Impact of Electronic Health Records
on
Job Characteristics and Job Satisfaction of Physicians in Punjab

A
Thesis
Submitted in Fulfillment of
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DOCTOR OF PHILOSOPHY

Submitted By:-

NAVNEET KAUR GILL
(Registration No. 951013013)

Research Supervisor (s):-

Dr. Harjot Singh

Assistant Professor

LM Thapar School of Management

Thapar Institute of Engineering and Technology
(Deemed to be University)
Patiala – 147004

Punjab, INDIA

Dr. Kalyan Kumar De

Professor

Institute of Management Studies

Ghaziabad - 201015

Uttar Pradesh, INDIA

LM Thapar School of Management

Thapar Institute of Engineering and Technology
(Deemed to be University) Patiala - 147004

Punjab – INDIA

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Declaration

I hereby declare that the present thesis titled "**Impact of Electronic Health Records on Job Characteristics and Job Satisfaction of Physicians in Punjab**" is an original work of research conducted by me under the supervision of **Dr. Harjot Singh**, Assistant Professor, LM Thapar School of Management, Thapar Institute of Engineering and Technology, Patiala, Punjab and **Dr. Kalyan Kumar De**, Professor, Institute of Management studies, Ghaziabad, UP. The work embodied in this thesis is being submitted in fulfillment of requirements for the award of the degree of **DOCTOR OF PHILOSOPHY** in **MANAGEMENT** at LM Thapar School of Management, Thapar Institute of Engineering and Technology, Patiala, Punjab. It has not been previously submitted in part or full to any other university or institute for award of any degree or diploma.

Date: 12th October' 2020 (NAVNEET KAUR GILL)

Place: Patiala Regn. No.: 951013013

Certificate

This is to certify that the thesis titled "**Impact of Electronic Health Records on Job Characteristics and Job Satisfaction of Physicians in Punjab**" which is being submitted by Ms. Navneet Kaur Bajwa, in fulfilment of the requirements for the award of the degree of **DOCTOR OF PHILOSOPHY** in **MANAGEMENT** at LM Thapar School of Management, Thapar Institute of Engineering and Technology, Patiala, Punjab, is a record of candidate's original research work carried out by her under my supervision and guidance. The matter embodied in this thesis has not been submitted in part or full to any other university or institute for award of any degree or diploma.

(Dr. Harjot Singh)
Assistant Professor
LM Thapar School of Management
Thapar Institute of Engineering and Technology
Patiala - 147004
Punjab, INDIA

Date: 12/10/2020
Place: Patiala

Certificate

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Kalyan Kumar De
(Dr. Kalyan Kumar De)

Professor

Institute of Management Studies

Ghaziabad – 201015

Uttar Pradesh, INDIA

Date: 06/10/2020

Place: Ghaziabad

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(Navneet Kaur Gill)

Abstract

The Indian economy has become one of the fastest growing economies in the world. The Indian market has become extremely competitive after a few years of effectuation of liberalization, privatization and globalization. Technological advancements in the last few years have thrown up fresh possibilities for improving efficiencies and effectiveness of business activities. Innovative technologies in fields related to information and communication management can lead to business excellence.

Healthcare sector in India started investing in information technology (IT) in early 1990s. IT was initially used for financial services and support billing. Later, the role of IT got enhanced in managing laboratory, pharmacy and radiology services. EHR technology was introduced to capture electronic information about a patient's mental, physical and social state over his/her lifetime. The technology also started recording health conditions of patients in primary, secondary or tertiary care. In summary, EHR technology is digitalization of medical history and current information of patients.

The scope of present study has been limited to Punjab's multispecialty hospitals using EHR technology. The healthcare sector, for the purpose of this study, refers to multispecialty healthcare service providers of Punjab that provide tertiary-care services. The sector and the state have been selected on grounds of a technology-focused environment, familiarity of the researcher and easy access to respondents.

The study focuses on physicians working in multispecialty hospitals in Punjab. The study identifies critical factors leading to success in implementation of EHR technology. Factors related to data management in the post-implementation phase of usage of EHR technology have also been identified. The impact of critical success factors and factors of data management on job characteristics and job satisfaction of physicians has then been analyzed.

A pre-tested, structured and non-disguised questionnaire has been used to gather data from 280 physicians. Statistical tools like exploratory factor analysis, multiple regression analysis and chi-square tests have been applied.

Five ‘critical success factors’ related to the implementation phase of EHR, namely, ‘training’, ‘acceptance to change’, ‘organizational support’, ‘software attributes’ and ‘computer knowledge’, have been identified. Two CSFs, namely, ‘computer knowledge’ and ‘software attributes’ have been found to be making a significant contribution in the impact on job characteristics of physicians. Four CSFs, namely, ‘training’, ‘computer knowledge’, ‘acceptance to change’ and ‘organizational support’ have been observed to be making a significant impact on levels of job satisfaction of clinicians.

In the post-implementation phase of usage of EHR technology, four factors of ‘data management’, namely, ‘effectiveness’, ‘accessibility’, ‘accuracy’ and ‘timeliness’, have been identified. Three factors, namely, ‘accessibility’, ‘effectiveness’ and ‘timeliness’ have been seen to be making a significant impact on job characteristics of physicians. Two factors related to data management, namely, ‘accessibility’ and ‘timeliness’ have been found to be making a significant impact on their levels of job satisfaction.

The study has attempted to provide insight to the hospitals using EHR technology, and also to the ones which are planning to adopt this technology. Recommendations to the hospital administration with respect to speedy achievement of success in adoption of EHR technology have been made. The study should be useful to hospital administrators in understanding behavior of physicians towards technology. It is also expected to help them in enhancing the overall effectiveness of health care initiatives. The study should also help in improving satisfaction levels of physicians

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List of Abbreviations

S. No.	Abbreviations	Description
1	ANOVA	Analysis of Variance
2	CIS	Co-operative Information System
3	CMS	Centers for Medicare and Medicaid Services
4	CPOE	Computerized Providers Order Entry
5	CSF	Critical Success Factor
6	DM	Doctor of Medicine
7	EHR	Electronic Health Records
8	EMR	Electronic Medical Records
9	FTE	Full Time Equivalents
10	GDP	Gross Domestic Product
11	GICS	Global Industry Classification Standard
12	HIT	Health Information Technology
13	ICT	Information and Communication Technology
14	ICU	Intensive Care Unit
15	IPD	In-Patient Department
16	IQ	Information Quality
17	IS	Information System
18	ISO	International Organization for Standardization
19	IT	Information Technology
20	JCM	Job Characteristics Model
21	JDS	Job Diagnostic Survey

S. No.	Abbreviations	Description
22	KMO	Kaiser-Meyer-Olkin
23	KPO	Knowledge Processing Organization
24	KT	Knowledge Translate
25	MBBS	Bachelors of Medicine and Bachelor of Surgery
26	MCH	Magister Chirurgiae
27	MD	Doctor of Medicine
28	MRI	Magnetic Resonance Imaging
29	OPD	Out-Patient Department
30	OT	Operation Theatre
31	PET	Positron Emission Tomography
32	PHR	Personal Health Records
33	SPSS	Statistical Package for Social Science
34	VIF	Variance Inflation Factor
35	WHO	World Health Organization

Chapter – I

Introduction

1.1 Introduction

Technological advancements result in new demands to firms, or provide possibilities for developing and improving business activities. An illustration of a technical advancement is deployment of information and communication technology by organizations (Pires and Aisbett, 2003). There are various technologies related to information and communication management resulting in numerous possibilities for firms to implement them as they direct their business functions (Prasad et al., 2001, Borders et al., 2001, Egan et al., 2003).

Various sectors have been using technology to develop innovative products and deliver services in time (McFarlan, 1984). Technology has been considered to be dynamic and keeps on updating because of the changing needs and demands of people. The revolution has been from 'industry age' to an 'information age'.

'Information age' altogether, provides a different working environment and an upper edge in this highly competitive market. Information technology (IT) is an advancement that allows user to transmit data or information from one place to another (Leonard and Sittig, 2007). Information has been used for various purposes. It has been used to communicate, exchange thoughts and express emotions (McCullough, 2008). Businesses have been using IT to facilitate transmission/exchange of information, quicken decision-making, satisfy needs and promote products as well as services (Madnick and Wang, 1988).

1.1.1 Health care sector

World Health Organization (WHO, 1946) has stated that health is a collective package of mental, emotional, physical and societal well being, rather than being a mere absence of disease or imperfection. Health care services refer not only to treatment but also prevention of illnesses. The services are delivered by professional physicians in dentistry, medicine, pharmacy, nursing and allied health sector. The nature of services in demand depends upon the changes in habits and customs of people (Sharma & Singh, 2015).

Health care system is an integration of organizations, resources, financing and management that culminates in delivery of health care services (Roemer, 1993). It is a complex, professionally administered, politically influenced and a dynamic system (Briggs et al., 2012). Healthcare sector is an integration of various sectors within the economic system that contribute in providing goods and services for preventive and palliative care (Klinefelter & Klinefelter, 2015).

Global Industry Classification Standard (GICS) has stated that health care sector includes health related tools and equipment, services, pharmacy, bio-technology and life sciences. Various domains related with these work-groups are drug manufacturers, drug delivery, bio-technology, health service-providers, diagnostic laboratories, nursing homes, medical equipment and instruments (Webster, 2002).

1.1.2 Health care services

Requirement of health care depends upon health condition of an individual. On the basis of requirement of a patient, healthcare services have been divided in three types, namely, primary, secondary and tertiary health care services.

1.1.2.1 Primary health care

Primary health care focuses on health equity and generation of social policies that go beyond traditional healthcare system (Bhat, 1999). Clinicians associated with primary care are general physicians dealing with everyday physical problems instead of critical conditions which are handled by specialists in a particular domain (Klein, 2011). Services provided by primary health care have been rapidly accelerating in both developed as well as developing nations. Rashmi and Vijaykumar (2010) have mentioned that WHO defines the goals of primary health services as follows:

- Increased involvement of stakeholders
- Health integration across multiple sectors
- Customization on the basis of needs of patients
- Practice of collaborative model of policy dialogue

1.1.2.2 Secondary health care

Secondary health care services are related to specific health problems. The specialists, including urologists, cardiologists, dermatologists, do not have a direct contact with patients. Patients in need of special care are referred by physicians operating in the domain of primary health care services. Patients cannot access secondary care services directly because the health system imposes constraints of referrals from primary care (Nayak, Bagchi and Nayak, 2012). The systems fall in the category of District health system and Nation health system. District health system caters to child and maternity health care cases which constitute primary health care services. National health centers receive referrals from district and community health care (Sodani, 2010).

1.1.2.3 Tertiary health care

Tertiary health care refers to third level of health care system. Consultative care by specialists is provided to patients referred by primary and secondary health care (Roemer, 1993). Advanced intensive care units (ICU), specialized diagnostic centers and professional care are the key components of this level of services. In India, tertiary-level services are practiced by various medical colleges and advanced medicine cum research institutes (Visaria and Gumber, 1994). Tertiary-level services provide high-grade burn treatments, plastic surgeries, cardiac surgeries, cancer treatment, neuro-surgeries and complex surgical interventions.

1.1.3 Information technology (IT) in health care sector

The Indian market has become extremely competitive after a few years of effectuation of globalization policies, liberalization and privatization (Aggarwal & Singh, 2004). The Indian economy has become one of the fastest accelerating economies in the world (Budhwar & Varma, 2011). As per the economic survey of 2017-18, service sector contributes more than 54 per cent to GDP of India. Of late, there has been a clear shift in Indian IT sector towards provision of services like IT consultation, integration processing services, remote infrastructure management, cloud computing and knowledge processing organizations (Budhiraja & Malhotra, 2013).

Healthcare sector in India started investing in information technology in early 1990s. IT was initially used for financial services and support billing. Later, the role of IT got enhanced and its applications were seen in laboratory, pharmacy and radiology services too (Collen, 1995). Services such as laboratory and pharmacy process management, along with those related to documentation of patient history, were introduced. Health IT systems became almost all pervasive by 2000 (McCullough, 2008). Advancement in record management systems led to automation of clinical services. IT systems transformed medical records of patients and reconciled clinical information from different ancillary services such as radiology, laboratory and pharmacy. Availability of online information further induced various stakeholders, for instance, physicians, insurance companies, pharmacists and patients to actively use the internet for searching pertinent information (Patwardhan et al., 2014).

Advanced systems allow clinicians to access medical records electronically. Computerized providers order entry (CPOE) has been aligned to reduce errors in communication and serve as a platform for template automation for treatments (Zolot, 1999). Although leading medical centers had adapted digitalized technologies, a wide diffusion of electronic technology innovation has happened only in the past decade (Rogers, 2010).

Sophisticated electronic record systems with CPOE have been used as guidelines for treatment. The systems help in early detection of hazardous drug interactions and encourage coordinated care amongst organizations. Intelligent decision-making system is the most assertive module of hospital IT (Rosenthal, 2002). Availability of real-time data should help in standardizing care, providing health quality and enhancing productivity. Decision-making systems should become highly effective when integrated information about patients is available. Thus, electronic records may be capable of generating network externalities by adapting to interoperable records (Smithline and Christenson, 2002).

IT provides a variety of mechanisms which should impact productivity of clinics (Cheung, 2001). Health care service-providers may also reap similar kind of benefits as exhibited by various service-provider firms. Three mechanisms, namely, ‘billing and finance management’, ‘provider’s service monitor’ and ‘decision-making’, have proved to be necessary for health care service-providers. IT systems have benefited hospitals the most by providing upgraded methods for billing and handling finances (Crownower and Rosenbaum,

2002). Costs vary with the type of treatment in multispecialty hospitals, providing wide range of tertiary-level services. Hence, the department of billing experiences maximum challenges in hospitals. The use of electronic records has increased because of its capability to provide well documented-care and facilitation of charges (Garrido, 2005).

Resources of hospitals are used mainly by clinicians. It is difficult to record and evaluate different actions and processes. Furthermore, a number of physicians have been employed with physician-owned medicine practices rather than being deployed in hospitals (Holden, 2011). IT has also been successful in monitoring behavior of physician and other personals. Clinical information systems may also be used to record time period reports on behavior of physicians and optimum utilization of resources (Jha et al., 2009). The reports may prove to be useful in improving quality and for modifying clinical resources such as laboratory, pathology, radiology. Electronic records help in providing advanced monitoring and may also lead to improvement in allocation of resources (Kemper, Uren, and Clark, 2006).

1.2 Indian health care sector

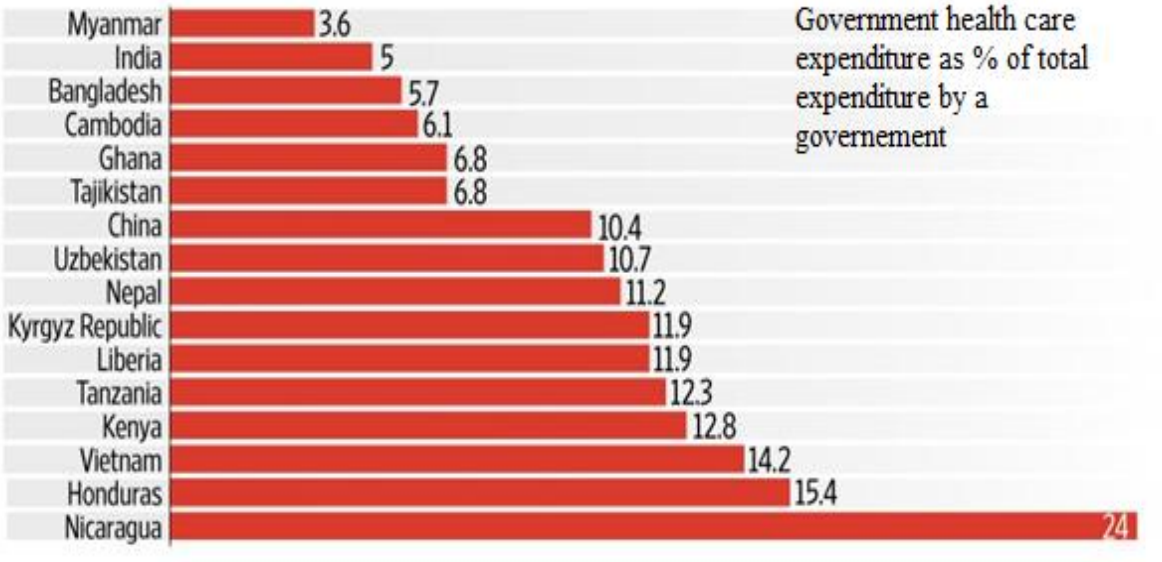
Post independence, the Indian economy has changed drastically. As per the economic performance in last few decades, it has been the fastest growing economies of the world with rapid development in physical infrastructure as well as technological capabilities (Budhwar and Varma, 2011). The private sector has laid huge emphasis on consumer orientation. Increased public awareness and expectations, growing competition and technological advancements have forced businesses to adopt a marketing approach which enhances consumer satisfaction (Aggarwal & Singh, 2004).

In the past few decades, Indian health care sector has also exhibited significant changes. It is one of the largest sectors with respect to revenue generation and employment proliferation. Traditionally, the health care services, in India were provided by the government. In early post-independence phase, health care sector of India faced issues related to shortage of doctors, nurses and medical staff (Rashmi and Vijaykumar, 2010). Lack of advanced medical tools, equipments and inadequate infrastructure were also some of the alarming problems (Bhatia and Cleland, 2004). In the late 1980s, approximately 30 per cent decline in use of rural, semi-urban and urban public health care facilities has been reported. The sector has witnessed tremendous growth and has been growing at a rate faster than the rate clocked in

the past two decades. During 1990s, health industry grew at a compound growth rate of 16 per cent annually. The size of health care sector in India was calculated as US$ 79 billion in 2012, which is expected to become a US$280 billion industry by 2020 (Verma & Khandelwal, 2011).

Total health care expenditure in India has grown at a slower rate than that of other economies. Government covers 20 per cent of total health expenditures, country's population pays 78 per cent of the expenditure through out-of-pocket mode and just 2 per cent of health care financing is provided by external aid (Nayak, Bagchi, & Nayak, 2012).

Figure 1.1 shows government expenditure on health care in developing nations, including India, for the year 2017.



Source: World Health Organization, World Health Statistics, 2017

Figure 1.1: Government expenditure on health care in India (2017)

Increase in urbanization and higher standards of living have led to an increase in demand for hospital services (Rashmi and Vijaykumar, 2010). Due to lack of government financing, majority of government hospitals are in a poor condition because of which people rely upon private hospitals more rather than on government hospitals. A diverse network of private, corporate hospitals is presently providing three-fourths of the total health services and is coping up with the requirements of rural and urban patients of the country (Bhat, 1999).

Private sector provides almost 60 per cent of Out-Patient Department (OPD) and 40 per cent of In-Patient Department (IPD). Reduced import duties on advanced medical equipments and restructuring of hospitals in the liberal economic policies have also accelerated growth of corporate hospitals which resulted in transformation from welfare orientated industry into business orientated industry (Visaria and Gumber, 1994).

Indian health care system has some specific characteristics. Government funding is only 1 per cent of the total gross domestic product (GDP). Beneficiaries for schemes related to bottom of the pyramid segment are generally for already heeled people and not for suffering ones (Sodani, et al., 2010). More than 80 per cent of total health care financing is from 'out-of-pocket' payments from patients. Around 75 per cent of health care services are provided by private hospitals and their expenses are generally higher with respect to the income levels of the population (Garg, 2010). This leads to an increase in total household expenditure on health care for a family.

There is a huge difference in quality of care amongst government and private hospitals. Service quality is generally of a lower level in government hospitals as compared to that of private hospitals. Satisfaction level of patients is also higher with services provided by private practitioners than those provided by government practitioners (Bhatia & Cleland, 2004). People opt for government facilities because they are inexpensive and have spatial convenience (Sodani, Kumar, Srivastava, & Sharma, 2010).

Reasons for poor urban people going to private hospitals are lack of attention and unavailability of specialists (Das & Hammer, 2007) as well as non-availability of basic drugs (Klein, 2011). Responsive services, accurate diagnosis, better privacy, effective doctor-patient communication and high quality of care are much better in the private sector. However, cost of drugs prescribed by this sector is by far more than that of government sector (Rashmi & Vijaykumar, 2010).

Teehankee (2007) has stated that business firms need to function for betterment of the humans by virtue of social license acknowledged by society. Nevertheless, private hospitals emphasize more on profits making rather than working for the society. Relationship amongst patients and hospitals is more that of 'consumers' and 'service providers'.

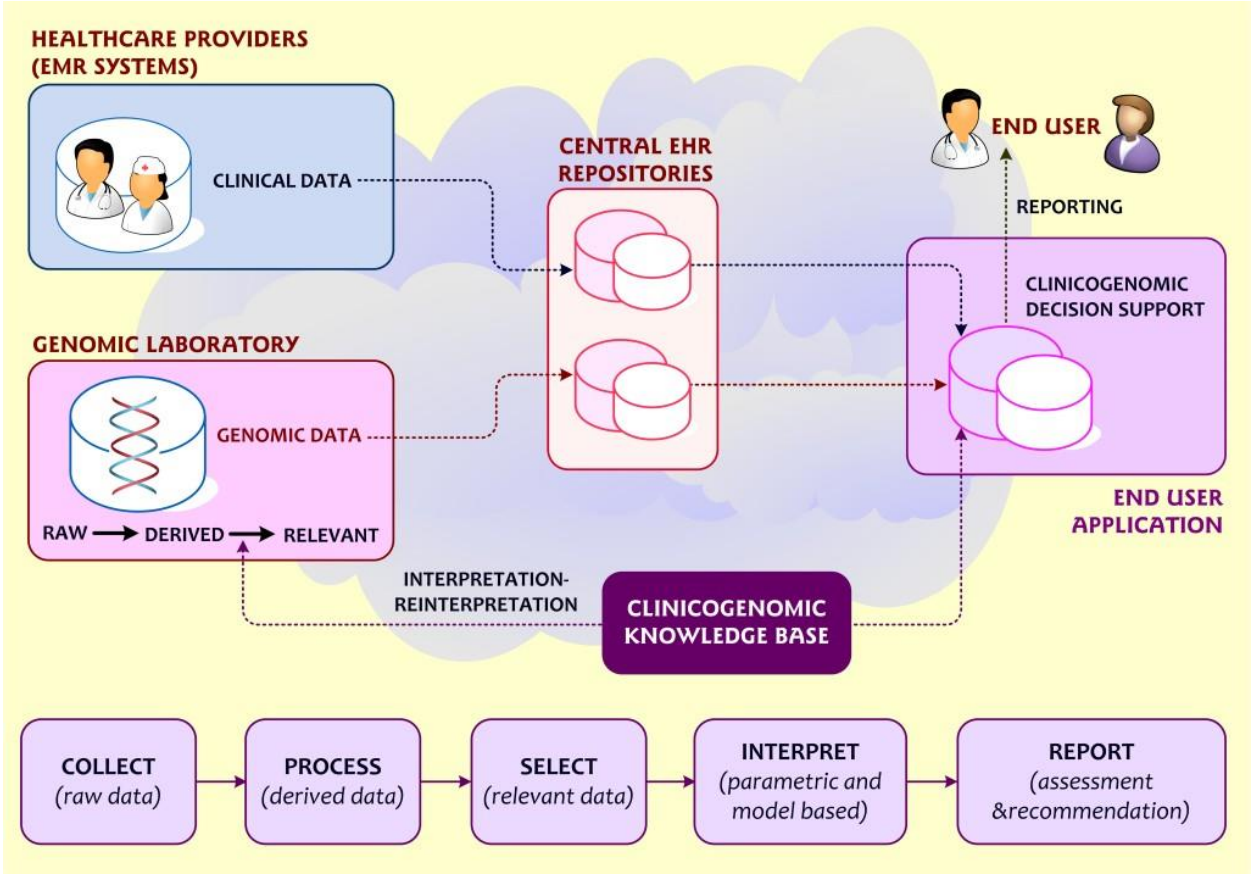
Since the health care sector is one of the largest service sectors in India, it has also emerged as one of the most challenging sectors. Numerous factors, namely, 'increasing population', 'changing lifestyles', 'decreasing treatment cost', 'growing health insurance coverage' and 'rising medical tourism', have contributed to overall demand of this sector (Bhatia and Cleland, 2004).

1.3 Electronic health records (EHR)

EHR are permanent documents which hold electronic information about a patient's mental, physical and social state over his/her lifetime. EHR technology also records diseases and other abnormal conditions which are detailed by healthcare professionals, in primary, secondary or tertiary care (Boaden & Munir, 2001). EHR enable physicians to continuously update and process patient health data and then upload that information in logical groups so that other physicians can access easily (Burton et al. 2004). In its simplest form, EHR are explained as digitalization of medical information in healthcare sector and its conjoining processes (Atreja et al., 2008).

One of the key features of EHR is that information related to patients can be created, managed and retrieved in digital format by an authorized service-provider. EHR can transmit integrated information related to departments like laboratories, medical imaging, emergency facilities, pharmacies and out-patient departments with various health care service-providers and other departments in hospital.

Figure 1.2 displays an integrated view of electronic health records.



Source: Centers for Medicare & Medicaid Services (CMS), 2014

Figure 1.2: Integrated view of Electronic Health Records

EHR navigates entire medical history of a patient. Instead of reviewing paper chart for lab results, it is a simple matter of few clicks (Haughom, Kriz, and McMillan, 2011). Records are available 24*7 and clinicians need not pull paper charts every time for viewing images and referrals. Adaption to electronic health records also reduces cost by decreasing Full Time Equivalents (FTE) and transmitting digital records for enhanced productivity (Jha et al., 2009). Importantly, electronic health records are accessible at multiple locations at the same time. Clinical information like previous prescriptions, medical history and advices of specialists is also available (Loomis et al., 2002). Apart from these benefits, EHR provide clinical decision support systems such as alerts and reminders to physicians as well as patients.

Jha et al., (2009) has mentioned the following benefits of EHR for patients:

(1) Improved accessibility of clinical prescriptions and notes

(2) Improved and timely access

(3) Reduction in duplicity

(4) Reminders for tests, diagnosis and re-visits

(5) Clinical decision support providing reminders for allergies, correct dosage of drugs, etc.

1.3.1 Technology implementation

Due to increasing global competition in the last few decades, not only the governments but the business establishments also have emphasized on access-to-information, by using it as a decisive tool for competent markets (Relly & Sabharwal, 2009). There is a need to formulate advanced strategies to switch from cost-based competition to time and value based competition (Singh & Kathuria, 2015). Available data stands in need of a technological modification which calls for an adequate technology adoption mechanism that should enable tracking technology upgradation and innovation reforms in organizational culture, and establishment of new personnel tasks (Kamath et al., 2011). Modularization in hospitals can increase efficiency in specialized hospital services (Silander et al., 2017).

Technology implementation includes management of an ongoing technology portfolio. Technology portfolio management enables optimization of interdependent technology projects over multiple conditions and time periods (Dilckinson et al., 2001). Technology improvements and distinct measurements of clinical decision-making, patient safety and patient experience can also improve healthcare quality (Lillrank, 2015). Quality care also requires that service industries should incorporate needful knowledge of various cultural beliefs and values, linguistic barriers, misapprehensions, traditional fear and historically negative perceptions while planning to implement models of practice (Bandyopadhyay & Pardasani, 2010).

Successful implementation of technology may provide organizational strengths and better operational efficiencies. On the contrary, failures or delay in successful implementation may result in drain of man-power, vitality and funds (Safdari, Ghazisaeidi, and Jebraeily, 2015).

Consequently, many organizations have been confused over reasons related to success, delay and failure of technology implementations. Kaplan and Harris-Salamone (2009) have suggested that following factors are crucial for adaption of technology in organizations:

- Interaction of organization and technology
- User participation and involvement.
- Resistance to change
- Organizational goals and commitment
- Planning and Organizing
- Associated risks

1.3.2 Phases in EHR technology implementation

(i) Implementation phase

Successful deployment of information and communication technology (ICT) is one of the most crucial aspects for administrators (Moon, 2007). Role of critical success factors (CSFs), in planning of health care services, is very important as a means for arranging, presenting and specifying information which is necessary to achieve organizational goals and managerial objectives (Eni & Tan, 1989). Non-acceptance of changes involved in EHR implementation may result in under-utilization, stalled implementation or even undo installation (Meinert, 2004).

The present research identifies CSFs that seem most relevant in the context under study. Impact of EHR technology on job characteristics and job satisfaction of physicians has been assessed in the implementation. Physicians working in multispecialty hospitals enabled with EHR technology are the subject of study

(ii) Post-implementation phase

Significant increases in price, capacity, dynamic performance and potential of new databases and communication techniques have generated vast opportunities for companies to modify their information resources for momentous competitive advantage in market (Bartini et al., 2009). Data is the primary foundation in tactical, operational and decision-making activities.

There are numerous data quality issues related to definition, measurement, analysis and improvement in data (Wang et al., 2001).

Relevant factors related to data management in the post-implementation phase of usage of EHR technology have been identified. The impact of identified factors on job characteristics and job satisfaction of physicians has then been analyzed.

1.4 Physicians as EHR users

An individual's understanding is based on sustainable development related to economic growth, but more crucially with economic development (Campbell, 2018). Teehankee (2007), in a study of role of businesses has contended that business firms are supposed to function for betterment of human beings. Study in sustainable user behavior is a crucial area with notable contributions in the field from various researchers view (Coste-Maniere, 2017). Understanding physicians' perceptions about impact of EHR is relevant in assessing progress in implementation.

A purpose of adopting 'Health Information Technology' (HIT) by physicians is betterment of health care delivery services (Berner et al. 2005, Middleton et al. 2005). Adoption of EHR by clinicians can reduce the possibilities of errors due to non-reliable and inaccurate paper records and hence can facilitate quick and effective decision-making (Thompson and Brailer 2004, Ohsfeldt et al. 2005). However, impact of EHR adoption on quality of health care is not always automatic; it counts on successful implementation and adoption of EHR on working of healthcare providers (Mehta & Partin, 2007).

1.4.1 Job characteristics

Job characteristics focus on describing a job in order to encourage the worker (Droar, 2006). Job characteristics, a function of psychological state of physicians, include various factors such as excellence of job (task identity, task significance and skill variety), outcomes (autonomy) and output of results (feedback) (Hackman et al., 1976). 'Job characteristic approach' has been developed on the basis of 'job diagnostic survey' (JDS). JDS is a tool designed to measure and rate the extent to which jobs have been designed so as to enhance internal work motivation, personal affection and readiness to respond positively to enriched

jobs (Hackman & Oldham, 1974). The 'job characteristic model' states that if task functions are present in a job, its incumbent is likely to have a better internal task motivation, better quality, higher satisfaction, lower turnover and lower absenteeism (Gomez-Mejia et al., 2005). It offers objective features of jobs, specifically the extent to which jobs are formulated so that job satisfaction can be enhanced (Hackman & Oldham, 1974).

Five corresponding characteristics of a job, namely, 'task significance', 'task identity', 'skill variety', 'feedback' and 'autonomy', are considered to be positively correlated to worker's satisfaction and performance (Hunter, 2006). Individual's consciousness for a particular task is explained as task significance (Janson, and Purdy, 1978). Identity of task enables an employee to fulfill all necessary functions required to accomplish a task (Balkin, & Cardy, 2008). The variety in skills is defined as the comprehensiveness and qualities required to perform a particular task (Buys et al., 2005). Feedback characteristic of job means that an employee gets clear and transparent revert of his/her job performance (Hunter, 2006). The job aspect which provides independence and authority, while taking decisions, is known as autonomy (Buys et al., 2007).

1.4.2 Job satisfaction

Satisfaction has been conceptualized by various researchers in terms of meeting different desires and expectancies (Zeithaml and Bitner, 2000; Saklani et al., 2000). Bontis (2011) has recognized that overall attitude towards a job can predict the extent to which an individual likes (satisfied) or dislikes (dissatisfied) the job. Satisfaction includes intangible factors like knowledge, cooperation, interpersonal warmth, adequate and timely information, prompt services, efficiency of the employees and convenience (Chahal & Sharma, 1999). Babbie (1990) has concluded that an employee predicts his/her level of satisfaction on the basis of psychological and physiological needs.

According to Gupta & Joshi (2008), worker's satisfaction is an important tool which encourages the individual to work with zeal. Job satisfaction is of utmost important because majority of people spend a huge part of their lives at work place. Workers have a positive outlook towards company's business and objectives when they are satisfied with their jobs. They provide better services in such circumstances (Bontis et al., 2011). Quality of job has a positive impact on satisfaction of clinicians as well (Chahal & Kumari, 2010).

1.5 Rationale of the study

With an increase in health care service-providers and adoption of IT technology, health care market has become more competitive. Consequently, the service-providers need to understand factors related to successful implementation of technology. There is also a need to understand the factors related to data management in the post-implementation phase of usage of EHR technology. The existing literature on Indian health care sector has primarily focused on service quality in hospitals. Very few studies have researched the impact of EHR on job characteristics and job satisfaction of physicians.

The present study aims to investigate impact of EHR on job characteristics and job satisfaction of physicians in Indian context. The study examines satisfaction of physicians with respect to usage of EHR technology. Further, it also examines the relationship of computer knowledge and duration of EHR usage of physicians with demographic and other variables.

According to Sharma and Aggarwal (2016), various stimulants necessitating a study on impact of EHR in a competitive market place like India are:

i. Advanced patient care
ii. Coordinated care
iii. Efficiency with low cost
iv. Participation of patients
v. Improved outcomes of patients
vi. Work-life balance

(i) Advanced patient care

Electronic health records improve quality of health care by making services convenient for both service-providers and patients. Accessibility to patient medical records from remote locations provides coordinated and better care. Efficient decision support systems providing clinical alerts, reminders and medical information are enhanced. EHR can provide templates related to performance improvements and real-time reporting of information. Digital records facilitate

accurate coding, billing and financial improvements. It also provides interfaces with laboratories, registries, and other databases (Rosenthal, 2002).

(ii) Coordination care

Accessibly to electronic health information by physicians and patients enables informed decisions. A lot of coordination is required in diagnosing, treating and managing chronic health conditions such as diabetes, obesity and asthma. EHR can help service providers in ensuring high quality care. Physicians are able to provide complete and accurate information about medical evaluation of patients. Clinicians can also offer follow-up data after an out-patient visit or an in-patient stay, such as self-care, reminders and links to web resources (Whetstone & Goldsmith, 2009).

(iii) Efficiency with low cost

Efficiency is primarily attributed to automate labor-intensive and time-consuming, paper-driven tasks (Middleton, 2005). Implementation of EHR can lead to:

- Reduction in prescription costs
- Less number of chart pull, storage, and re-filing costs
- Advanced reimbursement coding with digital documentation
- Reduction in medical errors, better accessibility to information
- Improvements in health care quality through better health management and patient education

(iv) Participation of patients

Personal Health Record (PHR) is a digital database used by patients to record, update and view their own health information. A PHR is different from EHR because in PHR, patients themselves record and set up health related information. PHR increases individual participation of patients. It also helps families to get involved in health care for family members (Jones et al., 2004).

(v) *Improved outcomes of patients*

Digital data provides reliable access to complete health information. A comprehensive view can

help in diagnosing the diseases quickly. Less possibility of errors can lead to better outcomes for patients. EHR help in exposing potential risks to patients. It helps service providers to take good care of patients. EHR help in identification of operational problems in a systematic manner. In a paper-based setting, identification of such problems is much more tedious and rectifying them can take a lot of time (Athavale and Zodpey, 2010).

(vi) Work-life balance

Physicians generally work in high pressure environments. EHR provide quality care for a large number of patients. It also helps physicians in practicing a balanced work-life style (Karthikeyan and Sukanesh, 2012).

1.6 Overview of research

The present study takes a holistic view of IT technology in health care services from an emerging country perspective. Factors which are critical for successful implementation of technology, in the context of tertiary-level multispecialty hospitals in India, have been identified. The research examines if these critical success factors impact job characteristics and job satisfaction of physicians. The study also extracts factors related to data management, in the post-implementation phase of usage of EHR technology. The impact of data management factors on job characteristics and job satisfaction of physicians has also been analyzed.

The population of the study consists of physicians working in IT-enabled multispecialty hospitals in Punjab. Primary data has been collected from physicians through a pre-tested, structured and non-disguised questionnaire. Physicians have been requested to give their responses on a five-point Likert scale.

Relationship of computer knowledge and duration of EHR usage have been analyzed with respect to demographic variables, namely, 'age', 'gender', and two other variables, namely, 'educational level', 'work area' and 'designation'. Statistical analysis tools, namely, exploratory factor analysis, multiple regression analysis and chi-square tests, have been used to analyze data with help of Statistical Package for Social Sciences (SPSS)® 21.0.

1.6.1 Research objectives

Objectives of the study are:

(i) Implementation phase

1. To identify the critical success factors with respect to implementation of EHR technology in hospitals

2. To examine the impact of identified critical success factors on job characteristics of physicians

3. To analyze the impact of identified critical success factors on job satisfaction of physicians

(ii) Post-implementation phase

4. To identify the data management factors in the post-implementation phase of EHR technology

5. To examine the impact of identified data management factors on job characteristics of physicians

6. To analyze the impact of identified data management factors on job satisfaction of physicians

1.6.2 Research hypotheses

Following hypotheses have been proposed:

H1: There is a significant impact of critical success factors, with respect to implementation of EHR technology, on job characteristics of physicians

H2: There is a significant impact of critical success factors, with respect to implementation of EHR technology, on job satisfaction of physicians

H3: There is a significant impact of identified data management factors on job characteristics of physicians

H4: There is a significant impact of identified data management factors on job satisfaction of physicians

1.7 Significance of the study

The present study aims to portray a comprehensive picture of impact of EHR on job characteristics and job satisfaction of physicians in Punjab. The study is expected to be useful for various stakeholders, namely, 'physicians', 'software companies', 'hospital administrators' and 'government'. It might help stakeholders in positioning EHR technology on the basis of needs and demands of users. It could assist them in improving overall performance. The study seeks to increase know-how of administrators of tertiary-level multispecialty hospitals. It also seeks to enrich job characteristics and increase job satisfaction levels of physicians working in such hospitals.

The study endeavors to understand the job nature of physicians using EHR technology that may help corporate and private hospitals in formulating their technology advancement and diversification plans. It aims to address the unexplored gaps in literature related to critical success factors, in the implementation phase of EHR technology. It also addresses gaps related to data management factors in the post-implementation phase of usage of EHR technology. Further, the study analyzes the impact of these identified factors on job characteristics and job satisfaction of physicians. Recommendations have been made to the concerned stakeholders on the basis of findings and implications of study.

1.8 Organization of dissertation

This dissertation has been organized in five chapters. A brief review of each chapter is given below.

Chapter I: Introduction

This chapter is introductory in nature and figure-outs the foundation of present research. It describes the context of health care sector, tertiary-level health care services, information technology (IT) in health care sector, Indian health care sector and implementation of technology. It also outlines the concept of EHR, physicians, job characteristics and job satisfaction. Research objectives and research hypotheses are outlined. The last section of chapter explains how the subsequent chapters of this dissertation are organized.

Chapter II: Review of literature

The available literature on EHR, job characteristics and job satisfaction of physicians has been presented. These studies help to identify the research gaps and define research objectives. Basic review of literature has been divided in five different categories, namely, 'EHR', 'critical success factors related to implementation phase', 'data management related to post-implementation phase', 'job characteristics' and 'job satisfaction'. The literature review helped the researcher to address the research questions, define objectives of the study and proceed further in order to achieve the objective by employing systematic and scientific investigation.

Chapter III: Research methodology

Third chapter elaborates the research plan and methodology that have been adopted in this study. It includes various phases, design, objectives and hypotheses. It also outlines population, respondents, sampling, data collection, questionnaire, data analysis tools, and data reliability and validity. A research framework has then been proposed.

Chapter IV: Statistical analysis and interpretations

Statistical analysis and interpretations of data have been discussed in fourth chapter. It reports findings of the research. Exploratory factor analysis, multiple regression analysis and chi-square analysis have been used, with the help of SPSS® 21.0.

CSFs related to implementation phase of EHR have been extracted. The impact of identified CSFs on job characteristics of physicians has been examined. The impact of CSFs on job satisfaction on physicians has been analyzed. The study also identifies various data management factors related to the post-implementation phase of usage of EHR technology. It examines the impact of data management factors on job characteristics of physicians. It further analyzes impact of data management factors on job satisfaction of physicians. It also proposes a framework for impact of EHR technology on job characteristics and job satisfaction of physicians.

Relationship of 'computer knowledge' with respect to 'EHR usage' has been analyzed. Relationships of 'computer knowledge' and 'EHR usage' with respect to demographic

variables, namely, ‘age’, ‘educational level’, ‘gender’ and two other variables, namely, ‘designation’ and ‘work area’, have also been studied.

Chapter V: Summary and conclusions

The chapter provides the summary of present research. It revisits the objectives to understand if the purpose of research has been achieved. It also presents implications, recommendations, contributions and limitations of the study. In conclusion, it discusses the scope for future research.

A list of references, used in the study, has been compiled at the end of the thesis.

Concluding remarks

Health care sector, Indian health care sector, tertiary-level health care services, application of Information technology (IT) in health sector have been discussed in this chapter. Rationale, overview and significance of the study have been mentioned in the chapter. A chapter scheme describing the organization of thesis has also been presented.

Chapter - II

Review of Literature

2.1 Introduction

A review of literature helps in formulating relevant questions. It aids in identifying research gaps and defining the research problem. This chapter presents a review of literature related to EHR technology and related aspects which are relevant in the context of current research. It has been divided into seven sections. Section 2.2 presents studies related to EHR. Studies related to implementation of EHR technology have been collated in section 2.3. Section 2.4 presents studies related to data management in post-implementation phase of usage of EHR technology. Studies related to job characteristics have been mentioned in section 2.5. Section 2.6 contains studies related to job satisfaction. The research gaps and statement of problem have been discussed in section 2.7.

2.2 Electronic health records (EHR)

Boaden and Munir (2001) have defined EHR as permanent documents which hold digital information about physical, social and mental state of a patient. EHR record diseases and other health related conditions which are detailed by clinicians at different levels in health care. The nature and possibilities of demand from patients for deployment of EHR in terms of their own health has been investigated. The authors have observed that many patients desire to access their health records in electronic form.

Jeselon and Schoeffel (2002) have remarked that Electronic Health Records are paperless, digital form of health records. EHR are longitudinal health records of patients, right from cradle to grave. The authors have attempted to study the differences between different kinds of digitalized records available in hospitals. It has been concluded that EHR are different from other medical records in terms of scope, usability and operation.

Smithline and Christenson (2002) have studied benefits of using digital data. The authors present methods used in reconstructing and redefining of a multiple-item scale in order to measure a construct. The authors have concluded that integration of stand-alone information

of individual clinics with information available with hospital-based physicians, provides quick accessibility to diagnostic test results, electronic prescriptions, referrals, and reports of visits and consultations.

Bathell et al., (2002) have described key features of EHR by theoretically and empirically examining the impact effect of health care service providers. The researchers have investigated the impact of alternative e-technology on coordinated care. They have concluded that standard templates are required to organize and manage basic health information which includes relevant, accurate and real-time facts about condition of a patient. 'Health related data', 'information and record storage', 'end-results management', 'order entry', 'decision making', 'e-communication', 'patient portal', 'administrative processing', 'reporting' and 'connectivity' have been summarized as key features of electronic health records.

Burton, Anderson and Kues (2004) have investigated inter-connectivity related to use of digital data. The authors have examined practical implications related to usage of EHR technology by several clinicians that can influence small practitioners in adapting the technology. It has been observed that EHR provide transmission of data amongst various clinicians, leading to treatment of patients in a variety of settings. The study has concluded that EHR technology presents clinical information to clinical groups which other physicians can access easily.

Mehta and Partin (2007) have attempted to differentiate EHR from electronic medical records. The authors have developed a model for mapping technological capabilities. The authors have defined EHR as longitudinal health records that integrate information from multiple sources and further transmit this information to various point-of-contacts. It has been concluded that EHR have a broader scope that offers a plethora of benefits which help in improving quality of patient care, reducing costs and fulfilling various types of administrative, transactional and educational needs.

Mukherjee and McGinnis (2007) have focused on the proposed structure, scope and functions of EHR in the context of patient satisfaction through communication. The authors have observed that many hospitals implement technology to reduce paper work, but not always with an objective to increase satisfaction of patients. The study has concluded that

EHR lead to creation of opportunities for improvements in doctor-patient communication through access and availability of alternative treatment options.

Atreja et al. (2008) have theoretically and empirically examined that information and communications technology (ICT) has a potential of enhancing boundaries of EHR. The study has attempted to analyze potential richness of EHR by itemizing technical possibilities. It has been concluded that data is recorded in the form of clinical imaging, including static (X-rays, MRI, PET scans), dynamic, speech, free text, document imaging and full/partial motion video, electronic data representing laboratory results, device settings, operational status with measurements, drawings and indexing/clinical encoding.

Hadwich et al. (2010) have also attempted to outline the differences between EHR and Electronic Medical Records (EMR). The authors have examined multiple record-keeping softwares in a sample of 15 hospitals. It has been observed that EMR refer primarily to electronic record generated by an ambulatory clinic, hospital or healthcare institution. On the contrary, EHR have been considered as electronic health technologies which have the potential to increase satisfaction level of patients. The study has concluded that EHR are 'patient-centric technologies' that enhance coordinated care.

Scheidlinger (2016) has outlined major objectives of EHR for administrators. The author has included physicians from four medium-to-large sized hospitals. The study has developed and tested hypotheses regarding the impact of EHR on shaping technology. It has been observed that EHR technology improves quality programs, promotes interoperability, and focuses on cost, access and quality aspects. The study has concluded that EHR include patient health information, E-scribing, clinical decision making, computerized order entry, patient electronic access to health information, coordination of care, health information exchange and public health reporting.

Mathai, Shiratudin and Sohel (2017) have conceptualized and empirically examined efficiency and productivity issue related to health care services. The authors have attempted to conceptualize benefits of EHR by health care service providers. In the opinion of the researchers, an appropriately designed EHR can eliminate need for noting down paper-based prescriptions and manage physician workflows leading to enhanced efficiency and productivity. The researchers have observed that a well-deployed health care system reduces

inefficiencies and promotes better health care. It has been concluded that EHR standards have been one of the most crucial building blocks for health care reform and supports efficient exchange of information between providers and health care organizations.

Feng, Le and McCoy (2019) have investigated the roles of electronic health records in detecting and assessing adverse drug events in ambulatory setting. The researchers have identified 30 studies related to adverse drug events in ambulatory care. It has been seen that a majority of studies have observed that use of EHR leads to early detection of adverse events. The study has concluded that a retrospective approach is appropriate for measurement of occurrence rate of events. It has also been concluded that digitalized technologies and electronic triggers enable researchers to counter preventable adverse drug events and take necessary actions.

2.3 Studies related to achievement of success in implementation of EHR technology

The present study seeks to identify factors which are perceived to be critical for attaining success in implementation of EHR technology. This section presents a review of studies with similar objectives.

Eni and Tan (1989) have opined that organizations must focus on critical factors related to success of technology implementation models. In the opinion of the researchers, the challenges and hurdles in implementation of technology are a source of competence. The researchers have attempted to explore benefits of technology implementation on health care organizations. The study has concluded that some critical factors reduce the possibility of delay in implementation or a complete failure of implementation process. The authors have recommended that health care organizations should focus on the critical factors identified in the study.

In the context of implementation of EHR technology, Williams (1992) has surveyed users in hospitals which are seeing rapid changes with the advent of digitalization and generation of pressure related to consolidation. The authors have observed that adoption of technology by clinicians relates to continuity in usage of technology. It has been concluded that mere presence of EHR technology in an organization does not imply that clinicians use it on a regular basis.

Meinert (2004) has investigated the process of acceptance of technology and its impact on organizations. The author has conducted a field research, on a sample of 350 physicians. It has been observed that non-acceptance of technology amongst physician results in under-utilization or stalled implementation or can even undo installation. It has been seen that implementation of EHR technology is a non-trivial and an ongoing activity. The study has concluded that EHR technology implementation cannot be treated as a trial-and-error experimentation, and its success cannot be ascertained.

In order to understand various stages in technology implementation, Loonam and McDonagh (2005) have conducted a study in a set of organizations which are adapting to new technology. It has been observed that an organization generally passes through three stages while planning the implementation of new technology. These stages have been defined as:

(a) Pre-implementation: A stage where organizations decide why they want to implement a new system, what they expect from it, and which critical factors could help them in achieving successful implementation;
(b) Implementation: A stage where organizations anticipate and prepare for the expected challenges, including organizational and technical issues needing attention during implementation; and,
(c) Post-implementation: A stage where organizations keep abreast of latest technology in order to be able to deal with updates, any potential recalls, potential hacking of patient information from third parties and other emerging cyber-security threats.

Stetler et al. (2008) have opined that long term success of technology adoption depends on many factors and organizations need to focus on implementation practices in order to motivate physicians. The study has examined factors related to success in adoption of technology. It has been observed that some differences in approaches of the users because of their diversification and unexplained variation in adaptability can increase the possibility of inferior outcomes. It has been concluded that a consistent and evidence-based approach should result in consistent and successful adoption of EHR among healthcare professionals.

In another study in the context of the Indian health care sector, Jha et al. (2008) have attempted to investigate the deployment of ICT in building a comprehensive EHR. It has been observed that IT implementation has gone a step further by accepting EHR as an

essential component of the country's healthcare system with the aim of working towards its adoption among all stakeholders. It has been concluded that good computer knowledge and an ability to enter patient health information, notes and prescriptions is essential for physicians to interact intelligently with an EHR system.

Kaplan and Harris-Salamone (2009) have studied the risks associated with unsuccessful implementation of technology. It has been observed that failing or delay in any timely roll out of EHR technology can result in an undesirable risk for hospitals. The authors have concluded that such risks can lead to erosion in benefits such as improvements in patient care and can pose a threat to finances of the hospitals.

Ludwick and Doucette (2009) have postulated that vendor consultants and management of hospitals often influences implementation outcomes for technology. It has been observed that institutional leadership has a tendency to take differing directions for implementation of EHR technology for reasons like low experiences, lack of technical expertise and a need for customization according to local conditions. It has been concluded that organizations need involvement of vendors in order to benefit from customized softwares.

Rogers (2010) has theoretically examined advancements in technology related to electronic health records. The author has observed that operational efficiency of hospitals and outcomes related to healthcare of patients cannot be improved unless EHR is successfully adopted. It has been concluded that EHR adoption improved and refers to consistent usage of this technology by individuals as well as organizations.

Holden (2011) has empirically examined key features of software technology embedded within the EHR package, which are designed to ease the implementation process. It has been found that support received by physicians from top management, peers and other allied healthcare professionals is essential for delivering high quality care services. It has been concluded that, as patients become more informed and healthcare providers become increasingly mindful about sharing inaccurate and misguided information, EHR process becomes a necessary and safety-critical process.

In another research in the context of the Indian health care sector, Malach and Baumol (2012) have studied important perspectives of ICTs implementation. The authors have observed that

the government of India has been pushing health care stakeholders, such as physicians, hospitals, and insurance companies, in deploying technologies for combating ever-increasing healthcare costs, while having a simultaneous need for improving quality and accessibility of healthcare facilities. It has been concluded that successful implementation of ICTs is one of the most crucial issues for hospitals, and has suggested several critical factors which drive success of EHR implementation.

Concurrently, Briggs, Smyth & Anderson (2012) have empirically examined success factors related to technology implementation in Indian context. It has been seen that deployment of EHR technology is limited to major corporate hospitals. The study has mentioned implementation tips for small healthcare organizations having less than 500 beds and also for medium-sized (500-1,000 beds) hospitals. It has been concluded that needs of the users must be clearly understood for effective implementation of EHR technology.

Coiera, Aarts and Kulikowski (2012) have stated that Indian hospitals need to become more cost-effective, efficient and competitive in their routine care delivery business. It has been observed that there is an urgent need for taking necessary steps and performing substantive changes in the outdated business processes that are still being practiced among India hospitals, including, the paper-based systems. It has been concluded that organizations need to focus on business process re-engineering. It has been recommended that the entire information systems and networks infrastructure within India's hospitals should deploy appropriate ICT mechanisms as a weapon for competitive advantage.

Moukheiber (2013) has compared various countries with respect to implementation of EHR technology. It has been observed that technological implementation of EHR in developing countries such as China and India often fails to realize timely success and/or achieve projected goals. The author has asserted that an implementation failure creates high risk by diverting capital, operating funds and human resources from productive use and also weakens the hospital's position in marketplace. It has been observed that failure in installation of EHR in a hospital amounts to a monetary loss and a negative impact on its reputation and image. It has been concluded that technical aspects of implementation are complex and require skillful execution for its success.

Ajami and Bagheri (2013) have studied various aspects and practices for successful implementation of technology in health care sector. It has been observed that physicians need to undertake selective training sessions to experience new technology and in order to make the best use of it. It has been concluded that training is one of the most crucial factors affecting implementation of technology.

Or et al. (2014) have stated that post-implementation challenges and experiential learning gained by healthcare professionals working within the context of developed countries (e.g., the USA and Canada) cannot be easily knowledge translated. It has been observed that common failures in implementation of EHR in less developed countries are possibly due to a number of reasons. It has been concluded that lack of know-how in reconciling difficult-to-change cultural habits, need for local adaption in work related practices and differing socio-political environments are some of the major challenges in implementation of EHR technology.

In a qualitative study, Safdari, Ghazisaeidi & Jebraeily (2016) have explored critical factors responsible for the success/delay/failure of technology implementation. The study has identified top management support, strategic planning, project champion, training, teamwork, change management culture, effective communication, computer knowledge, software attributes, testing and troubleshooting, as critical factors for success in implementation of EHR technology in healthcare organizations.

Zayaad and Toycan (2018) have explored the underlying factors that impact decision of healthcare professionals to adopt to electronic health technology in developing countries. A sample of 465 healthcare professionals was selected from 15 hospitals in Nigeria. It has been seen that perceived usefulness, willingness and attitude of healthcare professionals have a significant impact on intentions of workers to adopt electronic health technology. The authors have concluded that less computer knowledge and experience with using electronic technology, lack of motivation, poor organizational and management policies are some other strategic factors for successful adoption.

2.4 Studies related to data management

Another objective of the present research is to identify factors related to data management in the post-implementation phase of usage of EHR technology. The following studies have been reviewed for the purpose.

Cash and Konsynski (1985) have elaborated on factors related to data management in various sectors of the service economy. It has been observed that significant increases in costs, performance and capabilities, creation of new databases and information technologies have created numerous integration opportunities for organizations to attain competitive advantage in marketplace. It has been concluded that integration and maintenance of databases across sectors such as banking, retail pharmacy, health care and insurance have proved to be beneficial in improving the quality of decision-making.

Madnick and Wang (1988) have observed that integration of business activities and data bases accelerates the development and delivery of technology applications. The researchers have stated that technology applications need access to functional and product databases which have disparate levels of data management. It has been further stated that there is a need to re-think innovatively to achieve gains in management. The authors have concluded that data management has been defined by data users and not by manufacturers or data managers, such as Information systems (IS) departments. It has been recommended that practitioners should direct efforts toward data management by designing for the data users rather than computer professionals.

Lindgren (1991) has postulated that poor management of data can lead to substantial impact on outcomes of an organization. The author has stated that efficiency in administration and a process-drive design can lead to an improvement in quality of processes related to data management. It has been concluded that four most crucial dimensions of data quality are ‘intrinsic data’, ‘accessibility’, ‘contextualization’ and ‘presentation’. It has also been concluded that factors related to data quality are ‘validation’, ‘traceability’ and ‘availability’. In the category of ‘information systems’, the research has extracted four factors, namely, ‘reliability’, ‘authenticity’, ‘usability’ and ‘integrity’.

Mandl and Porter (1999) have identified ‘completeness’ and ‘effective communication’ amongst clinicians and patients as factors related to data management. It has been observed that an integrated and cohesive methodology is needed to addresses data order entry and information utilization. The authors have concluded that this methodology includes comprehensive analysis of all data management factors which affect data quality at the points of updation and information retrieval. It has also been concluded that appropriateness and proper form of data affect its utility in achieving the desired objectives.

Gil and Kim (2000) have postulated that technology affects management of data by facilitating intelligent systems. It has been observed that digital means helps users in comparing information provided by electronic technology with that stored already in the system. The authors have observed that factors related to data management, namely, ‘definition’, ‘organization’, ‘retrieval’, ‘storage’, ‘analysis’ and ‘updations’, are essential in ensuring high quality of data. It has been concluded that degradation of data quality happens if it is not managed properly.

Brumec et al. (2001) have studied aspects related to data entry with the help of digital technologies. It has been shown by the authors that issues related to slow speed of data entry can be resolved. It has been found that structured data entry enables users to enter data quickly and also helps in storing data in such a way that retrieval is effective. It has been concluded that transmission of data from one system to another can be made easy if proper standards are set. The authors have also concluded that decision trees can be used to from structured data sets which can lead to presentation of decisions in a fresh manner.

Geissbuhler and Tschopp (2001) have attempted to find out the contribution that intelligent interfaces have in enabling users to adapt to necessary requirements for different users and uses. It has been observed that ‘interfaces’ ensure that data has been collected and used in consistent ways while implementing necessary quality assurance procedures. It has been found that these interfaces can help in quick gathering of data, viewing historic data, and thus, it makes decision-making easy with very few chances for mistakes. It has been concluded that mobile technology providing easy interfaces as a key to achieve appropriate integration. It has also been concluded that there are some limitations of using mobile

technology, namely, ‘slow data entry’, ‘complete display’, ‘incompatibility’, ‘slow connectivity’ and ‘security issues’.

Similarly, Scott (2001) has emphasized in his paper that widespread use of intelligent interfaces can result in high productivity and reduction in stress for its users. It has been observed that consultants can improve usability of the system by performing tasks, such as scanning and sorting of information, through online assistance. The authors have concluded that data gathering, integration and retrieval on real-time basis is necessary if digital technologies are to be implemented.

Eckerson (2002) has conducted a study on technology that data processed in the form of information serves as the foundation for operational and tactical decision-making processes. It has been observed that data is one of the most crucial resources in an organization. The author has concluded that management of data is critical for professionals and operational processes involving efficiency issues.

At the same time, Mecella et al. (2002) have analyzed that data management can create variety in services for any organization. It has been observed that high quality data, with appropriate management, has a potential to achieve top quality services. On the contrary, with lack of data management, organizations might fail in maintaining co-operative information systems (CIS). The authors have concluded that CIS is a system which transmits and shares information amongst interconnected systems operative in diversified geographical areas. It has also been concluded that innovative and intelligent interfaces are growing in order to cope up with ever increasing need for integration, centralization and interdependence in operability of complex, static and incompatible systems.

Military Health Services, US (2003) have observed the perspective of analyzer, that data management factors have been used to improve transmission of information and its related processes. It has been observed that data management, related to EHR, has a narrow scope of ‘data verification’ and ‘validation’. The author has asserted that data management ensures appropriate use of health data. It has been acknowledged that standardization of quality of health data is a critical and challenging task. It has been concluded that factors, which impede data management, are, ‘inadequate management structures’, ‘accurate reporting’, ‘inadequate rules’, ‘training’, and ‘guidelines’. Management, organization and technological

mechanisms impact the potential of maintaining data quality. It has also been concluded that it is difficult to derive an exclusive list of factors that treats EHR data as a structured set and in a conventional manner.

Wang et al., (2008) have identified accuracy, timeliness and relevance as factors related to data management. In addition, 'internal control systems', 'reliability', 'accuracy', 'frequency' and 'size of data' have also been identified as factors related to management of data. The authors have concluded that information processing is quick and consistent, due to the identified data management factors.

Bartini et al. (2009) have examined strategies that have been adapted for improvements in management of data. It has been observed that two strategies, namely, 'data-driven' and 'process-driven' have the potential to improve data management. Data-driven strategy is a strategy which can improve data management by upgrading data value instantly. Some related techniques for improvements in data-driven processes are, 'acquiring updated data', 'standardization', 'error reduction', 'correction', 'record transmission', and 'data integration'. Process-driven strategy redesigns processes of data to enhance its quality. Process-driven strategy consists of two techniques, namely, 'control' and 'redesign'. Process control includes checking and management of data. Process redesigning eliminates causes of poor quality and also exhibits new processes which can yield high quality. Furthermore, updating activities that control formatting of data, prior to its storage, is another innovation in process redesigning.

Bartini et al. (2009) have opined that in the long run, advantages of process-driven strategies have been found to be more than those related to data-driven strategies. The researchers assert that process-driven techniques eliminate the main reasons for problems in management. The authors have concluded that data-driven strategies are expensive, but efficient, as compared to process-driven strategies.

At the same time, based on International Organization for Standard (ISO), Heravizadeh, Mendling and Rosemann (2009) have stated that data management refers to integrity of characteristics of an entity. It has been asserted that data management classifies information and data as per requirements. It has been concluded that data management provides means to measure data quality as well as information.

Alizamini et al. (2010) have contributed to the available literature with a number of definitions differing in perspective and scope. A fair amount of literature on data management has dealt with its definition, factors and scope. The researchers have defined 'management of data' as processed information that meets customer needs and desires. The authors have observed that quality of data needs to be appropriate for its use and to fulfill needs of the users. It has been concluded that data quality, through appropriate data management, is crucial for improving process activity related to fields involving 'management', 'medicine', 'statistics' and 'computer science'.

Man et al. (2010) have classified data management in two classes, namely, 'single-source' and 'multi-source'. An objective of the researchers to classify data management is to illustrate non-standardized data and to identify specific application of data. It has been concluded that three factors related to data management are 'quality of data', 'information systems' and 'accounting and auditing'.

2.4.1 Studies related to specific factors of data management

Literature that relates to various factors of data management, using IT, has been summed up in the next paragraph:

Timeliness: Extent of duration of data for which it is considered appropriate for use is termed as timeliness (Wang & Strong, 1996). It specifies the time-delay between changes in real world and correspondingly changes in the state of information (Batini et al., 2009; Wang & Wand, 1996). Timeliness comprises of two components, namely, 'age' and 'volatility'. Age is the measure of time period since when data has been recorded. Volatility is the extent of information stability and the range in modification of value for a specified feature of an entity (Batini et al., 2009; Bovee, Shrivastava & Mak, 2003).

Consistency: It is defined as the extent to which data is reported in a particular format and its compatibility with previous data (Wang & Strong, 1996). It relates to the violation of rules related to templates described over the set of data (Batini et al., 2009).

Accuracy: Data is said to be accurate when the records updated in database systems correspond to real-world records (Ballou & Pazer, 1985). It is also defined as the potential to provide correct, reliable and certified data sets (Wang & Strong, 1996).

Completeness: This factor refers to the potential of information technology to present data with an integrated view (Wand & Wang, 1996). It is also defined as the extent of accuracy, to which data is represented, with sufficient breadth, depth and scope (Wang & Strong, 1996). It is also said to be the degree to which data is presented in totality (Redman, 1996). Another meaning of completeness relates to the percentage of real-time data gathered in sources and data warehouses (Jarke, 2003). It can also be explained as a ratio that represents amount of values in source and of universal relation (Naumann, 2002).

Accessibility: The extent to which data is easily available and can be retrieved quickly, has been defined as accessibility (Wang & Strong, 1996). It can also be defined as a measure of uniformity of data in different data warehouses, applications, processes and systems for making data equivalent (McGilvray, 2008).

Safety: It is defined as capability of technology to achieve acceptable levels of uncertainties that might harm users. It is a level to which accessibility of information is limited to maintain security for its operators (Heravizadeh, Mendling & Rosemann, 2009).

Effectiveness: It is defined as the capacity of a feature to enable its users to fulfill visionary goals of accuracy and completeness (Batini, 2009).

Reliability: It is termed as accuracy and authenticity of data. It is the ability of a data management factor to acquire a specific level of performance when used in a specific condition (Heravizadeh, Mendling & Rosemann, 2009).

Synchronization: The measure to which equivalence in standardization of data is maintained. Consistent data is provided in data warehouses, systems and applications for generating equivalent data (McGilvray, 2008).

Timeliness: This factor is defined as the measure to which real-time data is available in the time frame in which information is expected (McGilvray, 2008).

Data management has a number of factors from different perspectives. Without complete information about the relations between data management factors, knowledge discovery is neither effective nor comprehensive. No single factor has been found to be strongly related to another factor in various studies. Identification of appropriate factors with significant correlations amongst each other can lead to improvements in quality of data.

2.5 Job characteristics

Success of an enterprise primarily depends on its employees and their commitment towards their jobs. A workplace can generate high productivity if employees are happy with the work environment. Pleasant working environment should lead to reduction in stress and uncertainties. In addition, customers attain high satisfaction while dealing with happy employees, as they perform in a substantially better way.

Hackman and Oldham (1974) have defined job characteristics as a set of features that combine the significance of a task and autonomy. The researchers have defined significance of a task as a degree to which jobs impact lives of the employees, working in an organization. Autonomy has been defined as a measure of freedom that has been provided to accomplish a task. Based on job diagnostic survey, the authors have developed a model called Job Characteristics Model (JCM). The authors have concluded that job characteristics are the objective characteristics for a job, and have the extent to which a job has been designed in order to enhance intrinsic job motivation and hence job satisfaction. According to the JCM, job characteristics of individuals are a moderating factor for job satisfaction. It has been observed that job characteristics depend upon psychological state of the employees. Characteristics related to job include various factors concerned with meaningfulness of work, namely, ‘task identity’, ‘task significance’ and ‘skill variety’. It has been concluded that JCM describes responsibility for outcomes which is termed as ‘autonomy’ and knowledge of results, which is defined as ‘feedback’.

Tonges, Rothstein and Carter (1998) have stated that enjoyment of work is considered as the most crucial factor relating to job satisfaction. The authors have studied interesting tasks that re-polish service skills, set up of training standards and enhance satisfaction amongst health workers. It has been concluded that enrichment of job, by considering practical aspect of tasks, motivates employees.

Luthans (1998) has defined motivation as a process which gives directions to predict employee behavior and improve task performance. The author has stated that motivation is classified in two categories, namely, 'intrinsic' and 'extrinsic'. Intrinsic motivation has been defined as the extent to which effective motivation, to perform their jobs, is provided. Extrinsic motivation has been referred to as motivation of employees when they engage in a task to earn a reward or avoid punishment. The author has concluded that extrinsic motivation arises from external environment of an individual while intrinsic motivation arises from within. It has also been concluded that the two types of motivation can differ in their effectiveness in driving behavior of workers.

Gomez-Mejia, Balkin and Cardy (2005) have conducted a study that supports job characteristics with intrinsic and extrinsic factors of motivation. It has been seen that job characteristic model predicts, that with the presence of intrinsic and extrinsic factors related to job, workers have high internal work motivation, better quality in task operation, high satisfaction and eventually, low absenteeism. The authors have concluded that five corresponding characteristics of a job, namely, 'task significance', 'task identity', 'skill variety', 'feedback' and 'autonomy', are considered to be positively correlated to workers' satisfaction and performance.

Droar (2006) has stated that JCM focuses on describing the job in a significant manner, which encourages employees to work for a given task. The author has called an individual's consciousness for a particular task as task significance. Identity of task enables an employee to fulfill all necessary functions required to accomplish a task. Variety in skills is defined as the comprehensiveness and qualities required to perform a particular task. Feedback characteristic of job means that an employee gets clear and transparent revert of his/her job performance. The job aspect which provides independence and authority, while taking decisions, is known as autonomy. It has been concluded that explaining the task in a significant manner increases ones belongingness towards his/her job.

In another study, Buys, Olckers, & Schaap (2007) have observed that approximately 47 percent of workers surveyed claim that they are satisfied with their job and 33 percent claim to be pleased. It has been observed that there is a significant correlation of situational variables, namely, 'autonomy', 'feedback', 'skill variety', 'task identity' and 'task

significance', with satisfaction level of workers. It has been found that both task autonomy and decision-making are linked to job satisfaction. It has also been seen that autonomy, skill variety and feedback have a positive impact on job satisfaction of employees.

According to Coelho and Augusto (2010), autonomy can eventually boost employees to try new, innovative ideas and learn from experiences. The researchers have observed that autonomy helps individuals in polishing their domain relevant skills. Feedback has been defined as the information revert being provided to employees about the quality of work performed by them. The authors have concluded that organizations need to provide effective feedback to workers so that they are well informed about the areas that need to be worked upon, which can eventually lead to better understanding of the nature of work.

Concurrently, Bajwa et al. (2010) have observed that various extrinsic factors, like 'economic situation', 'motivation', 'training' and 'family' impact job satisfaction. The study was conducted on a sample of 100 employees included doctors, nurses and paramedical personals. The authors have concluded that these extrinsic factors are essential for increasing commitment towards an organization.

Coelho and Augusto (2010) have investigated interactive effects of job characteristics and perceived changes after technology implementation on creativity of frontline staff. The study was performed with 460 employees belonging to a service organization. It has been observed that each factor of job characteristic has a significant impact. It has also been observed that extent to which users experience changes is related to technology and it depends upon other aspects like formal authority and nature of their work role. It has been concluded that job characteristics interact with each other to impact creativity.

Ghosh et al. (2015) have proposed that workers experience job significance only if they perceive their jobs as valuable, worthwhile, important and consistent with the systems or values that they are acceptable to them. It has been seen that incumbents exhibit personal responsibilities if the job provides a feeling of accountability for the results. The authors have concluded that all the three psychological phases must be experienced by an employee for positive behavioral outcomes.

Sangmook (2016) has observed the impact of job characteristics on Public Service Motivation (PSM) in context of Korean government firms. Data from Public Service Panel Survey of 2011 was used in the study which was conducted by Korea Institute of Public Administration. The author has concluded that three factors of job characteristics, namely, 'skill variety', 'task significance' and 'feedback', are positively correlated with PSM.

Bayoumy (2019) has investigated the relationship between job characteristics and work engagement amongst nursing staff of hospitals in Cairo. A sample of 104 nursing staff was included in the study. Two separate scales were used to measure the characteristics of job and the levels of engagement of nurses. The author has concluded that autonomy is positively correlated to absorption. Feedback is positively correlated to work engagement. Skill variety and task identity have been found to be negatively correlated to absorption, while task significance was not correlated with work engagement. It is also been concluded that hospital administrators can adopt a rewarding mechanism as it has been found to have a vital impact on job satisfaction and engagement in work, possibly reducing turnover.

2.6 Job satisfaction

Smith et al. (1969) have defined job satisfaction as overall as well as generalized satisfaction of worker with characteristics of job. The researchers have observed that facets of job might include the work itself, supervision, remunerations, organization environment and policies opportunities. Job satisfaction can be measured as generalized or overall satisfaction of a worker. It has been concluded that level of satisfaction with respect to various work facets/characteristics, forms the overall working structure of employees.

Spector (1997) has underlined that satisfaction cannot be specific to self-satisfaction, motivation or self-contentment. It has been observed that job satisfaction is a crucial outcome moderated by job characteristics. Job satisfaction has been defined as a degree to which people like or dislike their jobs. The author has concluded that job satisfaction is best described as an individual's feeling towards his/her job.

Luthans (1998) has stated that overall attitude towards a job can predict the extent to which an individual likes (satisfied) or dislikes (dissatisfied) a job. It has been seen that an

employee predicts his/her level of satisfaction on the basis of psychological and physiological needs. The author has concluded that attitude towards jobs is formed by feelings, beliefs and behavior of individuals.

In another study, Webster (2002) has defined employee satisfaction in health-care. The author stated that health care is a group of services provided to individuals or communities by various health care professionals for the purpose of motivating, supervising, asserting and reinstating good health. Health care services refer not only to treatment but also to prevention of illnesses. The services are delivered by professional physicians in dentistry, medicine, pharmacy, nursing and allied health. The researcher has concluded that health care is an integration of various sectors providing goods and services to cure patients by providing curative as well as preventive care. It has also been concluded that out-patients, in-patients, critical care and emergency services, present not only a basis for operational success of hospital, but also provide satisfaction to clinicians via patient-oriented measures.

According to Robbins (2003), the term job satisfaction has been referred as physicians' attitude towards his/her job. It has been observed that satisfaction is a pleasurable psychological state that arises due to appraisal at work place, affection, and positive attitude towards individual's job. Satisfaction outcomes of physicians further depend on their job characteristics. The author has described satisfaction as an important concern because it associates number of aspects for care. Satisfaction of physicians is co-related with several aspect of quality, namely, 'health care', 'workforce', 'patient satisfaction', 'patient compliance' and 'continuity of care'. It has been observed that dissatisfaction often leads to high rate of absenteeism, less productivity and turnover. Each of these factors increases the cost of providing effective medical care. The author has concluded that satisfaction is stated as global attitude of employee towards his/her job, which might also be related to internal characteristics of an individual. It has also been concluded that the level used to describe satisfaction can differ markedly amongst various job facets.

In another study, Hunter (2006) has concluded that four factors of job characteristics, namely, 'task significance', 'task variety', 'task identity' and 'feedback', relate to job satisfaction as strong and positive predictors. The author has concluded by stating that job

satisfaction is a multi-faceted construct which includes an individual's perceptions about a number of internal and external job elements.

According to Gupta & Joshi (2008), worker's satisfaction is an important tool which encourages an individual to work with zeal. It has been observed that job satisfaction is of utmost important because majority of people spend a huge part of their lives at work place. The authors have concluded that workers have a positive outlook towards company's business and objectives when they are satisfied with their jobs.

Rajat (2009) have stated that organizational studies have been intrigued by worker satisfaction. The author has described job satisfaction as an extent to which an employee is contented with his/her job. It has been seen that satisfaction related to career of physicians appears to be a tedious function of a number of factors with multiple dimensions. Insights to multiple facets of satisfaction, amongst physicians, are very complex to understand. It has been concluded that different perspectives of job satisfaction include demographic variables (age, gender, educational-level and marital status), job characteristics (wages, working hours, working tenure in company and attitude) and organization structure (staff specialists, control over work related practices and support from subordinates).

Kumari and Pandey (2011) have affirmed that job satisfaction is a major factor to improve and maintain overall outcome of an organization and loyalty by efficient service and better performance. The authors have concluded that job satisfaction is defined as a pleasant emotional state arising from the appraisal of individual's job; an affective reaction; and an attitude towards his/her job.

In the study by Smith (2015), satisfaction of a respondent focuses on relationships built and interactions happening between employees, co-workers, managers, supervisors, members and clients. It has been seen that a basic reason for satisfaction is enjoyment of work. It has been concluded that there is relation between job satisfaction and employee loyalty and commitment.

Bakotic (2016) has investigated the relationship between job satisfaction and organizational performance. The researchers have conducted an empirical study on a sample of 40 large to medium sized firms, with a total of 5806 workers surveyed. It has been observed that a

significant relationship between job satisfaction of employees and organizational performance. It has been seen through detailed analysis that the relationship between job satisfaction and organizational performance has been found to be stronger than relationship amongst organizational performance and job satisfaction. It has been concluded that job satisfaction impacts organizational performance, rather than organizational performance impacting job satisfaction.

Rozman, Treven and Cancer (2017) have investigated the differences between motivation and satisfaction of workers belonging to different age groups. Data were collected from employees of two age groups in Slovenia. The researchers have observed that the older employees were more motivated by flexibility provided in the organization, autonomy in work, strong interpersonal relationships, respect, and fair treatment to workers regardless of their age. It has been seen that motivation and satisfaction level vary with age. The researchers have concluded that managers and employers can employ appropriate measures to contribute to well-being of employees and provide better workplace, enhance productivity and creativity.

Frempong, Agbenyo and Darko (2018) have conducted a study to analyze factors for satisfaction in a set of industries. Data were collected from 150 employees from mining, financial and manufacturing industries. It study has been observed that there is at least one positive and a significant relationship amongst practices related to human resources, job satisfaction and commitment in different sectors. It has been concluded that job satisfaction shows a significant impact on commitment and loyalty in mining and manufacturing sector.

2.7 Research gap and statement of problem

As observed from the preceding review of literature, most of the studies have been conducted in the context of developed countries. Implementation of EHR technology is different from a perspective of developing or underdeveloped countries. Many differences have also been found amongst developed and developing countries, in terms of, culture, expectations of physicians, acceptance of technology and demographic characteristics of respondents.

Many studies have examined satisfaction of workers in a general perspective. Very few studies have focused specifically on physicians using technology-oriented databases in

multispecialty hospitals. Moreover, there are very few studies which have focused on successful implementation of technology and post-implementation impact of EHR technology on job characteristics and satisfaction of service-providers. Such gaps have been found to be existing in the context of both developed and developing economies. The available literature reveals that willingness of physicians in adopting electronic technology is not very high.

The present study attempts to identify factors which are critical for successful implementation of technology, in the context of tertiary-level multispecialty hospitals in India. It examines if these factors impact job characteristics and job satisfaction of physicians. It also identifies and analyzes the factors which affect data management during post-implementation phase of usage of EHR technology in hospitals.

Concluding remarks

This chapter presents a brief summary of literature related to EHR and its modules. Various aspects of data management using information technology have been elaborated. Literature related to job characteristics and satisfaction of health care service providers has been reviewed. Literature related to factors responsible for successful implementation of EHR technology and its post-implementation impact has also been reviewed. Based on review of literature, research gaps and a statement of problem have also been presented.

Chapter – III

Research Methodology

3.1 Introduction

Every research needs to be well planned. To carry out the research in a systematic and scientific manner, suitable research methodology needs to be developed. This chapter details the overall research design, including the methodology adopted for carrying out research work. It incorporates universe of study, sampling design, questionnaire formation, data collection, techniques of data analysis, sample profile of physicians using EHR technology and results of pilot-testing. In the present study, review of literature has led to conceptualization of a research framework and subsequent formulation of hypotheses for empirical testing. The collected data has been analyzed with the help of SPSS version 21.0 to validate the research framework. The statistical tools used for data analysis have been reported.

3.2 Phases of research

The research process has been carried out in the following four phases:

Phase I: Understanding the existing perspective

Existing literature on impact of EHR in health care industry has been explored. The surveyed literature includes studies covering success factors related to implementation of technology and post-implementation impact of EHR on data management. Identification of variables has been done in this phase.

Literature related to job characteristics and job satisfaction of physicians has also been reviewed thoroughly to understand the need for digitalization of data in hospitals. Studies related to impact of EHR on job characteristics and job satisfaction of physicians, have also been reviewed.

Phase II: Assessment of perspective of physicians

In this phase, physicians' perspectives have been assessed by administering a questionnaire to assess critical factors related to implementation of technology. Impact of EHR on data management, in the post-implementation phase, has also been assessed. Impact of EHR technology on job characteristics and job satisfaction of physicians has been studied through a questionnaire designed on the basis of review of literature and validation by academicians and experts from healthcare sector.

Phase III: Pilot testing of study instrument

The third phase of research involved pilot testing of study instrument before its use for final data collection. A sample of 80 respondents has been used to test the reliability and validity of the instrument.

Phase IV: Developing a research framework

Impact of EHR on job characteristics and job satisfaction of physicians of multispecialty hospitals has been observed. Primary data has been collected and analyzed with the help of SPSS® 21.0. A framework for studying impact of EHR on job characteristics and job satisfaction of physicians has then been proposed.

3.3 Research design

A well-structured questionnaire, based on a five-point Likert scale, has been used as a primary instrument for data collection. Exploratory, descriptive and confirmatory cross-sectional survey design has been used.

Statistical tools, namely, exploratory factor analysis, multiple regression analysis and chi-square tests have been used in data analysis. Exploratory factor analysis has been used to identify factors. Multiple regression analysis has been used to examine the impact of EHR technology on physicians. Explanatory cross-sectional survey design has been used to test hypotheses.

3.3.1 Research objectives

Objectives of the study are:

(i) Implementation phase

1. To identify the critical success factors with respect to implementation of EHR technology in hospitals

2. To examine the impact of identified critical success factors on job characteristics of physicians

3. To analyze the impact of identified critical success factors on job satisfaction of physicians

(ii) Post-implementation phase

4. To identify the data management factors in the post-implementation phase of EHR technology

5. To examine the impact of identified data management factors on job characteristics of physicians

6. To analyze the impact of identified data management factors on job satisfaction of physicians

3.3.2 Research hypotheses

Following hypotheses have been proposed:

H1: There is a significant impact of critical success factors, with respect to implementation of EHR technology, on job characteristics of physicians

H2: There is a significant impact of critical success factors, with respect to implementation of EHR technology, on job satisfaction of physicians

H3: There is a significant impact of identified data management factors on job characteristics of physicians

H4: There is a significant impact of identified data management factors on job satisfaction of physicians

3.3.3 Population and respondents

The scope of the present study has been limited to Punjab's multi-specialty hospitals using EHR technology. The healthcare sector, for the purpose of this study, refers to multispecialty healthcare service-providers of Punjab that provide tertiary-care services. The sector and the state have been selected on grounds of a technology-focused environment, familiarity of the researcher and easy access to respondents.

Punjab has better healthcare outcomes as compared to other Indian states (Gill et al., 2010). The state is home to some of the leading hospitals and medical research institutes in the country. According to Invest Punjab report (2015), private medical care is the chief health service-provider in the state covering 90 percent cases of non-hospitalized care and over two-thirds of the cases related to hospitalized care. The state government has been working on modernization of healthcare, with a focus on tertiary-care, by increasing the participation of private sector. Despite high costs, even poor consumers of the state are turning to private health service-providers (Garg, 2010). This shows that either households in Punjab lack faith in quality of public health care system or they have adequate resources to use private facilities (Kapur, 2011).

According to physicians and other practitioners, five districts, namely, 'Mohali', 'Ludhiana', 'Amritsar', 'Patiala' and 'Bathinda' together account for around 70-80% of the total base of multispecialty hospitals providing tertiary-care in the state. Therefore, physicians of multispecialty hospitals, located in the five mentioned districts, comprise the universe of study.

Factors related to implementation of EHR technology have been extracted in the study. Factors related to data management, in the post-implementation phase of usage of EHR technology, have also been extracted. Impact of EHR on the constructs of 'job characteristics' and 'job satisfaction' of physicians, has then been analyzed.

3.3.4 Sample and sampling design

A total of 350 questionnaires have been administered, between March and September 2016, to physicians of multispecialty hospitals located in Punjab, out of which 280 completely

filled questionnaires comprise the sample of the study. As a thumb rule, sample size should be at least five to seven times the number of variables to be analyzed (Hair et al, 2007). Since there are 15 final variables in the questionnaire for physicians, a sample of 280 physicians has been considered adequate for the study. As per the geographical location of hospitals in the state, 'Mohali' and 'Ludhiana' have comparatively more number of hospitals using EHR technology. As per the availability of respondents, 80 respondents each from 'Mohali' and 'Ludhiana' district, 50 respondents each belong to 'Patiala' and 'Amritsar' district and 20 respondents from 'Bathinda' district have been included in the sample. Table 3.1 presents name of districts, hospitals and number of respondents belonging to each hospital.

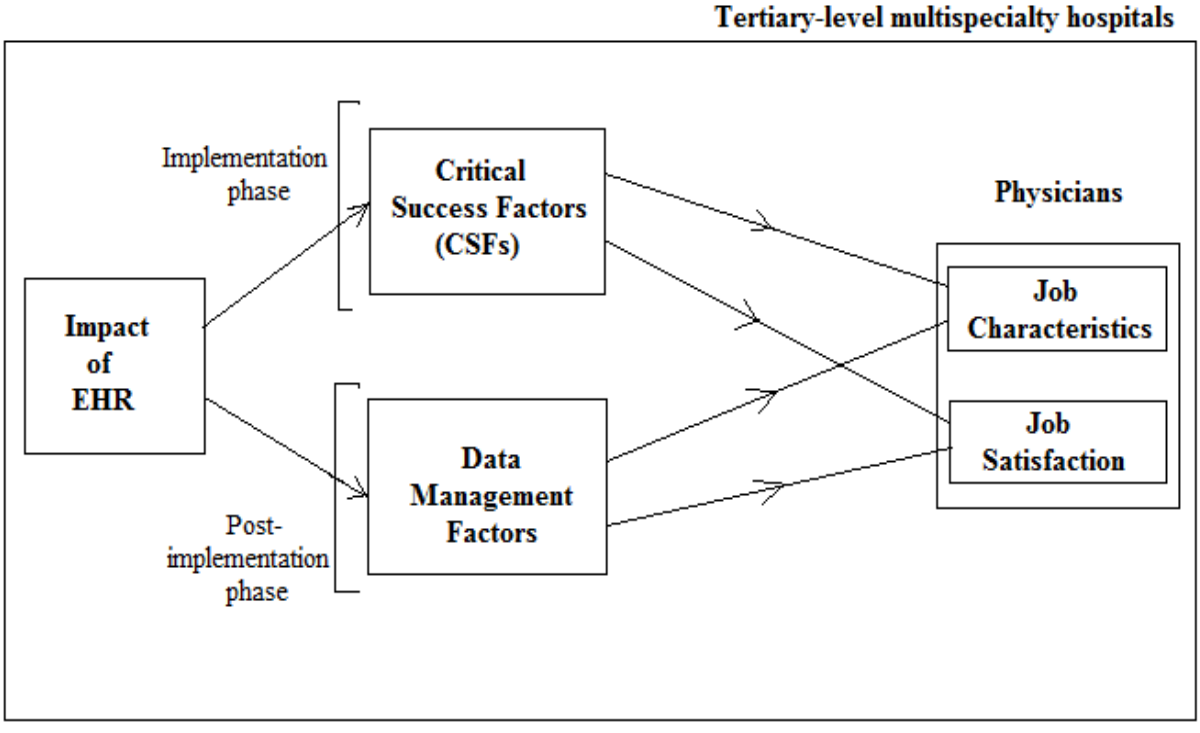
Respondents for this study were not easily available and contactable. Enumeration of all members was also nearly impossible. Therefore, convenience sampling technique has been adopted. This technique is often used for exploratory research work in social sciences where population is a non-probability sample, and respondents are chosen on basis of availability (Babbie, 1990; Zikmund, 1997). A structured questionnaire, based on a five-point Likert scale, has been used to collect primary data.

Table 3.1: Districts, hospitals and number of respondents

S.No.	District	Hospitals	Number of Respondents
1	Amritsar	Apollo Hospital, Fortis Hospital	15 + 35
2	Bathinda	Max Hospital	20
3	Ludhiana	Christian Medical College, Apollo Hospital	50 + 30
4	Mohali	Max Hospital, Fortis Hospital	35 + 45
5	Patiala	Amar Hopital, Columbia Asia Hospital	22 + 28

3.3.5 Theoretical Framework

Figure 3.1 depicts the proposed theoretical framework. The framework examines the impact of EHR, on the constructs of 'job characteristics' and 'job satisfaction' of physicians.



(Source: developed for this study)

Figure 3.1 Proposed theoretical framework: Impact of EHR on job characteristics and job satisfaction of physicians

According to the proposed framework, there could be some factors which are critical for the success of EHR technology implementation. These factors have been referred to as critical success factors (CSFs) in the framework. There could also be some factors related to data management which may affect post-implementation phase of usage of EHR technology. These factors have been called data management factors in the framework. The study examines whether the CSFs and data management factors impact 'job characteristics' and 'job satisfaction' of physicians.

3.3.6 Construction of questionnaires and data collection

Qualitative as well as quantitative information has been gathered through primary and secondary sources. Primary data has been collected from physicians using EHR technology, through a pre-tested, structured and non-disguised questionnaire.

Introductory questions relate to 'computer knowledge' and duration of 'EHR usage per week'. Four main constructs have been analyzed in the study. First construct relates to success factors in the implementation phase of EHR. The second construct represents data management in the post-implementation phase of usage of EHR technology. The third construct relates to job characteristics and the fourth one represents job satisfaction of physicians. All measures have been assessed for content validity, using expert opinions.

The first construct, representing success factors in the implementation phase, is based on 25 items. Eight items of the construct, namely, 'IT consultants are provided for better understanding', 'training is provided to handle, secure, enter and retrieve data', 'an IT person is available for updating software', 'better working group and user engagement has been established', 'effective leadership and team work has been practiced', 'top management is always interested in financing and deploying technology' and 'I feel culture of the hospital is cooperative', have been borrowed from literature as such. Various studies, related to technology implementation, have used the same measures to represent success factors (Ajami & Bagheri, 2013; Holden, 2011; Loomis et al., 2002; Safdari, Ghazisaeidi & Jebraeily, 2015). Nine items of the construct, namely, 'organization provides high security and confidentiality of information', 'sufficient funds are provided for EHR implementation', 'management provides good hardware and strong network infrastructure', 'I was involved in choosing or customizing the software', 'proper maintenance of software and database is done', 'easy and fast softwares are developed for providing better understanding and reduction in complexity', 'system is user friendly', 'high speed information processing is provided' and 'exchange of information between sectors is fast', have been adapted and modified as per need of the study. Various studies have used similar kind of statements to represent technology implementation (Crownower & Rosenbaum, 2002; Loonam & McDonagh, 2005; Meinert, 2004; Moon, 2007). Eight items of the construct, namely, 'I feel reluctant to change from paper based records to electronic records', 'I am in high spirits while using technology', 'I easily adapt to new technology', 'I participate in the implementation of system', 'I have a positive attitude in accepting technology', 'I am well versed with knowledge of Database Management Systems', 'I have a good knowledge of Microsoft Office, internet, operating systems, hardware and software' and 'I can retrieve lost data from a crashed system easily', have been included afresh because they appear to be

important in successful implementation of EHR technology, though references to these items were not found in literature.

The second construct representing data management in the post-implementation phase of usage of EHR technology consists of 19 items. Six items of the construct, namely, 'with the use of EHR, high quality medicine is practiced', 'status of metadata is described with the use of e-records', 'data available using EHR is inconsistent', 'EHR provide consistency between items of multiple data from multiple sources', 'complete view of records, images, tests and referrals is available using EHR' and 'EHR show the source and context of data', have been taken as such from the literature. Various studies, related to data management by use of EHR, have used the same measures (Bartini et al., 2009; Eckerson, 2002; Tee et al., 2007; Wang et al., 2001). Eight items of the construct, namely, 'EHR are easy to use interfaces', 'EHR provide appropriate form of data available', 'privacy from unauthorized users is strictly maintained with the use of EHR', 'time of entry and retention is stated using EHR', 'instant data is available on all systems with the use of EHR', 'EHR are easy and intuitive', 'duplication of data during documentation is removed using EHR' and 'reduction in error free interpretation of data using EHR is observed', have been adapted and modified as per need of the study. Various studies have used similar kind of statements to represent data management (Alizamini et al., 2010; Bartini et al., 2009; Man et al., 2010). Five items of the construct, namely, 'EHR reduce wrong prescription of medicines, tests and images', 'EHR provide fast access to records', 'EHR increase operational speed in ordering of lab tests, referrals and imaging study', 'EHR enable quick prescription of medicine and diagnostic tests' and 'EHR provide real time data exchange between physicians of various departments', have been included because they appeared to be important for data management in post-implementation phase of usage of EHR technology.

Job characteristics model (JCM), (Hackman & Oldham, 2005) has been used to develop a construct on job characteristics. 15 statements have been adapted and included in this construct. The job characteristics theory proposes a model of five 'core' job characteristics, namely, 'task significance', 'task identity', 'skill variety', 'feedback' and 'autonomy', which have been explained next.

1. Task significance – An individual's consciousness for a particular task is defined as task significance (Janson, and Purdy, 1978). Statements included to represent 'task significance' are, namely, 'my job is relatively significant in my hospital', 'my job is important in broader scheme of things' and 'my job is one where a lot of other people can be affected by how well the work gets done'.
2. Task identity – Identity of task enables an employee to fulfill all necessary functions required to accomplish a task (Balkin, & Cardy, 2008). Statements included to representing 'task identity' are, namely, 'my job is arranged so that I often have the opportunity to see jobs or projects through to completion', 'my job is arranged so that I have the opportunity to complete the work I start' and 'my job is arranged so that I have the chance to do a job from the beginning to the end'.
3. Skill variety – Variety in skills is defined as the comprehensiveness and qualities required to perform a particular task (Buys et al., 2005). Statements chosen to represent 'skill variety' are, namely, 'my job provides much variety', 'my job provides different responsibilities' and 'my job provides me considerable variety of work'.
4. Feedback – Feedback characteristic of job means that an employee gets clear and transparent revert of his/her job performance (Hunter, 2006). Statements included to represent 'feedback' are, namely, 'my job provides feedback on how well I am doing as I am working', 'my job enables me to find out how well I am doing' and 'my job provides me with the feeling that I know whether I am performing well or not'.
5. Autonomy – The job aspect which provides independence and authority, while taking decisions, is known as autonomy (Buys et al., 2007). Statements chosen to represent 'autonomy' are, namely, 'my job permits me to be left on my own to do my work', 'my job gives me considerable opportunity for independence and freedom in how I do the work' and 'my job provides an opportunity for independent thought and action'.

The fourth construct on job satisfaction consists of three statements, namely, 'overall, I am satisfied with my job', 'I would not prefer another job' and 'I am satisfied with important aspects of my job'. These statements have been adapted (Bontis, Richards & Serenko, 2011), on the basis of suitability and extent of citation in literature.

All four constructs have been tested for validity and reliability. Likert scale has been used in all constructs.

Data related to demographic variables, namely, 'age', 'educational level' and 'gender', has been collected. Information related to other variables, namely, 'work area' and 'designation', have also been captured.

Data has been collected by administering questionnaires to physicians. Respondents have been approached personally. The purpose of questionnaire was explained and help was extended to them, wherever required, for filling the questionnaire. Table 3.2 presents the sections, type of response and purpose of each section. The questionnaire has been shown as an appendix.

Table 3.2: Structure of questionnaire

Section	***Gist of questions in the section***	***Type of response***	***Purpose***
A	Introductory questions	Multiple categories	To collect information related to computer knowledge and EHR usage
B	Statements related to critical success factors for implementation of EHR technology	Five-point Likert scale	To identify factors affecting successful implementation of technology
C	Statements related to factors of data management in post-implementation phase of usage of EHR technology	Five-point Likert scale	To identify factors affecting data management in the post-implementation phase of usage of EHR technology
D	Statements related to job characteristics of physicians	Five-point Likert scale	To collect responses for parameters related to job characteristics
E	Statements related to job satisfaction of physicians	Five-point Likert scale	To collect responses for parameters related to job satisfaction
F	Demographic and other information Age, educational level, gender, work area, designation	Multiple categories	To collect demographic data and other information of respondents

3.4 Validity and reliability testing of the constructs

Validity of all constructs, having scale items, has been tested. Convergent validity has been established by observing the item/factor loadings. High item/factor loading indicates that items are highly correlated with each other. If factor loadings of the items on the same construct, as in rotated component matrix, are more than 0.5, it states that those constructs possesses construct validity through convergent validity (Hair et al, 2007). Items for which factor loading is less than 0.5 have been eliminated from the respective construct.

Reliability analysis has been carried out by using 'Cronbach's coefficient alpha' which indicates internal consistency for a multiple-item scale. It is based on the mean correlation of each item in the scale with every other item. It is typically used when there are several Likert-scale items that are summed to take a composite score or a summated scale (Hair et al, 2007). High value of 'Cronbach's coefficient alpha' suggests that the scale possesses a high internal consistency. However, an alpha co-efficient value of about 0.7 has generally been accepted as showing a high level of homogeneity with scale items to assist in determining whether they have a single dimension (Hair et al., 2005).

The questionnaire has been pre-tested on a sample of 80 physicians. It has helped in modifying the questionnaire usefully. The final questionnaire, as administered to the respondents, has been shown in Appendix I.

Item loadings for the test of validity and values of 'Cronbach's Coefficient Alpha' for the test of reliability, with respect to the construct representing 'CSFs', have been shown in Table 3.3.

Table 3.3: Validity and reliability analysis of construct representing CSFs

Name of the construct (Value of Cronbach's coefficient alpha)	Statements	Item loadings
Critical success factors (0.810)	IT consultants are provided for better understanding	0.894
	Training is provided to handle, secure, enter and retrieve data	0.711
	An IT person is available for updating software	0.887
	Better working group and user engagement has been established	0.742
	Effective leadership and team work has been practiced	0.691
	The top management is always interested in financing and deploying technology	0.693
	Top management encourages physicians to use new technology	0.851
	I feel culture of the hospital is cooperative	0.725
	Organization provides high security and confidentiality of information	0.692
	Sufficient funds are provided for EHR implementation	0.762
	Management provides good hardware and strong network infrastructure	0.795
	I was involved in choosing or customizing the software	0.832
	Proper maintenance of software and database is done	0.765
	Easy and fast softwares are developed for better understanding and reduction in complexity	0.652
	The system is user friendly	0.761
	High speed information processing is provided	0.711
	Exchange of information between sectors is fast	0.884
	I feel reluctant to change from paper based records to electronic records	0.752
	I am in high spirits while using technology	0.701
	I easily adapt to new technology	0.665
	I participate in the implementation of system	0.641
	I have a positive attitude in accepting technology	0.551
	I am well versed with knowledge of Database Management Systems	0.651
	I have a good knowledge of Microsoft Office, internet, operating systems, hardware and software	0.736
	I can retrieve lost data from a crashed system easily	0.754

The statements, namely, 'Any query related to software is backed up by user help-desk' and 'Internet connectivity is available for online information', have not been found to be valid and hence, have been removed from the table, and the final questionnaire.

Table 3.4 shows results of validity and reliability analysis of the construct representing factors related to 'data management'.

Table 3.4: Validity and reliability analysis of construct representing factors of data management

Name of the construct (Value of Cronbach's coefficient alpha)	Statements	Item loadings
Data management factors (0.755)	With the use of EHR, high quality medicine is practiced	0.757
	Status of metadata is described with the use of e-records	0.711
	Data available using EHR is inconsistent*	0.699
	EHR provide consistency between items of multiple data from multiple sources	0.689
	Complete view of records, images, tests and referrals is available using EHR	0.632
	EHR show the source and context of data	0.795
	EHR are easy to use interfaces	0.739
	EHR provide appropriate form of data available	0.719
	Privacy from unauthorized users is strictly maintained with the use of EHR	0.565
	Time of entry and retention is stated using EHR	0.511
	Instant data is available on all systems with the use of EHR	0.551
	EHR are easy and intuitive	0.741
	Duplication of data during documentation is removed using EHR	0.736
	Reduction in error free interpretation of data using EHR is observed	0.554
	EHR reduce wrong prescription of medicines, tests and images	0.541
	EHR provide fast access to records	0.593
	EHR increase operational speed in ordering of lab tests, referrals and imaging study	0.811
	EHR enable quick prescription of medicine and diagnostic tests	0.775
	EHR provide real time data exchange between physicians of various departments	0.735

*Ratings on these statements were reverse-scored prior to data analysis.

Table 3.5 shows results of validity and reliability analysis for construct representing 'job characteristics' of physicians.

Table 3.5: Validity and reliability analysis of construct representing job characteristics of physicians

Name of the construct (Value of Cronbach's coefficient alpha)	Name of the sub-constructs (Values of Cronbach's coefficient alpha)	Statements	Item loadings
Job characteristics (0.821)	Task significance (0.794)	My job is relatively significant in my hospital	0.894
		My job is important in broader scheme of things	0.711
		My job is one where a lot of other people can be affected by how well the work gets done	0.887
	Task identity (0.821)	My job is arranged so that I often have the opportunity to see jobs or projects through to completion	0.742
		My job is arranged so that I have the opportunity to complete the work I start	0.691
		My job is arranged so that I have the chance to do a job from the beginning to the end	0.693
	Skill variety (0.798)	My job provides much variety	0.851
		My job provides different responsibilities	0.725
		My job provides me considerable variety of work	0.692
	Autonomy (0.832)	My job permits me to be left on my own to do my work	0.762
		My job gives me considerable opportunity for independence and freedom in how I do the work	0.795
		My job provides an opportunity for independent thought and action	0.832
	Feedback (0.864)	My job provides feedback on how well I am doing as I am working	0.765
		My job enables me to find out how well I am doing	0.652
		My job provides me with the feeling that I know whether I am performing well or not	0.761

Table 3.6 shows results of validity and reliability analysis for construct representing 'job satisfaction' of physicians.

Table 3.6: Validity and reliability analysis of construct representing job satisfaction of physicians

Name of the construct (Value of Cronbach's coefficient alpha)	Statements	Item loadings
Job satisfaction (0.789)	Overall, I am satisfied with my job	0.711
	I would not prefer another job	0.884
	I am satisfied with important aspects of my job	0.752

3.4.1 Descriptive statistics

After successfully entering the data and preparing the SPSS data editor, Exploratory Data Analysis (EDA) has been conducted to explore the nature of data. The objectives of EDA are:

1. To understand the data and the relationship between variables.
2. To examine the extent to which the assumptions are met for the statistical tests to be applied.
3. To see if there are problems in the data such as presence of outliers, distribution being non-normal, any problem with coding and if there are missing values.

Table 3.7: Descriptive statistics of variables in research framework

Statistics	Construct of Critical success factors	Construct of Data management factors	Construct of Job characteristics	Construct of Job satisfaction
N	280	280	280	280
Mean	1.84	2.31	2.38	1.64
Median	2.00	2.20	2.23	1.67
Mode	2.00	2.60	1.67	1.67
Std. Deviation	0.44	0.86	0.96	0.48
Variance	0.19	0.74	0.92	0.23
Skewness	-0.05	0.74	0.68	0.53
Std. Error of Skewness	0.17	0.17	0.17	0.17

Table 3.7 shows the exploratory data analysis with different descriptive statistics like measurement of central tendency, skewness and kurtosis, also being reported.

The assumption of normality has been checked from the above table for descriptive statistics of variables in the research framework. The data is considered normal if the values of mean, median and mode are almost the same and value of skewness must lie between -1 to +1 (Hair et al, 2006). On this basis, the distribution of data can be considered as normal in this study.

3.4.2 Nomological and Discriminant validity

Nomological validity has been established by depicting that the constructs, as represented by the measures, behave according to predictions derived from theory (Hackman & Oldham, 1974). Hair et al. (2005) has also established that nomological validity can be based on the correlation matrix. Table 3.7 provides the indices for the constructs, establishing that all construct correlations are positively related and are significant. It has been observed that correlation (r) values range from 0.19 to 0.51 and are significant at 0.05 level of significance.

Table 3.8: Correlation matrix

	Measurement Models / AVE	**1**	**2**	**3**	**4**
1	**Construct of Critical success factors / 0.52**	**0.72****			
2	**Construct of Data management factors / 0.77**	0.19*	**0.88**		
3	**Construct of Job characteristics / 0.72**	0.41	0.51	**0.85**	
4	**Construct of Job satisfaction / 0.81**	0.46	0.48	0.46	**0.90**

Notes: *AVE = Average Variance Extracted; *Values in the lower half of the matrix are correlations and significant at 0.05 level; **Values in the diagonal of correlation matrix are the square root of AVE.*

Discriminant validity is supported when the shared variance between any two constructs is less than the square root of the AVE of the items measuring the respective constructs (Hair *et al*., 2010). Table 3.8 also shows evidence for discriminant validity for all the constructs.

The constructs have been found to be reliable, and also the face validity, discriminant validity and nomological validity have been met.

3.5 Data analysis

Data has been analyzed with the help of SPSS® 21.0. Statistical tools like exploratory factor analysis, multiple regression analysis and chi-square analysis have been used in the study.

3.5.1 Factor analysis

Factor analysis is a method to identify underlying factors from an array of apparently important variables (Hair et al., 2006). It is a set of techniques, which, by analyzing correlations among variables, reduces their number into smaller number of factors, which explain much of the original data, more efficiently. It relieves the researcher from confusion arising through overlapping measures of same underlying variables (Kim & Mueller, 1978; Nargundkar, 2005).

Exploratory factor analysis has been used to identify critical factors related to the implementation phase of EHR technology. Various factors related to data management in the post-implementation phase of usage of EHR technology, have also been extracted. Measures of sample adequacy such as Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity have been calculated. Principal axis factoring with varimax rotation method has been used for extracting the factors. Statements with factor loadings greater than value 0.50 have been considered for extraction of factors (Hair et al., 2006). Factors having eigen value, of one or more than one, have been extracted.

3.5.2 Regression analysis

This analytical tool allows a researcher to examine a set of relationships between independent and dependent variables. If there is one dependent and one independent variable, simple regression analysis can be used. In case of one dependent and more than one independent variables, multiple regression analysis has to be used (Field, 2005). The objective of regression analysis is to use predictor variables to predict value of dependent variable(s). This tool has been used to study the impact of EHR, in implementation and post-implementation phases, on job characteristics and job satisfaction of physicians.

3.5.3 Chi-square analysis

Chi-square analysis is used to measure differences between what is observed and what is expected. It explains whether or not two attributes are associated (Greenwood and Nikulin, 1996). This tool has been used in analysis of relationships of 'computer knowledge' and 'EHR usage per week' with respect to all demographic variables and two other variables, namely, 'work area' and 'designation'.

3.6 Profile of respondents

Background information of 280 physicians with respect to district, work area, designation, age, computer knowledge, educational level, gender and EHR usage per week, has been presented below.

Table 3.9 displays district-wise distribution of respondents.

Table 3.9: District-wise distribution of respondents

District	**Number and (percentage) of respondents**
Amritsar	50 (17.85)
Bathinda	20 (7.14)
Ludhiana	80 (28.57)
Mohali	80 (28.57)
Patiala	50 (17.85)
Total	**280**

Note: In this table and subsequent tables, figures without parentheses indicate frequencies, and figures in parentheses represent percentages out of the column total.

Majority of respondents belong to Ludhiana and Mohali (28.57% each), followed by respondents from Amritsar and Patiala districts (17.85% each). The remaining respondents (7.14%) belong to Bathinda.

District-wise distribution of respondents has also been depicted in figure 3.2.

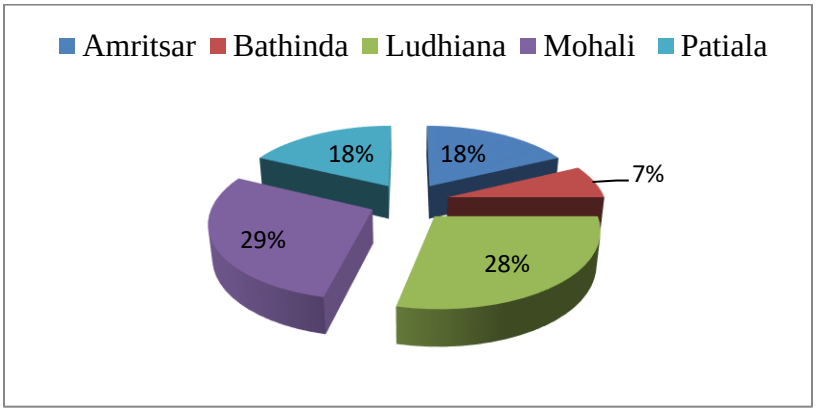


Figure 3.2: District-wise distribution of respondents

Table 3.10 displays work area-wise distribution of respondents.

Table 3.10: Work area-wise distribution of respondents

Work area	**Number and (percentage) of respondents**
Emergency ward	5 (1.78)
Intensive care unit	45 (16.07)
Operation theatre personnel	56 (20)
General ward	77 (27.5)
Out-patient department	97 (34.64)
Total	**280**

The table shows that most of the respondents (34.64%) belong to 'out-patient department'. This is followed by respondents from 'general ward' (27.5%), 'operation theatre personnel' (20%), 'intensive care unit' (16.07%) and 'emergency ward' (1.78%).

Work area-wise distribution of respondents has also been illustrated in figure 3.3.

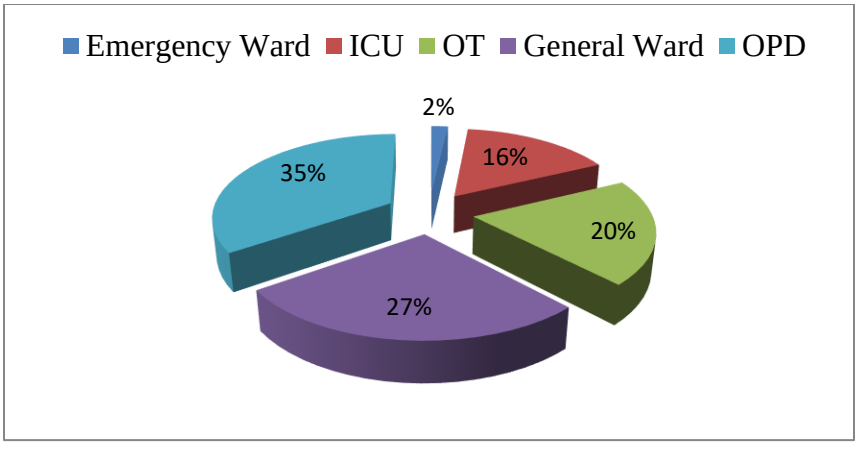


Figure 3.3: Work area-wise distribution of respondents

Table 3.11 illustrates designation-wise distribution of respondents.

Table 3.11: Designation-wise distribution of respondents

Designation	**Number and (percentage) of respondents**
Professor	7 (2.5)
Associate Professor	14 (5)
Assistant Professor	3 (1.07)
Senior Resident	143 (51.07)
Junior Resident	113 (40.35)
Total	**280**

The table shows that most of the respondents (51.07%) are 'senior residents'. This is followed by respondents who are 'junior residents' (40.35%), 'associate professors' (5%), 'professors' (2.5%) and 'assistant professors' (1.07%).

Designation-wise distribution of respondents is also depicted in figure 3.4.

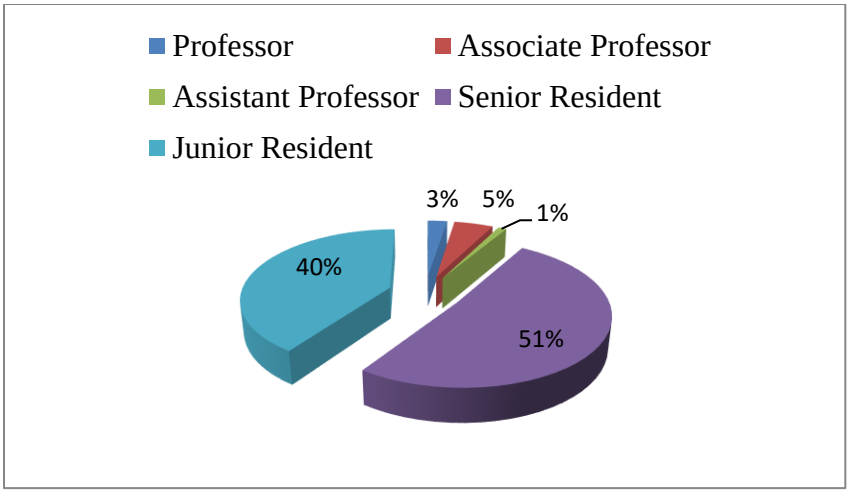


Figure 3.4: Designation-wise distribution of respondents

Age-wise distribution of respondents is shown in table 3.12.

Table 3.12: Age-wise distribution of respondents

Age	**Number and (percentage) of respondents**
20-30 years	66 (23.57)
30-40 years	47 (16.78)
40-50 years	36 (12.85)
50-60 years	66 (23.57)
60 years and more	65 (23.21)
Total	**280**

The table reveals that greater number of respondents (23.57% each) fall in the age-group of '20-30 years' and '50-60 years'. This is followed by respondents in the age-groups of '60 years and more' (23.21%), '30-40 years' (16.78%) and '40-50 years' (12.85%).

Age-wise distribution of respondents is also shown in figure 3.5.

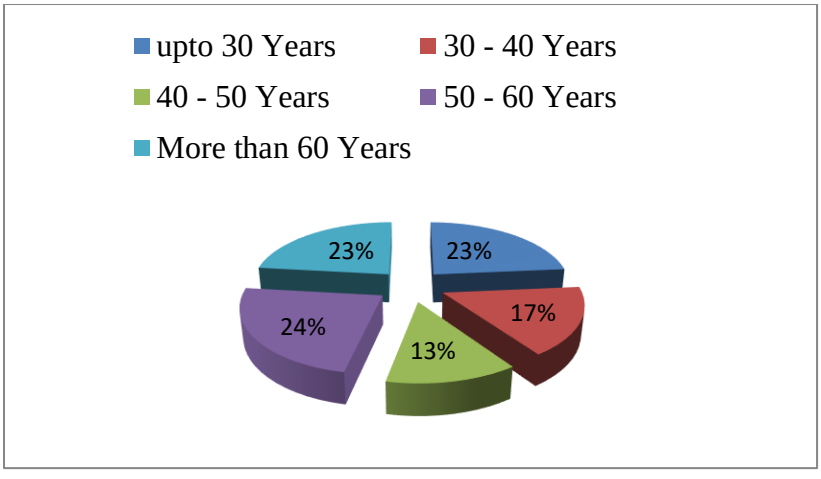


Figure 3.5: Age-wise distribution of respondents

Table 3.13 depicts computer knowledge-wise distribution of respondents.

Table 3.13: Computer knowledge-wise distribution of respondents

Computer knowledge	**Number and (percentage) of respondents**
Novice/ Beginner	97 (34.64)
Conversant	89 (31.78)
Expert	94 (33.57)
Total	**280**

The table shows that most of the respondents (34.64%) are 'novice/beginners' in computer knowledge. This is followed by respondents who claim to be 'experts' (33.57%) and 'conversant' (31.78%).

Distribution of respondents, on the basis of computer knowledge, is also shown in figure 3.6.

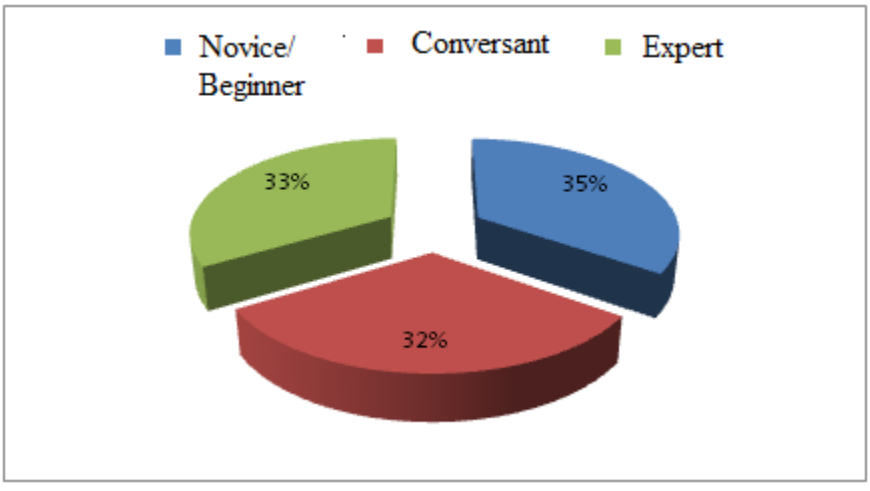


Figure 3.6: Computer knowledge-wise distribution of respondents

Table 3.14 displays educational level-wise distribution of respondents.

Table 3.14: Educational level-wise distribution of respondents

Educational level	**Number and (percentage) of respondents**
MBBS	96 (34.28)
MBBS-MD	91 (32.5)
DM/MCH	93 (33.21)
Total	**280**

The table reveals that most of the respondents (34.28%) have 'MBBS' as their educational qualifications. This is followed by respondents who have 'DM/MCH' (33.21%), and 'MBBS-MD' (32.5%) qualification.

Educational level-wise distribution of respondents is also shown in figure 3.7.

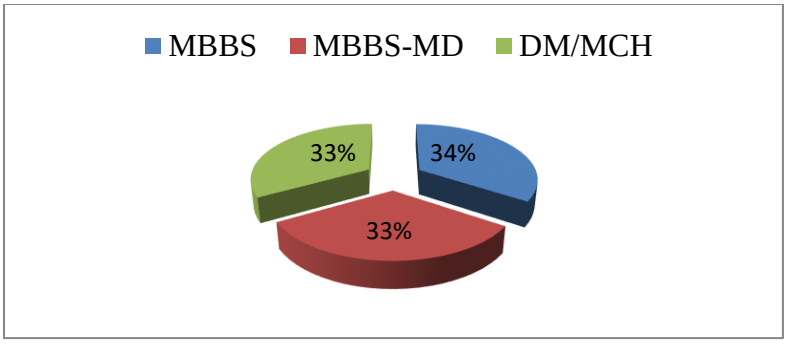


Figure 3.7: Educational level-wise distribution of respondents

Table 3.15 depicts gender-wise distribution of respondents.

Table 3.15: Gender-wise distribution of respondents

Gender	**Number and (percentage) of respondents**
Male	161 (57.5)
Female	119 (42.5)
Total	**280**

As per the table, 57.5 per cent of the respondents in the sample are males while 42.5 per cent of them are females.

Gender-wise distribution of respondents is also shown in figure 3.8.

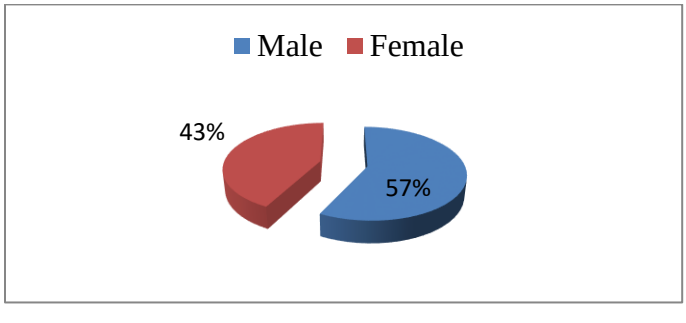


Figure 3.8: Gender-wise distribution of respondents

EHR usage-wise distribution of respondents is shown in table 3.16.

Table 3.16: EHR usage-wise distribution of respondents

EHR usage per week	Number and (percentage) of respondents
Up to 5 hours	68 (24.28)
5 - 10 hours	109 (38.92)
10 - 15 hours	79 (28.21)
More than 15 hours	24 (8.57)
Total	**280**

The table reveals that most of the respondents (38.92%) use EHR for '5-10 hours/week'. This is followed by (28.21%) respondents using EHR for '10-15 hours/week', (24.28%) 'up to 5 hours' and (8.57%) 'more than 15 hours' per week.

Distribution of respondents, on the basis of 'EHR usage per week', is also shown in figure 3.9.

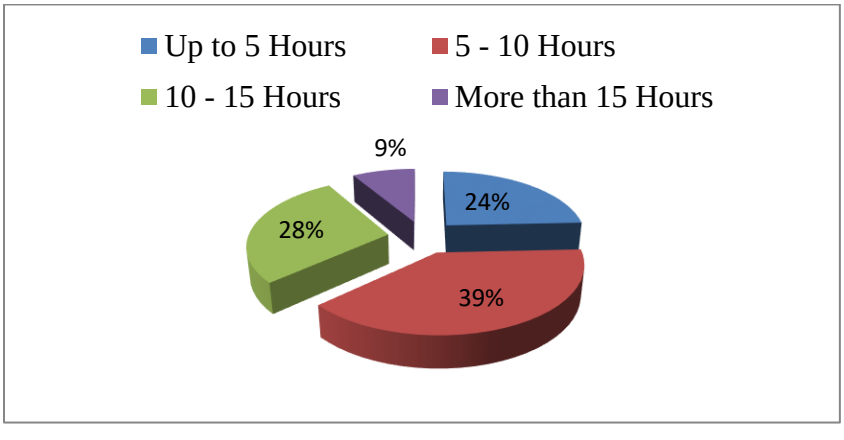
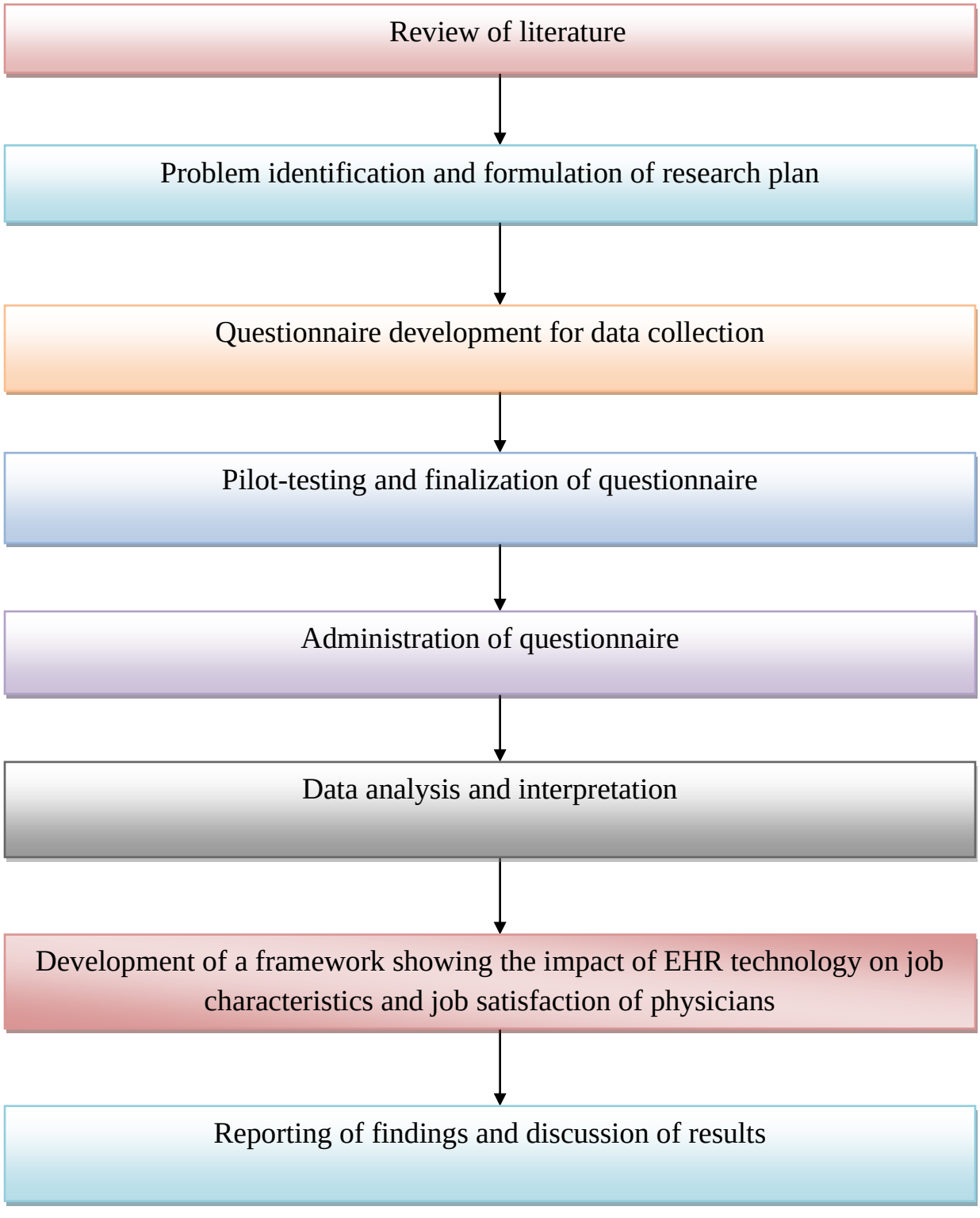


Figure 3.9: EHR usage-wise distribution of respondents

3.7 Research flow diagram



Concluding Remarks

The research design for the study has been presented in this chapter. Sections on research objectives, research framework, theoretical research framework, and hypotheses have been included. Research methodology, sampling plan, questionnaire design, validation, pilot testing, questionnaire administration and quantitative analytical tools have been elaborated. Next chapter presents data analysis and findings of the study.

Chapter – IV

Data Analysis and Interpretations

4.1 Introduction

This chapter presents the statistical analysis of data and reports the findings. Data has been analyzed with help of SPSS® 21.0. A framework for impact of EHR on job characteristics and job satisfaction of physicians in multispecialty hospitals has been proposed. Exploratory factor analysis and multiple regression analysis have been used to validate the proposed framework. The relationships of 'computer knowledge' and 'EHR usage per week' with demographic and other variables have been analyzed with the help of chi-square analysis.

This chapter has been organized in various sections. Extraction of critical success factors in the implementation phase of EHR has been presented in section 4.2. Results of multiple regression analysis related to impact of CSFs on job characteristics of physicians have been reported in section 4.3. Section 4.4 collates results of multiple regression analysis related to impact of CSFs on job satisfaction of physicians. Section 4.5 presents identification of data management factors related to the post-implementation phase of usage of EHR technology. Results of multiple regression analysis for impact of data management factors on job characteristics of physicians have been reported in section 4.6.

Section 4.7 presents impact of each identified data management factor on job satisfaction of physicians. Relationship of 'computer knowledge' with respect to 'EHR usage per week' has been analyzed in section 4.8. Section 4.9 presents relationships of 'computer knowledge' with demographic variables, namely, 'age', 'educational level', 'gender' and other variables, namely, 'designation', 'work area'. Relationships of 'EHR usage' with demographic and other variables have been presented in section 4.10. These variables have been considered to be important on the basis of review of some earlier studies and also opinions of academicians and practitioners in the area.

4.2 Critical success factors related to implementation phase of EHR

This section presents the findings related to the first objective of study, as mentioned next.

Objective 1: To identify the critical success factors with respect to implementation of EHR technology in hospitals

Factors which are critical for success of technology implementation have been extracted.

Success in implementation of EHR has been measured using a validated construct of 25 statements representing related domains such as 'IT consultants' (Safdari, Ghazisaeidi & Jebraeily, 2015), 'appropriate team work' (Ang, Sum & Yeo, 2002), 'administrative support' (Al-Mashari, Al-Mudimigh & Zairi, 2003), 'organization culture' (Gunasekaran & Abthorpe, 2004), 'confidentiality' (Wei & Wang, 2004), 'quality of software' (Shehab et al., 2004), 'self motivation' (Yusuf, Gunasekaran & Abthorpe, 2004), 'change management' (Hong & Kim, 2002), 'clear goals' (Umble & Haft, 2003), 'strategic planning' (Somers & Nelson, 2004) and 'IT legacy systems' (Holland & Light, 1999).

4.2.1 Extraction of CSFs related to implementation of EHR technology

Exploratory factor analysis has been used for extracting critical success factors related to implementation of EHR technology. Respondents have been requested to give responses on a five-point Likert scale to various statements affecting success in technology implementation.

Table 4.1 presents values of Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity. KMO measures the sampling adequacy (which determines if the responses given with the sample are adequate or not) which should be more than 0.5 for proceeding with factor analysis. Kaiser (1974) recommended that KMO should have a minimum value of 0.5. Any value between 0.7-0.8 is good and a value above 0.9 is considered to be excellent. Measures of sample adequacy (KMO value is 0.819) and Bartlett's test of Sphericity (approx chi-square 28347.230, degrees of freedom 897, significance .00) have shown that factor analysis can be applied.

Table 4.1: Kaiser-Meyer-Olkin and Bartlett's test of Sphericity for CSFs

Kaiser-Meyer-Olkin		0.819
Bartlett's test of Sphericity	**Approximate Chi-square**	28347.230
	Degree of freedom	897
	Significance	.000

The method of principal axis factoring, with varimax rotation method, has been used for extracting factors. Factors, with eigen values of one or more than one, have been extracted. Five factors, namely, 'training', 'acceptance to change', 'organizational support', 'software attributes' and 'computer knowledge', cumulatively explaining 69.08 per cent of total variance, have been extracted.

Table 4.2 presents the results of factor analysis for all extracted factors. It has been observed that five CSFs have a significant impact on implementation of EHR technology.

Table 4.2: Results of factor analysis related to CSFs in implementation phase of EHR

Names of CSFs	Statements	Eigen values	Explained variance
Training	IT consultants are provided for better understanding	5.154	17.487
	Training is provided to handle, secure, enter and retrieve data		
	An IT person is available for updating software		
	Better working group and user engagement has been established		
	Effective leadership and team work has been practiced		
Organizational support	The top management is always interested in financing and deploying technology	4.765	15.512
	Top management encourages physicians to use new technology		
	I feel culture of the hospital is cooperative		
	Organization provides high security and confidentiality of information		
	Sufficient funds are provided for EHR implementation		
	Management provides good hardware and strong network infrastructure		
Software attributes	I was involved in choosing or customizing the software	4.206	12.977
	Proper maintenance of software and database is done		
	Easy and fast softwares are developed for better understanding and reduction in complexity		
	The system is user friendly		
	High speed information processing is provided		
	Exchange of information between sectors is fast		
Acceptance to change	I feel reluctant to change from paper based records to electronic records	3.503	10.764
	I am in high spirits while using technology		
	I easily adapt to new technology		
	I participate in the implementation of system		
	I have a positive attitude in accepting technology		
Computer knowledge	I am well versed with knowledge of Database Management Systems	3.021	8.342
	I have a good knowledge of Microsoft Office, internet, operating systems, hardware and software		
	I can retrieve lost data from a crashed system easily		

Names of CSFs have been chosen on the basis of statements which have been found to be closely related. The available literature further explains the meaning of each success factor, which has been collated ahead.

Factor 1: Training

Training has been identified as the first factor affecting success in implementation of technology. Statements that significantly load on this factor are 'IT consultants are provided', 'training is provided to handle, secure, enter and retrieve data', 'IT person is available for updating software', 'better working group and user engagement' and 'effective leadership, team work'. A study by Leonard (2007) also supports that these statements represent the construct appropriately.

Factor 2: Organizational support

It has been identified as the second factor affecting success in implementation of technology. Six statements for which factor loading has been found to be significant are 'top management is interested in financing and deploying technology', 'administration encourages physicians to use new technology', 'better cooperative culture', 'organization provides high security and confidentiality of information', 'sufficient funds' and 'management provides good hardware and strong network infrastructure'. A study by Miller & Sim (2004) has also shown that these aspects affect success in implementation of technology.

Factor 3: Software attributes

The third factor affecting success in implementation of technology has been named as 'software attributes'. Six statements, namely, 'involvement of physicians in choosing or customizing the software', 'proper maintenance of software and databases', 'easy and fast software for better understanding and reduction in complexity', 'friendly system', 'high speed information processing' and 'fast exchange of information', significantly load on this factor. Findings from Haughom, et al. (2011) have also shown that 'software attributes' are an important determinant of success in implementation of technology.

Factor 4: Acceptance to change

It has been identified as the fourth factor affecting success in implementation of technology. Five statements which have significantly loaded on this factor are 'reluctant to change', 'high spirit while using technology', 'easily adapt to new technology', 'participation in

implementation of system' and 'positive attitude'. A study by Gagnon (2009) has also shown that these attributes are significant determinants of success in implementation of technology.

Factor 5: Computer knowledge

Computer knowledge has been identified as the fifth factor affecting success in implementation of technology. Statements which significantly load on this factor are 'well versed with knowledge of Database Management Systems', 'good knowledge of Microsoft Office, internet, operating systems, hardware and software' and 'easy retrieval of lost data from a crashed system'. A study by Safdari, et al. (2015) also supports that these statements are a good representation of 'computer knowledge'.

4.3 Impact of CSFs on job characteristics of physicians

This section presents the findings related to second objective.

Objective 2: To examine the impact of identified critical success factors on job characteristics of physicians

Regression analysis has been performed to examine if a relationship exists between 'CSFs' and 'job characteristics'. The related hypothesis is given below:

H1: There is a significant impact of critical success factors, with respect to implementation of EHR technology, on job characteristics of physicians

Table 4.3: Descriptive statistics for CSFs and job characteristics

Variable	Mean	Standard deviation
Training	2.07	0.44
Acceptance_to_change	1.87	0.84
Computer_knowledge	2.21	0.96
Organizational_support	2.05	0.49
Software_attributes	1.95	0.65
Job characteristics	2.04	0.74

Table 4.3 shows descriptive statistics (mean and standard deviation) of CSFs and job characteristics. The assumption of normality has been checked from the mentioned table. The values of mean have been observed to be almost the same. Thus the distribution of data can be considered as approximately normal.

Table 4.4: Model summary for CSFs and job characteristics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.480[a]	.206	.202	.70474	1.870

a. Predictors: (Constant), training, acceptance_to_change, computer_knowledge, organizational_support, software_attributes

b. Dependent Variable: job characteristics

Table 4.4 shows the model summary for 'CSFs' and 'job characteristics' of physicians. The value of multiple correlation (R=0.480) represents a correlation between both variables extracted by regression model. In terms of variability in 'job characteristics' by the fitted model, this amounts to a proportion of adjusted $R^2 = 0.202$. Serial correlation between errors, examined by the Durbin-Watson value, is 1.870. Since the value is close to 2, it proves that residuals are un-correlated (Field, 2005).

Table 4.5: ANOVA for CSFs and job characteristics

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	42.732	2	25.542	38.431	.000[a]
	Residual	51.513	204	.461		
	Total	94.245	206			

a. Predictors: (Constant), training, acceptance_to_change, computer_knowledge, organizational_support, software_attributes

b. Dependent Variable: job characteristics

Table 4.5 shows ANOVA for predictors and the dependent variable. The value (F (2,204) = 38.431, $p < 0.001$) signifies that at least one out of the five extracted factors, is strongly related to 'job characteristics'.

Table 4.6: Results of regression analysis for impact of CSFs on job characteristics

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1(Constant)	1.852	.124		12.185	.000***
Training	.054	.039	.209	1.699	.503
Acceptance_to_change	.184	.037	.152	1.870	.718
Computer_knowledge	.153	.048	.245	3.788	.000***
Organizational_support	.041	.037	.069	.434	.587
Software_attributes	.146	.035	.231	2.654	.000***

*** Correlation is significant at 0.001 level

a. Dependent Variable: job characteristics

Table 4.6 presents $\boldsymbol{\beta}$ values which represent the extent to which each predicted factor influences corresponding output. A significant contribution of each and every predictor has been measured with the help of t-test. It has been observed from the table that 'training', 'organizational support' and 'acceptance to change' ($p < 0.001$, sig > 0.050) have not contributed to the model. 'Computer knowledge' and 'software attributes' have been found to be making a significant contribution to the model.

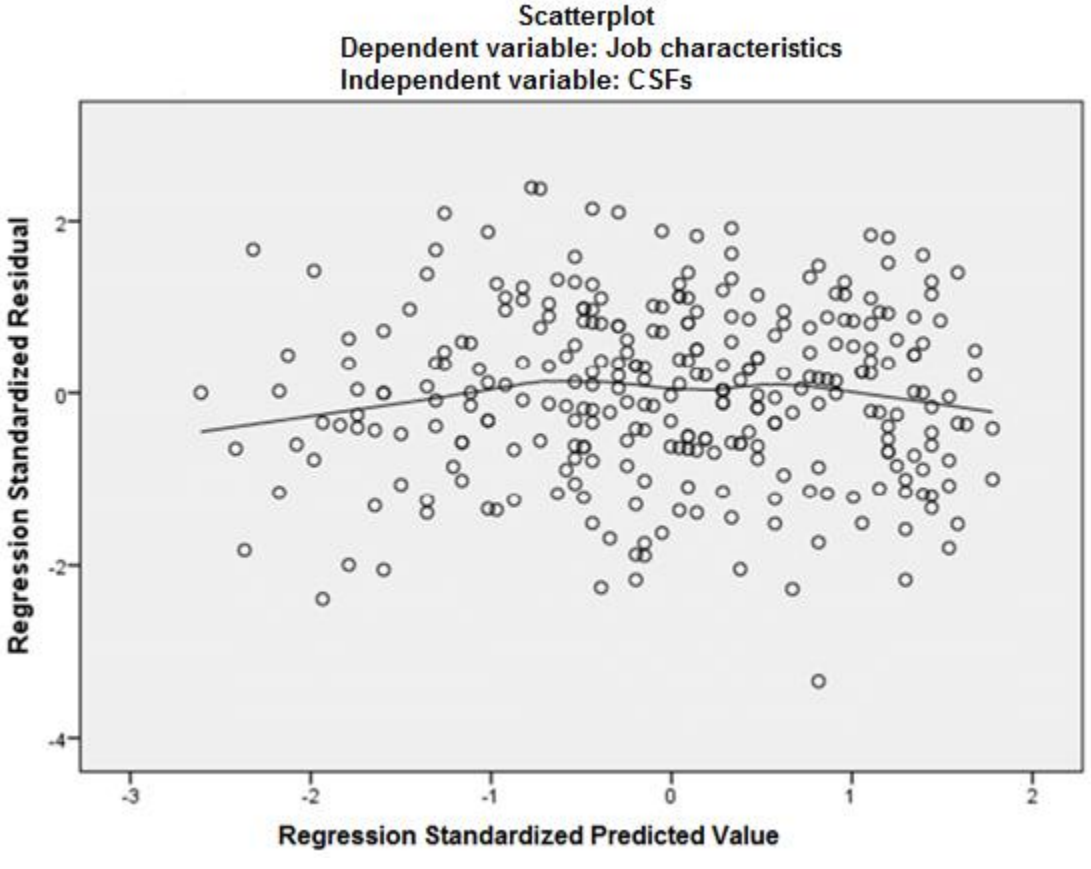
Table 4.7: Collinearity statistics for CSFs

Variables	Tolerance	VIF
Training	.468	1.761
Acceptance_to_change	.685	0.995
Computer_knowledge	.780	1.558
Organizational_support	.403	1.987
Software_attributes	.304	0.785

Table 4.7 shows that, assumption of 'no multicollinearity' holds positive as all variance inflation factor (VIF) measures are below 10 and the tolerance values are above 0.2. Aggregate VIF is quite close to 1 which confirms that collinearity is not an issue for this model.

Linearity of the model and homoscedasticity of the residuals can be seen from the graphical representation, namely, the scatter plot.

Figure 4.1: Scatterplot of the regression standardized residuals and regression standardized predicted value (Impact of identified CSFs on Job characteristics)



By analyzing figure 4.1, the assumptions of model linearity and homoscedasticity of the residuals can be checked. In regression analysis, the relationship between X and Y should be linear to minimize error (Hayes, 2013). As can be seen in Figure 4.1, the regression appears

fairly linear since the 'Loess curve' centers close to zero along the entire X-axis. To check homoscedasticity, consistency in the vertical range across the X-axis has been checked. In other words, it has been observed that the data spreads on the Y-axis consistently and equally throughout the plot, resembling a rectangle. The data in figure 4.1 shows a relatively constant vertical range. Thus, the assumption of constant variance of the residuals (homoscedasticity) is verified.

It is seen from the results that two CSFs, namely, 'computer knowledge' and 'software attributes', have a significant impact on 'job characteristics' of physicians. Hence, H1 has been partially accepted.

Training → Job characteristics	**Not supported**
Acceptance_to_change → Job characteristics	**Not supported**
Computer_knowledge → Job characteristics	**Supported**
Organizational_support → Job characteristics	**Not supported**
Software_attributes → Job characteristics	**Supported**

4.4 Impact of CSFs on job satisfaction of physicians

This section presents the findings related to third objective.

Objective 3: To analyze the impact of identified critical success factors on job satisfaction of physicians

Regression analysis has been performed to examine if a relationship exists between 'CSFs' and 'job satisfaction'. The related hypothesis is given below:

H2: There is a significant impact of critical success factors, with respect to implementation of EHR technology, on job satisfaction of physicians

Table 4.8 shows descriptive statistics (mean and standard deviation) of CSFs and job satisfaction. The assumption of normality has been checked from the above table for descriptive statistics of variables. The values of mean have been observed to be almost the same. Therefore, distribution of data can be considered as approximately normal.

Table 4.8: Descriptive statistics for CSFs and job satisfaction

Variable	Mean	Standard deviation
Training	2.04	0.54
Acceptance_to_change	1.37	0.72
Computer_knowledge	1.59	0.96
Organizational_support	2.65	0.94
Software_attributes	1.23	0.56
Job satisfaction	1.54	0.84

Table 4.9 shows the model summary for 'CSFs' and 'job satisfaction' of physicians. The value of multiple correlation (R=0.717) represents extent of correlation between both variables extracted by regression model.

Table 4.9: Model summary for CSFs and job satisfaction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.717[a]	.569	.560	.21924	2.003

a. Predictors: (Constant), training, acceptance_to_change, computer_knowledge, organizational_support, software_attributes

b. Dependent Variable: job satisfaction

In terms of variability in 'job satisfaction' by the fitted model, this amounts to a proportion of adjusted R^2 = 0.560. Value of Durbin-Watson, examining the serial correlation between errors, has been found to be 2.003. The value is close to 2, which indicates that residuals are un-correlated (Field, 2005).

Table 4.10 shows Analysis of Variance (ANOVA) for predictors and the dependent variable. Value of F (2,203) = 65.619, $p < 0.001$ signifies that at least one of the five factors is related to 'job satisfaction'.

Table 4.10: ANOVA for CSFs and job satisfaction

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63.605	2	31.803	65.619	.000[a]
	Residual	98.385	203	.485		
	Total	161.990	205			

a. Predictors: (Constant), training, acceptance_to_change, computer_knowledge, organizational_support, software_attributes

b. Dependent Variable: job satisfaction

Table 4.11 presents $\boldsymbol{\beta}$ values which represent the extent to which each factor influences the corresponding output. Only 'software attributes', ($p < 0.001$, sig > 0.050) has been found to be not generating a significant contribution to the model.

Table 4.11: Results of regression analysis for impact of CSFs on job satisfaction

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1(Constant)	1.452	.194		21.165	.000***
Training	1.454	.231	.439	1.699	.000***
Acceptance_to_change	.084	.031	.182	1.870	.003***
Computer_knowledge	.253	.049	.145	3.788	.007***
Organizational_support	.044	.047	.349	.434	.000***
Software_attributes	1.353	.048	.245	3.788	.518

*** Correlation is significant at 0.001 level

a. Dependent Variable: job satisfaction

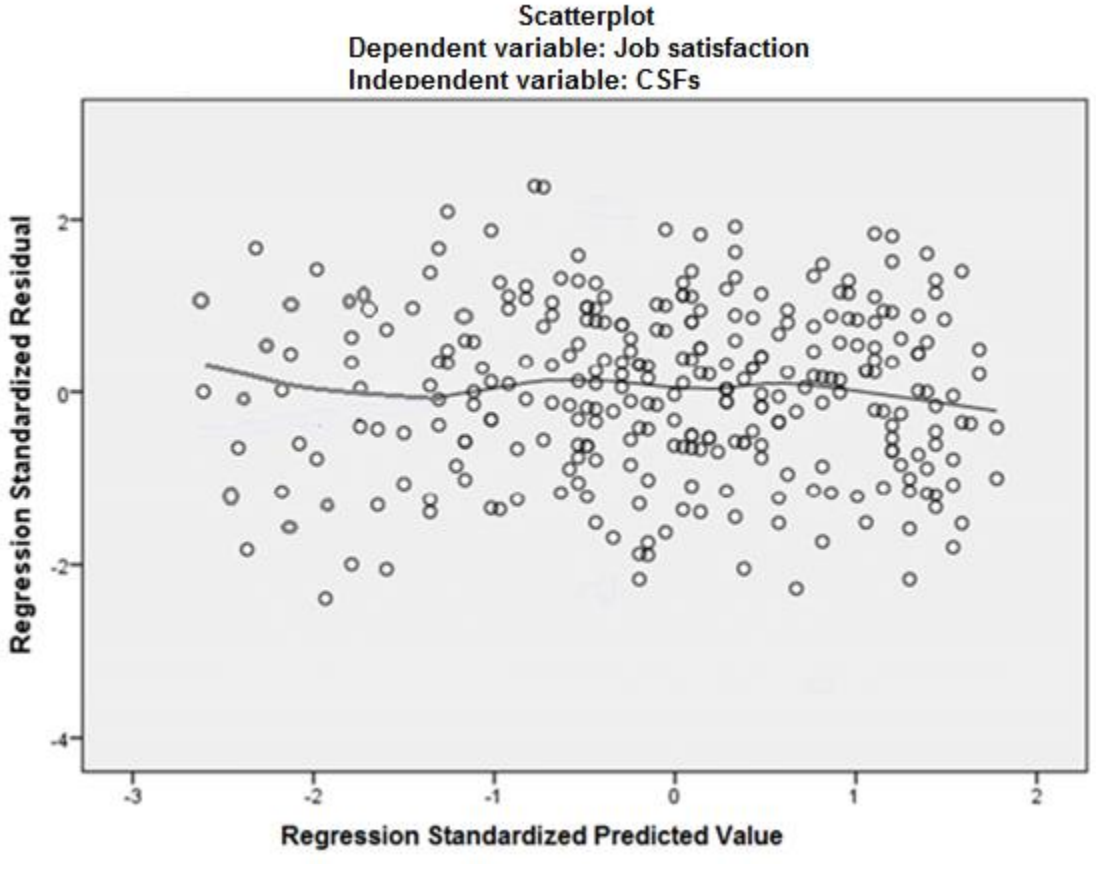
As seen from table 4.12, an assumption of 'no multicollinearity' is valid as all VIF measures are below 10 and the tolerance values are above 0.2. Mean value of all VIF measures are close to 1, which also confirms that collinearity is not an issue for this model.

Table 4.12: Collinearity statistics for CSFs

Variables	Tolerance	VIF
Training	.468	1.761
Acceptance_to_change	.685	0.995
Computer_knowledge	.780	1.558
Organizational_support	.403	1.987
Software_attributes	.304	0.785

Linearity of the model and homoscedasticity of the residuals can be seen from the graphical representation, namely, the scatter plot.

Figure 4.2: Scatterplot of the regression standardized residuals and regression standardized predicted value (Impact of identified CSFs on Job satisfaction)



In figure 4.2, the assumptions of model linearity and homoscedasticity of the residuals can be checked. In regression analysis, the relationship between X and Y should be linear to minimize error (Hayes, 2013). As can be seen in Figure 4.2, the regression appears fairly linear since the 'Loess curve' centers close to zero along the entire X-axis. To check homoscedasticity, consistency in the vertical range across the X-axis has been checked. The data in figure 4.2 shows a relatively constant vertical range. Thus, the assumption of constant variance of the residuals (homoscedasticity) is verified.

It is clear from these results that four CSFs, namely, 'training', 'computer knowledge', 'acceptance to change' and 'organizational support', have a significant influence on 'job satisfaction' of clinicians. Hence, H2 has been partially accepted.

Training → Job satisfaction	**Supported**
Acceptance_to_change → Job satisfaction	**Supported**
Computer_knowledge → Job satisfaction	**Supported**
Organizational_support → Job satisfaction	**Supported**
Software_attributes → Job satisfaction	**Not supported**

4.5 Factors of data management related to post-implementation phase of usage of EHR technology

This section presents the findings related to fourth objective.

Objective 4: To identify the data management factors in the post-implementation phase of EHR technology

Factors of data management related to post-implementation phase of usage of EHR technology have been extracted in this section.

'Data management' has been studied using a validated construct of 19 statements representing related domains such as 'inconsistent data' (Burton, Anderson & Kues, 2004), 'integrated view' (Mandl & Porter, 1999), 'appropriate data' (Boaden & Munir, 2001; Garrido et al., 2005), 'privacy' (Scott, 2001), 'fast access' (Ballou & Pazer, 1985), 'real time availability' (Alizamini et al., 2010), 'authenticity' (Overtveit et al., 2007), 'authorization'

(Crownower & Rosenbaum, 2002), ‘accuracy’ (Gil & Kim, 2000), ‘less duplication’ (Eppler & Wittig, 2002) and ‘intuitiveness’ (Zolot, 1999).

4.5.1 Identification of data management factors in post-implementation phase of usage of EHR technology

With respect to the fourth research objective, respondents have been asked to give responses on a five-point Likert scale to various statements related to data management. Measures of sample adequacy like Kaiser-Meyer-Olkin (.847) and Bartlett’s Test of Sphericity (approx chi-square 28584.230, degrees of freedom 861, significance .00) have shown that tools of factor analysis can be applied.

Table 4.13 presents the values of Kaiser-Meyer-Olkin and Bartlett’s Test of Sphericity.

Table 4.13: Kaiser-Meyer-Olkin and Bartlett’s test of Sphericity for data management factors

Kaiser-Meyer-Olkin		0.847
Bartlett's test of Sphericity	**Approximate Chi-square**	28584.230
	Degree of freedom	861
	Significance	.000

The method of principal axis factoring, with varimax rotation method, has been used for extracting factors. Factors, with eigen values of one or more than one, have been extracted. Four factors, namely, ‘effectiveness’, ‘accessibility’, ‘accuracy’ and ‘timeliness’, cumulatively explaining 65.74 per cent of total variance, have been extracted.

Table 4.14 presents the results of factor analysis. Four factors have emerged from the analysis.

Table 4.14: Results of factor analysis related to data management in post-implementation phase of usage of EHR technology

Names of Data management factors	Statements	Eigen values	Explained variance
Effectiveness	With the use of EHR, high quality medicine is practiced	5.254	19.487
	Status of metadata is described with the use of e-records		
	Data available using EHR is inconsistent		
	EHR provide consistency between items of multiple data from multiple sources		
	Complete view of records, images, tests and referrals is available using EHR		
	EHR show the source and context of data		
Accessibility	EHR are easy to use interfaces	4.865	17.512
	EHR provide appropriate form of data available		
	Privacy from unauthorized users is strictly maintained with the use of EHR		
	Time of entry and retention is stated using EHR		
	Instant data is available on all systems with the use of EHR		
Accuracy	EHR are easy and intuitive	3.506	15.977
	Duplication of data during documentation is removed using EHR		
	Reduction in error free interpretation of data using EHR is observed		
	EHR reduce wrong prescription of medicines, tests and images		
Timeliness	EHR provide fast access to records	2.503	12.764
	EHR increase operational speed in ordering of lab tests, referrals and imaging study		
	EHR enable quick prescription of medicine and diagnostic tests		
	EHR provide real time data exchange between physicians of various departments		

Names of factors have been chosen on the basis of statements which have been found to be closely related. The available literature also explains the meaning of each factor of data management.

Factor 1: Effectiveness

Effectiveness has been identified as the first factor affecting data management. Statements which significantly load on this factor are ‘high quality medicine than paper charts’, ‘status of metadata described with the use of e-records’, ‘data available using EHR is inconsistent’, ‘EHR provide consistency between items of multiple data from multiple sources’, ‘Complete view of records, images, tests and referrals is available using EHR’ and ‘EHR show the source and context of data’. A study by Burton, Anderson & Kues (2004) also supports that these statements represent the construct of ‘effectiveness’ and that effectiveness affects data management.

Factor 2: Accessibility

It has been identified as the second factor affecting data management. Five statements which have significantly loaded on this factor are: ‘easy to use interfaces’, ‘appropriate form of data available’, ‘privacy from unauthorized users’, ‘time of entry and retention is stated’ and ‘instant data is available on all systems’. A study by Garrido et al. (2005) has also shown that these attributes affect data management.

Factor 3: Accuracy

The third factor affecting data management has been named as ‘accuracy’. Four statements, namely, ‘easy and intuitive’, ‘duplication of data is removed’, ‘reduction of errors in documentation’, ‘reduced wrong interpretation of data’ and ‘lesser wrong prescription, tests and images using EHR’, significantly load on this factor. A study by Zolot (1999) also shows that accuracy of data is an important determinant of data management.

Factor 4: Timeliness

It has been identified as the fourth factor affecting data management. Four statements which have significantly loaded on this factor are ‘fast access to records’, ‘ordering lab tests, referrals and imaging study is fast’, ‘prescription of medicine, tests is fast’ and ‘exchange of data between physicians of various departments is on real time basis’. A study by Overtveit et al. (2007) has also shown that these attributes affect data management.

4.6 Impact of data management factors on job characteristics of physicians

This section presents findings related to the fifth objective.

Objective 5: To examine the impact of identified data management factors on job characteristics of physicians

Regression analysis has been performed to examine if a relationship exists between 'data management factors' and 'job characteristics'. The related hypothesis is given below:

H3: There is a significant impact of identified data management factors on job characteristics of physicians

Table 4.15 shows descriptive statistics (mean and standard deviation) of data management factors and job characteristics. The assumption of normality has been checked from the mentioned table. The values of mean have been observed to be almost the same. Thus the distribution of data can be considered as approximately normal.

Table 4.15: Descriptive statistics for data management factors and job characteristics

Variable	Mean	Standard deviation
Accessibility	1.84	0.45
Effectiveness	2.07	0.76
Timeliness	1.39	0.86
Accuracy	1.56	0.92
Job characteristics	2.04	0.48

Table 4.16 shows the model summary for 'data management factors' and 'job characteristics' of physicians. Value of multiple correlation (R=0.714) indicates the extent of correlation between both variables in the model. In terms of variability in 'job characteristics' by the fitted model, this amounts to a proportion of adjusted $R^2 = 0.505$. Serial correlation between errors, examined by Durbin-Watson value, is 1.996. Since the value is approximate to 2, it proves that residuals are un-correlated (Field, 2005).

Table 4.16: Model summary for data management factors and job characteristics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.714[a]	.510	.505	.52774	1.996

a. Predictors: (Constant), accessibility, accuracy, effectiveness, timeliness

b. Dependent Variable: job characteristics

Table 4.17 shows ANOVA for predictors and the dependent variable. The value (F (5,274) = 40.431, $p < 0.001$) signifies that at least one of the four factors is strongly related to 'job characteristics'.

Table 4.17: ANOVA for data management factors and job characteristics

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	52.762	5	10.552	40.431	.000[a]
Residual	71.513	274	.261		
Total	124.275	279			

a. Predictors: (Constant), accessibility, accuracy, effectiveness, timeliness

b. Dependent Variable: job characteristics

Table 4.18: Results of regression analysis for impact of data management factors on job characteristics

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1(Constant)	1.892	.144		13.185	.000***
Accessibility	.064	.037	.103	1.699	.003***
Effectiveness	.134	.057	.252	2.370	.018***
Timeliness	.183	.048	.245	3.788	.000***
Accuracy	-.031	.057	-.059	-.544	.587

*** Correlation is significant at 0.001 level

a. Dependent Variable: job characteristics

Table 4.18 presents $\boldsymbol{\beta}$ values which represent the extent to which each factor influences corresponding output. It has been observed that only 'accuracy' ($p < 0.001$, sig > 0.050) has not generated a significant contribution to the model.

Table 4.19: Collinearity statistics for data management factors

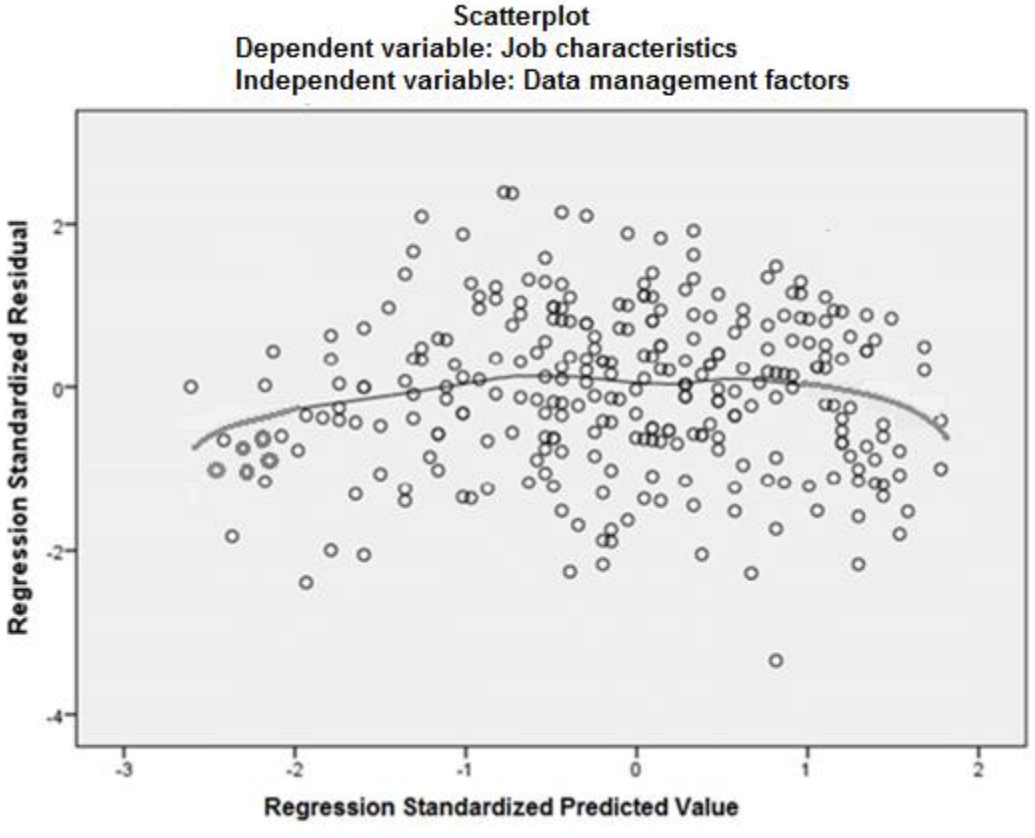
Variables	Tolerance	VIF
Accessibility	.568	1.761
Effectiveness	.285	5.395
Timeliness	.380	5.558
Accuracy	.503	1.987

As seen in table 4.19, assumption of 'no multicollinearity' is valid as all VIF measures are below 10 and the tolerance values are above 0.2. Mean of all VIF values is close to 1, which also confirms that collinearity is not an issue for this model.

Linearity of the model and homoscedasticity of the residuals can be seen from the graphical representation, namely, the scatter plot.

By analyzing figure 4.3, the assumptions of model linearity and homoscedasticity of the residuals can be checked. In regression analysis, the relationship between X and Y should be linear to minimize error (Hayes, 2013). As can be seen in Figure 4.3, the regression appears fairly linear since the 'Loess curve' centers close to zero along the entire X-axis. To check homoscedasticity, consistency in the vertical range across the X-axis has been checked. In other words, it has been observed that the data spreads on the Y-axis consistently and equally throughout the plot, resembling a rectangle. The data in figure 4.3 shows a relatively constant vertical range. Thus, the assumption of constant variance of the residuals (homoscedasticity) is verified.

Figure 4.3: Scatterplot of the regression standardized residuals and regression standardized predicted value (Impact of identified data management factors on Job characteristics)



It has been observed that three data management factors, namely, 'accessibility', 'effectiveness' and 'timeliness', have a significant impact on 'job characteristics' of physicians. Hence, H3 has been partially accepted.

Accessibility → Job characteristics	**Supported**
Effectiveness → Job characteristics	**Supported**
Timeliness → Job characteristics	**Supported**
Accuracy → Job characteristics	**Not supported**

4.7 Impact of data management factors on job satisfaction of physicians

This section presents the findings related to sixth objective.

Objective 6: To analyze the impact of identified data management factors on job satisfaction of physicians

Regression analysis has been performed to examine if a relationship exists between 'data management factors' and 'job satisfaction'. The related hypothesis is as follows:

H4: There is a significant impact of identified data management factors on job satisfaction of physicians

Table 4.20: Descriptive statistics for data management factors and job satisfaction

Variable	Mean	Standard deviation
Accessibility	2.51	0.59
Effectiveness	2.97	0.67
Timeliness	1.09	0.68
Accuracy	1.76	0.42
Job satisfaction	2.34	0.98

Table 4.20 shows descriptive statistics (mean and standard deviation) of data management factors and job satisfaction. The assumption of normality has been checked from the mentioned table. The values of mean have been observed to be almost the same. Thus the distribution of data can be considered as approximately normal.

Table 4.21: Model summary for data management factors and job satisfaction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.317[a]	.101	.087	.41924	2.073

a. Predictors: (Constant), accessibility, accuracy, effectiveness, timeliness

b. Dependent Variable: job satisfaction

Table 4.21 shows the model summary for 'data management factors' and 'job satisfaction' of physicians. Value of multiple correlation (R=0.317) indicates the extent of correlation between both variables in the model. In terms of variability in 'job satisfaction' by the fitted

model, this amounts to a proportion of adjusted $R^2 = 0.087$. Serial correlation between errors, measured by Durbin-Watson value, has been found to be 2.073. Since the value is close to 2, it proves that residuals are un-correlated (Field, 2005).

Table 4.22: ANOVA for data management factors and job satisfaction

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.977	3	1.326	7.543	.000[a]
	Residual	35.503	202	.176		
	Total	39.481	205			

a. Predictors: (Constant), accessibility, accuracy, effectiveness, timeliness

b. Dependent Variable: job satisfaction

Table 4.22 shows ANOVA for predictors and dependent variables. The value (F (3,202) = 7.543, $p < 0.001$) signifies that at least one of the four factors is related to 'job satisfaction'.

Table 4.23: Results of regression analysis for impact of data management factors on job satisfaction

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1(Constant)	1.043	.216		4.821	.000***
Accessibility	.242	.087	.193	2.599	.003***
Effectiveness	.021	.013	.013	.189	.850
Timeliness	.183	.048	.245	3.788	.000***
Accuracy	.031	.057	.059	.544	.597

*** Correlation is significant at 0.001 level

a Dependent Variable: job satisfaction

Table 4.23 presents $\boldsymbol{\beta}$ values which represent the extent to which each factor influences corresponding output. Both 'effectiveness' and 'accuracy', ($p < 0.001$, sig > 0.050) have not been found to be making a significant contribution to the model.

Table 4.24: Collinearity statistics for data management factors

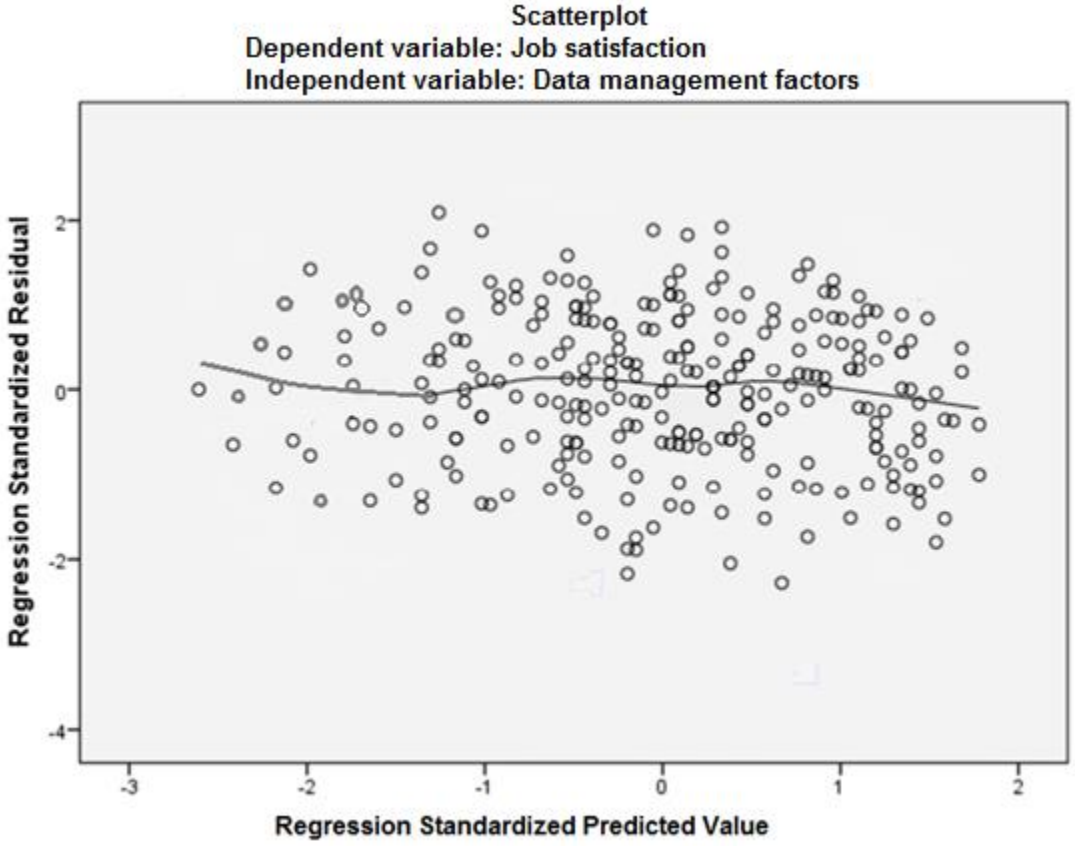
Variables	Tolerance	VIF
Accessibility	.568	1.761
Effectiveness	.285	1.395
Timeliness	.380	0.958
Accuracy	.503	1.287

Table 4.24 shows that assumption of 'no multicollinearity' is valid as all VIF statistics associated with these factors are below 10 and the tolerance values are above 0.2. Mean of all VIF measures is quite close to 1, which also confirms that collinearity is not an issue for this model.

Linearity of the model and homoscedasticity of the residuals can be seen from the graphical representation, namely, the scatter plot.

By analyzing figure 4.4, the assumptions of model linearity and homoscedasticity of the residuals can be checked. In regression analysis, the relationship between X and Y should be linear to minimize error (Hayes, 2013). As can be seen in Figure 4.4, the regression appears fairly linear since the 'Loess curve' centers close to zero along the entire X-axis. To check homoscedasticity, consistency in the vertical range across the X-axis has been checked. In other words, it has been observed that the data spreads on the Y-axis consistently and equally throughout the plot, resembling a rectangle. The data in figure 4.4 shows a relatively constant vertical range. Thus, the assumption of constant variance of the residuals (homoscedasticity) is verified.

Figure 4.4: Scatterplot of the regression standardized residuals and regression standardized predicted value (Impact of identified data management factors on Job satisfaction)

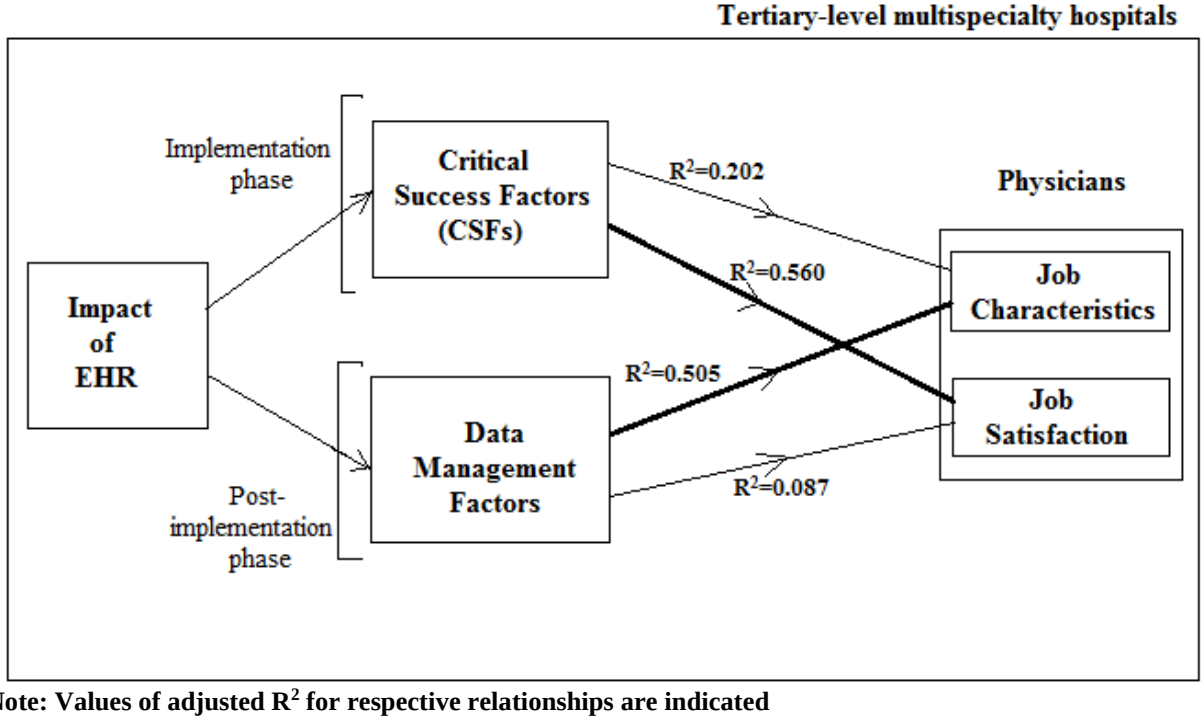


It can be concluded that two data management factors, namely, 'accessibility' and 'timeliness', have a significant impact on 'job satisfaction' of physicians. Hence, H4 has been partially accepted.

Accessibility → Job satisfaction	**Supported**
Effectiveness → Job satisfaction	**Not supported**
Timeliness → Job satisfaction	**Supported**
Accuracy → Job satisfaction	**Not supported**

4.8 A Framework related to impact of EHR on job characteristics and job satisfaction of physicians

Findings related to the proposed framework have been summarized in figure 4.1



Note: Values of adjusted R^2 for respective relationships are indicated

Figure 4.5: Framework depicting impact of EHR on job characteristics and job satisfaction of physicians

Figure 4.5 shows the framework for impact of EHR on job characteristics and job satisfaction of physicians.

As can be seen from the figure, value of adjusted R^2 between CSFs and 'job satisfaction' is higher as compared to that between CSFs and 'job characteristics'.

However, value of adjusted R^2 is higher between data management factors and 'job characteristics' as compared to that between these factors and 'job satisfaction'.

4.9 Impact of EHR on job characteristics and job satisfaction of physicians: Factor-wise representation

(i) Implementation phase

Impact of each CSF on 'job characteristics' of physicians has been shown below.

Two CSFs, namely, 'software attributes' and 'computer knowledge' have been found to be supporting 'job characteristics'.

Critical success factors	**Supported**	**Not-supported**
Training → Job characteristics		✓
Organizational support → Job characteristics		✓
Software attributes → Job characteristics	✓	
Acceptance to change → Job characteristics		✓
Computer knowledge → Job characteristics	✓	

Impact of each CSF on 'job satisfaction' of physicians has been shown below.

Four out of five CSFs, namely, 'training', 'organizational support', 'acceptance to change' and 'computer knowledge' have been found to be supporting 'job satisfaction'.

Critical success factors	**Supported**	**Not-supported**
Training → Job satisfaction	✓	
Organizational support → Job satisfaction	✓	
Software attributes → Job satisfaction		✓
Acceptance to change → Job satisfaction	✓	
Computer Knowledge → Job satisfaction	✓	

(ii) Post-implementation phase

Impact of each factor of data management on 'job characteristics' of physicians has been presented below.

Three data management factors, namely, 'accessibility', 'effectiveness' and 'timeliness' have been found to be supporting 'job characteristics'.

Data management factors	**Supported**	**Not-supported**
Accessibility → Job characteristics	✓	
Effectiveness → Job characteristics	✓	
Timeliness → Job characteristics	✓	
Accuracy → Job characteristics		✓

Impact of each factor of data management on 'job satisfaction' of physicians has been shown below.

Two factors of data management, namely, 'accessibility' and 'timeliness' have a significant impact on 'job satisfaction' of physicians.

Data management factors	**Supported**	**Not-supported**
Accessibility → Job satisfaction	✓	
Effectiveness → Job satisfaction		✓
Timeliness → Job satisfaction	✓	
Accuracy → Job satisfaction		✓

4.10 Relationship between computer knowledge and EHR usage

The physicians have been asked to rate themselves as a 'novice/beginner', 'conversant' or an 'expert' in terms of their computer knowledge. Computer knowledge-wise distribution of physicians with respect to 'EHR usage' has been shown in Table 4.25.

Table 4.25: EHR usage-wise distribution of physicians with respect to computer knowledge

Computer Knowledge	EHR usage (per week)				Total
	Up to 5 hours	5-10 hours	10-15 hours	More than 15 hours	
Novice/beginner	36 (52.9)	61 (55.9)	0 (0)	0 (0)	97 (34.7)
Conversant	29 (42.6)	25 (22.9)	31 (39.3)	4 (16.6)	89 (31.7)
Expert	3 (4.5)	23 (21.2)	48 (60.7)	20 (83.4)	94 (33.6)
Total (N)	**68**	**109**	**79**	**24**	**280**

Chi Square value: **122.243; Significant at 5% level of Significance**

Note: In this table and subsequent tables, figures without parentheses indicate frequencies, and figures in parentheses represent percentages out of the column total.

Table 4.25 reveals that 34.6 per cent of the total sample have rated themselves as 'novice/beginners', followed by 33.5 per cent as 'experts' and 31.7 per cent as 'conversant'.

52.9 per cent of physicians using EHR 'up to 5 hours per week' call themselves as 'novice/beginners'. This is followed by 42.6 per cent respondents who have rated themselves as 'conversant'. Only 4.4 per cent have called themselves as 'experts'.

55.9 per cent of physicians using EHR for '5-10 hours per week' have rated themselves as 'novice/beginners'. 22.9 per cent have called themselves as 'conversant' and 21.1 per cent have labeled themselves as 'experts'.

60.7 per cent of respondents in the category of '10-15 hours EHR usage per week' call themselves as 'experts'. 39.2 per cent rate themselves as 'conversant'.

In the category of physicians who use EHR for 'more than 15 hours' per week, 83.3 per cent call themselves as 'experts'. This is followed by 16.6 per cent of physicians calling themselves as 'conversant' with respect to computer knowledge.

Chi-Square value shows that there are significant differences, at 5 per cent level of significance, between levels of 'computer knowledge' and 'EHR usage per week'.

4.11 Relationship of computer knowledge with respect to demographic and other variables

Relationships of 'computer knowledge' with demographic variables, namely, 'age', 'gender' and 'educational level' and with other variables, namely, 'work area' and 'designation' have also been analyzed with the help of chi-square tests.

4.11.1 Relationship between computer knowledge and age

Respondents have been divided in five age-groups, namely, '20-30 years', '30-40 years', '40-50 years', '50-60 years' and '60 years and above'.

Distribution of sample with respect to 'computer knowledge' and various age-groups has been shown in Table 4.26.

Table 4.26: Age-wise distribution of physicians with respect to computer knowledge

Computer knowledge	**Age**					**Total**
	20-30 years	**30-40 years**	**40-50 years**	**50-60 years**	**60 years and above**	
Novice/beginner	7 (10.6)	8 (17.0)	8 (22.2)	35 (53.0)	39 (60.0)	97 (34.6)
Conversant	15 (22.7)	16 (34.0)	19 (52.8)	22 (33.3)	17 (26.1)	89 (31.8)
Expert	44 (66.6)	23 (48.9)	9 (25)	9 (13.6)	9 (13.8)	94 (33.6)
Total (N)	**66**	**47**	**36**	**66**	**65**	**280**

Chi Square value: **172.190; Significant at 5% level of Significance**

Table 4.26 reveals that a majority of respondents (66.6%) falling in the age-group of '20-30 years' have indicated that they are 'experts'. This is followed by 22.7 per cent physicians who call themselves as 'conversant'. Only 10.6 per cent have rated themselves as 'novice/beginners'.

In the age category of '30-40 years', 48.9 per cent of physicians rate themselves as 'experts'. This is followed up by 34.0 per cent who call themselves as 'conversant'. 17.0 per cent refer to themselves as 'novice/beginners'.

52.8 per cent of physicians falling in the age-group of '40-50 years' call themselves as 'conversant' in computer knowledge. 25.0 per cent of physicians feel they are 'experts' and the remaining 22.2 per cent rate themselves as 'novice/beginners'.

A majority of respondents (53.0%) belonging to '50-60 years' of age-group rate themselves refer to themselves as 'novice/ beginners'. This is followed by 33.3 per cent of physicians who refer to themselves as 'conversant'. Only a few (13.6%) respondents call themselves as 'experts'.

A majority of elderly respondents (60%), falling in age-group of '60 years and above' refer to themselves as 'novice/beginners'. 26.1 per cent of respondents in this age-group call themselves as 'conversant' and the remaining (13.8%) feel that they are 'experts'.

Chi-square value shows that there is a significant difference, at 5 per cent level of significance, between 'age' of the respondents with respect to 'computer knowledge'.

4.11.2 Relationship between computer knowledge and gender

Distribution of 'computer knowledge' with respect to gender has been shown in Table 4.27.

Table 4.27: Gender-wise distribution of physicians with respect to computer knowledge

Computer knowledge	Gender		Total
	Male	Female	
Novice/beginner	54 (33.5)	43 (36.1)	97 (34.6)
Conversant	45 (27.9)	44 (36.9)	89 (31.7)
Expert	62 (38.5)	32 (26.8)	94 (33.7)
Total (N)	**161**	**119**	**280**

Chi Square value: 5.500; Not Significant at 5% level of Significance

38.5 per cent of male physicians claim themselves as 'experts'. 33.5 per cent call themselves as a 'novice/beginner' and 27.9 per cent claim to be 'conversant'.

Amongst the female respondents, 36.9 per cent call themselves as 'conversant'. 36.1 per cent refer to themselves as 'novice/beginners'. 26.8 per cent females claim to be 'experts'.

No significant differences, at 5 per cent level of significance, have been observed between gender of respondents and computer knowledge possessed by them.

4.11.3 Relationship between computer knowledge and educational level

Educational level of respondents has been captured in three categories, namely, 'MBBS', 'MBBS-MD' and 'DM/MCH'.

Distribution for sample of respondents with respect to 'computer knowledge' and 'educational level' has been shown in Table 4.28.

Table 4.28: Educational level-wise distribution of physicians with respect to computer knowledge

Computer knowledge	Educational level			Total
	MBBS	MBBS-MD	DM/MCH	
Novice/beginner	43 (44.8)	32 (35.1)	22 (23.6)	97 (34.6)
Conversant	31 (32.3)	30 (32.9)	28 (30.1)	89 (31.8)
Expert	22 (22.9)	29 (31.8)	43 (46.2)	94 (33.6)
Total (N)	**96**	**91**	**93**	**280**

Chi Square value: 6.018; Not significant at 5% level of Significance

Table 4.28 shows that 35 per cent of respondents have MBBS qualification, 32 per cent have been found to be MBBS-MD and 33 per cent have DM/MCH qualification.

44.8 per cent of physicians with 'MBBS' qualification have indicated that they are 'novice/beginners'. 32.3 per cent of respondents call themselves as 'conversant' where as 22.9 per cent claim to be 'experts'.

Respondents, having 'MBBS-MD' educational qualification, 35.1 per cent of physicians have declared themselves as 'novice/beginners'. 32.9 per cent call themselves as 'conversant' where as 31.8 per cent claim to be 'experts'.

46.2 per cent of physicians having 'DM/MCH' qualifications call themselves as 'experts'. 30.1 per cent have called themselves as 'conversant', where as 23.6 per cent claim to be 'novice/beginners'.

No significant differences, at 5 per cent level of significance, have been observed between 'educational level' of physicians and their computer knowledge.

4.11.4 Relationship between computer knowledge and work area

Work area has been categorized in five segments, namely, ‘emergency ward’, ‘intensive care unit’, ‘operation theatre personnel’, ‘general ward’ and ‘out-patient department’.

Distribution of computer knowledge of physicians, with respect to work area has been shown in Table 4.29.

Table 4.29: Work area-wise distribution of physicians with respect to computer knowledge

Computer knowledge	Work area					Total
	Emergency ward	Intensive care unit	Operation theatre personnel	General ward	Out-patient department	
Novice/beginner	3 (60.0)	27 (60.0)	24 (42.8)	18 (23.5)	25 (25.7)	97 (34.6)
Conversant	1 (20.0)	10 (22.2)	19 (33.9)	23 (29.8)	36 (37.1)	89 (31.8)
Expert	1 (20.0)	8 (17.8)	13 (23.2)	36 (46.7)	36 (37.1)	94 (33.6)
Total (N)	**5**	**45**	**56**	**77**	**97**	**280**

Chi Square value: 21.618; Significant at 5% level of Significance

It has been reported that 35 per cent of respondents belong to ‘out-patient department’. 27 per cent belong to ‘general ward’. 20 per cent of respondents work as ‘operation theatre personnel’, 16 per cent are from ‘intensive care unit’ and only 2 per cent work in ‘emergency ward’.

Majority of respondents (60.0%) belonging to ‘emergency ward’ refer to themselves as ‘novice/beginners’. This is followed by 20 per cent physicians who call themselves as ‘conversant’. 20 per cent physicians claim to be ‘experts’.

60 per cent of the physicians working in ‘intensive care unit’ prefer to call themselves as ‘novice/beginners’. Out of the remaining respondents, 22.2 per cent claim to be ‘conversant’ and 17.8 per cent refer to themselves as ‘experts’.

42.8 per cent of respondents belonging to 'operation theatre personnel', call themselves as 'novice/beginners'. This is followed by 33.9 per cent who claim themselves as 'conversant'. The remaining 23.2 per cent refer to themselves as 'experts'.

46.7 per cent of physicians working in 'general ward' claim themselves as 'experts'. Out of the remaining, 29.8 per cent refer to themselves as 'conversant' and 23.5 per cent call themselves as 'novice/beginners'.

37.1 per cent of physicians working in 'out-patient department' claim to be 'expert'. An equal percentage of physicians call themselves as 'conversant'. 25.7 per cent refer to themselves as 'novice/beginners'.

Chi-square value shows that there are significant differences, at 5 per cent level of significance, between the work area of respondents and their computer knowledge.

4.11.5 Relationship between computer knowledge and designation

Respondents have been categorized in five segments with respect to designation, namely, 'professors', 'associate professors', 'assistant professors', 'senior residents' and 'junior residents'.

Distribution for sample of respondents with respect to computer knowledge and designation is shown in Table 4.30.

Table 4.30: Designation-wise distribution of physicians with respect to computer knowledge

Computer knowledge	**Designation**					**Total**
	Professor	**Associate professor**	**Assistant professor**	**Senior Resident**	**Junior Resident**	
Novice/beginner	3 (42.8)	6 (42.8)	1 (33.3)	57 (39.8)	30 (26.6)	97 (34.6)
Conversant	2 (28.5)	4 (28.5)	1 (33.3)	46 (32.2)	36 (31.9)	89 (31.8)
Expert	2 (28.5)	4 (28.5)	1 (33.3)	40 (28)	47 (41.5)	94 (33.6)
Total (N)	**7**	**14**	**3**	**143**	**113**	**280**

Chi Square value: 5.811; Not significant at 5% level of Significance

Table 4.30 shows that 51.5 per cent of respondents are ‘senior residents’. This is followed by 40 per cent ‘junior residents’. Out of the remaining respondents, 5 per cent are ‘associate professors’, 2.5 per cent are ‘professors’ and only 1 per cent respondents are ‘assistant professors’.

39.8 per cent of ‘senior residents’ call themselves as ‘novice/beginners’. 32.3 per cent of respondents indicate themselves as ‘conversant’ where as 28 per cent claim to be ‘experts’.

41.5 per cent of respondents, who are ‘junior residents’ call themselves as ‘experts’. Out of the remaining respondents, 31.9 per cent indicate themselves as ‘conversant’ and 26.6 per cent as ‘novice/beginners’.

No significant differences, at 5 per cent level of significance, have been observed between designations of physicians and their computer knowledge.

4.12 Relationship of EHR usage with respect to demographic and other variables

The relationship of ‘EHR usage’ with demographic variables, namely, ‘age’, ‘gender’ and ‘educational level’ and other variables, namely, ‘work area’ and ‘designation’ have also been analyzed with the help of chi-square tests.

4.12.1 Relationship between EHR usage and age

Age-wise distribution of physicians with respect to EHR usage has been shown in Table 4.31.

Table 4.31: Age-wise distribution of physicians with respect to weekly EHR usage

EHR usage (weekly)	Age					Total
	20-30 years	30-40 years	40-50 years	50-60 years	60 years and above	
Up to 5 hours	5 (7.5)	4 (8.5)	3 (8.4)	23 (34.8)	33 (50.7)	68 (24.2)
5-10 hours	13 (19.7)	30 (63.8)	5 (13.8)	29 (44)	32 (49.3)	109 (38.9)
10-15 hours	48 (72.7)	13 (27.6)	7 (19.4)	10 (15.1)	0 (0)	79 (28.2)
More than 15 hours	0 (0)	0 (0)	21 (58.4)	4 (6)	0 (0)	24 (8.7)
Total (N)	**66**	**47**	**36**	**66**	**65**	**280**

Chi Square value: **252.190; Significant at 5% level of Significance**

Table 4.31 reveals that EHR technology is being used the most by respondents falling in the age-group of '20-30 years'. A large number of physicians (72.7%) belonging to this age-group, use EHR for '10-15 hours'. This is followed by 19.7 per cent of physicians of this category who use technology for '5-10 hours'. Only 7.5 per cent of them use EHR 'up to 5 hours' per week.

63.8 per cent of respondents who belong to age-group of '30-40 years' use EHR for '5-10 hours' on a weekly basis. This is followed by 27.6 per cent of physicians falling in this category who use technology for '10-15 hours'. 8.5 per cent of them use technology 'up to 5 hours' per week'.

58.4 per cent of physicians falling in age-group of '40-50 years' use EHR for 'more than 15 hours' on a weekly basis. 19.4 per cent of physicians of this age-group use technology for '10-15 hours'. This is followed by 13.8 per cent of them who use EHR for '5-10 hours'. Only 8.4 per cent use technology 'up to 5 hours' per week.

44.0 per cent of respondents belonging to age-group of '50-60 years' use EHR technology for '5-10 hours' per week. This is followed by 34.8 per cent of physicians, of this age-group, who use technology 'up to 5 hours'. 15.1 per cent of them use technology for '10-15 hours' and only 6.0 per cent use EHR technology for 'more than 15 hours' on a weekly basis.

The elderly segment of physicians belonging to age-group of '60 years and above' make lesser use of technology as compared to the rest of age-groups. 50.7 per cent of physicians falling in this age-group use EHR only 'up to 5 hours'. This is followed by 49.3 per cent of respondents who use technology for '5-10 hours' on a weekly basis.

Chi-square value shows that there are significant differences, at 5 per cent level of significance, between age of the respondents and EHR usage on a weekly basis.

4.12.2 Relationship between EHR usage and gender

Gender-wise distribution of physicians with respect to EHR usage has been shown in Table 4.32.

Table 4.32: Gender-wise distribution of physicians with respect to EHR usage per week

EHR usage (per week)	Gender		Total
	Male	Female	
Up to 5 hours	31 (19.3)	37 (31.1)	68 (24.2)
5-10 hours	65 (40.4)	44 (37)	109 (38.9)
10-15 hours	52 (32.2)	27 (22.7)	79 (28.2)
More than 15 hours	13 (8.1)	11 (9.2)	24 (8.7)
Total (N)	161	119	**280**

Chi Square value: 6.500; Not Significant at 5% level of Significance

40.4 per cent of male physicians use EHR for '5-10 hours' per week. This is followed by 32.2 per cent of male physicians who use technology for '10-15 hours'. 19.3 per cent of them use EHR 'up to 5 hours' and only 8.1 per cent use technology for 'more than 15 hours' on a weekly basis.

37.0 per cent of female physicians use EHR for '5-10 hours'. This is followed by 31.1 per cent of them who use technology 'up to 5 hours'. 22.7 per cent use EHR for '10-15 hours'. Only 9.2 per cent of them use EHR technology for 'more than 15 hours' on a weekly basis.

No significant differences, at 5 per cent level of significance, have been observed between gender and EHR usage on a weekly basis.

4.12.3 Relationship between EHR usage and educational level

Educational level-wise distribution of physicians, with respect to weekly EHR usage has been shown in Table 4.33.

Table 4.33: Educational level-wise distribution of physicians with respect to weekly EHR usage

EHR usage (weekly)	Educational level			Total
	MBBS	MBBS-MD	DM/MCH	
Up to 5 hours	12 (12.5)	24 (26.3)	32 (34.4)	68 (24.2)
5-10 hours	41 (42.7)	30 (33)	38 (40.8)	109 (38.9)
10-15 hours	27 (28.1)	30 (33)	22 (23.6)	79 (28.2)
More than 15 hours	16 (16.7)	7 (7.7)	1 (1.1)	24 (8.7)
Total (N)	**96**	**91**	**93**	**280**

Chi Square value: 5.018; Not Significant at 5% level of Significance

42.7 per cent of physicians with 'MBBS' qualifications use EHR for '5-10 hours' on a weekly basis. This is followed by 28.1 per cent of physicians in this category of educational level use technology for '10-15 hours'. 16.7 per cent of them use technology for 'more than 15 hours' and 12.5 per cent use 'up to 5 hours' on a weekly basis.

It has been observed that physicians having 'MBBS-MD' qualifications follow the same pattern as 'MBBS' physicians. 33 per cent of physicians falling in this category use EHR for '5-10 hours'. This is followed 33 per cent of them who use technology for '10-15 hours'. 26.3 per cent use EHR 'up to 5 hours' and the remaining 7.7 per cent use for 'more than 15 hours' on a weekly basis.

40.8 per cent of physicians with 'DM/MCH' qualification use EHR technology for '5-10 hours' on a weekly basis. 34.4 per cent physicians belonging to this category use EHR 'up to 5 hours'. 23.6 per cent of them make use of EHR for '10-15 hours' and only 1.1 per cent use it for 'more than 15 hours'.

No significant differences, at 5 per cent level of significance, have been observed between educational level of physicians and their EHR usage on a weekly basis.

4.12.4 Relationship between EHR usage and work area

Distribution of physicians with respect to their work-areas and EHR usage has been shown in Table 4.34.

Table 4.34: Work area-wise distribution of physicians with respect to weekly EHR usage

EHR usage (weekly)	Work area					Total
	Emergency ward	Intensive care unit	Operation theatre personnel	General ward	Out-patient department	
Up to 5 hours	1 (20)	15 (33.3)	22 (39.2)	6 (7.7)	24 (24.7)	68 (24.2)
5-10 hours	3 (60)	7 (15.5)	21 (37.5)	32 (41.5)	46 (47.4)	109 (38.9)
10-15 hours	1 (20)	21 (46.7)	8 (14.2)	37 (48)	12 (12.3)	79 (28.2)
More than 15 hours	0 (0)	2 (4.4)	5 (8.9)	2 (2.5)	15 (15.5)	24 (8.7)
Total (N)	**5**	**45**	**56**	**77**	**97**	**280**

Chi Square value: 19.618; Significant at 5% level of significance

Physicians working in 'emergency ward' use less EHR technology. A possible reason could be that they have to attend to patients on an urgent basis without using EHR tools.

46.7 per cent of physicians working in 'intensive care unit' use EHR for '10-15 hours'. 33.3 per cent of physicians falling in this category use EHR technology 'up to 5 hours'. 15.5 per cent use EHR for '5-10 hours' and 4.4 per cent use for 'more than 15 hours' on a weekly basis.

39.2 per cent of physicians belonging to ‘operation department’ use EHR technology ‘up to 5 hours’ per week. This is followed by 37.2 per cent of physicians of this department who use technology for ‘5-10 hours’. 14.2 per cent use technology for ‘10-15 hours’ and 8.9 per cent use for ‘more than 15 hours’ on a weekly basis.

48.0 per cent of physicians working in ‘general ward’ use EHR for ‘10-15 hours’. This is followed by 41.5 per cent who use technology for ‘5-10 hours’. 7.7 per cent of them use EHR technology ‘up to 5 hours’ and the remaining 2.5 per cent of respondents use technology for ‘more than 15 hours’ on a weekly basis.

Maximum EHR usage has been reported by respondents working in ‘out-patient department’. A possible reason could be that this category of respondents needs to check registration identities, medical history of patients, previous prescriptions, images and referrals. 47.4 per cent of respondents working in this department use EHR technology for ‘5-10 hours’. 24.7 per cent of physicians working in this department who use EHR technology ‘up to 5 hours’ a week. 15.5 per cent of them use EHR technology for ‘more than 15 hours’ and 12.3 per cent use it for ‘10-15 hours’ on a weekly basis.

Chi-Square value shows that there are significant differences, at 5 per cent level of significance, between work-areas of physicians and their EHR usage on a weekly basis.

4.12.5 Relationship between EHR usage and designation

Designation-wise distribution of physicians with respect to usage of EHR has been shown in Table 4.35.

Table 4.35: Designation-wise distribution of physicians with respect to weekly EHR usage

EHR usage (weekly)	Designation					Total
	Professor	Associate professor	Assistant professor	Senior Resident	Junior Resident	
Up to 5 hours	1 (14.2)	2 (14.3)	1 (33.3)	58 (40.5)	6 (5.3)	68 (24.2)
5-10 hours	5 (71.4)	4 (28.5)	2 (66.6)	51 (35.7)	47 (41.6)	109 (38.9)
10-15 hours	1 (14.2)	7 (50)	0 (0)	13 (9.1)	58 (51.3)	79 (28.2)
More than 15 hours	0 (0)	1 (7.1)	0 (0)	21 (14.7)	2 (1.7)	24 (8.7)
Total (N)	**7**	**14**	**3**	**143**	**113**	**280**

Chi Square value: 35.811; Significant at 5% level of Significance

It has been observed that ‘professors’, ‘associate professors’ and ‘assistant professors’ make minimal use of EHR technology. It may probably be due to less usage of EHR technology in research and development work.

40.5 per cent of physicians who are ‘senior residents’ use EHR technology for ‘up to 5 hours’ per week. This is followed by 35.7 per cent of physicians falling in this category who use technology for ‘5-10 hours’. 14.7 per cent of them use technology for ‘more than 15 hours’ and the remaining 9.1 per cent use it for ‘10-15 hours’ on a weekly basis.

51.3 per cent of ‘junior residents’ use technology for ‘10-15 hours’ on a weekly basis. This is followed by 41.6 per cent of this category who use technology for ‘5-10 hours’. 5.3 per cent of them use EHR technology for ‘up to 5 hours’ and only 1.7 per cent use technology for ‘more than 15 hours’ on a weekly basis.

Chi-square value shows that there are significant differences, at 5 per cent level of significance, between designation and EHR technology usage on a weekly basis.

Concluding remarks

Physicians' perspectives with respect to EHR technology implementation in hospitals has been discussed in this chapter. Critical success factors in implementation phase of EHR have been explored. The impact of CSFs on job characteristics and job satisfaction of physicians has been studied. Factors of data management, in the post-implementation phase of usage of EHR technology, have also been identified. Impact of data management factors on job characteristics and job satisfaction of physicians, in the context of tertiary-level health care services, has also been analyzed. A framework of CSFs and data management factors, and their impact on job characteristics and job satisfaction of physicians has also been developed.

Chapter – V

Summary of Findings

5.1 Introduction

The present study analyzes the impact of EHR technology on job characteristics and job satisfaction of physicians. The study is based on a survey of physicians working in multispecialty hospitals, enabled with EHR technology, located in the state of Punjab. Primary data has been collected with the help of a structured questionnaire from 280 physicians working in twelve different hospitals. Data has been analyzed with the help of SPSS® 21.0. Various demographic and other variables have been used in categorizing the diverse population of physicians. Statistical tools like exploratory factor analysis, multiple regression analysis and chi-square tests have been used.

In this chapter, achievement of research objectives has been first discussed, followed by sections summarizing the findings and then the conclusion. Implications of the study, recommendations and contribution to research have then been presented. In the last section, limitations of the study and directions for future research have been discussed.

5.2 Discussion of research objectives

A discussion of research objectives is crucial in understanding whether the same have been achieved. This study has six major research objectives.

The first objective is to identify the critical success factors with respect to implementation of EHR technology in hospitals. Through exploratory factor analysis, it has been observed that there are five factors, in descending order of consideration, which lead to successful implementation. The factors are ‘training’, ‘organizational support’, ‘software attributes’, ‘acceptance to change’ and ‘computer knowledge’, in that order.

The second objective is to examine the impact of identified critical success factors on job characteristics of physicians. It has been observed that two factors, namely, ‘software attributes’ and ‘computer knowledge’ impact ‘job characteristics’ of physicians.

The third objective is to analyze the impact of identified critical success factors on job satisfaction of physicians. The study concludes that, four out of five factors have been found to be supportive of 'job satisfaction' of physicians. The factors are 'training', 'organizational support', 'acceptance to change' and 'computer knowledge'.

The fourth objective relates to identification of factors of data management involved in the post-implementation phase of usage of EHR technology. Exploratory factor analysis has led to identification of four factors, namely, 'effectiveness', 'accessibility', 'accuracy' and 'timeliness'.

The fifth objective relates to examination of impact of identified data management factors on job characteristics of physicians. It has been observed that three factors, namely, 'accessibility', 'effectiveness' and 'timeliness' impact 'job characteristics' of physicians.

The sixth objective is related to analysis of impact of identified data management factors on job satisfaction of physicians. It has been found that two factors, namely, 'accessibility' and 'timeliness' have a significant impact on 'job satisfaction' of physicians.

5.3 Summary of findings

Some studies have already been conducted in India to cover different aspects of technology deployment and benefits for hospital administration. The present study focuses on impact of EHR technology on job characteristics and job satisfaction of physicians working in multispecialty hospitals in Punjab state. It identifies critical factors related to successful implementation. It also identifies factors related to data management in the post-implementation phase of usage of EHR technology.

5.3.1 Extraction of CSFs related to implementation of EHR technology

Factors which are critical for success of technology implementation have been identified.

It has been observed through exploratory factor analysis that there are five factors which affect successful implementation of EHR technology in hospitals. The five factors, in descending order of consideration, are 'training', 'organizational support', 'software attributes', 'acceptance to change' and 'computer knowledge'.

‘IT consultants’, ‘training to handle, secure, enter and retrieve data’, ‘IT person for updating software’, ‘better working group and user engagement’ and ‘effective leadership, team work’ are the components of the construct of ‘training’ which determine success in deployment of EHR technology.

Six components which significantly load on ‘organizational support’ are ‘top management interested in financing and deploying technology’, ‘administration encouraging physicians to use new technology’, ‘better cooperative culture’, ‘organization provides high security and confidentiality of information’, ‘sufficient funds’ and ‘management providing good hardware and strong network infrastructure’.

It has been observed that the components which load significantly on the construct of ‘software attributes’ are ‘involvement of physicians in choosing or customizing the software’, ‘proper maintenance of software and databases’, ‘easy and fast softwares for better understanding and reduction in complexity’, ‘friendly system’, ‘high speed information processing’ and ‘fast exchange of information’.

‘Reluctance to change’, ‘in high spirit while using technology’, ‘easily adapt to new technology’, ‘participation in implementation of system’ and ‘positive attitude’ are the constituents of ‘acceptance to change’ which determine achievement of success in deployment of EHR technology.

Components which significantly load on ‘computer knowledge’ for successful implementation of EHR technology are ‘well versed with knowledge of Database Management Systems’, ‘good knowledge of Microsoft Office, internet, operating systems, hardware and software’ and ‘easy retrieval of lost data from a crashed system’.

5.3.2 Impact of CSFs on job characteristics of physicians

Multiple regression analysis has been used to observe the impact of CSFs on job characteristics of physicians. Statistically significant differences ($p<.05$) have been found with respect to impact of various CSFs, namely, ‘training’, ‘organizational support’, ‘software attributes’, ‘acceptance to change’ and ‘computer knowledge’ on ‘job characteristics’ of physicians.

Specifically two factors, namely, ‘software attributes’ and ‘computer knowledge’ have been found to be supportive of ‘job characteristics’ of physicians.

5.3.3 Impact of CSFs on job satisfaction of physicians

Multiple regression analysis has been performed to observe the impact of CSFs on ‘job satisfaction’ of physicians. Statistically significant differences ($p<.05$) have been found with respect to impact of CSFs, namely, ‘training’, ‘organizational support’, ‘software attributes’, ‘acceptance to change’ and ‘computer knowledge’ on ‘job satisfaction’ of physicians.

Four out of five factors, namely, ‘training’, ‘organizational support’, ‘acceptance to change’ and ‘computer knowledge’ have been found to be supportive of ‘job satisfaction’ of physicians.

5.3.4 Identification of data management factors in post-implementation phase of usage of EHR technology

Factors related to data management involved in the post-implementation phase of usage of EHR technology have been identified.

It has been identified through exploratory factor analysis that there are four factors of data management involved in the post-implementation phase of usage of EHR technology. The factors, in descending order of consideration, are ‘effectiveness’, ‘accessibility’, ‘accuracy’ and ‘timeliness’.

Components which significantly load on ‘effectiveness’, are ‘high quality medicine than paper charts’, ‘status of metadata described with the use of e-records’, ‘data available using EHR is inconsistent’, ‘EHR provide consistency between items of multiple data from multiple sources’, ‘Complete view of records, images, tests and referrals is available using EHR’ and ‘EHR show the source and context of data’.

Five components which have significantly loaded on ‘accessibility’, are ‘easy to use interfaces’, ‘appropriate form of data available’, ‘privacy from unauthorized users’, ‘time of entry and retention is stated’ and ‘instant data is available on all systems’.

Four components, namely, ‘easy and intuitive’, ‘duplication of data is removed’, ‘reduction of errors in documentation’, ‘reduced wrong interpretation of data’ and ‘lesser wrong prescription, tests and images using EHR’, significantly load on ‘accuracy’.

Four components which have significantly loaded on ‘timeliness’, are ‘fast access to records’, ‘ordering lab tests, referrals and imaging study is fast’, ‘prescription of medicine, tests is fast’ and ‘exchange of data between physicians of various departments is on real time basis’.

5.3.5 Impact of data management factors on job characteristics of physicians

Multiple regression analysis has been performed to observe the impact of data management factors on job characteristics of physicians. Statistically significant differences ($p<.05$) have been found with respect to impact of data management factors, namely, ‘effectiveness’, ‘accessibility’, ‘accuracy’ and ‘timeliness’ on ‘job characteristics’ of physicians.

Three factors, namely, ‘accessibility’, ‘effectiveness’ and ‘timeliness’ have been found to be supportive of ‘job characteristics’ of physicians.

5.3.6 Impact of data management factors on job satisfaction of physicians

Multiple regression analysis has been performed to observe the impact of data management factors on ‘job satisfaction’ of physicians. Statistically significant differences ($p<.05$) have been found with respect to impact of factors, namely, ‘effectiveness’, ‘accessibility’, ‘accuracy’ and ‘timeliness’ on ‘job satisfaction’ of physicians.

Two factors of data management, namely, ‘accessibility’ and ‘timeliness’ have been found to be having a significant impact on ‘job satisfaction’ of physicians.

5.3.7 Relationship of ‘computer knowledge’ and ‘EHR usage’ with demographic and other variables

Chi-Square tests have been performed to observe the relationship between different levels of computer knowledge and EHR usage on weekly basis. Chi-square values show that there are significant differences, at 5 per cent level of significance, between the two variables.

Chi-square analysis also shows that there are significant differences between different 'age-groups' and 'work-areas' with respect to computer knowledge possessed by physicians. No significant differences in computer knowledge of physicians with respect to 'gender', 'educational level' and 'designation', have been observed.

It is also seen through chi-square analysis that there are significant differences in weekly usage levels of EHR technology with respect to 'age-groups', 'work-areas' and 'designation'. No significant differences have been observed in usage levels of EHR technology with respect to 'gender' and 'educational level'.

5.4 Conclusion

In the present study, qualitative as well as quantitative information has been gathered through primary and secondary sources. Primary data has been collected from physicians using EHR technology, through a pre-tested, structured and non-disguised questionnaire. The study makes use of descriptive as well as inferential statistics to draw conclusions. It explores factors related to successful implementation of EHR technology and data management in the post-implementation phase. It also analyzes the impact of EHR technology on job characteristics and job satisfaction of physicians.

It has been concluded that five factors affect achievement of success in implementation of EHR technology in hospitals. The factors, in descending order of consideration are, 'training', 'organizational support', 'software attributes', 'acceptance to change' and 'computer knowledge'. Two factors, namely, 'software attributes' and 'computer knowledge' have been found to be supportive of 'job characteristics' of physicians. Four out of five factors, namely, 'training', 'organizational support', 'acceptance to change' and 'computer knowledge' have been found to be supportive of 'job satisfaction' of physicians.

The study has also identified four factors related to data management in the post-implementation phase of usage of EHR technology. The factors, in descending order of consideration, are 'effectiveness', 'accessibility', 'accuracy' and 'timeliness'. Three factors, namely, 'accessibility', 'effectiveness' and 'timeliness' have been found to be supportive of 'job characteristics' of physicians. 'Accessibility' and 'timeliness' have been found to be having a significant impact on 'job satisfaction' of physicians.

It has been concluded that there are significant differences in levels of computer knowledge with respect to 'age-groups' and 'work-areas' of physicians. Significant differences have also been observed in levels of weekly usage of EHR technology with respect to 'age-groups', 'work-areas' and 'designation' of physicians.

5.5 Research implications

Academic implications

The present study has attempted to address unexplored gaps in literature, with respect to impact of implementation of EHR technology on job characteristics and job satisfaction of physicians. Gaps in literature related to data management in the post-implementation phase of EHR technology have also been attempted to be addressed. These gaps may provide inputs for next studies. Constructs for analyzing critical factors related to implementation phase of EHR technology, and factors related to data management in post-implementation phase of usage of EHR technology, have been proposed.

Critical factors related to achievement of success in implementation of EHR technology can be corroborated in further studies. More factors in different contexts or sectors can be identified. Factors related to data management in post-implementation phase of usage of EHR technology can also be used to identify factors related to other stakeholders who use EHR technology. Factors related to implementation of EHR technology can also be studied with respect to stakeholders other than physicians. Similar studies related to other context and sectors can also be conducted.

Managerial implications

The study attempts to provide meaningful inputs to the management of hospitals with respect to EHR adoption. The findings of the study should improve helpful in improving operational performances and satisfaction levels of physicians. Patients visiting hospitals using EHR technology are also expected to benefit from the findings of the study. The study should also be useful to hospitals administrators in understanding behavior of physicians towards usage of EHR technology. It may also help administration in formulating expansion and diversification plans.

The study has sought to provide insight to the hospitals currently using EHR, and also to the ones which are planning to adopt EHR technology in future. Critical factors, namely, 'training', 'organizational support', 'software attributes', 'computer knowledge' and 'acceptance to change' can be seen as an input to achievement of success in implementation of EHR technology. Data management factors, namely, 'effectiveness', 'accessibility', 'accuracy' and 'timeliness', in the post-implementation phase of usage of EHR technology, should help the administrators and physicians in increasing usefulness of EHR technology. EHR technology can be used to improve the effectiveness of modules of data management.

5.6 Recommendations

Successful adoption of EHR technology should benefit patients, hospital administrators as well as physicians. Although there are a number of government hospitals in the country, a large chunk of patients opt for private healthcare services because the latter claim better quality of care, more modern infrastructure, relatively less waiting time, and more advanced medical facilities. EHR technology needs to be successfully deployed and well adopted in the government healthcare structure too. EHR technology can also be effectively integrated with other processes if it is successfully implemented and well accepted.

The hospital administration can enhance its operational performances through usage of EHR technology. The technology can create opportunities in leveraging workflow-automation capacities. Cumbersome administrative processes can be simplified. The administration needs to focus on critical factors related to achievement of success in implementation of EHR technology. IT consultants can also be employed to provide timely trainings to physicians. Effective leadership and a cooperative culture are required to bring a change in outlook towards technology adoption. Hospital administrators also needs to lay emphasis on security and confidentiality of information available with them.

Physicians can also benefit from successful deployment of technology. Electronic records can result in closer patient engagement, a more proactive approach and a better level of decision-making. Integration of the patient portal in hospitals with scheduling systems can reduce waiting time and improve communication. This can increase overall efficiency and enhance satisfaction level of patients and physicians. It is recommended that physicians

should be involved in selection of EHR software in order to make the best use of technology as per their requirements.

5.7 Limitations of the study

General limitations

This study has a few limitations. However, these limitations can also account for possible opportunities in the future researches. Out of 350 questionnaires circulated, only 280 were duly filled and fit to be considered. One limitation is the use of convenience sampling method. Only selected physicians of multispecialty hospitals were included in the study. On the basis of theoretical framework of the study, only five CSFs have been studied. This research has been conducted in Punjab and its results concur with results of many studies. However, there could be some differences in approach or results as compared to those of the studies conducted elsewhere.

Methodological limitations

The researcher has collected data in categorical form for demographic variables. Collection of data in a precise manner, rather than in categorical form, has the potential of improving the analysis statistically. It may be viewed as another methodological limitation.

5.8 Future research

Though the present study has attempted to cover many important aspects of technology implementation, other CSFs may also be studied. 'Job characteristics' can also be considered as a mediating factor for 'job satisfaction'. Convenience sampling method has limited generalizability. It is also possible that scope of the study can be diversified geographically. The sample size may be increased. Comparative study amongst hospitals, which use and which do not use EHR technology, can also be conducted. Studies relating to technology users including administrators, nurses and other healthcare professionals who practice the same technology but with a different perspective, can also be carried out. Tertiary-level government hospitals practicing EHR technology, which serve to a major part of bottom-of-pyramid patients, can also be included in future studies.

Concluding remarks

This chapter comprises the summary of results. Research objectives with respect to findings of the study have been discussed. It presents the theoretical discussion, implications, contributions and limitations of the present research. Recommendations for future research directions have also been highlighted.

References

Aggarwal, N., & Singh, R. (2004). Market orientation in Indian organizations: an empirical study. *Marketing Intelligence & Planning,* 22(7), 700-715.

Ajami, S., & Bagheri-Tadi, T. (2013). Barriers for Adopting Electronic Health Records (EHRs) by Physicians. *Acta Informatics Medical*, 21(2), 129-134.

Alizamini, F.G., Pedram, M., Alishahi, K., & Badie (2010). *Data quality improvement using fuzzy association rules*. V1-468-V1- 472.

Al-Mashari, M., Al-Mudimigh, A., & Zairi, M. (2003). Enterprise resource planning: A taxonomy of critical factors. *European Journal of Operational Research*, 146(2), 352–364.

Ang, J.S.K., Sum, C.C., & Yeo, L.N. (2002). A multiple-case design methodology for studying MRP success and CSFs. *Information & Management*, 39(4), 271–281.

Athavale1, A.V., & Zodpey, S.P. (2010). Public health Informatics in India: The potential and the challenges. *Indian Journal of Public Health*, 54(3), 131-6.

Atreja, A.G., Steven, M., Pollock, D.A., Olmsted, R.N., & Brennan, P.J. (2008). Oppotunities and challenges in utilising EHRs for infection surveillance, prevention and control. *American Journal of Infection Control,* 36, 37-46.

Babbie, E. (1990). *Survey research methods (2nd ed.*). Belmont, California: Wadsworth Publishing Company.

Bajwa, S.S., Virdi, S.S., Bajwa, S.K., Ghai, G.K., Singh, K., & Rana, C.S. (2010). In depth analysis of motivational factors at work in the health industry. *Industry Psychiatry Journal,* 19, 20-29.

Bakotic, D. (2016). Relationship between job satisfaction and organizational performance. *Economic Research,* 29, 118-130.

Ballou, D.P., & Pazer, H.L. (1985). Modeling data and process quality in multi-input, multi-output information systems. *Management science*, 6, 150-162.

Ballou, D.P., & Tayi, G.K. (1989). Methodology for allocating resources for data quality enhancement. *Communications of the ACM*, 13, 320-329.

Bandyopadhyay, S., & Pardasani, M. (2010). Do quality perceptions of health and social services vary for different ethnic groups? An empirical investigation. *International Journal of Nonprofit and Voluntary Sector Marketing*, 16(1), 99-114.

Bartini, C.C., Cappiello, C., Francalanci, A., & Maurino (2009). Methodologies for data quality assessment and improvement. *ACM Computing Surveys (CSUR)*, 41(16), 23-33.

Bathell, E.N., Cordell, W.H., Moorhead, J.C., Handler, J., Feied, C., Smith, M.L., et al. (2002). The Frontlines of Medicine project: A proposal for the standardized communication of Emmergency Department Data for Public Health uses including syndromic surveillance for Biological and chemical terrorism. *Annals of Emergency Medicine*, 39, 422-9.

Bayoumy, S.A. (2019). Relationship between job characteristics and Work engagement amongst Nursing staff. *International journal of nursing didactics*, 9(1), 45-57.

Berner, E.S., Detmer, D.E., & Simborg, D. (2005). Will the wave finally break? A brief view of the adoption of electronic medical records in the United States. *Journal of the American Medical Informatics Association*, 12, 3-7.

Bhat, R. (1999). Characteristics of private medical practice in India: a provider perspective. *Health Policy and Planning*, 14(1), 26-37.

Bhatia, J., & Cleland, J. (2004). Health care of female outpatients in south-central India: Comparing public and private sector provision. *Health Policy and Planning*, 19(6), 402-409.

Bierman, K.L., Domitrovich, C., & Darling, H. (2009). *Early prevention initiatives,* In: Roopnarine J, Johnson J, editors. Approaches to early childhood education. 5. Columbus, OH: Pearson Merrill Prentice Hall, 147–164.

Boaden, R., & Munir, S. (2001). *Patient empowerment and the electronic health record,* In MEDINFO 2001. Proceedings of the 10th World Congress on Medical Informatics, Amsterdam, 663–665. London: IOS Press, IMIA.

Bodner, G. (1975). Reliability modeling of internal control systems. *Accounting Review*, 5, 747-757.

Bontis, N., Richards, D., & Serenko, A. (2011). Improving service delivery: Investigating the role of information sharing, job characteristics, and employee satisfaction. *The Learning Organization,* 18(3), 239-250.

Borders, A.L., Johnston, W.J., & Rigdon, E.E. (2001). Beyond the Dyad: Electronic commerce and network perspectives in industrial marketing management. *Industrial Marketing Management,* 30, 199-205.

Bovee, M., Srivastava, R.P. & Mak, B. (2003). A conceptual framework and belief-function approach to assessing overall information quality. *International journal of intelligent systems*, 18, 51-74.

Briggs, D.S., Smyth, A., & Anderson, J.A. (2012). In search of capable health managers: What is distinctive about health management and why does it matter? *Asia Pacific Journal of Health Management*, 7(2), 71-78.

Brumec, V., Habjanic, A., Kokol, P., Nicklin, L., Procter, P., & Turk, D. (2001). Intelligent systems for nursing education. In *MEDINFO 2001: Proceedings of the 10th World Congress on Medical Informatics, Amsterdam* 1047–50. London: IOS Press, IMIA.

Budhiraja, S., & Malhotra, M. (2013). Leadership style & Organizational Effectiveness in Indian IT & Banking Industry. *The Indian Journal of Industrial Relations,* 49(2), 1-17.

Budhwar, P.S., & Varma, A. (2011). *Introduction: The business context. In doing business in India*: *Building research-based practice*, Hoboken: Taylor & Francis.

Burton, L.C., Anderson, G.F., & Kues, I.W. (2004). Using Electronic Health Records to help coordinate care. *Milbank Quaterly*, 82(3), 457-81.

Buys, M.A., Olckers, C., & Schaap, P. (2007). The construct validity of the revised job diagnostic survey. *South African Journal of Business Management*, 38, 33-40.

Campbell, D.F.J. (2018). *Global quality of democracy as innovation enabler*, Springer International Publishing.

Cash, J.I., & Konsynski, B.R. (1985). IS redraws competitive boundaries. *Harvard Business Review*, JI(2), 134-142.

Chahal, H., & Kumari, N. (2010). Development of multidimensional scale for healthcare service quality (HCSQ) in Indian context. *Journal of Indian Business Research*, 2(4), 230-255.

Chahal, H., & Sharma, R.D. (1999). A study of patient satisfaction in outdoor services of private health care facilities. *Vikalpa: The Journal of Decision Maker*, 22(4), 69-76.

Cheung, N., Chow, Y., Fung, V., & Tung, Y. (2001). Structured data entry of clinical information for documentation and data collection. In *EDINFO 2001: Proceedings of the 10th World Congress on Medical Informatics, Amsterdam* 609-13. London: IOS Press, IMIA.

Coelho, F., & Augusto, M. (2010). Job Characteristics and the Creativity of Frontline Service

Employees. *Journal of Service Research*, 13(4), 426-437.

Coiera, E., Aarts, J., & Kulikowski, C. (2012). The dangerous decade. *Journal of the American Medical Informatics Association*, 19(1), 2-5.

Collen, M. (1995). *A history of medical informatics in the United States*, American Medical Informatics Association, Washington, D.C.

COSTE-MANIERE, I., Ramchandani, M., & Van Holt, J. (2017). What drives sustainable luxury consumption in a status driven society like India? *Journal of Textile Engineering & Fashion Technology*, 65 (2), 1-4.

Crownower, A., & Rosenbaum, S. (2002). Designing user interfaces to maximize user acceptance of clinical information systems. 1998. http://www.diamondbullet.com.

Das, J., & Hammer, J. (2007). Money for nothing: The dire straits of medical practice in Delhi, India. *Journal of Development Economics*, 83(1), 1-36.

Dilckinson, M.W., Thornton, A.C., & Graves, S. (2001). Technology portfolio management: optimizing interdependent projects over multiple time periods. *IEEE Transactions on Engineering Management*, 48(4), 518-527.

Droar, D. (2006). *The Job characteristics model*. Retrieved May 1, 2009, from http://www.arrod.co.uk/archive/concept_job_characteristics.php.

Eckerson, W. (2002). *Data Warehousing Special Report: Data quality and the bottom line*, Applications Development Trends May.

Egan, T., Clancy, S., & O'toole, T. (2003). The integration of E-commerce tools into the business process of SMEs. *Irish Journal of Management*, 24, 139-145.

Eni, G., & Tan, J. (1989). Going north on a North-bound trail: A Model for achieving health management goals and objectives. *Health Services Management Research*, 2(2), 146-154.

Feng, C., Le, D., & McCoy, A.B. (2019). Using Electronic Health Records to indentify adverse drug events in ambulatory care: A systematic review. *Application of Clinical Information*, 10(1), 123-128.

Field, A. (2005). *Discovering Statistics through SPSS*. Sage Publication: London.

Frempong, L.N., Agbenyo, W., & Darko, P.A. (2018). The Impact of Job Satisfaction on Employees' Loyalty and Commitment: A Comparative Study Among Some Selected Sectors in Ghana. *European Journal of Business and management*, 10(12), 1-11.

Garg, R. (2010). Study on delivery practices among women in rural Punjab. *Role Of Medical Personnel In Promoting Appropriate Infant And Young Child Feeding*, 33(1), 23-33.

Garrido, T., Jamieson, L., Zhou, Y., Wiesenthal, A., & Liang, L. (2005). Effect Of Electronic Health Records In Ambulatory Care: Retrospective, Serial, CrossSectional Study. *British Medical Journal*, 330(7491), 581-84.

Gagnon, M.P., Legare, F., Labrecque, M., Fremont, P., Pluye, P., Gagnon, J., & Gravel, K. (2009). Interventions for promoting information and communication technologies adoption in healthcare professionals. *Cochrane Database Syst Rev.*

Geissbuhler, A., & Tschopp, M. (2001). Use of handheld computers as bedside information providers. In *MEDINFO 2001: Proceedings of the 10th World Congress on Medical Informatics, Amsterdam* 764-7. London: IOS Press, IMIA.

Gerbing, D. W., & Anderson, J. C. (1988). An Updated Paradigm for Scale Development Incorporating Undimensionality as its Assessment. *Journal of Marketing Research*, 25, 186 – 192.

Ghosh, P., Rai, A., Chauhan, R., Gupta, N., & Singh, A. (2015). Exploring the moderating role of context satisfaction between job characteristics and turnover intention of employees of Indian public sector banks. *Journal of Management Development*, 34(8), 1019-1030.

Gil, Y., & Kim, J. (2000). User studies of an interdependency-based interface for acquiring problem-solving knowledge. In *Proceedings of the International Conference on Intelligent User Interface, Louisiana*.

Gill, S.S., Singh, S., & Brar, J.S. (2010). *"Health services in Punjab" in globalization and Indian state: A state of delivery of education, health and agriculture extension services in Punjab*, Aakar Books.

Gomez-Mejia, R.L., Balkin, B.D., & Cardy L.R. (2005). *Management* (2nd ed.). New York: McGraw-Hill Irwin.

Greenwood, P.E., Nikulin, M.S. (1996). *A guide to chi-squared testing*. Wiley, New York.

Gupta, K.S., & Joshi, R. (2008). *Human Resource Management.*

Hackman, J.R., & Oldham, G.R. (1974). *The job diagnostic survey: An instrument for the diagnosis of jobs and the evaluation of job redesign projects*, Department of Administrative Sciences: Yale University.

Hackman, J.R., Oldham, G.R., Janson, R., & Purdy, K. (1975). A new strategy for job enrichment. *California Management Review*, 17, 57-71.

Hadwich, K., Georgi, D., Tuzovic, S., Buttner, J., & Bruhn, M. (2010). Perceived quality of e-health services: a conceptual scale development of e-health service quality based on the C-OAR-SE approach. *International Journal of Pharmaceutical and Healthcare Marketing*, 4(2), 112-136.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*. New Jersey: Pearson Education.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010). Multivariate data analysis: A 25 global perspective. *Upper Saddle River: Pearson*.

Hansen, J.V. (1983). *Audit considerations in distributed processing systems*, Communications of the ACM, 2 (August), 562-569.

Hansen, M., & Wang, Y.R. (1990). *Managing data quality: A critical issue for the decade to come*, composite information systems laboratory, MIT December 1990.

Haughom, J., Kriz, S., & McMillan, D.R. (2011). Overcoming barriers to EHR adoption, Healthcare financial management. *Journal of the Healthcare Financial Management Association*, 65(7), 96-100.

Hayes, A.F. (2013). *Introduction to mediation, moderation, and conditional process analysis*. A regression-based approach. New York, NY: The Guilford Press.

Heravizadeh, M.J., Mendling, M., & Rosemann (2009). Dimensions of business processes quality. *Quality of business processes*,5, 80-91.

Holden, R.J. (2011). What Stands in the Way of Technology-Mediated Patient Safety Improvements? A Study of Facilitators and Barriers to Physicians Use of Electronic Health Records. *Journal of Patient Safety*, 7(4), 193-203.

Holland, C.P., & Light, B. (1999). Global Enterprise Resource Planning Implementation. *Proceedings of the32nd Hawaii International Conference on System Sciences*, Hawaii, USA.

Hong, K.K., & Kim, Y.G. (2002). The CSFs for ERP implementation: An organizational fit perspective. *Information & Management*, 40, 25–40.

Hunter, E.P. (2006). *Viability of the job characteristics model in a team environment: Prediction of job satisfaction and potential moderators*. Published doctoral dissertation. University of North Texas, Texas.

Jarke, M. (2003). Fundamentals of data warehouses: Springer Verlag.

Jeselon, P., & Schloeffel, P. (2002). Ad Hoc Group report: standards requirements for the electronic health record and discharge/referral plans.

Jha, A.K., Bates, D.W., Jenter, C., Orav, E.J., Zheng, J., Cleary, P., & Simon, S.R. (2009). Electronic health records: Use, barriers and satisfaction among physicians who care for black and Hispanic patients. *Journal of Evaluation in Clinical Practice*, 15(1), 158–163.

Jones, S.S., Rudin, R.S., Perry, T., & Shekelle, P.G. (2014). Health information technology: an updated systematic review with a focus on meaningful use. *Journal of Internal Medicine*, 160(1), 48–54.

Kaiser, H.F. (1974). *An index of factorial simplicity*. Psychometrika, 39, 31–36.

Kamath, V., Rodrigues, L.L.R., & Desai, P. (2007). *The role of top management in using knowledge management as a tool for innovation - A system dynamics perspective*, Proceedings of The World Congress on Engineering 2011, London, U.K., 759-762.

Kaplan, B., & Harris-Salamone, K. (2009). Health IT success and failure: Recommendations from literature and an AMIA workshop. *Journal of the American Medical Informatics association*, 16(3), 291-299.

Kapur, B. (2011). *Analysis of health and health care services in Punjab.* Department of Economics Punjabi University, Patiala.

Karthikeyan, N., & Sukanesh, R. (2012). Cloud based emergency health care information service in India. *Journal of Medical Systems*, 36(6), 4031-4046.

Kemper, A.R., Uren, R.L., & Clark, S.J. (2006). Adoption of electronic health records in primary care pediatric practices. *Pediatrics*, 118(1), 20-24.

Kim, J.O., & Mueller, C.W. (1978). Factor Analysis: Statistical Methods and Practical Issues. Beverly Hills, CA: Sage.

Klein, T. (2011). *Why do India's urban poor choose to go private? Hospital choice experiments in slums of Hyderabad.* Paper presented at the meeting of Second European Research Conference on Microfinance.

Klinefelter, J.R., & Klinefelter, T.A. (2015). *Minimalist investor maximum profits.* New York, NY: Page Publishing.

Kumari, G., & Pandey, K.M. (2011). Job satisfaction in public sector and private sector: A comparison. *International Journal of Innovation, Management and Technology*, 2(3), 222.

Laudon, K.C. (1986). Data quality and due process in large interorganizational record systems. *Communications of the ACM,* 22(1), 4-11.

Leonard, K.J., & Sittig, D.F. (2007). Improving information technology adoption and implementation through the identification of appropriate benefits: creating improve-IT. *Journal of Medical Internet Research*, 9(2), 56-65.

Lillrank, P. (2015). Small and big quality in health care. *International Journal of Health Care Quality Assurance*, 28(4), 356-366.

Lindgren, B. (1991). *Getting data with integrity*, Enterprise, 5, 30-34.

Loomis, G.A., Ries, J.S., Saywell, R.M., & Thakker, N.R. (2002). If electronic medical records are so great, why aren't family physicians using them? *The Journal of Family Practice*, 51, 636-641.

Loonam, J., & McDonagh, J. (2005). *Principles, Foundations, & Issues in Enterprise Systems*. Ireland: Ideal Group Inc.

Ludwick, D., & Doucette, J. (2009). Primary care physicians' experience with electronic medical records: Barriers to implementation in a fee-for service environment. *International Journal of Telemedicine and Applications*, 2.

Luthans, F. (1998). *Organisational behaviour* (8th ed.). Boston: Irwin McGraw-Hill.

Madnick, S.E., & Wang, Y.R. (1988). Evolution towards strategic applications of databases through composite information systems. *Journal of Management Information Systems,* 5(2), 5-22.

Malach, M., & Baumol, W.J. (2012). Opportunities for Cost Reduction of Medical Care: Part 3. *Journal of Community Health*, 37(4), 888–896.

Man,Y., Wei, L., Gang, H., & Juntao, G. (2010). *A noval data quality controlling and assessing model based on rules*, 29-32.

Mathai, N., Shiratudin, M.F., & Sohel, F. (2017). Electronic Health Record Management: Expectations, Issues, and Challenges. *Journal of Health and Medicine Information*, 8(265), 234-243.

Mandl, K., & Porter, S. (1999). Data quality and the electronic medical record: a role for direct parental data entry. In *American Medical Informatics Association Three Year Cumulative Symposium Proceedings*.

McCullough, J. (2008). The adoption of health information systems. *Health Economics,* 17, 649-664.

McFarlan, F.W. (1984). Information technology changes the way you compete. *Harvard Business Review,* 62(2), 98-105.

McGilvray, D. (2008). *Executing data quality projects: Ten steps to quality data and trusted information*: Morgan Kaufmann.

Mecella, M., Scannapieco, A., Virgillito, R. Baldoni, T., Catarci, C., & Batini (2002). Managing data quality in cooperative information systems. *On the Move to Meaningful Internet Systems,* 486-502.

Meinert, D.B. (2004). Resistance to Electronic Medical Records (EMRs): A Barrier to Improved Quality of Care. *Informing Science: International Journal of an Emerging Transdiscipline*, 2, 493-504.

Mehta, N.B., & Partin, M.H. (2007). Electronic Health Records: a primer for practising physicians. *Cleveland Clinic Journal of Medicine* , 74 (11), 826-830.

Middleton, B., Hammond, W.E., Brennan, P.F., & Cooper, G.F. (2005). Accelerating U. S. EHR adoption: how to get there from here. Recommendations based on the 2004 ACMI retreat. *Journal of the American Medical Informatics Association*, 12, 13-19.

Miller, R.H., & Sim, I. (2004). Physicians' use of electronic medical records: barriers and solutions. *Health affairs,* 23(2), 116-126.

Moon, Y.B. (2007). Enterprise Resource Planning (ERP): A review of the literature. *International Journal of Management and Enterprise Development*, 4(3), 235-245.

Moukheiber. (2013). The Staggering Cost Of An Epic Electronic Health Record Might Not Be Worth It. *Forbes*.

Mukherjee, A., & McGinnis, J. (2007). E-Healthcare: an analysis of key themes in research. *International Journal of Pharmaceutical and Healthcare,* 1(4), 349-63.

Naumann, F. (2002). *Quality-driven query answering for integrated information systems*, 2261: Springer Verlag.

Nayak, A., Bagchi, K.K., & Nayak, C.R. (2012). Healthcare finance, health insurance and healthcare administration for the poor and elderly people in India–Scope of public-private partnership. *SIT Journal of Management,* 1(1), 106-121.

Ohsfeldt, R.L., Ward, M.M., Schneider, J.E., Jaana, M., Miller, T.R., & Lei, Y. (2005). Implementation of hospital computerized physician order entry systems in a rural state: feasibility and financial impact. *Journal of the American Medical Informatics Association*, 12, 20-27.

Overtveit, J., Scott, T., Rundall, T.G., Shortell, S.M., & Brommels, M. (2007). Improving quality through effective implementation of IT in healthcare. *International Journal of Quality Health care*, 19(5), 259-66.

Or, C., Dohan, M., & Tan, J. (2014). Understanding critical barriers to implementing a clinical information system in a nursing home through the lens of a socio-technical perspective. *Journal of Medical Systems*, 38(9), 1-10.

Patwardhan, A.A., Pandey, N., & Dhume, S.M. (2014). Analysis of physicians‘ technology acceptance literature in changing Indian pharmaceutical marketing context: A Markus and Robey‘s causal structure approach. *International Journal of Marketing & Business Communication*, 3(2), 33-45.

Pires, G.D., & Aisbett, J. (2003). The relationship between technology adoption and strategy in business-to business markets-The case of e-commerce. *Industrial Marketing Management,* 32, 291-300.

Prasad, V.K., Ramamurthy, K., & Naidu, G.M. (2001). The Influence of internet-marketing integration on marketing competencies and export performance. *Journal of International Marketing*, 9, 82-110.

Rashmi, & Vijaykumar, B. (2010). Quality assessment of child care services in primary health care settings of Central Karnataka. *Indian Journal of Community Medicine: Official Publication of Indian Association of Preventive & Social Medicine*, 35(1), 24-28.

Redman, T.C. (1996). *Data quality for the information age*: Artech House.

Relly, J.E., & Sabharwal, M. (2009). Perceptions of transparency of government policymaking: A cross-national study. *Government Information Quarterly*, 26(1), 148-157.

Robbins, S. (2003). *Organizational Behavior: International Edition*, 10th Edition, Prentice Hall, New Jersey.

Roemer, M.I. (1993). National health systems throughout the world. *Annual Review of Public Health*, 14(1), 335-353.

Rogers, E.M. (2010). *Diffusion of Innovations*. Simon and Schuster.

Rosenthal, D.A. (2002). Managing non-technical factors in healthcare IT projects. *Journal of Healthcare Information Management*, 16(2), 56-67.

Rozman, M., Treven, S., & Cancer, V. (2017). Motivation and satisfaction of employees in the workplace. *Business Systems Research*, 8(2), 34-45.

Safdari, R., Ghazisaeidi, M., & Jebraeily, M. (2015). Electronic Health Records: Critical success factors in implementation. *Acta Inform Med*, 23(2), 102–104.

Saklani, A., Purohit, H.C., & Badoni, D.C. (2000). Positive disconfirmation as a threshold to high satisfaction. *Journal of Management Research,* 1(1), 31-37.

Sangmook, K.I.M. (2016). Job characteristics, Public service motivation and work performance in Korea. *Gestion et Management Public*, 5(1), 7-24.

Scheidlinger, S. (2016). Meaningful use stage 3 and 2015 certification final rules released. Retrieved March 27, 2018 from, https://www.practicefusion.com/blog/meaningful-use stage-3.

Scott, N. (2001). *Information Impacts Magazine.* http://www.cisp.org.

Sharma, M.K., & Singh, K. (2015). Impact of changing socio-economic environment on business in India. *International Journal of Research in Business Studies and Management,* 2(4), 21-28.

Shehab, E., Sharp, M., Supramaniam, L., & Spedding, T. (2004). Enterprise resource planning: An integrative review. *Business Process Management Journal*, 10(4), 359–386.

Silander, K., Torkki, P., Lillrank, P., Peltokorpi, A., Brax, S. A., & Kaila, M. (2017). Modularizing specialized hospital services Constraining characteristics, enabling activities and outcomes. International Journal of Operations And Production Management, 37 (6), 791-818.

Singh, R., & Kathuria, L.M. (2015). A study of export marketing and other business practices of select garment exporters. *Foreign Trade Review*, 40(2), 69-88.

Smith, M.C. (2015). *Motivation and its Impact on Employee Loyalty and Commitment: A Qualitative Analysis* - Trinity Washington University.

Smithline, N., & Christenson, E. (2002). Physician and Internet: understanding where we are and where we are going. *Journal of Ambulatory Care Management* , 24, 39-53.

Smith, P.C., Kendall, L. M., & Hulin, C.L. (1969). *The Measurement of Satisfaction in Work and Retirement*, Rand McNelly, Chicago.

Sodani, P.R., Kumar, R.K., Srivastava, J., & Sharma, L. (2010). Measuring patient satisfaction: A case study to improve quality of care at public health facilities. *Indian Journal of Community Medicine: Official Publication of Indian Association of Preventive & Social Medicine*, 35(1), 52-56.

Somers, T.M., & Nelson, K.G. (2004). A taxonomy of players and activities across the ERP project life cycle. *Information & Management*, 41(3), 257–278.

Spector, P.E. (1997). *Job Satisfaction: Application, assessment, causes, and consequences*. Retrieved May 2, 2009, from http:// search.barnesandnoble.com/Job-Satisfaction/ Spector-Paul-E/e/9780761989233.

Stetler, C.B., McQueen, L., Demakis, J., & Mittman, B.S. (2008). An organizational framework and strategic implementation for system-level change to enhance research-based practice: QUERI Series. *Implementation Science*, IS, 3(30).

Tee, S.W., Bowen, P.L., Doyle, F.H., & Rohde, H. (2007). Factors influencing organizations to improve data quality in their information systems. *Accounting & Finance*, 47, 335-355.

Teehankee, B. (2007). *Why should corporations be socially responsible*?. In: Doing good in business matters: CSR in the Philippines frameworks. Manila: AIM & De La Salle GSB, 1-29.

Thompson, T.G., & Brailer, D.J. (2004). *The decade of health information technology: delivering consumer centric and information-rich health care*, Washington, D.C.: U.S. Department of Health & Human Services.

Tonges, M.C., Rothstein, H., & Carter, H.K. (1998). Sources of Satisfaction in Hospital Nursing Practice: A Guide to Effective Job Design. *Journal of Nursing Administration,* 28(5), 47-61.

Umble, E.J., Haft, R.R., & Umble, M.M. (2003). Enterprise resource planning: Implementation procedures and critical success factors. *European Journal of Operational Research*, 146(2), 241-257.

Verma, D. S., & Khandelwal, U. (2011). Consumers' preferences towards service industry: A factorial study of health care industry. *International Journal of Multidisciplinary Research,* 1(8), 83-89.

Visaria, P., & Gumber, A. (1994). Utilisation of and Expenditure on Health Care in India, 1986-87: A study of five states. *Gujarat Institute of Development Research, Gota, Gujarat*, 26-37.

Wang, R.Y., & Strong, D.M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of management information systems*, 12, 5-33.

Wang, Y.Y.R., Wang, R.Y., Ziad, M., Lee, Y.W. (2001). *Data quality*, Springer, 23.

Wang, Y.Y.R., Wang, R.Y., Ziad, Y.W., & Lee (2001). *Data quality*, vol. 23: Springer, 2001.

Webster, C. (2002). *The national health service: A political history*. USA: Oxford University Press.

Wei, C., & Wang, M. (2004). A comprehensive framework for selecting an ERP system. *International Journal of Project Management*, 22(2), 161–169.

Whetstone, M., & Goldsmith, R. (2009). Factors influencing intention to use personal health records. *International Journal of Pharmaceutical and Healthcare Marketing,* 3 (1), 8-25.

Williams, L.S. (1992). Microchips versus stethoscopes: Calgary hospital, MDs face off over controversial computer system. *Canadian Medical Association Journal*, 147(10), 1534-1540.

Yang, Z., Cai, S., Zhou, Z., Zhou, N. (2005). Development and validation of an instrument to measure user perceived service quality of information presenting Web portals. *Information and Management*, 42, 575-589.

Yusuf, Y., Gunasekaran, A., & Abthorpe, M.S. (2004). Enterprise information systems project implementation: A case study of ERP in Rolls-Royce. *International Journal of Production Economics*, 87(3), 251–266.

Zayyad, M.A., & Toycan, M. (2018). Factors affecting sustainable adoption of e-health technology in developing countries: an exploratory survey of Nigerian hospitals from the perspective of healthcare professionals. *Peer journal*, 12(3), 23-34.

Zeithaml, V.A., & Bitner, M.J. (2000). *Services marketing.* New York, NY: McGraw-Hill.

Zikmund, W.G. (1997). *Business Research Methods.* Fort Worth, TX: The Dryden Press.

Zolot, J.S. (1999). Computer-Based Patient Records. *American Journal of Nursing*, 99(12), 64-69.

Appendix (I): Research Questionnaire

Dear Respondent

The present questionnaire relates to a doctoral dissertation on the topic 'Impact of Electronic Health Records on Job Characteristics and Job Satisfaction of Physicians in Punjab'. This research is purely for academic purposes and your responses will be kept strictly confidential.

Section A:

Q1 How do you rate yourself with respect to computer knowledge?

☐ Novice/ Beginner ☐ Conversant

☐ Expert

Q2 For how many hours (per week), do you make use of Electronic Health Records technology?

☐ Up to 5 hrs ☐ 5 - 10 hrs

☐ >10 - 15 hrs ☐ More than 15 hrs

Section B: Statements related to implementation of EHR technology in your hospital are given below. Please encircle 5 if you strongly agree, or 1 if you strongly disagree with the statement. If your response is not strong on either side, encircle one of the numbers in the middle. There are no right or wrong answers – our interest is in a number that best describes *your opinion about implementation of EHR, in your hospital.*

	Statements					
1	IT consultants are provided for better understanding	5	4	3	2	1
2	Training is provided to handle, secure, enter and retrieve data	5	4	3	2	1
3	An IT person is available for updating software	5	4	3	2	1
4	Better working group and user engagement has been established	5	4	3	2	1
5	Effective leadership and team work has been practiced	5	4	3	2	1
6	The top management is always interested in financing and deploying technology	5	4	3	2	1
7	Top management encourages physicians to use new technology	5	4	3	2	1
8	I feel culture of the hospital is cooperative	5	4	3	2	1
9	Organization provides high security and confidentiality of information	5	4	3	2	1

10	Sufficient funds are provided for EHR implementation	5	4	3	2	1
11	Management provides good hardware and strong network infrastructure	5	4	3	2	1
12	I was involved in choosing or customizing the software	5	4	3	2	1
13	Proper maintenance of software and database is done	5	4	3	2	1
14	Easy and fast softwares are developed for better understanding and reduction in complexity	5	4	3	2	1
15	The system is user friendly	5	4	3	2	1
16	High speed information processing is provided	5	4	3	2	1
17	Exchange of information between sectors is fast	5	4	3	2	1
18	I feel reluctant to change from paper based records to electronic records	5	4	3	2	1
19	I am in high spirits while using technology	5	4	3	2	1
20	I easily adapt to new technology	5	4	3	2	1
21	I participate in the implementation of system	5	4	3	2	1
22	I have a positive attitude in accepting technology	5	4	3	2	1
23	I am well versed with knowledge of Database Management Systems	5	4	3	2	1
24	I have a good knowledge of Microsoft Office, internet, operating systems, hardware and software	5	4	3	2	1
25	I can retrieve lost data from a crashed system easily	5	4	3	2	1

Section C: Statements related to data management in the post-implementation phase of EHR in your hospital are given below. Please encircle 5 if you strongly agree, or 1 if you strongly disagree with the given statement. If your response is not strong on either side, encircle one of the numbers in the middle. There are no right or wrong answers – our interest is in a number that best describes *your experience with data management, in post-implementation phase of EHR, in your hospital.*

1	With the use of EHR, high quality medicine can be practiced	5	4	3	2	1
2	Status of metadata is described with the use of e-records	5	4	3	2	1
3	Data available using EHR is inconsistent	5	4	3	2	1
4	EHR provide consistency between items of multiple data from multiple sources	5	4	3	2	1
5	Complete view of records, images, tests and referrals is available using EHR	5	4	3	2	1
6	EHR show the source and context of data	5	4	3	2	1
7	EHR are easy to use interfaces	5	4	3	2	1
8	EHR provide appropriate form of data available	5	4	3	2	1

9	Privacy from unauthorized users is strictly maintained with the use of EHR	5	4	3	2	1
10	Time of entry and retention is stated using EHR	5	4	3	2	1
11	Instant data is available on all systems with the use of EHR	5	4	3	2	1
12	EHR are easy and intuitive	5	4	3	2	1
13	Duplication of data during documentation is removed using EHR	5	4	3	2	1
14	Reduction in error free interpretation of data using EHR is observed	5	4	3	2	1
15	EHR reduce wrong prescription of medicines, tests and images	5	4	3	2	1
16	EHR provide fast access to records	5	4	3	2	1
17	EHR increase operational speed in ordering of lab tests, referrals and imaging study	5	4	3	2	1
18	EHR enable quick prescription of medicine and diagnostic tests	5	4	3	2	1
19	EHR provide real time data exchange between physicians of various departments	5	4	3	2	1

Section D: Statements related to your job characteristics are given below. Please encircle 5 if you strongly agree, or 1 if you strongly disagree with the statement. If your response is not strong on either side, encircle one of the numbers in the middle. There are no right or wrong answers – our interest is in a number that best describes *your job.*

1	My job is relatively significant in my hospital	5	4	3	2	1
2	My job is important in broader scheme of things	5	4	3	2	1
3	My job is one where a lot of other people can be affected by how well the work gets done	5	4	3	2	1
4	My job is arranged so that I often have the opportunity to see jobs or projects through to completion	5	4	3	2	1
5	My job is arranged so that I have the opportunity to complete the work I start	5	4	3	2	1
6	My job is arranged so that I have the chance to do a job from the beginning to the end	5	4	3	2	1
7	My job provides much variety	5	4	3	2	1
8	My job provides different responsibilities	5	4	3	2	1
9	My job provides me considerable variety of work	5	4	3	2	1
10	My job permits me to be left on my own to do my work	5	4	3	2	1
11	My job gives me considerable opportunity for independence and freedom in how I do the work	5	4	3	2	1
12	My job provides an opportunity for independent thought and action	5	4	3	2	1
13	My job provides feedback on how well I am doing as I am working	5	4	3	2	1
14	My job enables me to find out how well I am doing	5	4	3	2	1
15	My job provides me with the feeling that I know whether I am performing well or not	5	4	3	2	1

Section E: Statements related to your job satisfaction are given below. Please encircle 5 if you strongly agree, or 1 if you strongly disagree with the statement. If your response is not strong on either side, encircle one of the numbers in the middle. There are no right or wrong answers – our interest is in a number that best describes *your job.*

1	Overall, I am satisfied with my job	5	4	3	2	1
2	I would not prefer another job	5	4	3	2	1
3	I am satisfied with important aspects of my job	5	4	3	2	1

Section F: Demographic profile and other information

Please tick in the appropriate ☐

A) Your age:

☐ 20-30 years

☐ 30-40 years

☐ 40-50 years

☐ 50-60 years

☐ 60 years and more

B) Education Qualification:

☐ MBBS ☐ MBBS-MD

☐ DM/MCH

C) Gender:

☐ Male ☐ Female

D) Work area:

☐ Emergency Ward ☐ Intensive Care Unit

☐ Operation Theatre Personnel ☐ General Ward

☐ Out Patient Department

E) Your designation in the hospital:

☐ Professor ☐ Associate Professor

☐ Assistant Professor ☐ Senior Resident

☐ Junior Resident

Thank you for sharing your valuable time to fill up this questionnaire.

Appendix (II) - Research Publications

(Research Paper - I)

Title of Paper: Critical Success Factors in Electronic Health Records (EHR) Implementation: An Exploratory Study in North India

Author(s): Navneet Kaur Bajwa, Harjot Singh, Kalyan Kumar De

Name of Journal: International Journal of Healthcare Information Systems and Informatics

ISSN: 1555-3396 (Print), 1555-340X (Online)

Publisher: IGI Global

Abstracted and Indexed: ABDC, Web of Science Emerging Sources Citation Index (ESCI), SCOPUS, Compendex (Elsevier Engineering Index), INSPEC and 16 more indices

Month of Publication: April-June 2017

Volume No., Issue No. & Page Nos.: Volume: 12, Issue: 2, Pages: 1 - 17

(Research Paper - II)

Title of Paper: Impact of EHR Technology Implementation on physician's job satisfaction

Author(s): Navneet Kaur Bajwa, Harjot Singh, Kalyan Kumar De

Name of Journal: International Journal of Applied Management and Technology

ISSN: 1544-4740

Publisher: Walden University School of Management

Abstracted and Indexed: ABDC, SCOPUS.

Month of Publication: February, 2019

Volume No., Issue No. & Page Nos.: Volume: 18, Issue: 1, Pages: 111 - 125