

## EVALUATION OF HEALTH MANAGEMENT INFORMATION SYSTEM (HMIS) IMPLEMENTATION IN THE CONTEXT OF HEALTHCARE PROFESSIONALS IN INDIAN HEALTH INDUSTRY

**Renu Garg<sup>1</sup>**

<sup>1</sup>Research Scholar, I.K.G PTU Jalandhar  
[gargrenu10@gmail.com](mailto:gargrenu10@gmail.com)

**Dr. Neeraj Sharma<sup>2</sup>**

<sup>2</sup>Professor and Dean, Gian Jyoti Group, Banur, Patiala  
[nrjsharma@yahoo.com](mailto:nrjsharma@yahoo.com)

**Dr. Arunesh Garg<sup>3</sup>**

<sup>3</sup>Asstt. Professor, LM Thapar School of Management, Patiala  
[aruneshgarg@gmail.com](mailto:aruneshgarg@gmail.com)

### ABSTRACT

*Objective: The goal of this study is to examine the challenges, issues and opportunities concerning implementation of Health Management Information System (HMIS) in Indian health industry.*

*Methods: The study is taken up in all 22 districts of Punjab state. The respondents categorized into Primary healthcare service provider and secondary healthcare service provider groups based on their working areas.*

*Results: The study indicates that there is gap in facilities provided through HMIS in primary healthcare centres and secondary healthcare centres.*

*Discussions: The study suggests that the Government need to work for the effective implementation of HMIS. It can be effectively implemented by providing sufficient computer hardware, network connectivity, sufficient HMIS manpower and regular capacity building programs for HMIS implementers.*

*Originality/Value: This is the first ever study conducted to examine the perception and attitude of healthcare professionals about the implementation of HMIS in Government healthcare organizations in Punjab state.*

### KEYWORDS

*Health Management Information System (HMIS), Healthcare Services, Electronic health records, Medical information system, Primary Healthcare centre, Secondary healthcare centre.*

## INTRODUCTION

The health management information system is a form of information system that endeavors to collect, store and analyze accurate health data at national level in order to improve data accuracy, record information on health events, improves service delivery efficiency and check the quality of services at central, state and district level. Health management information system is instituted at the national level by a country and involves record maintenance and information flow across various hospitals in the country. The function of a health management information system at the national level is to bring together data from all these different subsystems, to share and disseminate them to many different audiences for health information, and to ensure that health information is used rationally, effectively and efficiently to improve health action. A strong health information system at the national level is an essential requirement for strategic decision making in healthcare, providing the basis upon which improved health outcomes depend.

The HMIS web portal launched by the MoHFW on 21st October 2008 is a bold and innovative step in this direction. The objective of the HMIS portal is to enable capturing of public health data from both public and private institutions in rural and urban areas across the country. The portal envisaged as a “Single Window” for all public health data for the MoHFW. The MoHFW initially rolled out the HMIS up to the district Level and, from 2011 onwards, this has expanded to allow the Sub District/Block level facility wise data entry. Currently, all the states are reporting their monthly performance on a regular basis. In spite of this important initiative by GOI, the HMIS data is largely unutilized by the district and state administration for monitoring the health sector and planning remedial intervention to improve delivery of critical MCH and other health services. We suggest that the HMIS data quality has to improve substantially before it may use for monitoring and planning of the health sector. This paper argues that a major reason for the limited functional utility of the HMIS portal is the failure to prepare grass-root level functionaries –Medical Officers (MO), District Health Officers (DHO), and Auxiliary Nurse Midwives (ANM) – to provide data in an accurate and timely manner, as well as monitor the quality of data provided. The failure to prepare grass root level functionaries, who form the backbone of the system, led to errors creeping in at the facility level, which get compounded as this data is aggregated at the district and state level. The final data set, therefore, is of a not sufficiently high quality to be used by researchers or policy makers as of now (Husain *et al.* (2012); Kataria *et al.* (2014); Han and Lee (2010); Saebo and Titlestad (2004); Palasamudram and Avinash (2012)). The objectives of the study are to understand the challenges, issues and opportunities concerning

implementation of information system in healthcare services in the selected healthcare centres of state Punjab.

## LITERATURE REVIEW

One of the most cited works supporting the concept of information system in healthcare services is by Han and Lee (2010). The authors contended that adoption and implementation of HMIS by health centres does not meet the initial anticipation. Moreover, reasons for that have not explored yet. However, Murthy *et al.* (2014) are credited with coining the various challenges, issues and opportunities in HMIS implementation. Some studies have contested the quality of health data remains a major challenge, with many of the validity rules broken and existence of outliers in many variables Husain *et al.* (2012) and Saebo and Titlestad (2004) concluded that such inadequacies pose a challenge to improve the quality of HMIS data.

Kavitha (2013) contended that Healthcare organizations are using the information system only for administrative purpose and Kumar and Gomes (2012) examined that presently medical records in India are partially computerized. Sharma (2012) explained that health sector is applying IT applications but its usage is very less and tried to demonstrate the various challenges and issues concerning lack of information technology usage in the health sector supported by Scholl *et al.* 2011 that challenges related to the adoption of the medical information system in government healthcare centres. Ramani and Mavalankar (2006) made an attempt to show that health and socio-economic developments are so closely intertwined that is impossible to achieve one without the other. Diwasasri *et al.* 2013 talked that hospital already using Hospital Information System (HIS) for helping managing information flow. However, some of it does not really care about the quality of information. Information quality is a key element to determine the level of healthcare in hospital.

Ramani (2004), Athavale and Zodpey (2010) found that information system played a supportive role in effective functioning of Govt. healthcare centres as supported by Aggelidis and Chatzoglou (2008); Palasamudram and Avinash (2012). Aggelidis and Chatzoglou (2008) focused that the use of information and communication technology (ICT) in the healthcare sector offers great potential for improving the quality of services provided, the efficiency and effectiveness of personnel, and also reducing organizational expenses supported by Pandey *et al.* 2012 ; Sharma *et al.* 2011.

Paul *et al.* (2009) found that Electronic Health Record (EHR) plays an important role in patient information management also supported by Rajalakshmi *et al.* (2009). Palasamudram and

Avinash (2012) emphasized that Individuals' health data is the key source for Government to assess the healthcare status of the country. ICT (Information Communication and Technology) solutions needed to capture, manage and track individual's health data. This health data will be exposed to various health management information systems for further measurable targets, real time disease surveillance, in pattern analysis and in identifying community needs of healthcare services. Moghaddasi *et al.* (2011) forced that electronic health record provides access to all health information at organizational, regional, national and international levels and allows for the patient's health data usually with geographical distribution in several health information systems to become integrated. Therefore, international standards needed to share patient health information between national health systems and across borders.

Kumar *et al.* (2010) emphasized that most of the healthcare information systems are typically not interoperable. Achieving interoperability between two or more disparate systems has been both a strong desire and difficult challenge to information professionals ever since viable technological innovations. Hur and Kang (2012) had focused that Medical information systems facilitate ambulatory patient care, and increase safer and more intelligent diagnostic and therapeutic capabilities through automated interoperability among distributed medical devices. Appari and Johnson (2010) stressed Information security and privacy in the healthcare sector is an issue of growing importance.

Padhy *et al.* (2012) introduced a cloud based medical information system can offer new possibilities such as easy and ubiquitous access to medical data and opportunities to utilize the services of medical experts which are otherwise unavailable in rural areas supported by John and Shenoy (2014) ; Mouleeswaran *et al.* (2003). Hussain and Subramoniam (2012) focused on Information and communication technology (ICT) has the potential to improve the environmental footprint of the healthcare industry. ICT driven Business Process Reengineering (BPR) can help hospitals "go green". Krishnan *et al.* 2010 talked about implementation of computerized Health Management Information System (HMIS) in Ballabgarh public healthcare centres since 1988 and evaluated the effectiveness of a computerized Health Management Information System in rural health system in India. Author also compared the manual with computerized HMIS. Supported by Abdula *et al.* (2010) with Comparison of documentation time between an electronic and a paper-based record system with the adoption of electronic medical record (EMR) system. However, various time-motion studies revealed conflicting data regarding time effectiveness on workflow due to computerization.

From a survey of literature, it observed that while organizations in the developed countries are making use of Information Systems to their best advantage, the organizations in the developing countries including India are yet to make a complete use of Information Systems. The survey revealed that the use of information system in healthcare services is at a very nascent stage in India. Healthcare organizations are using the information system only for administrative purpose and examined that presently medical records in India is partially computerized. None of the research work integrated the challenges, issues and opportunities of healthcare professionals about the adoption of information system in healthcare services. Further, no study has conducted in this area as far as information system in Govt. run healthcare services in Punjab is concerned. Therefore, the present study has taken up to fill the research gap concerning health information system in case of healthcare services in Punjab.

## **HYPOTHESES DEVELOPMENT**

The foregoing review reveals that health data of private hospitals provided on regular basis, to enter in HMIS in nearby Government health centres or district hospitals. This data is managed by proper utilization of IT resources. In case of errors in HMIS data entry processes, data validation procedures are used. The HMIS users asked to give regular inputs for bringing changes in HMIS as per their functional needs. There are data management tools for doing data analysis from various perspectives in HMIS. Availability of documented procedures and user manuals about HMIS for all activities used to improve the flow of information. Removal of redundancy or duplication of work through HMIS used for improving system efficiency Nawaz *et al.* (2015). HMIS has led to increase in health data accuracy levels. HMIS should helpful in managing hospital inventory. HMIS need to have provisions for access of patient data in various healthcare centres/hospitals in case of referred patient. There is requirement of cross handling of data for centralized registration and subsequent handling of patients from other states especially migrant labourers. HMIS led to increase in health data completeness levels Nawaz *et al.* (2015). Video conferencing facility in healthcare centre/hospital can improve communication about patients and related matters through data transition. Simplified work processes leads to reduced paperwork and workload. HMIS enables efficient flow of information inward or outward across the healthcare centres Palasamudram and Avinash (2012). According to HMIS adoption literature as was reviewed, data management found to be one of the most frequent factors that affect the adoption of HMIS. HMIS adoption literatures strongly suggest that data management is playing a

crucial role in adopting HMIS in healthcare centres and hospitals. Hence, following hypothesis formulated as:

**H<sub>01</sub>: There is no difference in data management through HMIS between primary healthcare centres and secondary healthcare centres.**

Decision making efficiency refers to the degree to which population health policy decision-making perceive as consistent with the need of faster HMIS reports generated from health data for preparing effective schemes for next years. The faster and efficient decision-making will boost the adoption of HMIS (Bhati,2013). In addition, the adoption of HMIS system will improve the quality of health data. The critical data provided by HMIS is one of the important factor in managing widespread diseases and epidemics in the region. Explicit and clear reports in defined formats and quick communication among officials handling data through HMIS leads to effective decision making based on integrated data. HMIS data is quite helpful in planning for better managing health issues. The people working on HMIS need to maintain reports in MS-Excel. The HMIS used for generating reports majorly on monthly basis in healthcare centres Palasamudram and Avinash (2012). These reports used for reviewing the work progress of health services in the state. As a result, one of the important factors in the technical dimension is the decision-making efficiency based on health data. Hence, the following hypothesis formulated as:

**H<sub>02</sub>: There is no difference in decision-making efficiency in HMIS implementation between primary healthcare centres and secondary healthcare centres.**

IT infrastructure refers to the existence of computers and related hardware in healthcare centre/hospital. According to IT innovation adoption literatures as were reviewed, IT infrastructure found to be one of the most frequent factors that affect the adoption of HMIS. IT innovation literatures strongly suggest that IT infrastructure availability is playing a crucial role in adopting HMIS in healthcare centres and hospitals (Huang et al., 2006; Maidique & Zirger, 1984; Rogers & Shoemaker, 1971 ).

IT manpower refers to the IT trained experts for handling HMIS. HMIS adoption can increase the productivity of the hospital staff (Saebo and Titlestad 2004). According to HMIS adoption literature as was reviewed, IT manpower found to be one of the most frequent factors that affect the adoption of HMIS. HMIS adoption literature strongly suggests that IT manpower availability is playing a crucial role in adopting HMIS in healthcare centres and hospitals. Hence, the following hypothesis formulated as:

**H<sub>0</sub>3: There is no difference in IT Infrastructure and manpower available under HMIS between primary healthcare centres and secondary healthcare centres.**

The willingness to support the changes and adoption by the medical professionals is critical to ensuring the success and growth of HMIS technology (or any technology) in the hospitals. A top-down management approach might be the norm when a technology introduced, but the continual success and growth will depend on the uptake and the willingness of the end-users to adopt the technology. The hospitals' managers and staff concerns regarding the adoption of a new technology is different in some cases. For example, healthcare and supporting staff's willing to adopt a technology could be dependent upon whether that new technology can lower their medical duties (Yu *et al.*, 2008). HMIS adoption may easy to use (Aggelidis & Chatzoglou, 2009) , whereas hospitals' managers might be looking for a technology that can reduce costs (Wang, Xu, & Liu, 2007) and has a return on investment (Glabman, 2004). According to HMIS adoption literature as was reviewed, awareness of HMIS in medical professional found to be one of the most frequent factors that affect the adoption of HMIS. HMIS adoption literatures strongly suggest that awareness of HMIS in Medical Professional is playing a crucial role in adopting HMIS in healthcare centres and hospitals. Hence, the following hypothesis formulated as:

**H<sub>0</sub>4: There is no difference in awareness about HMIS in medical professional between primary health centres and secondary health centres.**

HMIS in healthcare centre/hospital affect the working pattern of medical staff. Number of patients handled by doctors per day can increased due to better availability of patient data. Registration and further follow-up of the patients can become easier after implementation of HMIS. HMIS can streamline operations of medical services to give to patients. The patient satisfaction can increase due to timely handling at healthcare centres and hospitals. There will be overall improvement in health services provided by health centres due to HMIS, hence increased patient satisfaction. Computerized records are maintained through online registration system for registering birth and death in the healthcare centre/hospital. HMIS helped in improving overall administrative functions and control functions of health centres (Handayani *et al.*,2017; Khalifa,2013; Asan,2016). According to HMIS adoption literature as was reviewed, patient handling and satisfaction was found to be one of the most frequent factors that affect the adoption of HMIS. HMIS adoption literatures strongly suggest that patient handling and satisfaction is playing a crucial role in adopting HMIS in healthcare centres and hospitals. Hence, the following hypothesis formulated as:



**H<sub>0</sub>5: There is no difference in patient handling and satisfaction under HMIS between primary health centres and secondary health centres.**

## **RESEARCH METHOD**

The study attempts to make a comparison of challenges, issues and opportunities concerning implementation of HMIS in primary health services and secondary health services. The scope of the study is restricted to health industry. Healthcare is one of the largest industries in India. It is an incredibly challenging domain in India. The use of information system in healthcare services is at a very nascent stage in India. However, implementation and usage of health management information system and hospital information systems in India is still at a very nascent stage, and healthcare sector in India is yet to experience complete benefits arising out of such systems. The universe of the study consists of Government-owned hospitals and medical centres in the State of Punjab in India. Punjab is one of the most developed states of India with a high GDP and per capita income. The State comprises 22 districts and has health care organisations at various levels viz., district hospitals at district level, sub-divisional hospitals at sub-divisional levels, community health centres at block level, primary health centres at sub-block levels and sub-centres at village levels. In Punjab, presently there are 2951 sub-centres, 449 primary health centres, 132 community health centres, 35 sub divisional hospitals and 22 district hospitals in 22 districts (National Rural Health Mission, GoI, 2015). For the sampling purpose, the population consists of all the civil surgeon offices, district and sub-divisional hospitals in various districts in Punjab. Further, this sample comprises 100 sub-centres, primary health centres and community health centres from the various districts. An attempt has made to represent sub-centres, primary health centres and community health centre from the different districts as primary healthcare services source while, district hospitals and sub-divisional hospitals are secondary source of healthcare services. Owing to the exploratory nature of the study, non-probability convenience sampling technique has adopted.

In order to gather data regarding challenges, issues and opportunities concerning implementation of Health management information system in all 22 districts of Punjab, populations consist of all the medical and para-medical staff working in various Government-owned hospitals and medical centres in the State of Punjab. However, the universe consists of the Civil Surgeons (CS), District Medical Commissioners (DMC), District Program Managers (DPM), District Monitoring and Evaluation Officers (DMEO), Statistical Assistants (SA), District Information Officers (DIO), working in civil surgeon office, district hospitals, sub-divisional hospitals (secondary



healthcare sector) and Community health centres, primary health centres and sub-centres (Primary healthcare centres). We also interacted with Director and Deputy Director (HMIS) in the Punjab Health System Corporation and Chief Medical Officers (CMO) of districts surveyed.

The survey method in this study is the close-ended questionnaire. Pre-tested, structured and non-disguised questionnaire has designed as instrument. The survey instruments for this study contain two sections. The first section (Section 1) includes questions for collecting the basic and background information of the respondents in this part, nominal scale used. The second section (Section 2) of questionnaire provides the data for understanding the challenges and issues concerning implementation of information system in healthcare services in the selected healthcare centres and the factors responsible for effective implementation of information system in public hospitals and healthcare centres in Punjab. In addition, each dimension includes several factors of and barriers to HMIS adoption. When designing the questionnaire, items derived from original measurements, which applied in various research areas and models. In addition, the adopted items from existing instruments modified to fit the context of HMIS when necessary. The five-point Likert scale used for respondents to describe their view of the extent of their agreement and disagreement on each statement. Thus, respondents were asked to identify the extent to which they agreed or disagreed with each statement using the five-point Likert scale (1 Strongly Disagree; 2 Disagree; 3 Neutral; 4 Agree; and 5 Strongly Agree).

As it discussed, the up-to-date list of all Punjab public hospitals and healthcare centres (study population) obtained through the Punjab Health System Corporation (2016) website. Moreover, the contact information and email address of all Civil Surgeons and Deputy Medical Commissions found through the Punjab Health System Corporation official website. By contacting the civil surgeons of the districts or referring to their official websites, the email address with respect to the top or mid-level officials like Deputy Medical Commissioners (DMC), District Program Managers (DPM), District Monitoring and Evaluation Officers (DMEO), Statistical Assistants (SA), District Information Officers (DIO) obtained and obtained the right persons to fill the survey. The Questionnaire distributed via e-mail and personal contact including first a cover letter stating the study objective and instructions of the survey and second the questionnaire.

Hence, the survey conducted via e-mail and personal contact. A sample of 212 respondents contacted for the purpose of data collection. Out of the respondents contacted, 102 respondents are from primary health sector, 110 respondents are from secondary health sector. Primary Healthcare centre covered under the study shows that CHC (28.77%), followed by PHC (18.40%)

and SC (0.94%). Further secondary healthcare centre covered under the study shows that CSO (10.38%), followed by DH (22.17%) and SDH (19.34%), in that order. Data tabulated and analyzed by using percentages and mean scores. Validity test use to check if there are enough relevant questions covering all aspects studied and those irrelevant questions not asked. The questionnaire submitted to a panel of HMIS professionals and lecturers to check that the questions reflect the concepts studied.

In order to test hypotheses H1 to H5, two groups of respondents viz., primary health services group and secondary health services group have been generated. Primary group constitute those HMIS professionals who are working in sub-centres, Primary health centres and community health centres and are providing services at primary healthcare level. Secondary group constitutes those HMIS professionals who are working in sub-divisional hospitals, district hospitals and civil surgeon offices at district and tehsil level and providing services to rural patients on secondary level and urban patients on primary level.

## RESULTS AND DISCUSSIONS

The demographic profile of the respondents presented in Table 1. The table reveals that majority of the respondents (88.68 %) are medical professional. Only 9.43 per cent are IT professional and 1.89 per cent is both medical and IT professional. Further, most of the respondents (52.36%) are senior medical officers, followed by HMIS professionals (22.17%), medical officer (18.87%), Deputy Medical Commissioners (6.60%), in that order. Further, healthcare centre covered under the study shows that Community Health Centre (28.77%), followed by District Hospital (22.17%), Sub-Divisional Hospital (19.34%), Primary Health Centre (18.40%), and Civil Surgeon Office (10.38%), Sub-Centre (0.94%), in that order.

**Table1. Demographic Profile of Respondents (n=213)**

Profile Characteristic	Categories	Number of Respondents	
Health Centre Type	Community Health Centre	61	28.77%
	Civil Surgeon Office	22	10.38%
	District Hospital	47	22.17%
	Primary Health Centre	39	18.40%
	Sub-Centre	2	0.94%
	Sub-Divisional Hospital	41	19.34%
Profession	Medical Professional	188	88.68%
	IT Professional	20	9.43%
	Medical/IT Professional	4	1.89%
Designation	Senior Medical Officer	111	52.36%

HMIS Professional	47	22.17%
Medical Officer	40	18.87%
Deputy Medical Commissioner	14	6.60%

District wise data collection presented in Table 2. The table shows that Mohali (9.91%), Jalandhar (8.02%), Ludhiana (8.02%), Ferozpur (5.19%), Gurdaspur (5.19%), other districts are having participation less than 5%.

**Table 2. District wise Respondents (n=213)**

Profile Characteristics	Categories	Number of Respondents	
%District Wise	SAS Nagar Mohali	21	9.91%
	Jalandhar	17	8.02%
	Ludhiana	17	8.02%
	Ferozpur	11	5.19%
	Gurdaspur	11	5.19%
	Other Districts	135	63.68%

## HYPOTHESES TESTING

In order to test hypothesis H1 for data management through HMIS in primary group and secondary group on basis of independent variables as given in table 3. It can be seen from table that as regularity in providing health data for data entry in HMIS from private sector in case of primary group (m.s=2.85) is relatively less as compared to secondary group (m.s=2.90). This pattern also holds for proper utilization of IT resources. Proper utilization of IT resources in primary group is relatively less as (m.s=4.02) as compared to secondary group (m.s=4.06). This pattern also holds for availability of data validation procedures. Availability of data validation procedure in primary group is relatively more as (m.s=3.57) as compared to secondary group (m.s=3.42). This pattern also holds for updations possible as per functional needs in the HMIS software. Updations possible as per functional needs in HMIS software in primary group is relatively less as (m.s=3.20) as compared to secondary group (m.s=3.37). This pattern also holds for availability of sufficient data management tools in HMIS for doing data analysis in primary group is relatively more as (m.s=3.69) as compared to secondary group (m.s=3.45). This pattern also holds for availability of documented procedures and user manuals for improving the flow of information. Availability of documented procedures and user manuals for improving the flow of information in primary group is relatively less as (m.s=3.77) as compared to secondary group (m.s=4.25). This pattern also holds for improved system efficiency due to removal of duplication of work. Improved system efficiency due to removal of duplication of work in primary group is relatively less as (m.s=3.89) as compared to secondary group (m.s=3.90). This pattern also holds

for increase in health data accuracy levels. Health data accuracy level in primary group is relatively less as (m.s=4.23) as compared to secondary group (m.s=4.44). Cross handling of data in HMIS between primary group and secondary group can be tested by management of hospital inventory in case of primary group (m.s=3.48) is relatively less as compared to secondary group (m.s=3.63). This pattern also holds for provisions for accessing referred patient data in primary group is relatively more as (m.s=2.64) as compared to secondary group (m.s=2.63). This pattern also holds for centralized registration system for migrant labourers in primary group is relatively less as (m.s=2.46) as compared to secondary group (m.s=2.99). Data transition in HMIS between primary group and secondary group can be tested by health data completeness level in case of primary group (m.s=1.79) is relatively less as compared to secondary group (m.s=2.73). This pattern also holds for proper communication through Video conferencing in primary group is relatively less as (m.s=4.00) as compared to secondary group (m.s=4.15). Flow of information across the healthcare centres about electronic health records(HER) between primary group and secondary group can be tested with simplified work processes leads to reduced paperwork and workload in case of primary group (m.s=2.87) is relatively less as compared to secondary group (m.s=3.96). This pattern also holds for efficient flow of information inward or outward across the healthcare centres in primary group is relatively less as (m.s=2.50) as compared to secondary group (m.s=3.24).

**Table 3 . Data Management between Primary Group and Secondary Group**

Independent variables	Primary Group Mean Score	Secondary Group Mean Score
Regularity in providing data for data entry	2.85	2.90
Proper utilization of IT resources	4.02	4.06
Availability of data validation procedures	3.57	3.42
Up-gradations possible as per functional needs	3.20	3.37
Availability of sufficient data management tools for doing data analysis	3.69	3.45
Availability of documented procedures and user manuals for improving the flow of information	3.77	4.25
Improved system efficiency due to removal of duplication of work	3.89	3.90
Increase in health data accuracy levels	4.24	4.45
Better management of hospital inventory	3.48	3.63
Provisions for accessing referred patient data	2.64	2.63
Centralized registration system for migrant labourers	2.46	2.99
Increase in data completeness level	1.79	2.73
Proper communication through video conferencing	4.01	4.15
Simplified work process and reduced paperwork	2.87	3.96

Efficient flow of information inward or outward across the healthcare centres	2.50	3.24
<b>Grand Mean Score</b>	<b>3.27</b>	<b>3.54</b>

**Table 4: T Test Result**

	Mean Score		T		P-Value
Data Management in HMIS	Primary Grand score=3.27	Group Mean	Secondary Grand score=3.54	Group Mean 1.167	.252987

The result of t test ( $t=-1.167$ ,  $p>.2529$ ) from table 4 confirm that statistically, the mean difference in primary and secondary group is not significant at 5 per cent of significance. Hence, hypothesis rejected and it can interpret that there is difference in data management in HMIS between primary health centres and secondary health centres.

In order to test hypothesis H2 for decision making efficiency through HMIS in primary group and secondary group on basis of independent variables as given in table 5. It can be seen from table that effective report generation in HMIS in case of primary group ( $m.s=4.32$ ) is relatively less as compared to secondary group ( $m.s=4.50$ ). This pattern also holds for effective decision-making. Effective decision making in primary group is relatively less as ( $m.s=4.29$ ) as compared to secondary group ( $m.s=4.43$ ). This pattern also holds for faster decision making due to HMIS generated reports. Faster decision making in primary group is relatively less as ( $m.s=4.24$ ) as compared to secondary group ( $m.s=4.43$ ). This pattern also holds for quality data in decision-making. HMIS is helpful in improving the quality of health data. Quality data for decision making in primary group is relatively less as ( $m.s=4.31$ ) as compared to secondary group ( $m.s=4.50$ ). This pattern also holds for critical data management in primary group is relatively less as ( $m.s=4.22$ ) as compared to secondary group ( $m.s=4.30$ ). This pattern also holds for decision-making by providing explicit and clear reports in required format. Decision-making by providing explicit and clear reports in required format in primary group is relatively less as ( $m.s=4.23$ ) as compared to secondary group ( $m.s=4.50$ ). This pattern also holds for quick communication among officials based on integrated data. Quick communication among officials based on integrated data in primary group is relatively less as ( $m.s=4.12$ ) as compared to secondary group ( $m.s=4.21$ ). This pattern also holds planning for better managing health issues. Planning for better managing health issues in primary group is relatively less as ( $m.s=4.04$ ) as compared to secondary group ( $m.s=4.09$ ). HMIS reporting effectiveness in primary group and

secondary group can be tested on basis of Reporting in MS-Excel in case of primary group (m.s=4.36) is relatively less as compared to secondary group (m.s=4.44). This pattern also holds for Report generation on regular basis in primary group is relatively less as (m.s=4.45) as compared to secondary group (m.s=4.62). This pattern also holds for Effective reporting schedule in primary group is relatively less as (m.s=4.24) as compared to secondary group (m.s=4.51).

**Table 5: Decision making between Primary Group and Secondary Group**

Independent Variables	Primary Group Mean Score	Secondary Group Mean Score
Effective report generation	4.32	4.51
Effective decision making	4.29	4.43
Faster decision making	4.24	4.43
Quality data for decision making	4.31	4.50
Critical data management	4.22	4.30
Decision-making by providing explicit and clear reports in required format	4.23	4.50
Quick communication among officials based on integrated data.	4.12	4.21
Planning for better managing health issues in my area	4.04	4.09
Reporting in MS-Excel	4.36	4.45
Report generation on regular basis	4.45	4.62
Effective reporting schedule	4.24	4.51
<b>Grand Mean Score</b>	<b>4.26</b>	<b>4.41</b>

**Table 6. T Test Result**

	Mean Score		T	p-Value
Decision Making	Primary grand score=4.26	Secondary Group mean score=4.41	-2.74417	0.012

The result of t test ( $t = -2.74$ ,  $p > .01$ ) from table 6 confirm that statistically, the mean difference in primary and secondary group is significant at 5 per cent of significance. Hence, hypothesis is accepted and it can interpret that there is no difference in effective decision making in HMIS between primary health centres and secondary health centres.

In order to test hypothesis H3 for IT Infrastructure and manpower available under HMIS in primary group and secondary group on basis of four independent variables as given in table 7. It can be seen from table that the computers and related hardware available in healthcare

centre/hospital for proper working of HMIS in case of primary group (m.s=3.28) is relatively less as compared to secondary group (m.s=4.19). This pattern also holds for internet connection available in healthcare centre/hospital for efficient working of HMIS in primary group is relatively less as (m.s=3.32) as compared to secondary group (m.s=4.05). This pattern also holds for HMIS staff in healthcare centre/hospital for effective working of HMIS in primary group is relatively less as (m.s=3.21) as compared to secondary group (m.s=3.81). This pattern also holds for regular training to HMIS staff for improving their efficiency in routine work. Regular training to HMIS in primary group is relatively less as (m.s=3.05) as compared to secondary group (m.s=3.67).

**Table 7: IT Infrastructure and manpower between primary group and secondary group**

<b>Independent variables</b>	<b>Primary group Mean Score</b>	<b>Secondary group Mean Score</b>
Sufficient computers and related hardware	3.28	4.12
Availability of internet connection	3.32	4.05
Sufficient HMIS manpower	3.21	3.81
Regular training modules	3.05	3.67
<b>Grand Mean Score</b>	<b>3.22</b>	<b>3.91</b>

Result of t test ( $t = -5.80$ ,  $p > .001$ ) from table 8 confirm that statistically, the mean difference in primary and secondary group is significant at 5 per cent of significance. Hence, hypothesis is accepted and it can interpret that there is no difference in IT infrastructure and manpower available under HMIS between primary group and secondary group.

**Table 8: T Test Result**

	<b>Mean Score</b>		<b>T</b>	<b>p-Value</b>
Availability of IT infrastructure and manpower	Primary group grand mean score=3.22	Secondary group grand mean score=3.91	-5.80416	0.001147

In order to test hypothesis H4 for awareness of HMIS in medical professional in primary group and secondary group on basis of two independent variables as given in table 9. It can be seen from table that awareness of HMIS in doctors and medical staff in case of primary group (m.s=3.60) is relatively more as compared to secondary group (m.s=3.57). This pattern also holds



for proper data recording by doctors and medical staff in primary group is relatively less as (m.s=3.89) as compared to secondary group (m.s=3.95).

**Table 9: Awareness of HMIS in Medical Professionals**

Independent variables	Primary group Mean Score	Secondary group Mean Score
Awareness of HMIS in doctors and medical staff	3.61	3.57
Proper data recording by doctors and medical staff	3.89	3.95
<b>Grand Mean Score</b>	3.75	3.76

Result of t test ( $t = -0.039$ ,  $p > .972$ ) from table 10 confirm that statistically, the mean difference in primary and secondary group is not significant at 5 per cent of significance. Hence, hypothesis rejected and it can interpret that there is difference in awareness about HMIS in Medical Professionals between primary healthcare centres and secondary healthcare centres.

**Table 10: T Test Result**

	Mean Score		T	p-Value
Awareness of HMIS in medical professional	Primary Group grand mean score=3.75	Secondary Group grand mean score=3.76	-0.03882	0.972564

In order to test hypothesis H5 for patient handling and patient satisfaction under HMIS in primary group and secondary group on basis of independent variables as given in table 11. It can be seen from table that the increase in data entry work of medical staff in case of primary group (m.s=3.81) is relatively more as compared to secondary group (m.s=3.43). This pattern also holds for increased number of patients handling per day in primary group is relatively less as (m.s=2.42) as compared to secondary group (m.s=2.73). This pattern also holds for easier registration and follow up of the patients under HMIS in primary group is relatively less as (m.s=2.60) as compared to secondary group (m.s=3.00). This pattern also holds for streamlined operations of medical services in primary group is relatively more as (m.s=3.59) as compared to secondary group (m.s=3.55). Patient satisfaction level due to implementation of HMIS between primary group and secondary group can be tested due to timely handling of health data through HMIS in case of primary group (m.s=3.80) is relatively less as compared to secondary group (m.s=3.96). This pattern also holds for overall improvement in Health services provided by Health centres due to HMIS in primary group is relatively less as (m.s=3.95) as compared to

secondary group (m.s=3.98). Administrative and control functional efficiency of health centres after implementation of HMIS between primary group and secondary group can be seen from table that computerized record maintenance through online registration system for registering birth and death in the healthcare centre/hospital in case of primary group (m.s=3.92) is relatively more as compared to secondary group (m.s=3.84). This pattern also holds for improvement in administrative functions and control functions in primary group is relatively less as (m.s=3.91) as compared to secondary group (m.s=4.0).

**Table 11: Patient Handling**

Independent variables	Primary group Mean Score	Secondary group Mean Score
Increase in data entry work of medical staff	3.81	3.43
Increased number of patients handling per day	2.42	2.73
Easier registration and follow up of the patients	2.60	3.00
Streamlined operations of medical services	3.59	3.55
Timely handling of health related data	3.80	3.96
Improvement in health services	3.95	3.98
Online registration system for registering birth and death	3.92	3.84
Improvement in administrative and control functions	3.91	4.00
<b>Grand Mean Score</b>	<b>3.50</b>	<b>3.56</b>

Result of t test ( $t = -0.219$ ,  $p > 0.82$ ) from table 12 confirm that statistically, the mean difference in primary and secondary group is not significant at 5 per cent of significance. Hence, hypothesis rejected and it can interpret that there is difference in patient handling under HMIS between primary health centres and secondary health centres.

**Table 12: T Test Result**

	Mean Score		T	p-Value
Patient Handling	Primary Group grand mean score=3.50	Secondary Group grand mean score=3.56	-0.219	0.82

## CONCLUSION

Based on the analysis of relevant theories in line with reviewing the previous empirical researches on HMIS implementation, the potential factors like challenges, issues and opportunities are identified for the adoption of HMIS in Punjab. The findings of the study show that there is gap in facilities provided through HMIS in primary healthcare centres and secondary

healthcare centres. The primary healthcare centres are facing different type of challenges/issues and opportunities in comparison to the secondary healthcare centres. There is difference in data management tools at primary healthcare centres and secondary healthcare centres. There is no difference of decision making efficiency and reporting effectiveness at primary level. IT infrastructure and manpower is comparatively equal at primary healthcare centres and secondary healthcare centre. More capacity building programs are required at primary level for training to the existing manpower. There is lack of awareness of HMIS in medical professionals in primary healthcare centres as compared to secondary healthcare centre. There is also difference in patient handling and patient satisfaction at primary level. There is less patient satisfaction at primary level due to lack of amenities as compare to secondary level. While the primary levels ought to provide more direct preventive and curative services for most of the common diseases, the secondary level centres are supposed to cater to a more selected set of patients who are in need for more specialized services not available at the lower public health facilities. Apart from this, the higher public health facilities have an obligation on providing supervision, training, and technical support to facilitate smoother functioning of the primary level facilities. It follows then that there is a synthesis across different levels of public healthcare service providers and breakdown at any level has consequences for all levels.

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