Challenges for developing health-care knowledge in the digital age

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Abstract

Purpose – *Health-care knowledge is dispersed among different departments in a health care organization, which makes it difficult at times to provide quality care services to patients. Therefore, this study aims to identify the main challenges in adopting health information technology (HIT).*

Design/methodology/approach – *This study surveyed 148 stakeholders in 4 key categories [patients, health-care providers, United Arab Emirates (UAE) citizens and foresight experts] to identify the challenges they face in adopting health care technologies. Responses were analyzed using exploratory (EFA) and confirmatory factor analysis (CFA).*

Findings – *EFA revealed four key latent factors predicting resistance to HIT adoption, namely, organizational strategy (ORGS); technical barriers; readiness for big data and the internet of things (IoT); and orientation (ORI). ORGS accounted for the greatest amount of variance. CFA indicated that readiness for big data and the IoT was only moderately correlated with HIT adoption, but the other three factors were strongly correlated. Specific items relating to cost, the effectiveness and usability of the technology and the organization were strongly correlated with HIT adoption. These results indicate that, in addition to financial considerations, effective HIT adoption requires ensuring that technologies will be easy to implement to ensure their long-term use.*

Research limitations/implications – *The results indicate that readiness for big data and the IoT-related infrastructure poses a challenge to HIT adoption in the UAE context. Respondents believed that the infrastructure of big data can be helpful in more efficiently storing and sharing health-care information. On the technological side, respondents felt that they may experience a steep learning curve. Regarding ORI, stakeholders expected many more such initiatives from health-care providers to make it more knowledge-specific and proactive.*

Practical implications – *This study has implications for knowledge management in the health -care sector for information technologies. The HIT can help firms in creating a knowledge eco-system, which is not possible in a dispersed knowledge environment. The utilization of the knowledge base that emerged from the practices and data can help the health care sector to set new standards of information flow and other clinical services such as monitoring the self-health condition. The HIT can further influence the actions of the pharmaceutical and medical device industry.*

Originality/value – *This paper highlights the challenges in HIT adoption and the most prominent factors. The conceptual model was empirically tested after the collection of primary data from the UAE using stakeholder theory.*

Keywords *Stakeholder theory, United Arab Emirates, Barriers to knowledge management, Health-care information technology, Health-care knowledge, Dispersed knowledge*

Paper type *Research paper*

1. Introduction

Public health is a critical aspect of any economy's well-being. The robust public health policies helps in preventing the spread of disease and enhances the life expectancy through structured measures in place by organizations, individuals and society as a whole (Menghi *et al.*, 2019; Ocloo and Matthews, 2016; Örnerheim, 2016; Sinha, 2010). This is possible when information on the health of the population reaches to authorities, organizers,

policymakers and managers at the right time, where and when needed (Van de Goor *et al.*, 2017). With the advent of advanced technologies in the past decade, it makes easier to store, share and analyze the data related to the health of an individual (Bhuyan *et al.*, 2017; Grundy *et al.*, 2016; Nussbaum *et al.*, 2019). Health information technologies (HIT) is an umbrella term to describe a platform that can perform this type of management of information and its secure exchange among relevant stakeholders in the health care sector [including patients, health-care providers, government, insurers, family members of patients, society and quality-control organizations (labs)] (Blumenthal and Glaser, 2007; Sharma and Kaur, 2017; Sinha, 2010).

HIT is a set of tools that can transform the entire system of health-care by integrating the knowledge dispersed among patients, technology providers, health care-organization departments and clinicians. HITs meets the important needs of modern health care institutions and it is essential for a secure, responsive and efficient care ecosystem (Hayajneh and Zaghloul, 2012; Sittig *et al.*, 2018). HIT is also crucial for developing dynamic capabilities in complex and inter-organizational settings (Ambrosini and Bowman, 2009; Oliva *et al.*, 2019). For instance, hospitals are closely related to the network of laboratories and pharmaceutical companies for different tests and medicines. Health care organizations lack technologies that can integrate the dispersed knowledge of pharmaceutical firms and labs to HITs; however, there is increasing appreciation that modern technologies can facilitate better access, excellence and reduce the cost of services in health-care (Bates and Bitton, 2010; Ojo *et al.*, 2007; Wang *et al.*, 2018). Economies across the world are undertaking large-scale initiatives to implement various forms of HIT, but several barriers and challenges can hinder or even halt its mass acceptance (Liang *et al.*, 2019; Kaye *et al.*, 2010; Oliva and Kotabe, 2019). Despite many beneficial uses of HIT, its usage among health care stakeholders is generally low due to various reasons, including a lack of understanding of the value of knowledge for their service (Greaves and Rozenblum, 2017). Most significant challenges found in the literature related to the budget and intricacy while implementing HITs, which involves significant modifications in day to day operations and culture of the organization (Anwar *et al.*, 2012; Mutlag *et al.*, 2019; Sarala *et al.*, 2016). In addition, the payment policies designed for the quality and quantity of health care services offered and customized delivery systems also influence the adoption of HIT (Osei-Frimpong *et al.*, 2018).

Both public and private actors are engaged in increasing HIT adoption rates within and across medical settings (Vest *et al.*, 2014). Modern HITs are capable of integrating and transferring the dispersed knowledge to multiple stakeholders (Oliva *et al.*, 2019). In integration, interoperability can act as an additional measure to enhance the performance of a health care system. Further, the focus can be on standardizing record formats, nomenclature and means of communication (Bakshi, 2012; Campbell *et al.*, 2019; Masys *et al.*, 2012). Medical professionals and other relevant participants in the health care system can no longer ignore HIT (Bryan *et al.*, 2014; Gour and Srivastava, 2010; Poder and Bellemare, 2018), as it has revolutionized practices and delivery patterns (Mittal, 2019). Although the inter-relational organizational arrangements in the health-care context, however, pose a challenge to knowledge management, HIT can play an essential role in improving the quality of health-care in such settings. Improved quality of health-care is possible through the utilization of knowledge management in a structured process (Al Khamisi *et al.*, 2019). However, several challenges and barriers still exist in its widespread acceptance. Its adoption has been particularly slow in some developing nations (Lambooij and Hummel, 2013; Zayyad and Toycan, 2018), owing to challenges in access, financial needs and limited professional resources (Uluc and Ferman, 2016). Anwar *et al.* (2012) grouped deterrents to HIT adoption in developing economies into six clusters, namely, infrastructure; cost and time; national policies; social and cultural factors; educational considerations; and organizational resources. Kundi (2010) found that many countries lack the infrastructure and specialists needed for the application of modern technology in health

care sector. Hence, the readiness and operative utilization of technological infrastructure is vital for mass acceptance in health-care from an integration perspective (Qureshi *et al.*, 2013; Wang *et al.*, 2018; Wood and Bischoff, 2019). Another major challenge to HIT acceptance and its use in developing states is the lack of proper regulatory policies at different stages of the planning process related to all decision-makers on the basis of health-care knowledge (Khoja *et al.*, 2012; Oliva and Kotabe, 2019; Sittig *et al.*, 2018). Researchers have used both qualitative (Afrizal *et al.*, 2019; Ludwick and Doucette, 2009; MacNeil *et al.*, 2019; Pizziferri *et al.*, 2005; Terry *et al.*, 2009; Tieu *et al.*, 2015) and quantitative methods (Burt and Sisk, 2005; Chen, 2019; Mardani *et al.*, 2019; Rumsfeld *et al.*, 2016; Simon *et al.*, 2007; Zayyad and Toycan, 2018) to examine barriers to HIT adoption. Studies have explored knowledge management in health care systems from the perspectives of capabilities, infrastructure and decision support (Bose, 2003; Shortliffe and Sepúlveda, 2018; Ullah *et al.*, 2017). For instance, Ullah *et al.* (2017) explained the big-data and internet of things (IoT) infrastructure requirements in health-care, but they failed to explore the challenges in adopting HITs, particularly in developing economies such as the UAE.

Challenges may arise in the health care eco-system, however, because, if HIT is to be effective, it must be adopted by all relevant stakeholders, whether patients, providers or administrators (Sittig *et al.*, 2018; Teerawattananon *et al.*, 2020; Yusif *et al.*, 2019), all of whom can help in creating the knowledge. On the one hand, although the health care sector understands the potential of technologies, it can find it extremely difficult to implement them. Traditional health-care facilities do not have sufficient infrastructure to support IoT and big-data operations (Pauleen and Wang, 2017). Apart from the customized technical requirements, the orientation (ORI) of health care firms has developed over the period and the strategy of firms also acts as one of the challenges in adopting HITs (Dabic and Kiessling, 2019; Sánchez-Polo *et al.*, 2019). Advanced technologies have been emphasized time and again in the health-care setting, but concerns such as fear, complexity, usefulness, time to learn and adjust, initial investment and legal implications remain among health care managers, clinicians and top management. Many health care organizations do not realize the importance of data and patients' digital history in relation to how it can help them in automating recommendations for the next course of treatment. Hence, this creates a gap in existing practices related to HIT; health care organizations are sufficiently aware of or ready to enhance, big-data and IoT capabilities. Health care organizations need to adopt actionable steps toward achieving specific goals in the digitized economy but, compared to manufacturing and other standard industries, health care firms (especially in the developing world) are lagging in terms of aligning their actions to the vision and mission. Hence, this creates another opportunity for health-care providers to systematize and use their strategic ORI toward HITs. Health care firms spend a large amount on infrastructure (physical and technological), according to their capabilities. Technological-infrastructure requirements change frequently and need continuous upgrading, which can put firms off as, usually, a complete overhaul is needed to ensure compatibility between old and new technology. HIT adoption is also difficult due to the ORI of the ecosystem, including staff, suppliers, patients and their belief system. Therefore, it is important to undertake research to model and confirm the specific barriers to HIT adoption. The identification of challenges and their prominence in HIT adoption will help practitioners and researchers to understand their role in creating an effective ecosystem. This leads us to the following research questions (RQs):

RQ1. Which factors pose challenges in HIT adoption?

RQ2. Which factors are most prominent in HIT adoption?

This study identifying barriers/challenges toward health-care knowledge in the digital age contributes toward integrating the knowledge flowing from different stakeholders to provide effective and efficient health care services. The study has adopted the empirical approach as compared to multi-criteria decision-making methods such as the interpretive structural

model (ISM) approach. This is due to the reason that ISM is based on human judgment with limited respondents, whereas empirical research study have a scope of wider respondents. This study promotes HIT adoption for applications such as telemedicine, medicine management, imaging and flow of activities, along with continuous monitoring of patients in the health care sector. It will further promote the application of HIT in smart remote care, personal health care and robot-based, real-time health systems. The identification of barriers/challenges and eliminating them will help health care organizations to provide quality services, reduce costs and enhance the engagement of consumers.

The remainder of this paper is structured as follows. Section 2 outlines and discusses the arguments in the literature. Section 3 details the methodology adopted, while Section 4 presents and analyzes the results. The results are further discussed in Section 5 and conclusions are drawn in Section 6, including implications for research and practice. Finally, Section 7 describes the limitations and scope for future research.

2. Literature review

Information and technology play a key role in health care systems in providing secure and improved services to stakeholders (Gaur *et al.*, 2019). These technologies and systems can help in tracking health patterns and earlier treatments, promoting better control and accountability within the health care system (Lee *et al.*, 2019; Wang *et al.*, 2018). Better outcomes in health care operations are possible through well-designed and integrated systems, with the involvement of clinicians, nurses, patients, managers, regulators and other relevant stakeholders such as insurance agents, governments and the public. The involvement of various stakeholders leads to better decision-making (De Gooyert *et al.*, 2017). Such systems are also helpful in performance measurement and management, which ultimately leads to competitive advantage (Kotabe and Kothari, 2016). HIT can also help create an open innovation culture, which ultimately helps in effectively using and applying the dispersed knowledge (Spender *et al.*, 2017). Integrated health care systems can help in evaluating, communicating and monitoring the different dimensions of the system in relation to its objectives (Oliva *et al.*, 2019). Hence, these information technologies in health care systems have three objectives, related to health, responsiveness and productivity (Vendrell-Herrero *et al.*, 2019). Here, health relates to better outcomes and a broader view of the people's health status, including their geographical location. Responsiveness relates to prompt services, communication speed, quality of services offered and choice of provider. To do so, firms in the health care system require global sourcing and third parties to support them in their objective of efficiency and effectiveness (Kotabe and Murray, 2018). Productivity relates to the efficiency of resource utilization (Malsch and Guieu, 2019).

2.1 Stakeholder theory in health-care

Over recent decades, the term "stakeholder" has been widely used in academic environments (Pouloudi *et al.*, 2016; Shackleton *et al.*, 2019), although the roots of stakeholder theory (ST) lie in strategic management (Donaldson and Preston, 1995; Freeman, 1984; Frooman, 1999) and organizational theory (Rowley, 1997). Definitions vary, but the most common one identifies a stakeholder as "any group or individual who can affect or is affected by the achievement of an organization's objectives" (Freeman, 1984, p. 46).

Earlier studies have investigated themes such as technology acceptance and the opinions of health care stakeholders toward HIT (Hsieh, 2015; Palanisamy and Thirunavukarasu, 2019; Van Velthoven and Cordon, 2019). These studies have used different models those are developed on the principles of technology acceptance model (TAM) outlined by Davis (1986), innovation diffusion theory (Rogers, 1962), theory of planned behavior (Ajzen, 1985),

TAM2 by Venkatesh and Davis (2000) along with theory of reasoned action (Fishbein and Ajzen, 1975). These models have been used to evaluate the issues in HITs in a fragmented manner. However, an integrated approach that includes the view of multiple stakeholders is not explored much in literature. Further, HITs can offer innovative and unique health care solutions (Khan *et al.*, 2016). The existing studies applied ST in limited one or two categories of stakeholders (Elms *et al.*, 2002; Hung *et al.*, 2014; Poon *et al.*, 2006). Therefore, to have the best outcome and integrated knowledge exploitation for the well-being of society at large, the present study explores the multiple stakeholder perspective in health-care.

Stakeholders can be classified as primary and secondary. Primary stakeholders include members without whose participation an organization cannot survive. Secondary stakeholders are those who are affected or influenced by the actions of an organization and those who can exert influence on an organization. However, secondary stakeholders are not engaged directly in the transactions of the organization, nor are they essential for its survival (Clarkson, 1995). Primary stakeholders in the health care sector include patients, technology providers for digital transactions, clinicians, health-care provider firms and governments. The secondary stakeholders include insurance companies, pharmaceutical companies, friends, relatives, children, spouses and parents that are impacted by or can influence, health-care knowledge development in the digital world. Digital platforms facilitate the continuous communication between primary and secondary stakeholders in today's health-care services. The characteristics of primary and secondary stakeholders also contribute to the challenges in HIT adoption. The role of primary and secondary stakeholders can be viewed from different angles, as presented in Table 1 to better understand their ORI toward HIT. The close relationship among primary and secondary stakeholders further poses challenges for HIT.

2.2 Knowledge management in organizations

Knowledge management is a structured process involving creating, assimilating, sharing and using specific knowledge to improve an organization's performance. Knowledge

Table 1 Orientation of primary and secondary stakeholders in health care

Characteristic/ orientation	*Primary stakeholder*	*Secondary stakeholder*
Goals	•Complying to the standards •Provide quality services •Incurring low cost in delivering services	•Adequate and fast treatment •Information about each component of service delivered
Decision-making	•Quick and logical recommendation •Alternate options in case patient in not capable either physically or financially	•Easy access and consultation with clinician •Knowledge about the health insurance and budget for the treatment
Technology	•Document creation, storage and sharing among different stakeholders •Improved access to big data and using IoT •Reduce the risk of hacking critical medical records •Amplify the expertize of clinicians	•Facilitation on home care and remote care services •Effective in telemedicine services •Self-diagnosis and save on time while visiting clinician
Expected outcome	•Integrating the past and present knowledge to predict the future and course of action by using emerging technologies •Improving public health and quality of life •Reducing health-care waste	•Enhance the engagement among clinician and patient family members or friends •Enhance the medical safety and reduce the errors in treatment •Developing new remedies and vaccines

Source: Developed by author(s)

management facilitates the creation of new skills, acquiring new capabilities, enhancing competencies and sharing knowledge across the eco-system of an organization (Abubakar *et al.*, 2019; Bose, 2003; Du Plessis, 2007). Therefore, knowledge management enables an interactive and engaged environment, where firm members can share, discuss and debate what they already know, how they mentally process it and think about new knowledge creation.

Knowledge management encompasses elements from identification to making knowledge available to the right stakeholders at the right time. In organizations, knowledge is dispersed and needs to be identified and integrated to achieve adequate distribution (Sole and Edmondson, 2002; Zhang *et al.*, 2019). Knowledge management can be organized and aligned through the strategic ORI of a firm (Bosua and Venkitachalam, 2013). It can be techno-centric, where an organization drive its efficiency by focusing on technology and knowledge sharing. It can be designed around an organization so that processes are designed to facilitate the knowledge that works best (Israilidis *et al.*, 2019; Jarrahi *et al.*, 2019). The knowledge management design also can be viewed from the ecology perspective, where more focus is on people's interaction and environmental factors (Chatti, 2012). Organizations use knowledge management for varied reasons, ranging from business strategy, acquiring customer-insight-led knowledge and asset management to innovation and knowledge creation (Khodakarami and Chan, 2014). The knowledge management journey can be viewed from the first era of industrialization to today's emerging technologies (Schulz and Jobe, 2001). Overtime, and with the progression of information technologies, knowledge management has shifted toward systematic and intelligent platforms for leveraging the knowledge assets. Emerging technologies are facilitating the knowledge that is valuable and transparent through organizational learning (Gaviria-Marin *et al.*, 2018; Kebede, 2010; Soto-Acosta *et al.*, 2018). In this way, knowledge management is used in diverse fields, ranging from organizational science to education and training. It is a common myth that data, information and knowledge are one and the same thing. Therefore, it is important to distinguish between them. Data are directly observable (one can verify them) and information represents the analyzed data, whereas knowledge concerns developing the logic on the basis of reasoning and experimental results. Additionally, knowledge management is capable of addressing the tacit and explicit knowledge, unlike information and data (Zins, 2007).

Organizations use different levers to exploit knowledge. For instance, the knowledge of people, e.g. patients in a health care system, can be used to correctly understand their expectations. The knowledge of customers can be used to understand their tacit requirements and expectations and to design the processes accordingly (Zerbo *et al.*, 2015). Marketing strategy can be strengthened by having better and articulated knowledge of products and services (Mosadeghrad, 2013). Knowledge about the processes can facilitate the right information being provided rapidly to the system. Reading, writing and discussing data stored in the firm's database can be used to enhance firm performance (Martin *et al.*, 2017; Wamba *et al.*, 2017). Data needs to be coordinated among various stakeholders for better outcomes of knowledge. The stakeholders from the external and internal environment contribute to the competitive edge in knowledge management of an organization. The absorptive capacity of an organization use the knowledge developed from the external environment (Senivongse *et al.*, 2019; Cohen and Levinthal, 1989), whereas dynamic capabilities view the knowledge from internal and external environment by equal significance (O'Reilly and Tushman, 2008). In the competitive environment, intellectual capital act as a critical and intangible asset for most organizations (Egbu, 2004; Marr *et al.*, 2003). Intellectual capital includes assets belonging to humans (skills, expertize, professionalism, knowledge and maturity), intellectual property (white papers, patents, trademarks, logos and copyrights), organizational capital (processes, procedure, products, work instructions and databases) and relationships with its downstream and upstream stakeholders in terms of ORI and alliances (Hoenig and Henkel, 2015). Hence, knowledge

acts as a driving force in the development of an ecosystem. Knowledge management facilitates competence among organizations, economies and individuals (Pérez-López and Alegre, 2012). We have highlighted the key studies on knowledge management and how it can be helpful for organizations in Table 2. Knowledge and its management help firms to optimize decision-making, forecasting, diagnosing, analyzing and evaluating complex situations (Aydin and Bakker, 2008; Bhatt, 2001; Wang *et al.*, 2018). However, this does not grow automatically; it evolves with experiments, failures, successes and learning over time.

2.3 Health information technology in the United Arab Emirates

Despite enjoying a generally high level of financial resources, most Arab nations exhibit slow progress in the adoption of HIT, mainly owing to the lack of devoted capital and specialized skill sets (Alsadan *et al.*, 2015). Apart from this, the private sector is constrained financially, which seems to prevent HIT deployment. The UAE, however, has seen more growth in this area compared to its neighboring countries. This exemplifies how health care technologies can be effectively implemented in other nations, as witnessed by the UAE's position on the Philips Future Health Index. This index measures countries' perceptions regarding the accessibility and overall integration of the health care system and the adoption of connected health-care (Li *et al.*, 2019; Wang *et al.*, 2018; Wood and Bischoff, 2019). The UAE has been able to surpass expectations through positive views of health care stakeholders and their readiness for HIT. The infrastructure of HIT involves the availability of electronic records of health, 24/7 telemedicine hotlines and prevention programs. Additionally, the health-care structure also offers access to a medical library for health-care providers. This infrastructure may be in place because, historically, the UAE has faced numerous health problems. History indicates the presence of diseases, including cardiovascular, cancer, congenital, obesity and metabolic syndromes, due to the affluent and sedentary lifestyle of the public.

All of these places a great pressure on the nation's resources. Innovative uses of technology and partnerships with other countries and international bodies have helped relieve this pressure and led the country to achieve success in its pioneering development of health-care (Del Giudice *et al.*, 2017; Kotabe *et al.*, 2014). The deficiency of computer skills among health-care professionals has been one of the key de-motivator for HITs and this in line with the findings of earlier studies those highlight the importance of computer skills for the adoption of emerging technologies (Singh and Muthuswamy, 2013; Takian *et al.*, 2012). Al Alawi *et al.* (2014) indicated that knowledge of computer operating, training and period were the key challenges to HIT adoption as perceived by medical professionals in the UAE. Furthermore, variability has been documented in terms of the effects of prior computer knowledge on the benefits of technology. To allay fears and break barriers, leaders and policymakers should focus on training that incorporates proper mentoring and continued education. Many scholars emphasize these factors; they remain a constant challenge to health care systems and prevent the integration of dispersed knowledge (Kalogeropoulos *et al.*, 2003; Oliva, 2014; Oliva *et al.*, 2019). Terry *et al.* (2009) contended that the acceptance and development of HIT can be realized to its fullest when all stakeholders are trained for the technology use. However, because of the current and future importance of HIT to modern health-care, it is essential that time must be devoted to this training.

In summary, despite the documented promise that HIT holds for all health care stakeholders, its diffusion in the UAE remains low and it has met resistance from medical specialists. Although the government is allocating impressive amounts of resources to enhance HIT implementation in line with its long-term vision for the country, the public sector is far from reaching optimal results. Health-care leaders must understand the barriers to HIT acceptance better to increase adoption rates and reshape the standard of care provided.

Table 2 Key knowledge management literature

S. no	Author (s) and year	Research intentions	Approach adopted	Tool of analysis	Respondents	Major findings
1	Del Vecchio *et al.* (2020)	Integration of business analytics to netnography toward value creation by using social big data	Content analysis	Case study	Aurora Company	Integration of netnography and big data analytics is beneficial for customer relationship management. The study highlighted the categorization of knowledge about, for and from sources to develop and maintain customers
2	Matricano *et al.* (2019)	Examining the open innovation procedure of companies to absorb in-bound knowledge	Interview	Case study	Fiat Chrysler Automobiles	Study finds the knowledge in four phases starting from inbound knowledge with accurate acquisition of knowledge, assimilation, transformation and exploitation. First two stages (acquisition and assimilation) represent the potential absorptive capacity that how well is understood and insights generated. Last two stages (transformation and exploitation) represent the realized absorptive capacity of an organization
3	Oliva and Kotabe (2019)	Identify the barriers, methods, tools of knowledge management and practices in the startups to develop dynamic capabilities those can meet the demands of volatile and uncertain business environment	Survey	Linear regressions and cluster analysis	Coworking spaces from São Paulo	Startups with high degree of innovation maturity and development of solution will lead toward the employment of tools, methods and practices required for effective knowledge management
4	Oliva *et al.* (2019)	Analyzing the integration of dynamic capabilities and knowledge management for management by objective through organizational agility	Interview	Case study	A startup firm	The study propose a model on the basis of insights drawn from interviews. The model describe the modus operandi toward testing, measure and capturing the knowledge that is inherent in developing new business in uncertain environment
5	Castaneda *et al.* (2018)	To investigate the relationship among organizational learning and knowledge management	Literature review	VantagePoint 10.0 software	16,185 papers from different search engines	Individual and nuclear procedures ranging from creation to acquisition of knowledge are successfully absorbed by knowledge management literature in past years
6	Natalicchio *et al.* (2017)	Reviewing the knowledge management practices supporting the space for open innovation	Literature review	—	34 articles	The study highlights that knowledge developed in external environment and flow toward focal firm (Inbound knowledge) comprises of maximum percentage followed by the knowledge outgoing developed internally by a focal firm (Outbound knowledge). Further, the last category fall under coupled knowledge driven open innovation described by simultaneous flow into and from focal organization
7	Ferraris *et al.* (2017a)	The investigate the role of culture of subsidiaries in merging the external and internal knowledge toward open innovation	Survey	Ordinary least squares regression	163 European MNC subsidiaries	The culture of different subsidiaries enable the internal and external knowledge openness that have further positive impact on the innovation performance of subsidiaries. The high level interaction among external and internal teams of the organizational also present the multiplicative and positive impact toward performance led by innovation
8	Ferraris *et al.* (2017b)	Investigating the impact of knowledge management practices between the relationships of outsources R&D and innovative performance	Survey	Ordinary least squares regression	117 European MNC subsidiaries	Knowledge management act as an effective moderator to drive excellent capabilities using external R&D and it further helps in expanding the external sourcing for knowledge management that, in turn, impact the innovative performance of an enterprise
9	Spender *et al.* (2017)	To develop a map of knowledge management for startups in the context of open innovation	Theme analysis	Literature review	41 papers about startups and open innovation	The study presents total seven themes those drive the knowledge management in the context of startups and open innovation. The list of themes include: Startup network, actors, impact of ecosystem, entrepreneurial orientation, finance and funding institutions, performance and knowledge flow among startups and open innovation processes

(*continued*)

Table 2

S. no	Author (s) and year	Research intentions	Approach adopted	Tool of analysis	Respondents	Major findings
10	Jiménez-Jiménez *et al.* (2014)	Evaluating the various practices of knowledge management that endorse firm innovation. Study also aims to analyze the links among reversing the knowledge transfer, internationalization, social capital and innovation	Survey	Structural equation modeling	104 multinational companies	Internationalization does not have a significant effect on firm innovation. However, an indirect affect external subsidiaries to the corporate office via knowledge transfer is observed. Additionally, the knowledge developed from social capital also plays critical role toward innovation
11	Cheng and Fu (2013)	To model the relationship among institutional and relationship orientation along with relational risk and knowledge sharing	Survey	Structural equation modeling	312 manufacturing firms from Taiwan	For ensuring inter-organizational knowledge sharing, the institutional and relationship orientation play a critical role. The study facilitate supply chain professionals in aligning their institutional and relational view for governing the relational risk. This further helps in improving the collaborative behavior that is helpful to gain competitive advantage in the era of knowledge sharing
12	Andreeva and Kianto (2012)	To investigate the relationship between knowledge management practices, competitiveness and firm performance	Survey	Structural equation modeling	234 companies	Information and commination technology (ICT)-related processes along with human resources impact significantly the competitiveness and financial performance. Findings further indicate that ICT facilitate financial performance when integrated with human resource management practices

Source: Developed by author(s)

3. Research design

3.1 Questionnaire development

We initially developed the questionnaire based on discussion with practitioners in January 2019 to understand the challenges faced while adopting HITs; they mentioned about 30 challenges and barriers. Subsequently, after consulting the literature to create a simple and understandable questionnaire design, we divided the questionnaire into two parts. The first part related to basic demographic information and the second part contained questions related to the above-mentioned four constructs that are challenges in HIT adoption. Additionally, we discussed with three academicians in the area of health care management and removed two items. In the second round, we discussed the questionnaire items with four industry professionals from the UAE with more than 10 years of experience and removed two more items. The final questionnaire comprised 26 items covering four constructs.

3.2 Data collection

Different stakeholders from the health-care domain were considered for the survey, primarily providers and patients along with other users of the health care technology. Moreover, the government, private players are expected to spend heavily in the coming years. The growing medical tourism in the UAE is creating pressure to match the service quality provided in developed countries. The UAE government's policies also support investment in the sector and improvements in health care standards. According to the Dubai Health Authority, the country is committed to attracting and retaining a qualified workforce. Additionally, the UAE Government has set a goal of providing excellent medical education opportunities. Currently, around 96% of nurses and 82% of physicians are expatriates, and the UAE wants to reduce its dependence on them. Hence, HITs and their

users are increasingly being seen as critical in efforts to achieve a balanced health care system. We circulated about 250 questionnaires stating the intention of research to employees, patients, society members and a few experts in the health care domain. We used Google Forms to disseminate the questionnaire following phone-call confirmation. We followed up with those who had not responded over two weeks. After three or four follow-ups, we gathered around 151 responses, representing a 59.2% response rate. We further refined the count, when three questionnaires were found with missing values; hence, 148 responses were finally considered for analysis. The sample size should be a minimum of five times greater than the number of items according to Bryant and Yarnold (1995). Another study recommends a minimum of 50 responses to conduct exploratory factor analysis (EFA) and principal component analysis (PCA) (de Winter *et al.*, 2009). In this study, we had 26 items and a sample size of 148, which exceeds both 5 times of 26 and the minimum sample size 50. Therefore, the sample size in this study is enough to conduct EFA and confirmatory factor analysis (CFA). Through EFA we have explored the items structure and their group to address the first research question about the identification of factors those pose challenge to HIT adoption. Further to answer the second research question, we have conducted CFA (first- and second-order) to determine the interplay among latent variables.

3.3 Measures

To operationalize the challenges in health-care knowledge, we examined four prominent areas, namely, the ORI of the health care firms; their capability of understanding and implementing the potential of IoT and big data in their day-to-day operations; firms' strategy to achieve their productivity and provide excellent health care services; and technological challenges such as the ability to maintain and pursue the technology. The recognized items were measured using a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The five-point scale was used to increase the response rate by reducing the frustration level of respondents. A five-point scale is also considered easy for respondents to make selections from the list of options (Babakus and Mangold, 1992; Dawes, 2008). PCA was performed to measure the contribution in terms of challenges posed to managing knowledge in a health-care setting.

3.4 Profile of respondents

Representatives (n = 148) of the stakeholder groups were electronically invited to engage in a 30 to 40 min survey (5 min for the purpose of study, 5 min for demographic, around 20–25 min for the second part (key items)). These questions represent (Appendix) the barriers those are internal and external to adopting different forms of HIT. The responses were gathered over a three-month period, including multiple follow-ups. A detailed demographic breakdown of the sample is presented in Table 3.

4. Analyzes and results

The methodology suggested by Podsakoff *et al.* (2003) was used to test the existence of common method bias and non-response bias in our data. All respondents were assured of the confidentiality of their responses. The initial number of responses was 151. This number was reduced to 148 after removing three surveys and replacing the missing values with the mean (Schafer and Graham, 2002). Furthermore, we observed that most of the variance was not due to a single factor (i.e. different factors explained different variance ranging from 5.64% to 48.52%). Further, we exposed the model with and without marker variable as exogenous variable in the prediction of barriers to HIT. Initially, correlation among marker and other constructs (organizational strategy (ORGS) [0.110], technical barriers (TEBA) [0.074], RTGS [0.072], ORI [0.68]) were low and their influence on endogenous constructs

Table 3 Demographic breakdown of the sample

Demographics	*Category*	*Count*	*(%)*
Status	Employee in the health-care sector	75	50
	Future foresight expert	7	4
	Patient using the health-care services	18	12
	Society member	48	32
Gender	Male	63	42
	Female	85	56.7
Age	18 to 24	6	4
	25 to 34	48	32
	35 to 44	58	38.7
	45 to 54	26	17.3
	55 to 64	9	6
	65 to 74	1	0.7
Years of experience	Less than 5	23	15.3
	5 to 10	36	24
	10 to 15	34	22.7
	15 to 20	28	18.7
	20 to 25	12	8
	25 to 30	11	7.3
	More than 30	4	4
Level of education	High school	17	11.3
	Higher diploma	11	7.3
	Bachelor's degree	59	39.3
	Diploma	11	7.3
	Master's degree	39	26
	Doctoral/PhD degree	11	8.7

Source: Developed by author(s)

(ORGS: β = 0.052, RTGS; β = 0.072; ORI; β = 0.080) were also low and non-significant that indicated the appropriateness of marker construct. Additionally, the comparison between with and without marker construct model indicated not worthy difference. All the paths maintained the almost same estimates and statistical significance. Thus, it can be safely concluded that the results would not be inflated due to the existence of common method bias (Lee and Hallak, 2018; Singh and Singh, 2019).

We conducted EFA on these responses to identify the key latent barriers that deterred respondents from adopting HIT, and hence, using the knowledge to improve health-care in the UAE. The data were filtered to remove repetitive answers and information by theme grouping. Then, using AMOS software, the EFA-derived factors were analyzed using CFA to determine first- and second-order structural models of the associations among individual items, the key factors and HIT-adoption challenges. CFA was used to explore the interplay between latent constructs, which belongs to the covariance-based family of statistical techniques called structural equation modeling (Mardani *et al.*, 2017). CFA incorporates a fusion of factor analysis and multiple regression/path analysis (Fox, 2008). It has wide application, from the behavioral sciences to management research, and is a popular analytical tool in a variety of contexts, such as manufacturing and service, tourism, universities, pharmaceuticals, firms and the public sector (Ahmad *et al.*, 2016; Cegarra-Navarro *et al.*, 2009; Hassneen *et al.*, 2019; Kochan *et al.*, 2016; Kura, 2016; Muralidhar and Karthikeyan, 2016). We conducted CFA for three main reasons. First, it enables variable clustering into theoretically grounded constructs. Second, it provides accurate estimates for measurement errors, which is not common in most other multivariate procedures; this characteristic is particularly important when there is a significant error (Byrne, 2001). Third, unlike the many other multivariate analyzes that exist, centered on observed variables, CFA facilitates the simultaneous examination of both observed and unobserved variables (Beran and Violato, 2010).

To determine the number and nature of the latent challenges that explain the failure to adopt HITs, an EFA was conducted on participants' responses to 30 items related to challenges in adopting HITs. Before the EFA was conducted, two important thresholds had to be met: a Kaiser–Meyer–Olkin value (KMO = 0.91) was above the recommended threshold (0.6) for factor analysis (Worthington and Whittaker, 2006); and the test of sphericity was statistically significant (χ^2 = 2,524.59, df = 210, $p <$ −0.001) (Treiblmaier and Filzmoser, 2010). Following previous work (Matsunaga, 2010), items with factor loadings below 0.3 were excluded from the analysis, as were items with sufficiently large primary–secondary discrepancy. In total, five items were excluded from the analysis based on these criteria. The EFA, with Promax rotation, revealed four components (ORGS, TEBA, readiness for big data and the IoT and ORI) that had eigenvalues above 1. Composed, these four factors contributed about 72.64% of total variance in responses. Cronbach's alpha coefficient was calculated to test the reliability of the obtained constructs, and all resulting values were above the threshold of 0.7 (Cortina, 1993). Thus, it was concluded that the constructs used had a good internal consistency. Table 4 presents the rotated component matrix with item loadings, the variance explained by each component and Cronbach's alpha coefficient for each component.

To determine the strengths of relationships between items and their associated factors and the strengths of the relationships among the factors, a first-order CFA was conducted on the data, using the four factors produced by the EFA. The evaluation of the measurement model began with an assessment of the overall goodness of fit. The sensitivity of the chi-square test to sample size led to the χ^2/degrees of freedom ratio to be used (Byrne, 2001; Wheaton *et al.*, 1977; Worthington and Whittaker, 2006). Further, six fit indices were used in two groups: absolute indices (the goodness of fit, standardized root mean squared residual and root mean square error of approximation); and incremental indices (the comparative fit index, normed fit index and Tucker–Lewis index). Absolute indices signify how well a model

Table 4 Rotated component matrix of items on four key factors

Item	*Label*	*ORGS*	*TEBA*	*RTGB*	*ORI*
ORGS11_1	Lack of motivation	0.97			
ORGS5_1	Lack of training strategy	0.91			
ORGS9_1	Lack of unified procedures	0.80			
ORGS4_1	Lack of coordination between health authorities	0.80			
ORGS7_1	Lack of marketing strategy	0.70			
ORGS6_1	Cost strategy	0.66			
ORGS10_1	Weak technology strategy	0.65			
ORGS8_1	Low standards	0.52			
TEBA2_1	Availability of technology		0.93		
TEBA1_1	Scope of telecom infrastructure		0.85		
TEBA5_1	Technology life span		0.81		
TEBA3_1	Compatibility between old and new technology		0.78		
TEBA6_1	Technology maintenance		0.78		
RTGB4_1	Sensitivity of data			0.92	
RTGB3_1	Information security (Privacy)			0.87	
RTGB2_1	Information infrastructure			0.79	
RTGB5_1	Social awareness of big data and IoT technology			0.78	
RTGB1_1	Maturity of big data and IoT technology			0.75	
ORI1_1	Educational background				0.89
ORI4_1	Learning behavior of staff				0.74
ORI2_1	Lack of global orientation				0.66
Variance explained (%)		48.52	9.92	8.54	5.64
Cronbach's alpha coefficient		0.93	0.92	0.89	0.78

Notes: ORGS = organizational strategy; TEBA = technical barriers; RTGB = readiness toward Big Data and IoT; ORI = orientation
Source: Developed by author(s)

reproduces sample data, whereas incremental indices assess improvement in model fit by comparing a specific model to a baseline structural equation model (Hu and Bentler, 1999; Worthington and Whittaker, 2006). Initial iterations of the model exhibited poor model fit; consequently, five items were excluded from the model until it achieved a good fit. The final model is presented in Figure 1, and the model fit indices are indicated in Table 5, along with the recommended values for each.

Finally, the validity of the model was evaluated. To examine the convergent validity we analyzed the loading of average variance extracted (AVE) and composite reliability (CR). Good convergent validity is indicated by factor loadings for each item of at least 0.5, AVE above 0.5 and CR above 0.7 (Hair *et al.*, 2010; MacKenzie *et al.*, 2011). We further used maximum shared variance (MSV) and AVE to calculate discriminant validity. Analysis indicates the appropriate discriminant validity, as AVE value is larger than MSV and for a square root of the AVE value greater than the correlation values between the constructs (Hair *et al.*, 2010). Table 6 indicates that the model shows both convergent and discriminant validity.

All data points were extracted from a single instrument, so the common method bias was a possibility. The zero-constrained method, in which an unconstrained common method factor model is compared to a fully constrained common method factor model, was used to

Figure 1

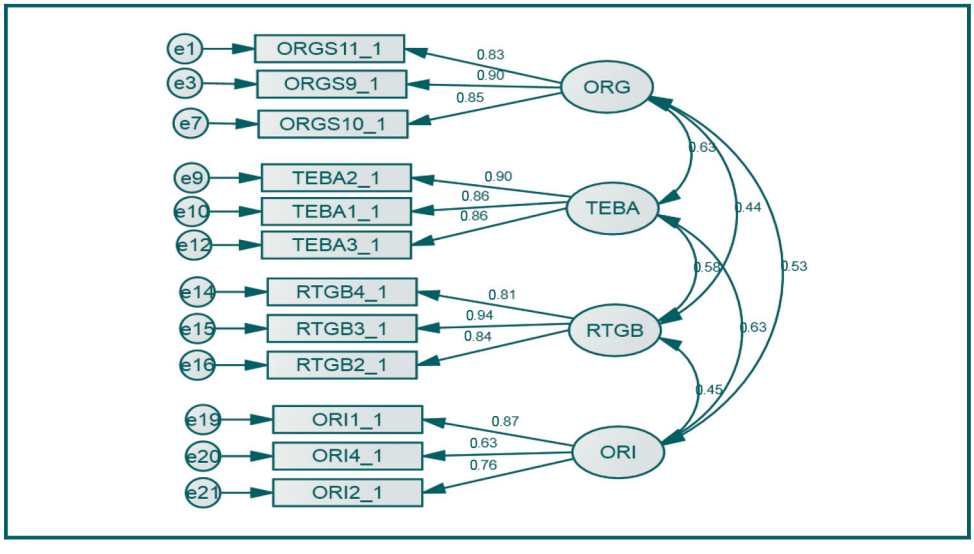

Table 5 Goodness of fit indices for the first-order model

Index	*Obtained value*	*Recommended value*
χ^2/df	2.14	<3
GFI	0.90	0.90–1.0 Hoyle (2000), Kline (2005)
SRMR	0.05	<0.1, ideally <0.06 Kline (2011)
RMSEA	0.08	<0.08 Hu and Bentler (1999)
NFI	0.92	0.95–1.0 Miles and Shevlin (2007); Thompson (2004)
TLI	0.94	0.95–1.0 Miles and Shevlin (2007); Thompson (2004)
CFI	0.95	>0.90 Kline (2011)

Notes: χ^2/df = normed chi-square statistic; GFI = goodness-of-fit index; RMR = root-mean-square residual; RMSEA = root mean square error of approximation; NFI = normed fit index; TLI= Tucker-Lewis index; CFI = comparative fit index
Source: Developed by author(s)

check for this. The result of the comparison was significant (χ^2 = 54.9, df = 12, $p < 0.001$), indicating a substantial shared variance. Thus, a factor score imputation was performed to obtain the factors that could account for shared variance, as explained by the common latent factor. Further, we conducted a CFA (second-order) to identify the association among four factors against the key outcome variable (latent variable): resistance to HIT adoption (Figure 2). Goodness-of-fit indices indicated that the model was an adequate fit for the data as presented in Table 7.

Figure 2

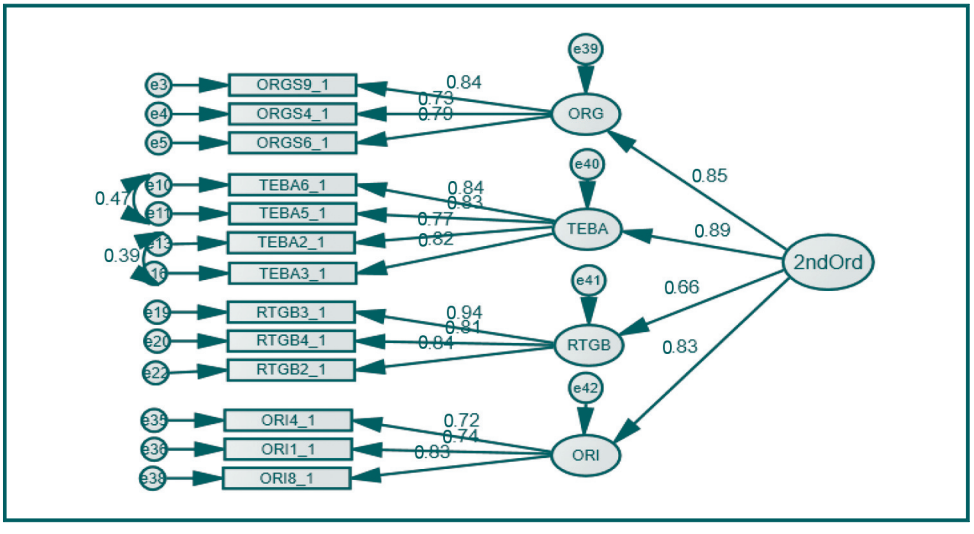

Table 6 Validity and reliability of four constructs

Constructs	*CR*	*AVE*	*MSV*	*MaxR(H)*	*RTGB*	*ORGS*	*TEBA*	*ORI*
RTGB	0.898	0.747	0.340	0.921	**0.864**			
ORGS	0.894	0.739	0.397	0.900	0.440	**0.859**		
TEBA	0.906	0.762	0.397	0.908	0.583	0.630	**0.873**	
ORI	0.803	0.580	0.392	0.841	0.452	0.525	0.626	**0.762**

Notes: CR = composite reliability; AVE = average variance extracted; MSV = maximum; the italicized diagonal indicates the square root of the AVE
Source: Developed by author(s)

Table 7 Goodness of fit indices for the second-order model

Index	*Obtained value*	*Recommended value*
χ^2/df	1.78	<3
GFI	0.90	0.90–1.0 Hoyle (2000), Kline (2005)
SRMR	0.05	<0.1, ideally <0.06 Kline (2011)
RMSEA	0.07	<0.08 Hu and Bentler (1999)
NFI	0.92	0.95–1.0 Miles and Shevlin (2007); Thompson (2004)
TLI	0.95	0.95–1.0 Miles and Shevlin (2007); Thompson (2004)
CFI	0.96	>0.90 Kline (2011)

Notes: χ^2/df = normed chi-square statistic; GFI = goodness-of-fit index; RMR = root-mean-square residual; RMSEA = root mean square error of approximation; NFI = normed fit index; TLI= Tucker-Lewis index; CFI = comparative fit index
Source: Developed by author(s)

4.1 Non-response bias

It is critical to determine the non-response bias in primary data-based studies. Out of 250 respondents associated with the health care industry in UAE around 151 have responded and finally, we considered 148 responses for further analysis. Therefore, it is important to determine if there is any difference of opinion among respondents and non-respondents. The responses were divided into two parts equally (i.e. 74 each) to compare the significance difference. The *t*-test specify that, there is no significant difference among two clusters of responses (p = 0.15). Therefore, we can claim that this study do not have a concern of non-response bias.

5. Discussion

As the need for HIT develops, it is fundamental to understand and analyze the barriers in adopting it to further improve the quality of care services and exploiting the existing health-care knowledge to its maximum potential. The numerous benefits via adopting HITs are documented in earlier studies that include the enhanced efficiency, security, productivity, stakeholder's satisfaction and reduction of errors (Ahmadi *et al.*, 2017; Ahmad *et al.*, 2016; Black *et al.*, 2011; Ehteshami *et al.*, 2013; Shekelle *et al.*, 2006; Wang *et al.*, 2018). Health-care provision is one of the basic service any economy should have for its public. Technology adoption and implementation is characterized by big lag due to myriad of challenges that includes, readiness in terms of basic infrastructure, change management culture, low computer skills, privacy and confidentially risk (Boonstra and Broekhuis, 2010; Del Giudice *et al.*, 2017; Ebrahim and Irani, 2005; Laerum *et al.*, 2001; Simon *et al.*, 2007; Stewart *et al.*, 2004). This study focuses on challenges to HIT adoption (in the context of better knowledge utilization) and explore four categories of stakeholders in the health care sector in UAE to comprehend the key factors in the adoption of vital HITs. UAE is a country showing good progress toward HITs but on slow pace that could serve as a positive example to others. Based on the responses, four key groups of barriers emerged, namely, ORGS, TEBA, RTGB and ORI, hence answering the first research question. Correlation among ORGS and resistance to HIT adoption is found significant (0.85). Similarly, the factors relating to cost strategies (0.79), lack of unified procedures (0.84) and lack of coordination among health authorities (0.73) is observed a significant. This indicates the miscommunication and slip-up are the key barriers in adopting HITs. Stakeholders are in the favor of potential changes provided as a well-organized mechanism should be in place. The main stakeholders for this relationship between ORGS and resistance toward HIT adoption are clinicians and top management (Lin *et al.*, 2012; Lluch, 2011). Driving the ORGS is mainly dependent on top management in the health care sector, and their resistance influences the adoption of other stakeholders as well (Ingebrigtsen *et al.*, 2014).

The correlation among TEBA and resistance indicate the strong significance (0.89), with stout association toward availability of technology (0.77), lifespan of the technology (0.83), compatibility in new and old technology (0.82) and maintenance of technology (0.84). These relationships propose the perceived difficulty is particularly persuasive constraint. If stakeholders consider technology as difficult to learn, use or maintain, it could deter them from adopting it. Other studies have also highlighted the compatibility issue as a strong barrier to HIT adoption (Hung *et al.*, 2014; Tian *et al.*, 2019). The difficulty in maintaining adequate infrastructure to support HITs is another challenge for many health care organizations (Afrizal *et al.*, 2019; MacNeil *et al.*, 2019). ORI was also strongly correlated with opposing HIT adoption (0.83), with strong correlations with staff learning behavior (0.72) and educational background (0.74). This suggests that people believed that there would be a steep learning curve to using new health care technologies, which may deter them. Technology itself does not pose many challenges in adoption compared to human factors. Lack of experience in computer applications and knowledge of the benefits can pose challenges for a health-care eco-system in the context of HIT adoption (Khalifa, 2013;

Lin *et al.*, 2012). Finally, RTGB displayed an adequate connection with resistance (0.66) but exhibited sturdy connection to information security (0.94), information infrastructure (0.84) and data sensitivity (0.81). These results suggest that worries about the safekeeping of personal health information are significant deterrents to adopting HITs. Hence, the rising concerns over the access of personal health-care records by clinicians and others forms a barrier to patients and their relatives, who are secondary stakeholders in HIT adoption (Russo *et al.*, 2016). Ensuring secure storage and sharing of health information can, therefore, prove effective in promoting acceptance of HIT. This answers the second research question. The EFA showed that ORGS describes around half of the variance (48.52%), while other factors were below 10% (Table 2). The variability in responses from stakeholders' responses to questions on cost, coordination, strategies and processes accounted for most of the variation and it suggests the challenges of understanding the strategy of the organization and having different opinions.

5.1 Implications for research

HITs are critical in providing consistent and quality care. The adoption of HITs influences the quality of services offered in hospitals and clinics. The improved understanding about HITs and their benefits among primary stakeholders will influence the ORGS and enhance the utilization of HITs. This study reveals compatibility as a concern under TEBA, whereas other studies have that compatibility among in-use or existing setups will further enhance the perceived usefulness and trust for HITs (Hung *et al.*, 2014; Moores, 2012). This study indicates that readiness for big data and IoT as another barrier in adopting HITs, whereas other studies have highlighted the role of big data in value creation in health-care (Dash *et al.*, 2019; Roski *et al.*, 2014). This study indicates that before value creation, sufficient infrastructure and readiness for big data and IoT is required by health care organizations. Dimitrov (2016) highlighted that fiscal and policy issues, followed by technology, are two big challenges for HITs. As clinicians are paid for face-to-face encounters with patients, they may show a resistance toward HITs, which, therefore, can be related to their behavioral intention. In health-care, knowledge is dispersed among different silos/areas of specialization that really should need to be aggregated to become useful (Bordoloi and Islam, 2012), which could solve interoperability problems, as well as allow further scope for artificial intelligence and machine learning on a real-time basis (Braunstein, 2018; Pan *et al.*, 2018; Sumbal *et al.*, 2019). Machine-learning-type systems can help in the effective integration of dispersed knowledge (Oliva *et al.*, 2019). This will help the entire health care system to shift from a reactive to a proactive ORI.

This study also highlights the involvement and importance of primary and secondary stakeholders and their features. The engagement both of primary and secondary stakeholders can be increased through HITs, though there are some differences in each case. Cooperation and collaboration among primary and secondary stakeholders will enhance the knowledge integration process through HITs. This study advocates increased collaboration and communication to help integrate the dispersed knowledge, which will help promote wellness, prevention of disease and intervention to disease as rapidly possible (Chen *et al.*, 2017; Greenes, 2016). Modern HITs can help stakeholders in decision-making through better-understood maps, graphs and trends of their health. This is possible because of the prognostic capability of HITs and using the modeling knowledge to make better recommendations based on patient data, as well as aiding communication in inter-firm networks (Del Giudice and Maggioni, 2014; Nuruzzaman and Singh, 2018). The use of HITs also ensures safety and helps avoid errors because of the appropriate and rapid use of the knowledge stored and developed. HITs can be further used for upcoming treatments or changes needed in patient status before further recommendations are made (Greenes, 2017). In health care systems, the importance of HITs becomes significant due to their potential to direct knowledge along the right path. In care systems, problems unfold over

time and this happens iteratively; hence, knowledge management and continuous monitoring are critical. The care process is a four-stage process comprising:

1. obtaining patient data;
2. assessing data;
3. making decisions; and
4. performing actions.

All these stages are critical as they need to be effective (Al Nahyan *et al.*, 2019; Kaur *et al.*, 2018). For instance, in patient data, through analysis and image processing, multiple specializations of medicine are involved in ultimately addressing a problem by accumulating and integrating the dispersed knowledge among departments. The second stage concerns more knowledge about proteins, cells, genes, meta-analyzes, side effects, interactions and clinical trials. In the third stage, making the decision is complex, where providers and clinicians need to balance cost and effectiveness, safety and quality, increased documentation and liability and compliance. This is possible when the knowledge about patient's background, physical condition and budget is integrated for final decision-making. The final stage, performing actions, increases pressure on the system, where patients undergo clinical tests, surgery and prognosis. In all the stages, HITs play an important role in facilitating the multiple stakeholders (nurses, physicians, patient, family, society, friends and others) to provide a smooth and optimal experience during health care service provision. This is only possible by overcoming the challenges and focusing on the importance of HITs highlighted in Table 8.

5.2 Implications for practice

HITs play a key role in stakeholders' rights, from top management and governments to the community at large. HITs offer a means of establishing the right thing to do regarding optimal care for patients. Aggregation of the data, achieved through data warehousing, helps to create and revise the knowledge base in health care systems. This data warehouse integrates multiple stakeholders, from insurance agents to clinical laboratories, enabling

Table 8 Challenges for HIT adoption (source: developed by author(s))

Challenges	*Description*
Interoperability	Hospitals often use diverse instruments from different companies and their software is not always compatible. Therefore, it can become extremely difficult for nurses and clinicians to exchange the data from one system to the other, posing a challenge in delivering high-quality and rapid care
Integration with existing technology	Most health-care facilities have some amount of technology to enable the workflow they are using. It is possible that, after a certain time, the provider or vendor may no longer support the technology and, when a new provider comes along, it will push for buying all new equipment and replacing the older technology entirely. Hence, this poses a challenge for health care organizations regarding learn about, and investing continuously in, new technologies
Culture of change management	In the adoption of new technologies in health-care, there is a need for behavior change and acceptance among clinicians, nursing staff and other stakeholders, such as suppliers and patients. It will diminish the effectiveness of the entire system if users do not adopt newly bought HIT
Concerns regarding balancing costs and time	Health-care facilities are often overwhelmed by the challenges associated with the introduction of HITs. Health-care systems do not usually have the bandwidth to opt for advanced HITs that can save time and money. Most of the time, they are busy upgrading their old technologies
Others	Many HITs lack certain facilities that meet the expectations of health-care firms, such as asset-tracking facilities, occupancy rate and related marketing strategies. Additionally, firms are not usually aware the benefits of harnessing data through the IoT and big data and how these technologies can positively impact the performance of their organization. The technologies often neglect the links among focal health care organizations and primary and secondary stakeholders and hence, the knowledge among these is dispersed and poses challenges for quality care

Source: Developed by author(s)

meaningful decisions to be taken that would otherwise not possible in a dispersed knowledge setting. Health care professionals can use data analytics for decisions about the process of care. This knowledge base, and data that have been adopted in an inter-organizational arrangement such as health-care, can help to create new standards. A digitized economy offers an opportunity for health-care ecosystems to update, share information with, collaborate with and provide feedback to different stakeholders on a real-time basis. HITs are capable of using the dispersed knowledge for patients and other stakeholders in the form of operational systems, social media, chatbots, product catalogs and ticketing and front office services. HITs and their knowledge-management capabilities not only help health-care-provider firms but also pharmaceutical and medical-device-manufacturing companies to design their processes to cater to the needs of hospitals and patient groups. HITs also enable knowledge transfer to call centers that can provide 24/7 service to patients and their family members, enabling improved health services. Additionally, in the digital and open-innovation era, HITs can act as a cost-cutting tool, especially for community hospitals, due to limited resources and the maximum utilization of dispersed knowledge. In health care systems, there are certain protocols, pathways, workflows and care process models. Modern HITs are capable enough to handle and facilitate stakeholders for better outcomes. For instance, the health insurance company can better understand the status of an individual health and ready the amount he may require or claim in near future. HITs can potentially help the health care system to predict certain outcomes and set formal rules such as reminders and alerts, along with information grouping and reporting. HITs help in facilitating the interoperability among different types of data ranging from X-ray images, videos to typical medical reports of the patients to decide on the right course of remedy even from remote locations. HITs are not only beneficial for hospital administration but also to the stakeholders such as pharmaceutical firms, patients and their family members as it offers fast and accurate communication. The exposure to HITs enhances the expectations of customers, when they visit other location to seek health care services. Hence, it pushes the competition among the health care sector.

Apart from this, HITs can help in visualizing the care process at each stage and workflow models. Professionals can use HITs in multifaceted health-care architecture to gain sound knowledge and learning capabilities, where data from all the sources is integrated toward knowledge-enhanced solutions. Further, these HITs can use extrapolation to provide support to public health by identifying those people at risk or in need of attention. This can help in generating new practices in knowledge management. There are various challenges currently preventing HIT adoption that need to be addressed by technology providers and health care organizations. Table 8 highlights these challenges, along with their description, which may benefit practitioners when considering using HITs.

6. Conclusion

In this study, we have examined the challenges for developing health-care knowledge in a digital environment. We have examined the concerns related to adopting HITs among primary and secondary stakeholders. After a careful instrument design and refinement, this study examined a total of 21 items through EFA. The EFA results revealed the four main challenges (under the categories of "ORGSs," "TEBA," "readiness for big data and IoT" and "ORI of the organization") to HIT adoption. There are studies in technological adoption (Raj *et al.*, 2020; Xia *et al.*, 2019; Patil and Kant, 2014), but the studies in HIT adoption and development of a related scale are scarce. This study presents a scale that academicians and practitioners can use while planning for HIT adoption. The present study offers interesting implications for practitioners. The adoption of HITs will help the health care sector and professionals to develop new standards, advancements and raise the expectations of consumers with better knowledge management in place. HITs can help in integrating the dispersed knowledge to design the action of various associated

stakeholders ranging from insurance agents to pharmaceutical companies. Additionally, this study highlights the challenges for health care organizations. In reality, apart from the four constructs confirmed by EFA and CFA, challenges such as interoperability, the need to balance costs and time, the utilization and integration of existing technology with new ones, and culture driven by top management all pose challenges for HITs in the sector. Other factors such as concerns about return on investment and lack of knowledge about the benefits of these technologies lead to confusion in organizations state in the context of choosing HITs. Health care organizations are, ultimately, concerned with life and death, so HIT adoption needs to be strongly linked to how to create a knowledgeable organization, which can lead to a transparent environment and more informed decisions in their daily routines. In summary, this study can help not only clinicians and patients to achieve effective communication but also technology providers to address some the challenges and convince organizations and individuals of HIT usage based on innovative solutions. In brief, this study furthers understanding of concerns regarding HIT adoption in relation to knowledge enhancement that can change the way the health care system works and the approach taken. The findings may be helpful for secondary stakeholders, where HIT adoption can lead toward increased satisfaction through the exchange of knowledge among the health care organization, medical staff, community stakeholders and family.

7. Limitations and scope for future research

In this study, we covered the respondents including health-care providers, patients, their families and other associated people and they have valued the security and safety of their health data. They have different opinions on how to price, use and market the HITs effectively. Hence, the research in this direction of how and why different categories of stakeholders differ on these issues is required. Conversely, the concerns related to data and basic infrastructure may not require much exploration. Respondents indicated consistently that RTGB may not strongly envisage HIT adoption, may be due to enhanced technological and metro culture in UAE. These findings from single and small countries such as UAE offer more space toward generalizability. The attitude could be further explored in different cultural settings in the adoption of HITs. The stakeholders from pharmaceutical companies, pharmacies and insurance companies can also be included in the future studies to see a wide spectrum of insights in HIT adoption. Future research can explore the elements of a resilient health care system by using knowledge management in the eco-system.

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Appendix. Questionnaire used to collect the data

PART-I						
Your Name						
Email ID						
Status of employment in healthcare						
Experience						
Education						
Gender						
Age						
PART-II						
Please indicate the status of challenges/barrier in adopting health information technology in your or associated organization (1=strongly disagree; 5=strongly agree)						
Organizational barriers in adopting HIT	**Reference**	**1**	**2**	**3**	**4**	**5**
There is no support of appropriate systems towards new technology adoption*	Alrahbi et al., 2019; Lin et al., 2012; Lluch, 2011; Bramble et al., 2008					
Scope of telecom infrastructure may be a barrier in switching to a new information technology						
Educational background is a barrier while adopting an information technology						
Maturity of big data and IoT technology is a challenge in the adoption of a new information technology						
Non-reliance on data for operational effectiveness hinders the new technology adoption*						
Availability of a technology tool may cause hindrance in adopting new information technology						
Lack of global orientation of the organization is a barrier in switching to a new information technology						
Information infrastructure may become a challenge while switching to a new information technology						
The mis-alignment among strategy and technology poses a challenge for new technology adoption*						
Compatibility between old and new technology is a hindrance while switching to a new information technology						
Culture of the organization influence the adoption of information technology*						
Information security and privacy are issues that hinder the adoption of an information technology						
Lack of coordination between health authorities is a big challenge in implementing information technology						
Availability of technology can be an issue while adopting an information technology*						
Learning behavior of staff can be a challenge when it comes to adopting a new information technology						
Sensitivity of data is a big challenge while adopting an information technology						
Lack of training strategy is a challenge while adopting information technology						
Technology life span is a big barrier in adopting information technology						
Social awareness of big data and IoT technology can rather be a barrier when adopting a new information technology						
Cost strategy is a potential barrier while adopting a new healthcare information technology						
Technology maintenance can be a challenge while switching to a new information technology						
Lack of marketing strategy is a barrier in the adoption of information technology						
Low standards cause a problem while adopting a new healthcare technology						
Lack of unified procedures causes problems while designing/implementing information technology solutions						
Weak technology strategy is a serious issue in switching to a new information technology						
Lack of motivation hinders the adoption of information technology						

Note: Items marked with *have been dropped during final analysis