The impact of knowledge on e-health: a systematic literature review of the advanced systems

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Abstract

Purpose – Economists have recognized knowledge management as a promising tool regarding all aspects of the economy, including health care. The volume of biomedical literature is currently growing at an exponential rate, and the vast number of studies makes it extremely difficult for researchers to keep up with new developments in their research areas. Therefore, the efficient management of huge amounts of data and the accuracy of the knowledge thus obtained are vital concerns. Electronic health (e-health) has emerged as a useful concept to provide data for solo self-care management. Although health care is a common topic on the internet, patients rarely share their health care-related knowledge on social media. This study aims to examine the impact of knowledge on e-health.

Design/methodology/approach – This paper complies with the methodological requirements of systematic literature reviews. The present paper has investigated the newest systems and studied their practical techniques in detail. The effects of knowledge on e-health have been categorized into major groups.

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Findings – The outcomes indicate that the capabilities of information and communication technology certainly promote the exchange of knowledge within clinics. The results also show that institutional architectures have significant impacts on knowledge-sharing exercises, significantly improving patient safety.

Practical implications – These findings will be essential in the understanding of the interplay among various signals in theory and in the understanding of patients' choice in the e-health community in practice. The results have implications for existing health management and e-health literature. The present paper will help policymakers, health-care executives and project managers to effectively set their operations and make them maintainable, prevent unpredicted obstacles and better allocate their resources. Overall, the results of this paper will guide researchers who are working in the field of e-health.

Originality/value – E-health attempts have mostly focused on answering questions using context-specific technical answers, regardless of the key role of knowledge resources. The present paper has provided an innovative viewpoint on how knowledge resources and knowledge-sharing initiatives may have a role in the innovative work behaviors shown by health-care employees. As noted before, there have been only a few studies regarding the effects of knowledge on health care, so the present paper contributes to the previous literature, particularly about e-health.

Keywords Health care, Knowledge, Systematic literature review, Knowledge management system, Electronic health records

Paper type Research paper

1. Introduction

Electronic health (e-health) is a novel specific notion in health-care delivery (Olok *et al.*, 2015). E-health interventions to enhance patient outcomes are now heavily promoted because of the aging population and growing demands on health-care resources (Wagenaar *et al.*, 2019; Zhang *et al.*, 2018), and a growing number of scholars have identified the potential role of e-health in appropriate health-care delivery (Lam *et al.*, 2016). For example, e-health has a key role in achieving enhanced ambulant and distant therapeutic services, better quality outcomes, decreased demands on staff and decreased probable expenses in health care (Liang *et al.*, 2020; Lokshina and Lanting, 2019). Health care is a matter of socio-economic interest in many countries so that we can see numerous attempts around the world of the application of e-health archives (Castillo *et al.*, 2010; Pape *et al.*, 2019). The benefits of e-health are quick access to crucial and precise health data, decreased repetition of services, more time for direct care, better portability of health documents for a mostly mobile population, more privacy options for the users, a higher user contribution in health-care decision-making and improved information-sharing among health-care staff for better diagnoses and care (Hovenga *et al.*, 2005; Uzun and Kucuk, 2019). On the other hand, the efficient incorporation of e-health into the current care system by using it to replace repetitive consultations could decrease the time needed per patient for nurses, giving them more time to provide care for more patients (Cowie *et al.*, 2016; Xu *et al.*, 2019).

To date, people have made use of medical/health websites to enhance their health knowledge, practice their disease-management skills and reduce their anxiety about treatment and the number of times they need to see a doctor, and also the expense of medical treatment (Ampaw *et al.*, 2020; Hung, 2019). Knowledge is regarded as an essential component of health literacy in children and young people. Knowledge is the concept, skill, experience and vision that provide a framework for creating, evaluating and using information. Health knowledge literacy has received great attention recently with regard to its effect to improve mental health knowledge, decrease stigma and enhance help-seeking behaviors (Ristić *et al.*, 2017; Wei *et al.*, 2016). Rudinger *et al.* (2014) described health-related basic knowledge as the comprehension of basic terms describing the body or basic health-related systems and functions. Paakkari and Paakkari (2012) described conceptual

knowledge as procedural knowledge or the skills needed "to behave in a health-promoting way," which is often experimental, situation-specific and linked to daily practices. In the USA, 72% of internet users tend to seek health-related information from online resources (Li *et al.*, 2018). On the other hand, knowledge about the associations among biomedical entities is essential for numerous automatic biomedical uses such as pharmacovigilance and decision-making (Pamučar *et al.*, 2018; Wang *et al.*, 2010). The innovation–decision procedure is an information-seeking and information-computing process where an adoption unit is triggered to decrease doubt about the benefits and drawbacks of innovation, as knowledge is a key component of this procedure (Castillo *et al.*, 2010; Obermayer and Toth, 2019). Knowledge discovery is a growing field in computer science, with applications in several domains, from databases to images and natural language processing (NLP) (Alshahrani *et al.*, 2019). Researchers and health specialists have been motivated, by the new developments in health text-computing methods, to dig deeper than just reading the data obtained from published manuscripts (such as academic texts and medical accounts) and organized questionnaires, to find new knowledge by extracting it from health resources (Piad-Morffis *et al.*, 2019a, 2019b). As such, knowledge and knowledge sharing (KS) have appeared as key problems for e-health management, because of the active interactions among various health care-related parties and the intricate data architectures within these (Guo *et al.*, 2016). Effective management of information, knowledge, information mechanisms and technology is essential in today's health-care institutions to gain a competitive benefit, support medical decision-making, patient management, financial management, resource scheduling, resource assignment, priority setting, tactical managing and altering institutional procedures. Health-care institutions work in an active setting, and so should have the following capabilities: gathering information/knowledge such as evidence-centered medical data or the ideal practice rules as needed, communicating inside and outside of the setting, incorporating novel/current knowledge and computing information to facilitate decision-making by executives and doctors (Hovenga *et al.*, 2005). In this regard, Rao *et al.* (2015) explained that physicians' KS behavior could be defined as a benevolence signal of their beneficial intentions and motives toward the patients. Zhang *et al.* (2017) also posited that physicians' knowledge contribution could increase their economic return.

1.1 Motivation and related works

We could not find a review article exploring the impact of knowledge on e-health. Although there have been some attempts, there are very few and they did not carry out systematic reviews. Moreover, they were written many years ago, with two of the relevant articles analyzed below. Therefore, our main goal was a systematic review of the impact of knowledge on e-health.

Edirippulige *et al.* (2006) examined the knowledge, experiences and expectations of nurses in e-health. They studied all nurses from 27 hospital departments of a tertiary pediatric hospital, from whom 253 completed surveys were obtained (69 %). Most of the subjects stated that they had never had an e-health learning course (87 %), and thus their e-health knowledge and abilities were low (71 %). Nevertheless, 11% had some introduction to e-health in their careers. More than half (56 %) reported that e-health is crucial, very crucial or critical for health care, whereas 26% reported they were unsure on this issue. Many of them (71 %) identified the absence of teaching and training as the two key obstacles to e-health implementation. Although it seems that they had an average awareness of the possible advantages of e-health, their actual abilities and knowledge of the subject were quite restricted. Canestrino *et al.* (2019) reinterpreted e-health at the intersection of social

innovation (SI) and knowledge ecosystems (KE). In doing this, a systematic literature review (SLR) about SI, KE and e-health was carried on to identify the common issues found between the two selected fields of research. The results identified the notion of co-creation as the most effective tool in the investigation of e-health in merging the SI and KE theoretical perspectives. The emergency medical service ecosystem model was then examined within the provided theoretical framework.

The features of the health-care domain set a high requirement for knowledge depth. Increasing amounts of research have indicated the value of e-health in health-care delivery. Although e-health communities are quite prevalent in public health promotion, only a handful of works have investigated the parameters affecting the patient's knowledge of e-health. However, how knowledge influences e-health is unclear. The purpose of the present article is to examine this issue. Moreover, although scholars have attempted to execute e-health in mainstream health care, they have barely focused on developing e-health knowledge and abilities among health clinicians (Edirippulige *et al.*, 2018). Therefore, the purpose of this research is to investigate how knowledge affects e-health.

2. Method

An SLR is a kind of literature review evaluating and synthesizing the key works to respond to one or more queries (Charband and Jafari Navimipour, 2018). It contains the proposing of an official search tactic to recover the pieces of research, having the potential for inclusion in the SLR (Aakre *et al.*, 2019). Scholars have done an SLR with a search tactic (the query) to be issued to one or more search engines indexing the previous works. In medical and biomedical research, search tactics are usually represented as (large) Boolean queries. After the execution of the search tactic, the title and then the abstract of the recovered papers are investigated using a procedure called screening. Where the paper seems relevant, the full-text is then downloaded for an examination that is more detailed. The articles that meet all the requirements are then analyzed in the research, and readers can refer to various articles to further understand the current study's method (Azhir *et al.*, 2019; Scells *et al.*, 2017). In this study, we examine the following questions:

RQ1. What is the effect of knowledge on e-health?

RQ2. How does the method can search the papers in the field of the effect of knowledge on e-health?

RQ3. What are the unanswered problems of the effect of knowledge on e-health?

2.1 Systematic literature review and article selection method

The primary databases to identify the articles evaluating the effect of knowledge on e-health are Google Scholar, public libraries and electronic databases such as ScienceDirect, Springer Link, Web of Science and IEEE Xplore (Jahantigh *et al.*, 2019; Saberi and Pazooki, 2019). This is because most of the articles published on the subject of this article were available in these databases. We carried out the search using the subject terms "knowledge health" and "knowledge e-health" and then filtered them for systematic reviews and meta-analysis. A total of 132 articles were found.

2.2 Screening

The authors screened the titles and abstracts. A total of 52 studies were excluded, including editorial notes, accounts, review papers, working articles and articles written in languages

other than English. During the abstract screening, 58 further studies were excluded because their abstracts had nothing to do with the effect of knowledge on e-health. We then reviewed the full-text of the selected articles to verify their relevance and extract data, with eight papers omitted at this stage. Finally, 14 articles remained which were focused on the effect of knowledge on e-health and described the introduced technique thoroughly.

2.3 Quality assessment

A quality assessment was carried out to ensure that only qualified publications were selected. Therefore, more focus was put on those articles published by Elsevier, Springer, IEEE and ACM. As part of this process, low-quality conference articles, reports, editorial notes, book reviews, working papers and interpretative articles were omitted. Figure 1 describes all the steps in this process.

3. Review of selected articles

In this section, we separated the chosen papers into two categories: challenges/barriers to knowledge development in e-health and the frameworks provided.

3.1 Challenges or barriers to knowledge development in e-health

E-health has a significant role in personal health management and health conduct (Piad-Morffis *et al.*, 2019a, 2019b). Nevertheless, a variety of obstacles (access, resources and abilities) are keeping health-care users from complete participation. Users may participate in numerous e-health tasks such as attending health dialog forums and recording individual health data. E-health literacy calls for an important group of abilities and knowledge to enable fruitful exchanges with technology-centered health devices, such as competence in information recovery tactics and effective communication of health notions (Chan and Kaufman, 2011; Stevens *et al.*, 2019). Therefore, it is important to know the potential issues

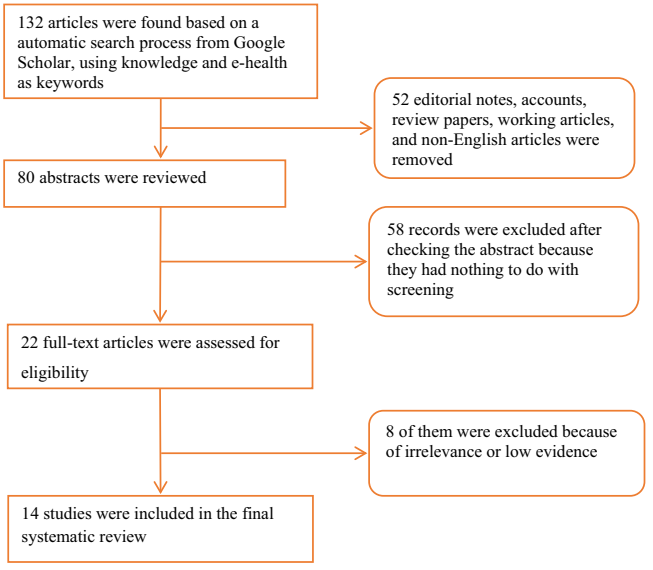

Figure 1.
The PRISMA flow diagram

that may hinder the effective execution of e-health. In this section, we have examined the challenges and weaknesses of e-health knowledge.

Dritsas *et al.* (2006) introduced a knowledge-oriented method for the safe investigation and planning of e-health uses. According to this method, the knowledge learned by the procedure of developing secure e-health applications has been characterized as security designs. In this paper, the authors present a group of security designs based on the above method. Security necessities for this group have been determined after a security and privacy investigation. The security designs have been created based on a security ontology made for this goal. The ontology enables users to detect all notions of significance and their associations. The authors also defined the authentication of the established ontology and juxtaposed the introduced method with other related ones in terms of safe application expansion.

Edirippulige *et al.* (2007) investigated the experiences and attitudes of nursing students regarding e-health, the level of their knowledge of e-health and their expectations of e-health. They also investigated the obstacles hindering the growth of knowledge and abilities in e-health within a nursing program. The research scheme used was a cross-sectional survey questionnaire emphasizing the attitudes and experiences of the students toward e-health. It was given to 60 junior nursing students at a university in Queensland, Australia. The results showed that 77% (43) of the subjects accepted that they had no previous knowledge of the term e-health. Of the respondents, 82% (46) scored their knowledge of e-health technologies as low. A total of 87% (49) of them accepted that they had no e-health education at all. More than 50% (34) of all subjects indicated that they were unsure as to whether e-health would have any importance in their upcoming careers. A total of 82% of them rated their computer abilities as advanced or moderate, whereas 39% (22) of them mentioned that the key obstacle for enhancing their knowledge and abilities in e-health was the absence of organized education and training.

Gagnon *et al.* (2008) examined the parameters affecting the use of academic knowledge for the ideal execution of e-health in the health-care system, using a three-year multi-approach study done in Canada. Decision-making at each level was analyzed based on specific approaches. This can determine how decisions concerning the execution of e-health could be affected or not by academic knowledge. At the medical-grade, questionnaires were given to doctors who participated in e-health plans to investigate the parameters affecting knowledge use in their decision-making. The authors then conducted a triangulation of the outcomes by combining practices to enable a transversal test of the outcomes at each level of decision-making. They identified the parameters affecting the application of academic evidence and other kinds of knowledge by decision-makers used during the scheduling, financing, executing and assessing of e-health plans.

Abodunrin and Akande (2009) examined the effects of knowledge and experience of health experts (at the LAUTECH Teaching Hospital, Osogbo, Nigeria) on e-health and remote therapy. In a cross-sectional descriptive study, they chose 110 health experts using relative multi-phase sampling via a self-managed, semi-structured questionnaire to evaluate their knowledge and experience of e-health and remote therapy. Just 34.1% of the respondents had appropriate knowledge regarding e-health and remote therapy. Also, just 13% of them had attended any related workshops. Their knowledge was affected by their jobs and presence in workshops. While 91.6% of the health experts supported the development of e-health practices in Nigeria, many thought that the costs, illiteracy and weak infrastructures such as the electric power supply and internet services could restrict its full functionality. Even though the knowledge of the health experts of e-health and remote therapy was weak, most of them supported such services.

Also, Almuayqil *et al.* (2015b) investigated the combined outline of knowledge management (KM) and knowledge discovery to support e-health for Saudi diabetic patients. The primary phase of the study focused on eliciting obstacles related to diabetic patients in the Kingdom of Saudi Arabia (KSA) and their health-care providers. The combined outline that was introduced needs to handle any problems of information technology (IT) experts in KSA about applying the mechanism across health-care clinics. The particular field of diabetes mellitus was applied to assess the introduced e-health KM framework. The paper outlined the difficulties of applying Nonaka's socialization, externalization, combination and internalization (SECI) design to other states as it was developed for Japanese firms. The study made some recommendations for KSA with regard to sharing knowledge inside the parts of the SECI design. It presented a new outline to satisfy the new government initiatives of the Saudi Ministry of Health for enhancing citizens' health care. The introduced outline will be used in diabetes mellitus treatment, referring to the problems of diabetic patients.

Lam *et al.* (2016) examined the supposition that students go to university as digital natives who can confidently and capably adjust their application of information and communication technology (ICT) to novel settings. They studied the preparedness of health sciences students for working and directing change in e-health-empowered settings. Using a cross-sectional model, 420 undergraduate and postgraduate students took an electronic survey testing their understanding of and attitude toward e-health, the regularity of their electronic activities and software usage, confidence learning and incorporating ICTs and related educational attainments. Even though the students reported regular engagement in many electronic activities (including software usage) and that they felt confident in learning new ICT abilities, particularly if they have enough time or support, their understanding of e-health was inexact or limited. A weak understanding of the abilities learned in an individual setting and problematic translation of them into the professional setting may damage the students' skills and abilities to confidently participate in e-health-empowered workshops.

Furthermore, Hung (2019) compared the instructive usefulness of e-health to convey health knowledge among higher literacy consumers and lower literacy ones. A test was carried out in four phases. In the first phase, a website was made as the examination context to present health-care knowledge related to children's allergies. Next, a reliability and validity analysis was done to ensure that all questionnaire items were acceptable. In the third step, a pre-post knowledge examination was done with 66 subjects (33 with higher literacy and 33 with lower literacy). In the last step, a usability assessment was carried out to investigate the principles applied by consumers with diverse levels of health literacy to assess e-health. The results showed that the effects of e-health interference were positive in the two groups, and no meaningful differences were found between consumers with higher and lower literacy. Nevertheless, the average mean for the latter group was slightly higher than the average mean of the former. The results also indicated that the principles could be analyzed and incorporated in the assessment of e-health with respect to the quality of information, appearance, appeal and interaction. However, consumers with lower literacy have dissimilar assessment principles than those with higher literacy.

Finally, Sutton *et al.* (2019) gathered data from a group of patients suffering from inflammatory bowel illness and noted an inclination toward family planning in their medical setting. The gathered data contains baseline demographics, clinical background, reproductive background and standardized confirmed questionnaires on knowledge ("CCPKnow"), reproductive worries, beliefs about medications ("BMQ") and medication adherence ("MARS-5"). These questionnaires were completed before the intervention, instantly after accessing the resources, and a minimum of six months later. Two publications have been created out of the analysis and CCPKnow data ("Pregnancy-related

beliefs and concerns of inflammatory bowel disease patients are modified after accessing e-Health portal").

We found that the most important challenges in this area were the lack of e-health knowledge, financial implications, security, poor infrastructure and illiteracy. To overcome these challenges, local health workers should obtain knowledge of legal frameworks and clinical ethics. It is also vital to improving the teaching style used with the discipline, both at the undergraduate and postgraduate levels (Luna *et al.*, 2014).

3.2 Provided frameworks

Various frameworks and structures have been proposed for improving and enhancing knowledge of e-health, and several of these are examined in this section.

Anya *et al.* (2010) proposed a framework for context-aware knowledge modeling in e-health, which they referred to as Context Morph. They sought to find novel methods for automating the procedure of offering context-aware knowledge-rich support for decision-making in the emerging cooperative e-work spaces. Context Morph combines the common knowledge acquisition and design structuring (KADS) knowledge modeling practice with the notion of activity landscape and context-aware modeling methods to morph, enhance and optimize knowledge material to support decision-making in different settings. The study aimed at integrating explicit data and implicit professional experiences in different settings into a knowledge material suitable for supporting the work of the places where it is to be used.

Amato *et al.* (2015) introduced a knowledge-based collaborative system (ABC), which has two settings: an electronic clinical decision support system (CDSS) and an offline medical data checking and computing mechanism. The CDSS will support health-care users while drafting records related to their work. Automatically mined data from such records will be restructured and combined to create joint clinical oncology having the ABC's dispersed knowledge foundation. Although the CDSS is significantly associated with the quality improvement of the services, the offline system emphasizes the checking of medical threats and managing spending. The study created the ABC to carry out auto-diagnoses of the security and the quality in clinics; thus the staffs are always ready to effectively handle experts' checkups, although this system is not considered a supervisory control tool. Human cognitive procedures are still the main segment of clinical activities. ABC does not seem to own the knowledge of human staff, and its basic aim is to open the way to a broader platform for the sharing of clinical data. Moreover, ABC can prevent any illegal use of sensitive information from the patients and health operators.

Also, Sołtysik-Piorunkiewicz (2015) provided a technique for assessing the practicality of Web 2.0/3.0 applications to support KM in knowledge-oriented firms which are at different phases of the KM cycle – considering: producing knowledge, assessing knowledge, sharing knowledge, etc. – according to the use of an e-health KM system. Every principle could have the propriety measurements of quantity and percentage amount of the selected parameter, clearness of the selected parameter, keeping in the company of the selected parameter, the easiness of the selected parameter, matching of the selected parameter, the regularity of the selected parameter, accessibility of the selected parameter, etc. The method focused on five aspects of assessment: graphical user interface, functional architecture, content publication procedure, administrative dimension and technological domain. The technique is based on the scoring introduced for these five aspects.

Anya *et al.* (2015) presented a context-aware design for medical KS over administrative and geographical limits in e-health. The model draws on activity and situation awareness theories, and also the belief theory in artificial intelligence. The main goal of the design is to empower physicians in different places to acquire a joint illustration of the related

situational data in each other's workspaces, according to the concept of medical work practice. They described the theoretical scheme and investigated an instance use case showing how the method can simplify the practice-oriented medical KS over geographical limits.

Guo *et al.* (2016) suggested an activity theory grounded on an ontology design to systematically signify numerous health operators in the e-health mechanism. Three typical inter-activities among these health actors were presented. The aim of the recommended design was to enhance the interactivities among them for the effective achievement of KS goals. They also developed a prototype software system based on the suggested ontology model. The system was then used in practice for evaluation purposes, and the results of the operators' data have indicated the practicability of the created software system.

By adopting an NLP technique, the knowledge structure of a physician is constructed as manifested by the knowledge contributed in a question and answer (Q&A) platform, using two dimensions: knowledge depth and breadth (Li *et al.*, 2017). The authors then examined the effects on subscriptions to paid medical services. They used the physicians' characteristics such as clinical title, gender and specialty, to explore the interaction effects on physician popularity. Their analysis showed that deep generalists (who demonstrate both high knowledge breadth and depth) and specialists (who are high on knowledge depth but low on knowledge breadth) could secure more subscriptions to medical services. Further, the clinical title of deep generalists enhances the positive impacts of knowledge contribution and diffusion on medical service subscriptions. For specialists, answering cross-specialty questions will gain more subscriptions.

Finally, Noaman *et al.* (2018) introduced a novel knowledge-oriented e-health monitoring mechanism for forecasting hospital-acquired infections. The mechanism gathers patient data from many resources such as laptops, internet and hospital databases. This procedure is useful for clinics to collect patient data proficiently and precisely. Patients' documents were then automatically computed for Hospital-Acquired Infections-Central Line Associated Bloodstream Infections (HAI-CLABSI) diagnoses and forecasts, according to the knowledge discovery HAI-CLABSI algorithms. This decreased the time needed for infection forecasting, thus decreasing the HAI-CLABSIs rates. The results of the forecast infections were generated in visualized multimedia forms, such as text accounts, colored risk pointers and graphic diagrams. This is useful for clinical decision-makers to study and thus confirm the policies for monitoring programs. The mechanism also has a built-in simulator to simulate certain patient data, in case needed, for nurses' training and learning, decreasing and avoiding several HAI-CLABSIs instances, thus protecting a clinic and at the same time, decreasing the cost of therapy.

As we have seen, different frameworks have been proposed for cost reduction and system improvement, including support systems, remote monitoring systems, improved clinical knowledge across geographic boundaries and improvement of rare disease prediction systems.

4. Results

The results have shown that many of the subjects have limited awareness and knowledge of e-health, despite the fact that they have frequently used personal computers and the internet in daily chores and nursing education. It is thus vital to offer undergraduate student's formal e-health training for nurses so that they acquire the necessary abilities for simplifying e-health applications. The findings presented here will thus be essential to the understanding of the interplay among various signals at the theoretical level and the understanding of patients' choices in the e-health community at the practical level. Table 1 outlines the most important features and objectives of the articles reviewed in this paper.

Paper	Main feature
Challenges or barriers to knowledge development in e-health	
Dritsas *et al.* (2006)	• Providing health security patterns
Edirippulige *et al.* (2007)	• Facilitating e-health care
Gagnon *et al.* (2008)	• Optimizing the implementation of e-health • Creating major transformations in the health-care systems
Abodunrin and Akande (2009)	• Examining the knowledge and perception of health professionals • Increasing participants' knowledge
Almuayqil *et al.* (2015b)	• Delivering competitive e-health care services • Improving intellectual capital
Lam *et al.* (2016)	• Increasing svelf-confidence • Cross-sectional data • Poor understanding of skills learned
Hung (2019)	• Evaluating e-health
Sutton *et al.* (2019)	• Presenting an e-health intervention for pregnancy in the context of inflammatory bowel disease
The provided frameworks	
Anya *et al.* (2010)	• Proposing a framework for context-aware knowledge modeling in e-health
Amato *et al.* (2015)	• Introducing ABC • Supporting health operators • Improving the quality of the services
Sołtysik-Piorunkiewicz (2015)	• Providing a method for evaluating the usability of Web 2.0/3.0 applications • Supporting KM in knowledge-based organizations
Anya *et al.* (2015)	• Presenting a context-aware model for clinical KS across organizational and geographical boundaries in e-health
Guo *et al.* (2016)	• Upgrading efficient KS purposes • Feasibility of the developed software system
Li *et al.* (2017)	• Providing a better understanding of the mechanism of knowledge flow • Exploring the dynamic influence process among different individuals
Noaman *et al.* (2018)	• Reducing medical costs • High security • Efficient and accurate patient data collection • Increasing the speed of patient data collection • Offering the capability to train nurses and medical staff to enhance their qualifications

Table 1.
The most essential features of the analyzed articles

5. Discussion and open issues

E-health is a key information-sharing method in health-care management and delivery across the world. Using its platforms, physicians share health-care knowledge with patients, which will have financial and social returns for both groups (Liu *et al.*, 2019; Pashazadeh and Navimipour, 2018). On the other hand, knowledge could be a signal of physicians' expertise. Therefore, knowledge has a positive influence on patient's e-health literacy. Social communication ties have positively assessed the impact of knowledge-seeking on patient's e-health literacy (Zhou and Fan, 2019). Nevertheless, the use of e-health may only be likely when health-care specialists have positive attitudes toward it. Moreover, in the context of health care, physicians should be specialized in a specific direction. Therefore, the absence of ICT-centered abilities leads to severe obstacles to using ICT. As such, the acceptance and

execution of e-health have not been so simple, as it merges technology into what has been long a manual procedure of recording patient data.

The research found that increasing the knowledge of the patient and their family members was effective in improving the selected health and patient portals' usage outcomes (Nahm *et al.*, 2019). On the other hand, the integration of KM and knowledge discovery can have a key role in supporting e-health (Almuayqil *et al.*, 2015a). In general, knowledge breadth and depth could promote innovation. For example, when physicians present high knowledge depth and breadth by answering the questions on Q&A sites, patients will have more trust in their ability to offer high-quality medical services. Therefore, designing an e-health curriculum aimed at improving such capabilities is the key to delivering the needed knowledge and abilities to assist students in practicing e-health in their jobs.

Two major and quite different challenges in e-health are as follows: strong assessments of e-health mechanisms are crucial but not possible without difficulty; and scholars must identify how to fully use the potential to make and distribute new knowledge using the data obtained by e-health.

The results of the research indicate that the most investigated health-care services do not have any formal KM mechanism, so, health-care experts rely on informal talks and conferences to share knowledge. Moreover, the absence of trust of technological accommodations, along with the fear of facing additional work or responsibilities, network failure and culture are several problems with regard to health-care experts' KS (Assem and Pabbi, 2016).

Patient access to an electronic knowledge system could have substantial advantages both for the patient and the system, as seen in improvements in the quality and arrangement of care, better patient adherence and decreased system use. However, the concerns surrounding the development and implementation of such access are complex (Beard *et al.*, 2011).

Research has shown that no single method exists that investigates all the problems regarding the usage of knowledge in e-health (Ahmed *et al.*, 2019). On the other hand, with the advances in ICT, the programs of the distant health-care department are growing to enable patients to get distant therapy. It has several advantages, such as reducing expenses, decreasing time, simplifying communication, promoting functionality and enhancing the services.

The real-world problems of combining data and e-health documents are size, intricacy, insufficient use of standards for data and restrictions in e-health record capacity to keep and analyze data. On the other hand, EHealth can accelerate clinical research and genomic medicine, but are hindered by the limited number of validated processes and tools to enable accurate and rapid extraction.

6. Conclusion

Knowledge is considered as one of the important research directions for many purposes in the context of e-health. As such, this paper systematically studied previous and current papers on knowledge mechanisms in e-health domains. In this article, 15 selected articles were analyzed, with the studied subjects and results comprehensively reviewed. This paper has addressed the challenges of various methods to develop more efficient knowledge in e-health in the future, and also suggested a few topics for future works.

The results show that the greatest benefit of improving knowledge is increasing the knowledge of individuals and reducing medical errors. Future works should more fully study the other advantages of knowledge in e-health to better familiarize consumers with these benefits. The increased knowledge associated with electronic data has enabled physicians to become more aware of what and whom their coworkers know to avoid, save more time and develop more innovative ideas for helping patients and providing services to them. Hence, the

findings of this study will extend the literature on the e-health community by providing an understanding of the patient's decision-making process from the knowledge perspective.

This study suffers from several limitations. First, only articles written in English have been included in this study. We are confident that there are articles written in other languages that have investigated knowledge in e-health. Second, we have included the articles that we have searched for using the keywords "knowledge" and "e-health," and there may be articles (related to our research topic) not been found with these terms. Finally, there may be articles in other databases not included in our article. While the introduced issues and frameworks could be identical for all contexts, there is the probability of more instances that need to be investigated. Moreover, these problems are the most debated ones in developing countries, in which decision-makers must be aware of the main obstacles and problems rising when attempting to carry out IT projects.

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