effective and evidence-based practices must be placed within the context of the specific setting and key determinant differences between diverse health care systems. Considering the few primary health centers and rural and urban health care providers that are officially equipped with computer hardware or linked to telecommunication systems in India, Indian policymakers and practitioners may find some of the findings, practices, and approaches presented useful for future health care management strategies.

5.1. Successful Implementation Examples

There are many initiatives worldwide on integrating modules of different functions of health care. Adoption of these practices has led to impressive outcomes. The electronic health record implementation linked over 20 functions and 150 care processes across a range of services, leading to outcomes of 54.8% lower mortality rate and

12.9% lower cost in cardiology for three months compared with three months of the preceding year **(Tanwar et al.2020) (Shah and Khan, 2020).** The application of Lean principles in a hospital led to the reconfiguration of eye services that in turn led to 10% more patients being seen with the same resource level, 93% more treated cataract patients, with a fourth having day surgery outside an expensive trust, and a significant saving **(Usman, 2020) (Martins and Sérgio 2022).** Work in pediatrics using the same principles released 130 hours more of nursing time to care for acutely sick children and reduce waiting times **(Kelen *et al.*2021).**

A health region implemented a Care Model, which is an integrated module of bundled services for a specific population, disease, or condition by the various services involved in and supporting the clinical and supportive care needs of that patient. This module is completely coordinated with clinical pathways and forms **(Verma *et al.*2023)**. Financial and health services analysis found that the implementation led to a significant reduction in the absolute volume of services engaged, a 30% cost reduction, a 36% bed day saving, value-added experience for the patients, a 12% reduction in re-hospitalization rate, and an 81% drop in lost to follow-ups **(Health Organization, 2022).** The leadership team and the governance body set their sights on complete integration of all care modules under one perinatal system in the form of a health neighborhood. The foregoing is an example of a successful cutting away of the silos and integration of care modules. The study also shows not only how but what the benefits can be. Awareness and experience of such systems were identified as a significant barrier to implementation. The need for dissemination and ongoing coaching and monitoring for continuous improvement is significant. Evaluation and quality improvement are key activities in the successful development and implementation of modules, yet are an area of need in various system operations. Evaluation becomes linked to the computerized system for regular quarterly national monitoring purposes.

References:

- Fletcher-Brown, Judith, et al. "Mobile technology to give a resource-based knowledge management advantage to community health nurses in an emerging economies context." Journal of Knowledge Management 25.3 (2021): 525-544. port.ac.uk
- Das, Sudakshina, Vrinda Garg, and Jerush John Joseph. "Advancements in e-governance initiatives: Digitalizing healthcare in India." International Conference on Advances in IoT and Security with AI. Singapore: Springer Nature Singapore, 2023. [HTML]
- Mustafa, A. and Shekhar, C. "Is quality and availability of facilities at Primary Health Centers (PHCs) associated with healthcare-seeking from PHCs in rural India: An exploratory cross …." Clinical Epidemiology and Global Health, 2021. sciencedirect.com
- Chowdhury, Moinul H., et al. "Digital health inclusion towards achieving universal health coverage for Bangladesh utilizing general practitioner model." Health Policy and Technology (2023): 100731. [HTML]
- Nordlund, A. J. "SOCIAL WORK LEADERSHIP NARRATIVES IN FINLAND: PERCEPTIONS OF LEADERSHIP AND MANAGEMENT AND THE IMPLICATIONS FOR SOCIAL …." 2024. researchgate.net
- Ramasubramani, P., Krishnamoorthy, Y., and Rajaa, S. "Prevalence and socio-demographic factors associated with double and triple burden of malnutrition among mother-child pairs in India: Findings from a nationally …." Heliyon, 2024. cell.com
- Dwivedi, Ruby, Divya Mehrotra, and Shaleen Chandra. "Potential of Internet of Medical Things (IoMT) applications in building a smart healthcare system: A systematic review." Journal of oral biology and craniofacial research 12.2 (2022): 302-318. nih.gov
- Kelkar, Sanjeev, and Sanjeev Kelkar. "The Western Model in Disease and Health Care Delivery." India's Private Health Care Delivery: Critique and Remedies (2021): 245-273. [HTML]

- Health Organization, W. "Operational framework for primary health care: transforming vision into action." 2020. who.int
- Sony, M. and Naik, S. "Industry 4.0 integration with socio-technical systems theory: A systematic review and proposed theoretical model." Technology in society, 2020. [HTML]
- Sheikh, Aziz, et al. "Health information technology and digital innovation for national learning health and care systems." The Lancet Digital Health 3.6 (2021): e383-e396. thelancet.com
- Balasubramanian, Sreejith, et al. "A readiness assessment framework for Blockchain adoption: A healthcare case study." Technological Forecasting and Social Change 165 (2021): 120536. exeter.ac.uk
- Sawan, Mouna, et al. "A systems approach to identifying the challenges of implementing deprescribing in older adults across different health-care settings and countries: a narrative review." Expert review of clinical pharmacology 13.3 (2020): 233-245. nih.gov
- Li, Edmond, et al. "Perceptions of chief clinical information officers on the state of electronic health records systems interoperability in NHS England: a qualitative interview study." BMC Medical Informatics and Decision Making 23.1 (2023): 158. springer.com
- Thakral, Y. "Institutional work for digitally mediated AMR data management: A process-based approach in a resourceconstrained setting in India." 2023. uio.no
- Tanwar, Sudeep, Karan Parekh, and Richard Evans. "Blockchain-based electronic healthcare record system for healthcare 4.0 applications." Journal of Information Security and Applications 50 (2020): 102407. academia.edu
- Shah, S. M. and Khan, R. A. "Secondary use of electronic health record: Opportunities and challenges." IEEE access, 2020. ieee.org
- Usman, I. "Lean hospital management implementation in health care service: A multicase study." Systematic Reviews in Pharmacy, 2020. unair.ac.id
- Martins Drei, Samuel, and Paulo Sérgio de Arruda Ignácio. "Lean healthcare applied systematically in a medium-sized medical clinic hospitalization." Journal of health organization and management 36.5 (2022): 666-689. researchgate.net
- Kelen, Gabor D., et al. "Emergency department crowding: the canary in the health care system." NEJM Catalyst Innovations in Care Delivery 2.5 (2021). mhaonline.org
- Verma, Manisha, et al. "Patient-centered care: key elements applicable to chronic liver disease." Hepatology 78.1 (2023): 307-318. [HTML]
- Health Organization, W. "Mental health and COVID-19: early evidence of the pandemic's impact: scientific brief, 2 March 2022." 2022. who.int