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The Impact of Using Modern Technology in the Field of Pharmacy

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Abstract

This study examines how contemporary technology has revolutionized pharmacy services in Saudi Arabia, with a focus on the incorporation of digital tools such as electronic health records, automation systems, and tele pharmacy. Utilizing an extensive array of secondary sources spanning from 2016 to 2024, the research emphasizes greater pharmacist-patient contact, streamlined workflows, and improved patient safety. The results indicate that the use of contemporary technology in pharmacies promotes proactive healthcare delivery in accordance with Vision 2030 while also increasing efficiency. Key issues and policy considerations for sustainable implementation are also identified in the study.

Keywords: Pharmacy Technology, Digital Health, Telepharmacy, Saudi Arabia.

Introduction

In most of the healthcare services, pharmacies play a vital role in and deal with the complexities of the system as well. Here the motive is to cure the patient in a better manner. Pharmacies always move hand in hand with the different avenues of healthcare sector in order to promote certain cures, patient handling medicinal logistics and other related components. In the present times the tradition process of medicine and prescription dispensing is also changing. This is due to the changing role of pharmacies all around the world, including Saudi Arabia. **[1], [7]** This can be seen as the part of great responsibility of pharmacies in deciding on dosage, quantity, timely reach and appropriate medicines to the patient at right time and in right form. Then on the other hand the pharmacist also plays a crucial role in the development and processing of public health campaigns. **[2]** It can be easily found that the pharmacies are generally at common public places and used as a communication point by different medical related agencies to help in different vaccination campaigns, health camps, and even for treatment at times. In order to look for better patient

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care, most of the the pharmacist work hand in hand with the doctors and other healthcare workers, like specialists, nurses, operating room staff and many other related entities. **[5]** In general the pharma companies are engaged in the various inventions and development of medicinal systems that are crucial for the treatment of patient, then on the other hand they also play a crucial role in the development of strategies of treatment, recommending safe terms and conditions for dispensing of drugs and many other related aspects. This overall process can be seen as a good cooperative approach where the patients and overall system of medical treatment is benefited. **[2], [3], [11]** also the related pharmacy professionals are engaged in educating patient and healthcare workers in terms of better treatment and saving lives; by providing them with the material related to training, drugs dispensing, technological updates and many other related aspects. **[4]** Patient-centric approach, even for the pharmacies, is very important and in the present scenario of technological advancement and use of Artificial Intelligence is development of drugs and medical treatment, the responsibility of pharmacies has increased. There is a single motive that the patient should be cured and get satisfied with the overall process of treatment. **[5], [9]** COVID-19 has changed many things in the routine life of people and healthcare system is one of them. This was the time when a person cannot come in close contact of doctors, healthcare workers and even to his own family members. In such a scenario the process of healthcare delivery also changed and systems like tele-medicine and online consultation became popular. Looking at the success rate of the same many countries are even now following the process and relying on the same with great percentage. The name given to this overall process was 'Digital Health System'. in the present times this system is helping the overburdened healthcare institutions to take better care of their patients and increase in the percentage of cured and satisfied patients. The time which was saved, used in the development of new and better technologies. This process has benefited healthcare systems all over the world and Saudi Arabia was also one of the beneficiaries. **[6], [7]** Growth and development of above-mentioned telehealth services has changed the way of treatment process forever and provided great contribution in further development of the process. It was never easy but then again, pharmacies played a vital role in the process and taken the healthcare systems to another level. Usage of modern technology and AI has also contributed generously in the process. Such developments were welcomed by the healthcare workers and even by the patient who are in core of this system. This was also seen as a paradigm shift in the patient care and delivering patient care in due course of time, as the precision level of medicine improved and workflow of healthcare workers also made easier. This digital health system has added some extra feather in the process of patient care and treatment. **[8], [12]** The above-mentioned digital health system has brought enormous changes and improvement in overall healthcare system, right from diagnosis of the patient to dispensing of medicine. Even the overall system has become more effective and efficient. Pharmacies have considered this system of digital health and using it

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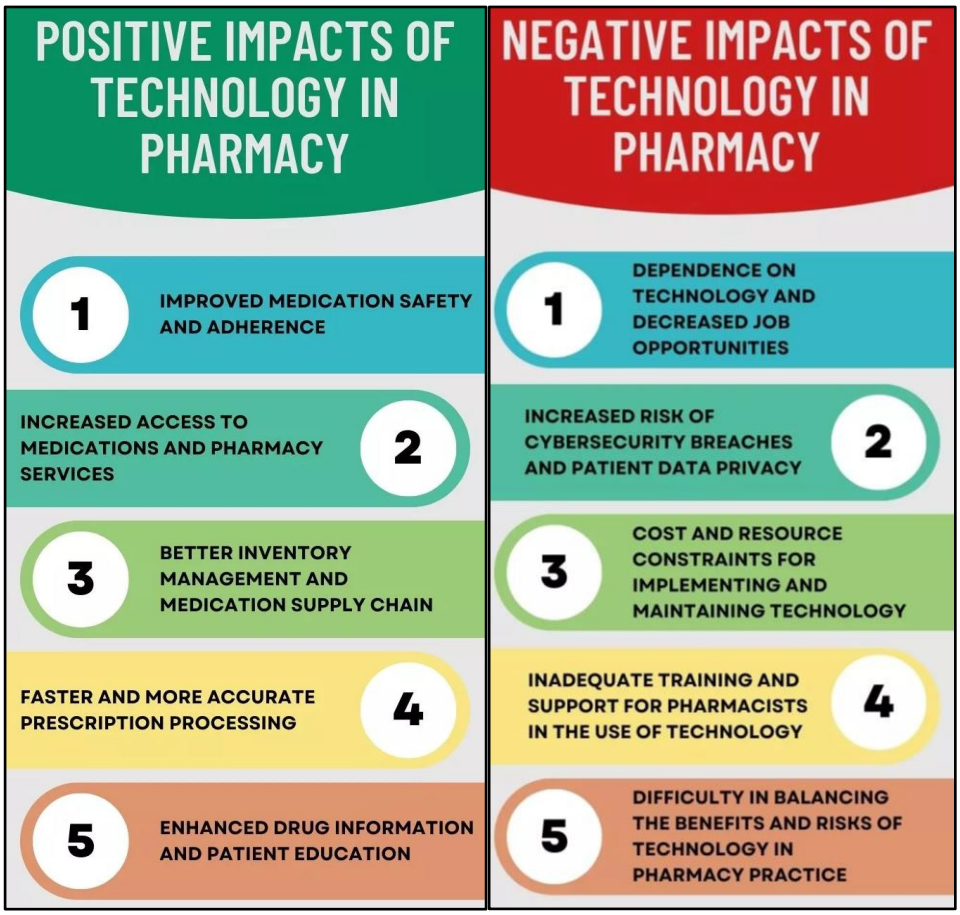
for the patient care and physical distribution of medicines. **[9], [10]** some of the example of the same can be Automated medicine dispensing, medication related application and even electronic prescribing. All this has improved the productivity of the patient care and the possibility of errors have also been reduced. **[14]** Then on the other hand the management of therapies related to pharmaceutical, consultations, and providing personalized health recommendations became more easier, here the credit should be given to modern day technology and use of AI in this system. **[11]**



Source: https://hubvela.com/hub/technology/positive-negative-impacts/pharmacy/

Figure 1: Positive and Negative Impacts of Technology in Pharmacy

The use of modern technology and use of AI has enabled the pharmacy services to further broaden their approach by the way of facilitating online consultations and improving patient care in many of the remote locations where the exact reach of healthcare system is not possible. Now people in the remotest location can take the advantage of modern day health system. This was made possible by the use of technologies like precise bar-codes and Radio Frequency Identification Systems (RFID), such systems have reduced the margin of error an

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d made the overall system more efficient. **[12], [3], [16]** Digital health technologies have added new milestone to the process of diagnosis, drug delivery and even patient care irrespective of the location of terrain of the area. **[14], [15]** This present study will evaluate the scenario in terms of relationship between technological advancements & AI enabled services and the improved processes of patient care in terms of diagnosis, drug delivery, consultation and even the development of overall medicinal system. Due to the general orientation of technology, people are becoming more aware about their health and using wearable devices, online consultations, using health related applications at a large scale. **[9], [4]** the main motive of the study will be to assess the overall healthcare system in the light of new technological developments and impact of the same on pharmacy services.

Objective

The main objective of the study is to assess the impact of using modern technology in pharmacy services at Saudi Arabia. Some focus will also be thrust on the related components and devices, engaged in the advancement.

Research Methodology

Research Design

This present study is based on the pillars of secondary data and follows exploratory research design. Based in Saudi Arabia this study uses review design to process the the flow of research. Application criteria will be the impact of modern technology on pharmacy related services. The process flow of study holds the review of research done in the recent past. The respective time frame of the same will be 2016 to 2024.

Area of Study

The main context of the study will be usage and application of modern technology in delivery of pharmacy and related services in Saudi Arabia. It is a well known fact that in the the light of Vision 2030 country is growing fast on development of health technologies and determined to achieve the goal of overall growth and development.

Criteria for Inclusion and Exclusion

Inclusion

- ✓ Researcher has included many avenues like journals of national and international repute, some official reports from MoH (KSA) and WHO, etc., some policy documents from the recent past and other related documents.
- ✓ English-language studies released in the duration of 2016 to 2024.
- ✓ News items and articles related to comparison of past, present and future health informatics in the field of pharmacy.

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- ✓ To get the better idea of the scenario some studies were also selected from the overall gulf region.

Exclusion

- ✓ Only complete studies were included,
- ✓ Publications that are not pharmacy specific,
- ✓ Articles published or presented before 2016,
- ✓ Studies not having appropriate key words,
- ✓ Studies published or presented in languages other than English.

Sources of Data

The researcher reached out to a number of electronic sources of data, some of them are SCI, PubMed, ScienceDirect, Web of Science, MoH (Saudi Arabia) official documents and related documentation and reports from WHO and related agencies.

Important Keywords

Most of the studies were searched on the basis of following keywords:

"health informatics", "digital health", "modern technology", "tele-pharmacy", "AI in medicinal development and distibution", "big data" and "KSA" or "Saudi Arabia".

Review Process

The studies selected as per the process mentioned above some of the themes and patterns were identified and even research gaps were identified, further all the selected studies were categorized as under,

a. Type of technology used
b. Technology implementation
c. Results that have benefited society actually
d. Some important shortcomings and
e. Policy framework.

Discussion

a. Online or E-Pharmacy

There have been differing levels of adoption and advancement in telehealth and telepharmacy in the Middle East. **[10]** The region has made efforts to improve healthcare delivery, although telemedicine has advanced slowly and some expectations have not yet been met. Nonetheless, the adoption and application of these technologies have advanced significantly. **[13]** More Saudi respondents (48%) than those from the UAE (36%), according to a survey comparing

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the use of digital health apps in the two countries, had used online pharmacy services. **[16]** However, compared to Saudi Arabia (35%), the United Arab Emirates (43%) had a greater awareness of teleconsultation services without past use. **[9]**

According to retention data, a sizable percentage of users in both nations still make use of these services; 71% of participants in the UAE and 80% of participants in Saudi Arabia use teleconsultations at various intervals. Remarkably, a sizable majority of Saudi Arabian users (90%), who reported regularly using online pharmacies, reported doing so on a regular basis. **[13], [4]** This level of involvement with these digital health modalities is slightly greater than that of the United Arab Emirates (78%). **[22]** The main factors driving consumer adoption of telehealth solutions are noteworthy: time savings (48%) and convenience (47%), with 34% of consumers being influenced by both 24-hour accessibility and efficacy. **[13]** Affordability and personal recommendations are also notable factors, while a wide range of options and quality are lesser but relevant considerations.

b. PPP (Public-Private Partnership) in Logistics

The telemedicine and digital platforms that have been highlighted are prime examples of the private sector's innovative contributions to the development of digital healthcare. A key approach for achieving universal healthcare (UHC) in India, for example, is public-private partnerships (PPP), particularly in light of the country's severe healthcare shortage and urban-rural divide. **[18], [22]** It is noteworthy that large-scale PPP projects have effectively implemented technology-enabled remote healthcare (TeRHC), proving its viability and effectiveness in reaching rural areas. By overcoming several obstacles, these programs provide a convincing case for widespread implementation and highlight the revolutionary role that PPP plays in healthcare delivery. **[23]** Additionally, a sizable minority of telemedicine literature suggests policy implications, indicating a complex synergy between the public and private sectors in shaping the digital healthcare framework, while the vast majority emphasizes the need for profound research implications. It can be said that the private sector is contributing generously in the digital transformation of healthcare system and advancing on the line of betterment of patient care and better healthcare related innovations. **[16], [8]**

c. Process Improvement and Automation

Automated systems in pharmacy and improved efficiency of workflow got transformed by the application of systems like automated medicine dispensing and better management of pharmacy systems. **[17], [24]** in the present times the pharmacist are having more time to devote on the patient care rather than pulling of their administrative duties. Apparently this is a great relief for the related health care staff and now they can take care of the patient in a better manner. Processes like pharmacy management systems, electronic prescription

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processing, pharmacy inventory control, electronic billing have given them edge over the other related tasks of patient care. **[25], [9]** New technologies have enabled them in accurately delivering pharmaceuticals, automated dispensing systems have improved the process of workflow and improved the overall efficiency of the system. **[8]** For making pharmacy related tasks more precise, this digital transformation ensures that pharmacists focus their knowledge and skills on making the patient care better and improve the overall pharmacy experience of the patient. **[18]**

d. Improved Reach to Patients

Pharmacy patient care has entered a new era thanks to digital health initiatives, especially the incorporation of remote patient monitoring made possible by wearable technology and remotely trackable sensors. **[11], [14]** Patients can actively engage in their healthcare through wearable technology, such as fitness related devices and smartwatches, that are able to keep the track of vital health signs, track physical activities, and related components. The data produced by these devices can be used by pharmacists to spot patterns, customize drug schedules, and learn more about the health of their patients. Additionally, remote sensors, which are frequently included in home-based monitoring devices, offer real-time health data that empowers pharmacists to modify treatment plans and take preventative action. **[19]** Using this technology, pharmacists can keep an eye on patients with long-term conditions from a distance, guaranteeing early identification of possible problems and encouraging prompt interventions. In the pharmacy context, wearable technology and remote sensors not only boost patient engagement but also enhance patient outcomes and general wellbeing by enabling a more thorough and proactive approach to healthcare. **[24], [18]**

e. Improved Safety

Digital health efforts that have integrated drug interaction alerts with cutting-edge technologies like bar-code and RFID have greatly increased pharmacy medication safety. Because barcode and RFID technologies ensure precise dispensing, they are essential in lowering the likelihood of medication errors. By utilizing these technologies to compare electronically generated prescriptions and patient records, pharmacy technicians can confirm the identity and dosage of medications. Pharmacists can improve medication dispensing accuracy by using RFID tags or barcode scanning, which reduces the possibility of giving the incorrect medication or dosage and minimizes errors related to manual procedures. Pharmacy management systems with drug interaction alert features examine current medication profiles and point out possible drug interactions. Instant alerts give pharmacists vital information to weigh the advantages and disadvantages of particular drug combinations. To prevent adverse reactions and improve overall medication safety, this proactive approach enables pharmacists to step in and work with medical professionals to alter treatment plans as needed. These initiatives not only protect patient health but also show how digital health technology can

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support a continuous improvement culture and medication safety awareness in the pharmacy setting. It is anticipated that the significance of these digital health initiatives in improving pharmaceutical safety procedures and raising the bar for care that pharmacies offer will grow as technology develops. **[16], [9], [13]**

Conclusion

Healthcare delivery is undergoing a fundamental shift due to the pharmaceutical industry's digital revolution, which is being propelled by the adoption of cutting-edge technologies like blockchain and artificial intelligence. This change has led to a significant expansion in the online pharmacy market. Growing dependence on online pharmacy platforms, there has been a discernible increase in customer confidence in online drug transactions, suggesting a move towards digital healthcare solutions. Telehealth services, including telepharmacy, have become more and more popular. These technology developments thrusts on an unparalleled system of patient care, improved pharmaceutical safety, and a proactive healthcare ecosystem as pharmacies transform into digitally driven healthcare hubs.

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