Knowledge Management System in Pharmaceutical Healthcare Sector: A Conceptual Research

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

Aim: Pharmaceutical healthcare is a process comprising knowledge-intensive tasks. Therefore the tools used in the management of knowledge are gaining more attention. This paper aims to investigate knowledge management systems, their implementation, tools used for decision making.
Methods: We have used three databases to research the knowledge management system in the pharmaceutical healthcare sector. PubMed, Google Scholar and journal websites were used for the search of the required key terms.
Results: After analyzing the data, it was found that the effective utilization of knowledge management systems in the pharmaceutical health care sector has increased the quality of care. There are many opportunities; some create new advances in health care, and some even create barriers. All these help in clinical decision support.
Conclusion: Right decision at the right time is made by evidence-based decisions in the healthcare sector. A knowledge management system is paramount in the pharmaceutical healthcare sector. Implementation of appropriate tools will significantly enhance the quality of care.

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1. INTRODUCTION

Information technology is increasing; the pharmaceutical health care sector has welcomed such new implementations and applications that bring new opportunities to better quality care. The pharmaceutical health care sector is shifting towards the e-health age; pharma organizations are now developing towards a knowledge-based community connected with the quality care of the patients, clinics, hospitals, thus sharing the knowledge and reducing costs. Various business models have been experimented with globally for the advantage of pharmaceutical healthcare organizations to react potentially to the changes in the market. The knowledge management system has been evolved strategically for the pharmaceutical healthcare sector. Knowledge management is a complete process that describes all Information gathered with experience, interpretation, and reflection. In an organization, knowledge flows through multiple entities E-health is becoming the norm; consequently, the barriers to accessible and transparent Information are now dissolving. Knowledge management issues concerning clinical and medical Information are rising with time. The main challenges faced are: 1. Integration process of various standalone and desperate information settings to a knowledge-based system forming a single version for pharmaceutical professionals. 2. Management with IT; of knowledge which is desperate. Knowledge management of pharmaceutical professionals within the pharmaceutical health care sector is critical in such competitive e-health systems. Pharmacists are knowledge-intensive and play a crucial role in health management and drug dispensing. Professionals are required to avail the latest pharmaceutical experience and knowledge gathered by the internet or various applications. The responsibilities of pharmacists are increasing with the increasing demand for different products related to protection and safety against coronavirus. IT support still lags for pharmacists, which has raised issues of concern. The pharmaceutical business has many crucial issues rising day by day to improve operational processes, especially regulatory compliance. Such organizations create, own and manipulate immense knowledge. The new drug application is one of the main processes in the pharmaceutical healthcare sector; it needs revised regulations by health authorities and should make it uniform worldwide. Developing integrated infrastructure based on the technological functions will reduce costs and improve efficiency for new drug dossier compilation [1]. Efficient e-health is built up by better IT applications to analyze organization-wide pharmaceutical knowledge in the health care sector. IT capabilities are growing fast, which supports a knowledge-centric view that is far better than the data-centric view; pharmaceutical practices must take advantage of such IT capabilities. A well-designed, well-operated knowledge management system improves the quality of care, which is the ultimate goal of the health care sector. Generally, it opts that IT-based technologies should be applied to the development of the knowledge management system. Kerwin's study highlighted the critical technologies related to the internet to improve quality care and medical knowledge management. FDA's Knowledge Aided Assessment and Structured Application is one of the KMS tools which is designed for the direction of the drug lifecycle, for the establishment of the rules used in assessment, communication and control, for performing computer aided management of applications for regulatory tasks and to reduce text-based narrations of the information [2]. Such KMS tools are required for enrichment of the regulatory quality and drug lifecycle management. This study aims to evaluate the knowledge management system tools used in the pharmaceutical health care sector for evidence-based decision making. The best evaluation is done by researching works done by scholars in the knowledge management system in the healthcare sector. A broad literature review was done and screened the papers for the past ten years (2010-2020). This paper also proposes a framework based on IT for designing a pharmaceutical knowledge management system that integrates IT into the pharmaceutical process, which supports the creation, management, and application of pharmaceutical knowledge.

2. LITERATURE REVIEW

2.1 Knowledge

Knowledge is considered a highly valued state in which reality is in the cognitive contact of the person. It is a relation. A relation is a conscious subject on one side while on the other side a portion of reality t which the knower is directly or

indirectly related. Knowledge is gained from education and experiences, a state of understanding, awareness, and innovative thoughts. It is developed by a person's ideas, competencies, judgments, and skills [3].

2.2 Knowledge Management System

Managing organizational knowledge utilizing a set of information systems is referred to as knowledge management systems. These are the systems based on the IT processes supporting and increasing the efficiency of organizational knowledge management processes (creation, storage, transfer, and application). The FDA pharmaceutical quality for the 21st Century aims to provide an agile, efficient, and flexible manufacturing sector that includes the production of high-quality drugs without the requirement of immense regulatory oversight [4]. With the new advances in technologies, progress has been rising in the healthcare sector, bringing new KMS tools such as Process Analytical Technology (PAT) [5], Quality by Design [6], Current Good Manufacturing Practices, continous manufacturing, emerging technology[7], six sigma pharmaceutical [8] quality.

3. RESEARCH QUESTIONS

This study aims to provide answers to these main research questions

1. How is the pharmaceutical healthcare sector affected by knowledge management systems?

2. What are the current tools utilized for improving quality care?

3. What are the challenges faced by the knowledge management system in the pharmaceutical healthcare industry?

4. Which conceptual framework would help enhance the pharmaceutical sector processes?

4. MATERIALS AND METHODS

4.1 Sourcing Strategy

In our research paper, we have used electronic resources. Mainly, three databases were used; PubMed Central, open-source journal websites (Electronic Journal of Knowledge Management and Journal of Knowledge Management Research and Practices), and Google scholar. Recent papers were studied, published in the past ten years (2010-2021) in English. The key search terms used were as shown in Fig. 1.

4.1.1 Screening

The searched records were screened. Some articles were excluded due to non-relevant Information by studying the titles, abstracts, and finally, full texts evaluation. Some pieces were screened by using Mendeley software. Selected articles were chosen, and screening was successfully done. After screening the articles studied, Information was abstracted and categorized based on keywords selected used.

4.1.2 Inclusion and exclusion criteria

All the articles published before 2010 and after 2020 were excluded. The articles within the specified period and specified keywords were included. The English language articles were included, and the rest were excluded. Detailed study of the paper which does not cover the research questions were also excluded.

The following flow diagram depicts the overall searching, screening, inclusion and exclusion criteria in Fig. 2.
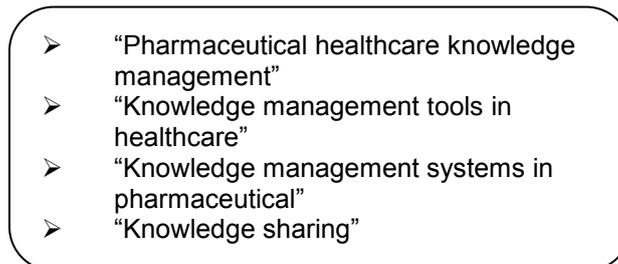
> ➢ "Pharmaceutical healthcare knowledge management"
> ➢ "Knowledge management tools in healthcare"
> ➢ "Knowledge management systems in pharmaceutical"
> ➢ "Knowledge sharing"

Fig. 1. Search terms in electronic databases

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┌─────────────────────────────┐
│ SEARCHING : total records :  │
│ N=17405  (PubMed:N=5096;     │
│    e-journals:N=446;google   │
│       scholar:N=11863)       │
└─────────────────────────────┘
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┌─────────────────────────┐
│ exclusion : N=17225; not │
│ related to our search key│
│          words           │
└─────────────────────────┘
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┌─────────────────────────────┐
│ SCREENING: total retained    │
│   articles: N=180; PubMed:   │
│    N=65; e-journals: N=79;   │
│     Google Scholar: N=36.    │
└─────────────────────────────┘
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┌─────────────────────────┐
│ exclusion: N=134;        │
│ duplicate or full text   │
│       unavaialable       │
└─────────────────────────┘
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┌─────────────────────────────┐
│ ELIGIBILITY : N= 46;         │
│      PubMed=14; e-           │
│  journals:N=25; google       │
│        scholar:N=7)          │
└─────────────────────────────┘
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┌─────────────────────────┐
│ exclusion: N=2; not      │
│        related to        │
│      pharmaceutical      │
│         healthcare       │
└─────────────────────────┘
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┌─────────────────────────────┐
│ INCLUSION: N=44;             │
│      PubMed=14; e-           │
│  journals:N=23; google       │
│        scholar:N=7           │
└─────────────────────────────┘
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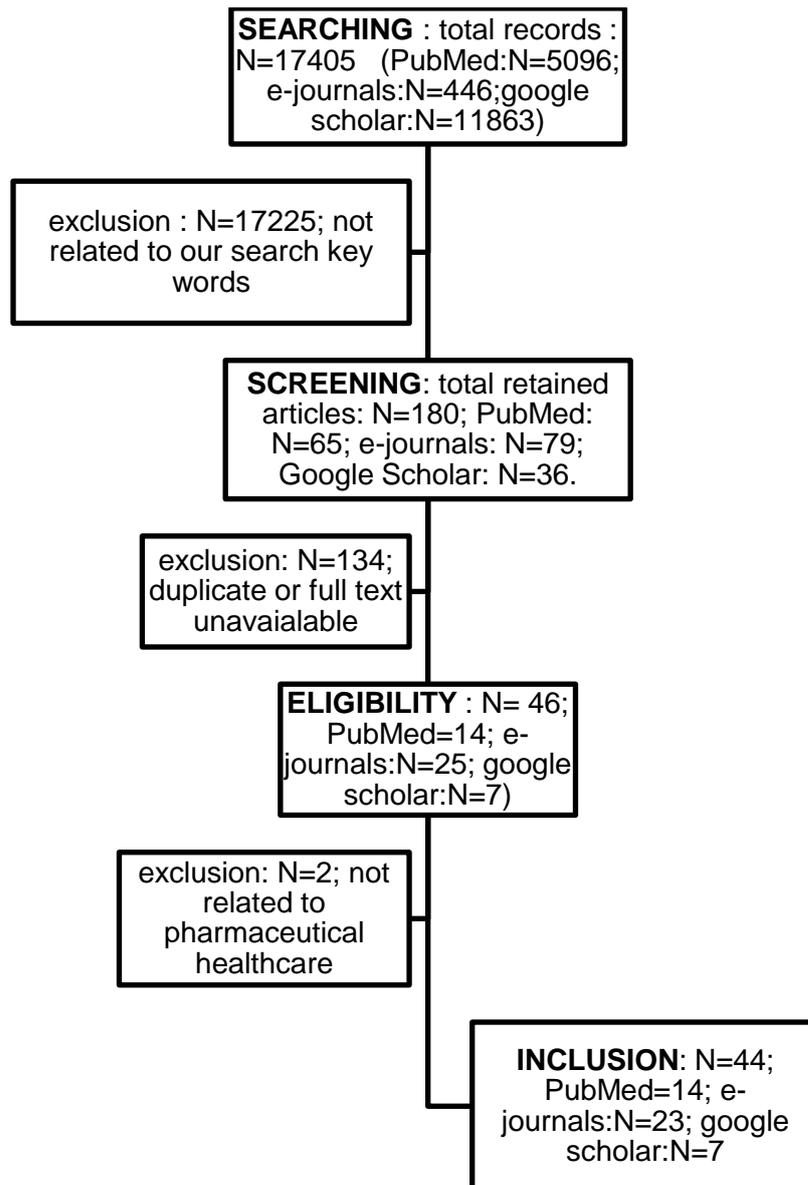
Fig. 2. Steps of the systematic review process

4.2 Pharmaceutical Knowledge Management System

Pharmaceutical management processes are knowledge-intensive and highly complex, which depend on experience and know-how. Effective utilization of a knowledge management system by a pharmacist plays a vital role in quality care. Advances to the IT systems influence the development of the professional's practices. These systems include prescription orders, health records and clinical decision support. Current advances in the knowledge management systems concerning IT applications have proved to be efficient for the needs of pharmaceutical managerial processes.

4.2.1 A conceptual framework

A well-designed framework will be required in the development of IT for the organization. A knowledge management system framework should be designed to incorporate the business processes with the required IT systems to perform the associated functions. First, it is necessary to understand the knowledge management activities of the organization to support the knowledge led systems and technology-led systems [9,10]. For the development of a successful pharmaceutical knowledge management system, a framework is required. A pharmaceutical process is based on the IT system, which will enhance

the steps of the knowledge management; creation, modification, transfer, and application for the overall pharmaceutical processes. The dimensions of the pharmaceutical knowledge management system include the IT technologies and the organizational processes driven by the e health systems, as shown in Fig. 3.

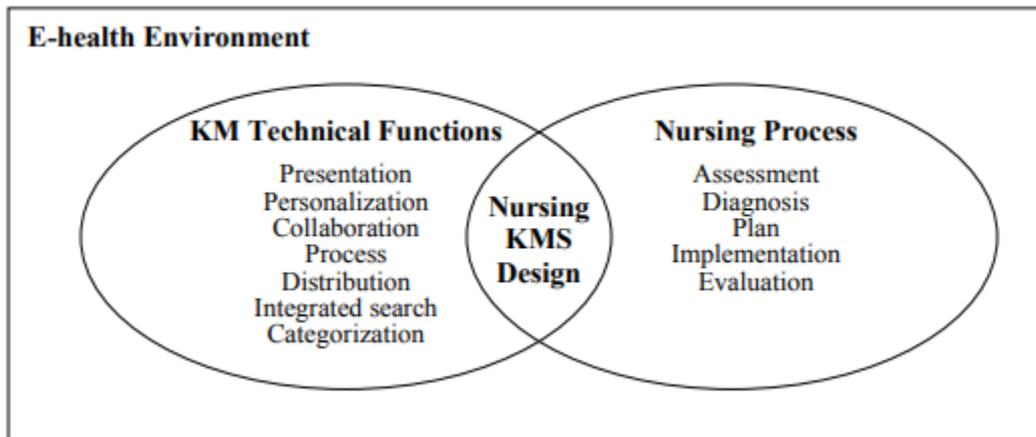The pharmaceutical model interplays between IT technologies and pharmaceutical managerial processes in the e-health environment. The pharmaceutical organization process consists of assessment, diagnosing, planning, implementation, and finally evaluation. To integrate such methods, the technical functions and available IT applications must be deployed. The essential functions of the knowledge management include presentation, personalization, collaboration, process, distribution, integrated search, and categorization functions.

Table 1. Technical functions in KMS

Technical Functions	Description
Presentation	It is the presentable form for displaying the user interactions results with the system.
Personalization	Services and content can be personalized for the user based on the user's preferences
Collaboration	It helps in collaborating people with people by integrating knowledge and IT applications
Process	It is the role of an individual in the business processes and their participation.
Publishing and distribution	It is a platform to gather and distribute a set of data or knowledge they need without learning.
Integrated search	It enhances proper search and at the same time, overload of Information is decreased.
Category	It helps in categorizing the knowledge into browsing, managing or creation.
Integration	It helps build consistent knowledge navigation such that it is easily accessible by all individuals of the organization.

Table 2. A framework: supports the pharmaceutical process by enabling IT

Pharmaceutical Practices	Critical Activities in KMS	Technical Functions of KMS	Enabling IT
KMS Assessment	Knowledge application	Integrated search Presentation Personalization	Online analytical processing (OLAP) FAQs Visualization Rule-based personalization Knowledge directories and classifiers Search engines
KMS Process	Knowledge creation Knowledge application	Collaboration Process Integrated search	Case-based reasoning Knowledge-based systems Data Mining Discussion forums Expert systems Clinic decision support systems (CDSS)
KMS Planning	Knowledge codification	Publishing Categorization and distribution	Knowledge repositories Databases Data warehouse Operational Electronic publishing knowledge store
KMS Implementing	Knowledge transfer	Collaboration	Extranet and Intranet Workflow systems Groupware
KMS Evaluation	Knowledge codification Knowledge transfer	Integration	Electronic portal (e-portal) Decision support systems (DSS) Group Decision support systems (GDSS) Learning tools

Fig. 3. Integrated knowledge management design

The following Table 2 explains and relates the various process of the knowledge management system; it illustrates how enabling IT supports the overall healthcare process in an organization. The pharmaceutical knowledge management system designer should focus on the activity and link to its enabling IT.

5. RESULTS

The results of our paper are categorized as follows 1) how knowledge management is implemented in the pharmaceutical healthcare system, 2) tools utilized in the knowledge management system 3) challenges and opportunities of the knowledge management system. The emergence of knowledge management in the healthcare sector with an increasing amount of Information and data has increased the need for the KM in an organization. Due to an increase in turnover or retirement, it is essentially required to prevent loss of knowledge. The other most important aspects for implementation are continuous learning with the fulfilment of the customer's needs. The three main components of knowledge management are people, process and technology. Successful implementation depends on the right balance of the three components. People share the Information; the process supports knowledge management, and technology links people with IT. A good strategy, better framework for the process will provide evidence-based decision-making, which will enhance quality care. The tools used in the knowledge management of the pharmaceutical healthcare sector facilitate the processing of a large amount of data and information, which is the utmost demand of today's pharmaceutical industry. A variety of

tools used in the storage, transfer, creation, retrieval, and applications of knowledge are the supporting knowledge management systems. The technologies of knowledge management serving as a centre in an organization improve the overall quality of care, which Is the ultimate aim of all healthcare sectors. The tools used for public health are meta-analysis and systematic reviews, which are most potent for the practice decisions. The best example is a website built for evidence-based medical practices that provides ease to access published information and is up to date. There are various opportunities for the knowledge management system in the pharmaceutical healthcare sector, whereas several barriers also exist which limit the decision-making process. Several best strategies are adopted to overcome these barriers. Some critical barriers inhibit effective knowledge management system such as exhaustive work, organizational politics, lack of management support, lack of incentives for the employees, poor quality of Information documented, lack of expenses for KMS, lack of awareness of KMS, lack of trust, lack od researchers. Though many barriers affect the stability of an efficient KMS, several opportunities provide a new way to enhance quality care. Communication technology has advanced, which helps in the motivation of the employees to transfer their knowledge efficiently. Efforts are now being made to improve quality care, and hence clinical decision support systems and knowledge management systems are developed. Some examples are the 'info button' used by the healthcare professionals to gather the required authentic up to date information. Electronic health records help integrate public and clinical health data management for collecting patient data. This

paper's framework we proposed here allows us to integrate the data and links to the IT systems. This framework will be helpful in the pharmaceutical processes management for the healthcare professionals linking to practical IT tools.

6. DISCUSSION

The results of this study emphasize the pharmaceutical knowledge management system; researchers can utilize the conceptual framework proposed in our research to create methodologies for a knowledge management system for an organization. Satisfaction of organizational goals is possible with an efficient knowledge management system. The methodology engineers and corporate managers are responsible for developing an effective KMS for the organization. In today's pharmaceutical healthcare sector, the tremendous amount of knowledge formation and processing has become an overwhelming task, such as designing each individual's daily tasks, providing the facilities and so on. There is a need for knowledge management tools for the distribution of knowledge required for the ultimate goal of improving quality care [10]. The most important factor is knowledge of the employees in KMS, efficiently utilizing the tools. Continuous training should be given for the efficient utilization of tools. Implementation of knowledge management tools such as EHR will improve the quality of care. Communication is done by knowledge sharing, which in turn will enhance KMS. When employees are not motivated by incentives, they will become a barrier in KMS [11]. Any process will not work if employees are not ready to do so. Some issues related to these are lack of awareness and interest, lack of trust with the organization. Therefore organizational policies must be set so to improve the KMS [12]. Several new technologies are rising with the advances in the healthcare industry, such as advances in health ICT have WEB 2.0 technologies. Professionals utilize tools for effective communication, generating discussions, finding new researches and being up to date. Social media is gaining more and more attention and is thought to play a significant role in the healthcare sector shortly, serving as a tool in KMS. All concerned bodies in the healthcare environment have a crucial role in implementing a pharmaceutical KMS such as policy makers, pharmacist researchers, managers, and administrators. We have pointed out the opportunities, essential tools and barriers for a pharmaceutical KMS providing the proper world knowledge at the right time. This will significantly improve the quality and safety of the patients. In the education sector of pharmaceutical healthcare effective KMS tools will be helpful in building interactive methods. A national database tool will be more helpful and cost effective [13]. The pharmaceutical research and development department is based on information technologies where KMS already plays a critical role [3]. The efficiency and effectiveness of KMS still depend on the current challenges faced by the pharmaceutical sector in implementation, integration, sharing, and analysis of the data necessary [14].

7. CONCLUSION

In this study, we have built a framework that points out the interplay between pharmaceutical activities or processes and the technical functions of KM for the successful development of KMS. We have also designed a set of the function of the KM relating to the pharmacy process and linked to enabling IT that supports KMS. This conceptual framework research will eventually help pharmaceutical organizations, whether small or large scale healthcare sector, effectively build up a technical infrastructure. This study contributes twofold, firstly, by providing a conceptual framework that will guide the KMS designers; secondly, this research will help healthcare professionals evaluate the importance of KMS and its implementation, which is immensely required for effective clinical decision-making.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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