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AN ANALYSIS OF THE DATA-DRIVEN REVOLUTION IN INDIAN HEALTH MANAGEMENT INFORMATION SYSTEM AT THE NATIONAL LEVEL

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ABSTRACT

Health Management Information System (HMIS) is a complete government web-based portal designed to manage healthcare data nationally in India. On 23rd October 2008, the government of India dispatched this national-level portal to screen the progress of the National Health Mission so that this HMIS portal could provide a structured report and monitor data over some time, which could help formulate the new national-level policy. This study was conducted through primary and secondary data collection and consisted of

a graphical analysis of data observed from April 2008 to March 2020. Various stages of development of national-level HMIS were considered and studied. The Knowledge, Attitude, and Practice (KAP) levels among the Indian healthcare professionals about the Nation Health Portal were studied. Other than that, the analysis provided information on the coverage and usage of health data reporting to national-level HMIS in India. Various underlying causes for data capturing methods and errors in HMIS were identified in the study. The existing challenges and limitations regarding using HMIS were discussed based on statistical analysis and results. The exciting advancements and standardization efforts in enhancing the quality of Health Management Information Systems (HMIS) are poised soon to make a significant impact on integrating national-level data for maximizing the effectiveness of healthcare systems. India must go a long way in the race for a data-driven revolution in health care. Note that the National level Health portal is a great initiative by the government of India.

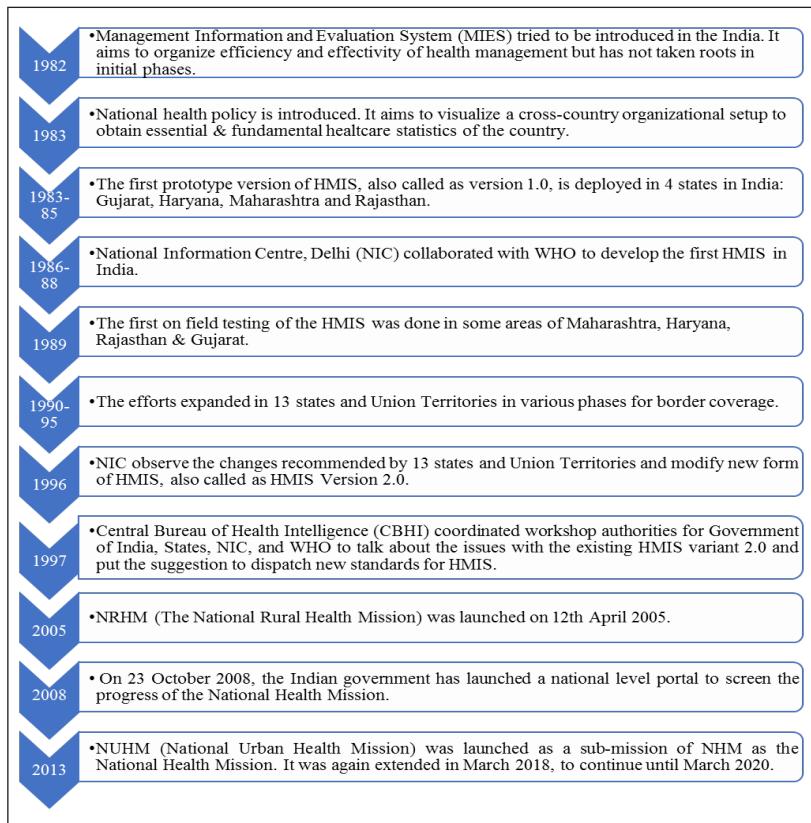
Keywords: HMIS (Health Management Information System), National Health Portal, Indian HMIS, Evolution of Indian HMIS, NRHM (National Rural Health Mission).

BACKGROUND

Health Management Information Systems (HMIS) is a key health information management platform essential for strengthening the country's healthcare system. The national portal HMIS is specifically designed for health-related data collection (Ganapathy & Ravindra, 2008). It aims to support healthcare planning, management, and decision-making activities for health facilities and organizations in the country (Mukherjee & Babu, 2014). The HMIS facilitates national health-related policies and schemes in expanding their coverage and healthcare delivery nationwide. Hence, monitoring and accurate evaluation of health indicators and statistics can be ensured in the long run (Samal & Dehury, 2016). The short history of the advancement of the HMIS under WHO-collaborated projects in India is shown in Figure 1 (Bodavala, 1998).

Figure 1

History of the Evolution of HMIS in India



INTRODUCTION

The HMIS was created to maintain a diversified source of statistical health indicators. A piece of managerial and administrative information needs planning, organizing, observing, and analyzing the healthcare strategically deliberated plans & policymaking (Dehury, 2014). It strengthens data collection and monitoring activities (Raban et al., 2009). The core intention of HMIS is continuous & sustainable improvement in healthcare (Sharma et al., 2016). This also improves timeliness, completeness, healthcare event compilation, and reported data accuracy. With an accurate interpretation of HMIS, evidence-

based decision-making can be initiated by regular dissemination and feedback (Downey et al., 2018). Consequently, this enhances the healthcare staff's technical knowledge and skills in database management, assessment, analysis, and utilization at different levels of healthcare service delivery (Bhattacharya & Ramachandran, 2015).

The national portal, the HMIS system, enhances the information stream at different levels of healthcare. By suggesting timely & essential inputs for healthcare programs and policy development, regular monitoring is performed better (Bhattacharya & Ramachandran, 2015). Understanding the need for an information base, the Ministry of Health and Family Welfare (MoHFW), India, has designed & developed this dedicated portal for managing different public health-related information at a single access point (Nandan, 2015). The main objective is strengthening the current capacities for information collection, assessment, planning, organizing, reviewing, and superstition of healthcare delivery systems at various levels (Dehury, 2014).

HMIS portal collects primary data from various districts of India. The data collected is based on the revised HMIS guidelines from an online web-based portal at the district level. This structured data can be easily collated and used as information for policy and decision-making (Downey et al., 2018). Consequently, the information flow is directed to the state health headquarters and the central health Ministry (Pandey et al., 2010). The system also maintains a hierarchy in information access, and the information is then to be entered by each facility. Note that the Management Information System (MIS) reporting regarding quality standards is up to the mark (Mukherjee & Babu, 2014).

Aim of the study

To understand the health data sets at the national level and improve the high quality of data services to be used by researchers and policymakers for improving the health status.

Objective

- 1) To study the knowledge, attitude, and practice among healthcare professionals about the National Health Portal of India.

- 2) To increase awareness about the upgradation of Health Management Information System (HMIS) data quality in the near future with the key benefit of national data integration.
- 3) To analyze the coverage and usage of Health Management Information System (HMIS) data in India.

Table 1

Type of Reports Generated at Different Levels of the Indian Healthcare System

Sub-Centre to Primary Health Centers		
PERFORMANCE REPORT	INVENTORY CONTROL REPORT	
<ul style="list-style-type: none">• Immunization Report.• Family Planning Report Arvind Pandey et al.• Leprosy.• Malaria.• Blindness.• All types of other deaths.		<ul style="list-style-type: none">• Malaria Medicine availability, consumption, and requirement.• Vaccines stock and storage report.• Oral Rehydration Solutions availability and consumption report.• Fundamental drugs & different other medicine consumption reports.• Balance record estimate whether it is enough or not.• Family planning resources.
Primary Health Centers to Community Health Center		
FAMILY WELFARES	VITAL STATISTICS	MEDICAL INTELLIGENCE DATA
<ul style="list-style-type: none">• Number of Sterilizations, Intrauterine Devices.• Count of condom users.• Cause of Medical Termination of Pregnancy.• Stock allotment & re-positioning report.	<ul style="list-style-type: none">• Number of births & deaths.• Maternal Mortality Report.• Cases of Infant Deaths, Neonatal deaths, and Anti-Natal cases.• The number of Institutional Deliveries.	<ul style="list-style-type: none">• Report of 41 different diseases identified from general fever.• Casualty cases like snake bites, Dog bites, and Accidents.• Reports on Group activities, Medical Training.

(continued)

Primary Health Centers to Community Health Center

- Staff-wise and unit-wise reports.
- Vaccination Report of Individual.
- Cold Chain Management.
- The epidemiological surveillance report of Diphtheria and Measles.
- Monthly report of diseases like Tuberculosis, Malaria, Leprosy, and Blindness monthly reports.
- Monthly report of diseases like Tuberculosis, Malaria, Leprosy, and Blindness monthly reports.
- Summary of program statistics running under National Rural Health Mission (NRHM).
- Summary report of family welfare services.
- Reproductive and child health report.

Community Health Center to District Hospital

- Monthly report of diseases like Tuberculosis, Malaria, Leprosy, and Blindness monthly reports.
- Summary of program statistics running under National Rural Health Mission (NRHM).
- Summary report of family welfare services.
- Reproductive and child health report.

District Hospital to State Headquarters

- Monthly report of diseases like Tuberculosis, Malaria, Leprosy, and Blindness monthly reports.
- Summary of program statistics running under National Rural Health Mission (NRHM).
- Summary report of family welfare services.
- Reproductive and child health report.

State Headquarters to Central Headquarters

- Monthly report of diseases like Tuberculosis, Malaria, Leprosy, and Blindness monthly reports.
- Summary of program statistics running under NRHM (National Rural Health Mission).
- Summary report of family welfare services.
- Reproductive and child health reports.

Materials and Methods

This study used multiple methods, such as Exploratory, Descriptive, Longitudinal, Qualitative, and Quantitative designs, to explore the data. It reviews existing resource materials, including text material, publications, and review articles. This verified healthcare data could help the residents of the country, researchers, students, medical services professionals, and health specialists as the information provides a source for substantial and authenticated data. Consequently, the secondary data were collected from the National Health Mission, the Health Statistics Information Portal of the government of India at <https://www.india.gov.in/nhm-health-statistics-information-portal>.

Study Procedure

The primary data was collected on knowledge, attitude, and practice among Healthcare Professionals about the Nation Health Portal of India using a survey conducted in different states and union territories of India. Google Forms and other surveyor tools are used to gather the information. The data was aggregated, compiled, and analyzed by Statistical Package for Social Sciences (SPSS) and Excel tool. The targeted population contained 265 individual responses from medical professionals and healthcare managers practicing in India on 10 attributes related to knowledge, attitude, and practice about the Nation Health Portal. We selected 135 individuals through a simple random sampling, from which 4 samples were rejected because of incomplete data. The final sample size was 131 responses, for which analysis is shown in Figure 5.

The secondary data were gathered from other resources, which include the Census, Survey report of District Level Household Survey (DLHS), National Family Health Survey (NFHS), and other national-level health committee reports from the National Rural Health Mission (NRHM) portal (nrhm-mis.nic.in), an authenticated gateway of information related to the vital health statistics of India.

The staff and facilities primarily collected this data from various health centers. According to the reporting facility, these data were sorted, as illustrated in Figure 4. The data were observed for some time and represented in a graphical format to extract useful information. Subsequently, the parameters include the data reported by the total active healthcare facilities from different states. States-wise reports were compared to conclude the research, as depicted in Figure 1.

Quality by design was planned initially to reduce and minimize errors, including inconsistent data, data downtime, ambiguous data, duplicate data, excess data, inaccurate data, and hidden data. This was followed by a data verification and validation process to enhance data quality.

RESULTS

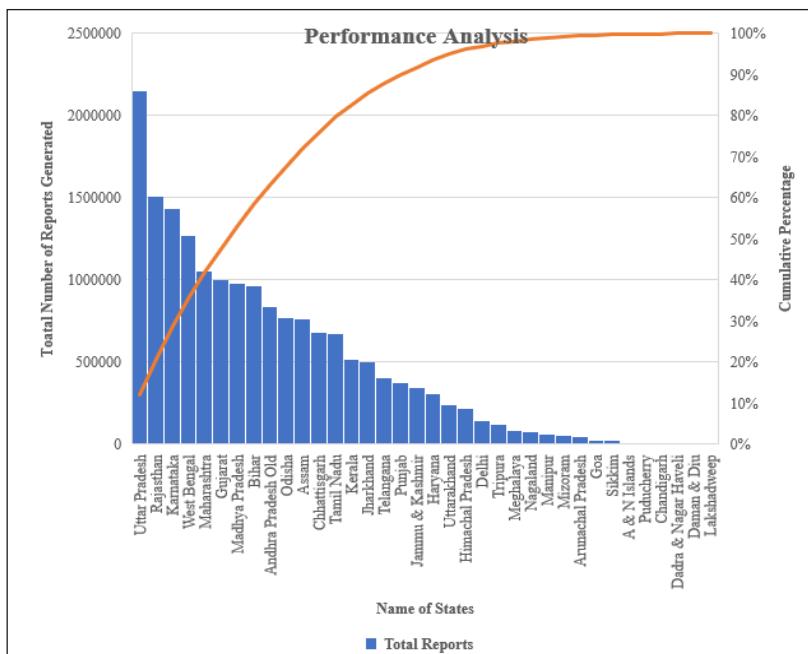
State-wise Performance Analysis

Figure 1 represents the cumulative frequency distribution of the total number of reports generated by states and union territories between

the observation period from April 2008 to March 2020 by the HMIS portal of India.

Figure 1

Total Number of Reports Generated by States and Union Territories between the Observation Period from April 2008 to April 2020 by the HMIS Portal



From the graphical analysis of Figure 1, it was found that about 60% of the total number of reports were generated by only 8 states, including Uttar Pradesh, Rajasthan, Karnataka, West Bengal, Maharashtra, Gujarat, Madhya Pradesh, and Bihar. The reports consisted of 36 entities, comprising 28 states and 8 union territories, during the observation period of 12 years from 1st April 2008 to 31st March 2020. Uttar Pradesh generated the highest number of reports in the decade, with a 12.15% contribution of total reports. Union Territories of India, including Ladakh, Puducherry, Andaman, Nicobar Islands, Dadra, Nagar Haveli, Chandigarh, Daman, Diu, Lakshadweep, Jammu, and Kashmir, do not have significant contributions in the data reporting to national level HMIS.

The general healthcare offices at the National Capital Region (NCR) are a focal arranging area focused upon the National Capital Territory (NCT) of Delhi; it is likewise insufficient in revealing information. Kerala is the most proficient state in India in terms of literacy, with a 96.2% education rate, as indicated by a report dependent on a National Statistical Office study. However, open medical care resources in the state encountered back foot in HMIS information detailing.

Year-wise Performance Report

Figure 2 represents year-wise Total Available Facilities vs. Data Reported by Active Facilities during the observation period from April 2008 to April 2020 to the HMIS portal from all over India.

The number of active facilities increases with the report contribution. From 2012-2013 onwards, the numbers in terms of the volume of data reporting are enhanced. The average ratio of active vs. total facilities in the observed period was 0.9531.

Figure 2

Graphical Analysis of Reports Generated during the Observation Period from April 2008 to April 2020 by the HMIS Portal from all over India

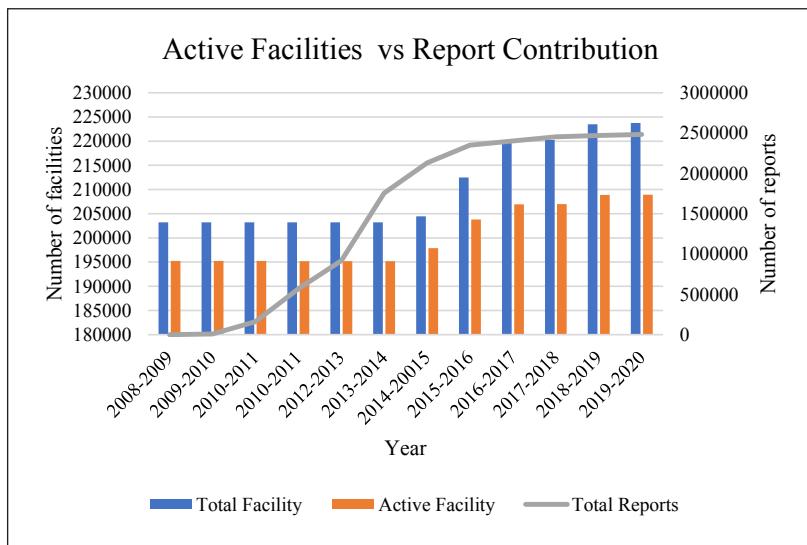


Table 1

Performance of HMIS Portal Observed from April 2008 to April 2020 from India

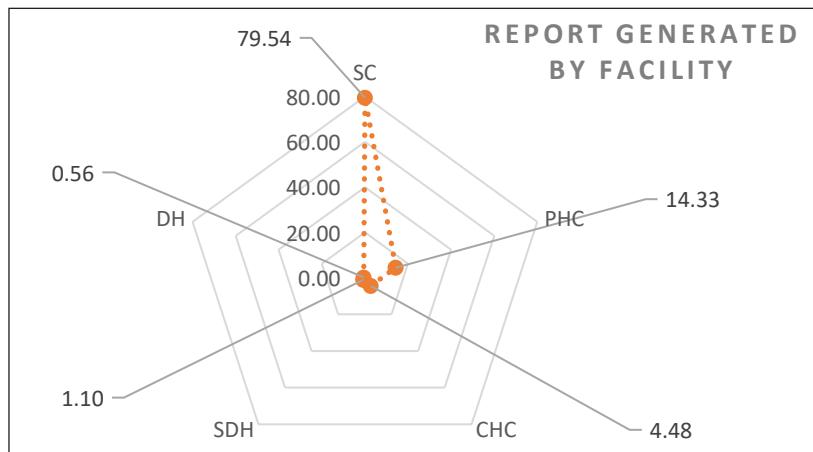
Parameters/ Years	2008-2009	2009-2010	2010- 2011	2010- 2011	2012-2013	2013-2014	2014-20015	2014-20015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Total Facilities	203240	203240	203240	203245	203245	203245	204449	212502	220228	220235	223482	223782	
Active Facilities	195222	195222	195222	195209	195209	195209	197893	203806	206958	206966	208903	208923	
Total Reports	2	9225	161618	567645	919077	1754087	2130156	2351441	2402863	2454044	2470577	2483615	
Active Vs Total Ratio	0.96055	0.96055	0.960549105	0.96046	0.96046	0.96046	0.96793	0.95908	0.93974	0.93975	0.93476	0.9336	

In the initial after-launch till 2010-2011, the rate of report generation was minimal. From 23rd October 2008 to 31st March 2009, only two cases were reported to the portal. Nevertheless, with the advancement in infrastructure, facilities, and awareness about the portal, in 2019-2020, it achieved a significant count of 2,483,615 with exponential growth. The total number of reports generated till 1st April 2020 is 1,77,04,350.

The latest total number of available facilities in 2019-2020 is 1,69,125, of which 1,61,019 are actively reporting data to the HMIS portal. Out of the total facilities, the majority of data were reported by Sub-center (79.54%), followed by Primary Healthcare Centers (PHC) (14.33%), Community Health Centers (CHC) (4.48%), Sub-district Hospitals (SDH) (1.10%) and District Hospital (DH) (0.56%).

Figure 3

Facilities-Wise Contribution in Percentage

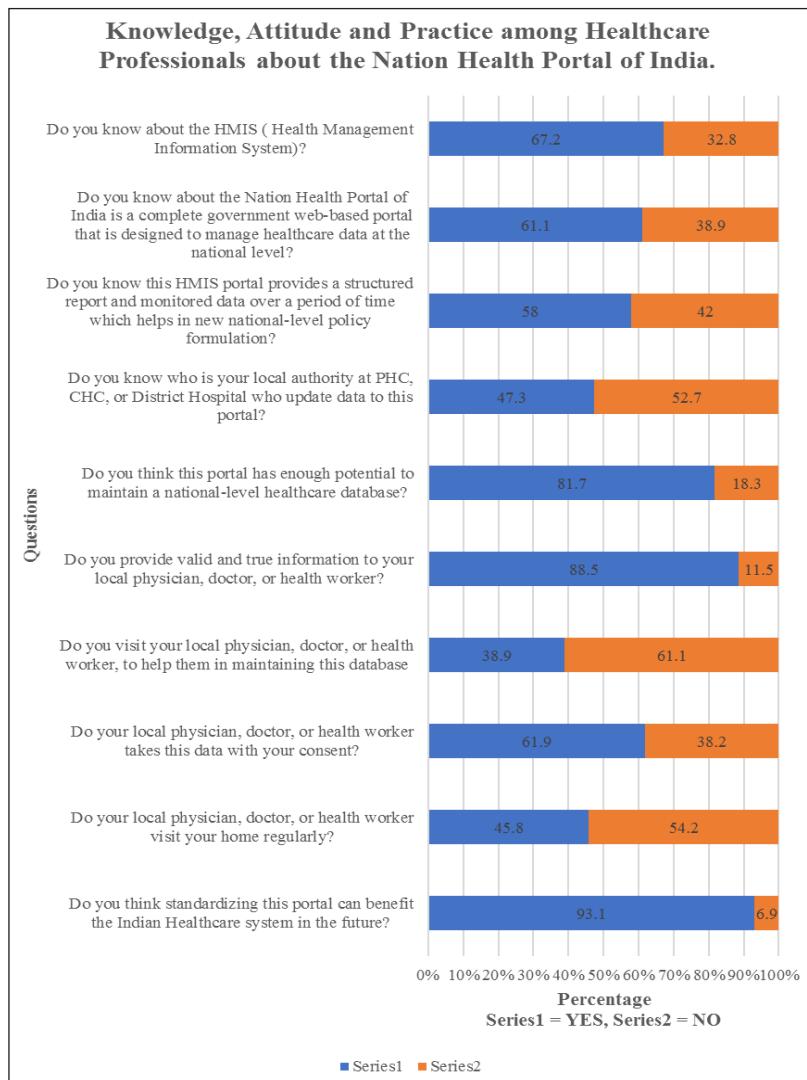


KAP Analysis among Healthcare Professionals about the Nation Health Portal of India

The survey was conducted on knowledge, attitude, and practice among 131 healthcare professionals from different states and union territories of India using the Nation Health Portal. Other than that, 10 different attributes related to knowledge, attitude, and practice were studied, as demonstrated in Figure 4.

Figure 4

Knowledge, Attitude, and Practice Among Healthcare Professionals on the Nation Health Portal of India



It was determined that the knowledge about using HMIS and the National Health Portal among healthcare professionals is not up to the mark. Meanwhile, 32.8% of healthcare professionals did not know about the HMIS, 38.9% were unaware of the National Health Portal,

42% did not know the use of the National Health Portal, and 52.7% did not know the local concern authority. The attitude of workers towards the use of health portals was positive. Around 81.7% of health professionals believed that the portal had enough potential to maintain the healthcare database of the nation, while 88.5% provided valid information for the portal. Nevertheless, the positive attitude was not followed by active practices. While 61.9% of the local faculty took data with the concerned individual's consent, only 38.9% visited the portal and uploaded vital statistics regularly. On the other hand, 45.8% of visit-home data presents an integrated healthcare system (preventive health care, promotive, curative health, rehabilitating healthcare) and follow-up care at their homes.

DISCUSSION

On 12th April 2005, the Government of India launched the National Rural Health Mission (NRHM), which aimed to provide effective healthcare to the rural population throughout the country, focusing on 18 states and union territories.

In 2007, World Health Organisation (WHO) identified HMIS as a key health system building block. On 23rd October 2008, the government of India launched the HMIS Indian portal (Downey et al., 2018). This HMIS system is putting in place the functional mechanisms that would strengthen the monitoring and evaluation systems through performance statistics, surveys, community monitoring, and quality assurance (Mukherjee & Babu, 2014).

The objectives of this portal are:

1. To monitor and evaluate the program's performance under the NRHM (Nandan, 2015).
2. To convert local health data into useful real-time information, management trends, and vital indicators, which could be displayed systematically in the reports (Samal & Dehury, 2016).
3. To improve the quality of the health services provided under the NRHM program (Nandan, 2015)
4. To strengthen the existing evaluation & monitoring abilities of health data by putting functional mechanisms in place (Dehury, 2014).
5. To provide a data management platform enabling healthcare policymakers to make effective predictions for better public health delivery (Dehury, 2014).

This study established that the newly launched HMIS system was enhancing the information flow at various levels of healthcare. This enhanced the ability to give timely and essential inputs to national health programs and policy developers (Arulmohi et al., 2017; Downey et al., 2018).

The midcourse interventions in the existing national-level policies and programs can be easily analyzed using this national-level health portal. The highly advanced database established that all public health-related information existed at a single point and was made available anywhere in the country through one click (Srivastava, 2016). This portal significantly increased the current capacities of real-time monitoring, data collection, prompt supervision, skilled assessment, and easy review for effective and evidence-based reporting and planning.

Consequently, the HMIS portal collected the data based on the newly revised HMIS formats. Through a web-based system, data is uploaded by the respective district health officer. The structured data could be accessed, and information easily transferred to the central health ministry and the state health headquarters. The system also maintained a hierarchy and enhanced the information quality of the MIS report (Balsari et al., 2018).

BENEFITS OF STANDARDIZATION OF HMIS

The standardization of HMIS improves medical service proficiency and reduces other expenses (Dandona et al., 2011). This enhances the effectiveness, improving the quality of healthcare. It also improves the scope of medical care by permitting correlations between various levels of healthcare, including patients and doctors. Almost 93.7% of health professionals in this study believed that the standardization of HMIS could benefit the Indian healthcare system in the future. On 24th March 2019, the MoHFW placed the National Digital Health Blueprint in the public domain to standardize the use of HMIS all over India. It helps in adequacy and productivity during health system assessment at the state and national levels. Acquiring the national database also opens new roads for understanding the data flow of specific medication and empowers evidence-based decision-making in healthcare at the national level (Prinja & Verma, 2007). Apart from that, the doctors can be instructed through online clinical training,

which could empower their current skills. It helps disseminate health data in a normalized route between healthcare organizations and the government. The extent of medical services could be reached throughout the nation.

CHALLENGES

There are numerous public and state-wide information utilized for gathering HMIS information and those utilized for operations in healthcare (Samal & Dehury, 2016). There is a difference in data collection in different regional areas, which could lead to the distortion of information (Raban et al., 2009). This hampers the meaningful information that is to be delivered throughout. Moreover, there are no specific parameters for evaluation patterns in the report generated. New challenges arise, such as online expert practice, data protection, and ethical issues.

LIMITATIONS

There was restricted access to data. There were variations in the data entry as there were no structured training and record-keeping frameworks. Furthermore, there was a distortion of the quality of information. Each individual had their complexity of understanding and interpreting the data entry in the portal. The causes, effects, and reasoning aspects could not be made out for the data to be interpreted. The inert and hidden aspects were not factual, and we tend to interpret them with different dimensions. In the Knowledge, Attitude, and Practice (KAP) study, it was hard to guarantee an exact interpretation of the information from the subjects. There were some social biases concerning the understanding of the results. Hence, the dependability of the information was affected by the hidden relevant and social components.

CONCLUSION

As advanced countries have sufficient data that can be interpreted using artificial intelligence, we are in a nascent stage in India; this data is yet to be factual and concrete. India needs to explore digitization processing to make it available for researchers and academic

institutions, and management schools to utilize the same. There should be streamlined data transfer among multiple layers of users. A tracking system must be in place to monitor the data uploaded for correctness and completeness. There must be an end-user tracking modality that uses the same tracking system, as India has a well-established IT infrastructure base. Now, India needs sustainable digital initiatives in healthcare to take up medical services ahead.

RECOMMENDATIONS

The government has to adopt standard practices in using HMIS technology, improving decision-making and healthcare services management in India even more efficiently. A new campaign needs to be initiated with the involvement of giant players in the healthcare market to educate healthcare professionals in India regarding using the National Health Portal and the standard practices in HMIS technology. The government must ensure that the portals should be used only to improve healthcare service delivery and should not be mishandled.

On the other hand, young leaders and industry experts, along with technology, need to be brought together from the healthcare sector in India to dive deep into the current state of the data-driven healthcare revolution. The key area of HIMS Technology must be amalgamating public and private healthcare organizations to speed up diagnosis and develop accuracy to a level of excellence to provide quality care. We need to unite public and private healthcare data by developing skills and efficacy to ensure the quality of care. Other than that, a global partnership must be promoted to achieve the best practices in digital technology. The emerging trend is the ability to render health care services through HIMS to ensure quality care.

FUTURE SCOPE OF RESEARCH

Healthcare operation efficiency needs to be urgently rendered in capacity building through sheer execution by standardized HIMS. Healthcare information technology companies in India must identify a roadmap for systematically adopting HMIS technologies to improve healthcare designing strategy and building technological infrastructure

for data privacy and interoperability. The country needs to understand the skill gaps to minimize them using HMIS. Building skills is key for HMIS technology.

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