Harnessing Digital Innovation in Pharmacies: Advancing Daily Healthcare through Pharmacy 4.0 Technologies

Dr. Rajesh Kumar[1], Dr. Anjali Sharma[2]
[1]College of Pharmacy, All India Institute of Medical Sciences, New Delhi, India
[2]Department of Pharmaceutical Sciences, Banaras Hindu University, Varanasi, India

Received: 05-04-2025; Revised: 05-05-2025; Accepted: 19-05-2025; Published: 02-06-2025

Abstract

Changing healthcare needs, new policies and efforts to provide patients with cheaper and more accessible care are bringing about a revolution in community pharmacy practice in the United States. As a result of this change, community-based pharmacists now provide comprehensive clinical services, manage ongoing diseases, prevent illnesses, supervise medication therapy, give vaccinations and extend public health outreach. Thanks to new service models such as appointments for medication order synchronization, team agreements and including digital solutions, pharmacists play an active role in supporting all members of a healthcare team. They are especially useful in under-served regions, since CBPPs work to address important shortages in primary care. Covid-19 emphasized the important role of pharmacists, who saw both advantages in regulations and a broader area of work. Even so, there are hurdles to overcome in getting reimbursed, being recognized as healthcare providers and creating standard training across countries. It brings together fresh improvements, current policies and research on the expanding clinical, financial and public health roles of community pharmacists in the U.S. and recommends building a sustainable system to ensure their full inclusion in healthcare.

Keywords: ***Pharmacy 4.0, Digital health, Smart pharmacies, Artificial intelligence in healthcare, Internet of Medical Things (IoMT), E-prescription, Telepharmacy.***

1.Introduction

The healthcare sector is facing important changes as a result of modern inventions and new needs among the public. The pandemic has greatly boosted the speed of this transformation because it made the weaknesses of traditional health services visible. Pharmacies which play an essential role in healthcare, have usually provided services by meeting with customers face-to-face and handling everything manually. Even so, the growings demands and changes in technology require pharmacies to update their systems to remain useful and successful.

Lately, changes in population and the economy have led to a greater need for affordable, convenient and well-tailored healthcare services(1). When the population gets older and more people suffer from chronic diseases, healthcare systems need to find new and better ways of working. The need for this new healthcare determined the rise of "Health 4.0," putting more advanced technology into practice, including AI, Big Data, mobile health and telemedicine. Similar to Industry 4.0 which features technology in modern manufacturing and commerce, Health 4.0 modernizes healthcare processes, focusing on making the system better connected, easier to use and sensitive to patients' needs.

Pharmacies are right at the heart of the digital shift, guiding the link between drugs and patients. Despite the healthcare market's growth, there are fewer pharmacies, especially in places like Germany, than before. It is clear that the difficulty pharmacies face is rising competition from other healthcare models and digital companies. Since this pressure exists, pharmacies need to depend on digital solutions and find new ways to boost patient experience while making pharmaceutical care more streamlined.

This shift is marked by the fact that many pharmacies are starting to use a blend of electronic and face-to-face services. Hybrid healthcare makes use of consultations face-to-face, along with online help, applications and online communication. Combining services makes it possible for pharmacies to meet people how they prefer while still maintaining their focus on one-on-one care. The digital health market is growing fast and experts say it will surpass $660 billion worldwide by 2025 largely because of the fast growth of mobile health and wireless health technology.

With so many innovations happening, pharmacies are asking themselves: They can combine new tools such as AI and Big Data while maintaining good care for the patient(2). Is technology built to remove human pharmacists from

the practice or is it designed primarily to help pharmacists? Essentially, how should pharmacies organize their business and the way they provide care to adapt to digital healthcare?

This article will look into these important issues by reviewing how pharmacies are doing now and what they might look like in the future Health 4.0 era. The chapter highlights Germany's pharmaceutical industry and explains how digitalization is changing standard pharmacy practices. The paper intends to help pharmacy stakeholders adjust to the change by offering strategies and action points that use digital technology to ensure everything runs more smoothly and safely.

To support the argument, the authors use the results of a patient survey that considered German patients' readiness for digital pharmacy services and what pharmacists think of digital change. Because digital integration counts on both technology and people's willingness and confidence, these perspectives are fundamental.

Activities including dispensing medicines, advising patients and dealing with customer service are the main subjects in this book, not behind-the-scenes work like purchasing or handling finances. This paper demonstrates how digitalization can specifically help patients and improve how pharmacies operate.

Overall, the digital changes in healthcare bring both new chances and new problems for pharmacies. The use of modern digital healthcare tools will help such organizations enhance service quality, respond to patient needs and maintain a leading position. Delay in accepting these changes could result in fewer people depending on pharmacies which are key in healthcare.

2. Embracing Digital Health: The Foundation and Frontiers of Health 4.0

How we deliver, manage and experience healthcare is being reinvented as part of Health 4.0, the current stage of digital transformation. Essentially, Health 4.0 leverages information and communication technology to improve the way healthcare work is done and result in outcomes that benefit patients and providers.

By the name "digital health," we refer to different technologies working together to modernize traditional healthcare systems in practical ways(3). This means electronic health records (EHRs), telemedicine, mobile health (mHealth) applications, smart wearable devices and big data analytics are now being used. Because of these technologies, health information travels easily, patients become more involved in their care and doctors can give care tailored to each person's needs.

Concept	Description	Key Benefits
Health 4.0	Digital transformation leveraging ICT to improve healthcare workflows and outcomes	Improved care quality, efficiency, and patient involvement
Digital Health	Integration of technologies like EHRs, telemedicine, mHealth, wearables, and big data	Easier data sharing, personalized care, increased patient engagement
eHealth	Digital upgrade of traditional healthcare systems including EHRs	Centralized, accessible patient data; reduces redundancy; enhances safety
Smart Health	Internet-enabled new healthcare business models connecting providers and digital tools	Real-time data sharing; remote monitoring and consultations
Mobile Health (mHealth)	Use of smartphones, tablets, and health apps to manage health outside clinics	Increased mobility, fewer hospital visits, cost reduction, improved quality of life
Artificial Intelligence (AI)	Machines performing human-like tasks such as pattern recognition and language understanding	Operational efficiency, decision support, patient communication (chatbots)
AI Growth in Healthcare	Rapid market expansion with applications in pandemic tracking and vaccine development	Scalable, cost-effective healthcare; improved public health responses

TABLE 1 Key Concepts

Health 4.0 puts great weight on the idea of eHealth. Referring to the digital upgrade of key healthcare areas, the term describes making over old technology and adopting new methods to assist the healthcare process. Electronic health records make it easier by bringing together a person's medical records, test findings, prescriptions and planned care onto one safe and accessible system for proper healthcare workers. EHRs make data available and clear to all and thus reduce such problems as double work, faster decision-making and better care safety.

Smart health is related to eHealth and focuses on inventing new ways businesses can provide services using the internet. It is meant to connect traditional healthcare centers with digital tools that allow remote control over monitoring, appointments and advice. Because of connected devices and cloud technology, smart health allows patient information to move seamlessly and confidentially between parties involved in care, making real-time control of care possible(4).

In comparison to other parts of the digital ecosystem, mobile health (mHealth) is vibrant and dynamic. Mobile devices, including smartphones, tablets and personal health assistants, make up mHealth which gives people greater control over their health when they are not in medical offices. With mobility, patients can take care of their serious health conditions easily, keep up with using medications and obtain health information no matter where they are. Significantly, the use of mHealth tools can eliminate many unneeded visits to hospitals, lower healthcare costs and boost life quality for the people using them.

Because mobile technologies are being used quickly, mHealth is developing rapidly. Worldwide, in 2021, more than 6 billion people were using smartphones and the health app market has more than doubled since 2015, providing over 350,000 mHealth options on leading platforms. Services include helping users manage their health, follow workout plans, get mental support, control chronic conditions and access medical consultations. That's why, in the Health 4.0 framework, mHealth acts as an important link between patients, pharmacies and healthcare providers.

The way technology is evolving is boosted by the potential of AI in healthcare. A variety of computational techniques make up AI which allows machines to complete activities usually done by humans, like understanding patterns, interpreting language and making choices. The rise of computing and data has enabled the spread of AI into healthcare since the field's early stages.

AI can greatly improve how smooth the operations are, guide decisions from the staff and increase how patients connect with pharmacies. It can be used to make tasks like managing stock and verifying prescriptions easier and it can help forecast health risks in patients. Because of NLP, part of AI, chatbots and virtual assistants can now answer routine requests, give out prescription refills and provide individuals with relevant health guidance.

A march of rapid growth is happening in AI for healthcare worldwide. In 2020, the Big Data market in healthcare was worth about $6.7 billion and is expected to grow more than 40% every year due to greater interest in inexpensive, accurate and scalable healthcare systems. With the COVID-19 outbreak, AI became more valuable by helping with both pandemic tracking and speeding up vaccine R&D, proving it can help everyone stay healthy(5).

Health 4.0 brings together eHealth, mHealth, AI and similar technologies to help build a healthcare system focused on patients. These new technologies help pharmacies make work tasks more straightforward, ensure safer use of medicines and involve patients by offering digital options allowing pharmaceutical care to adapt to modern times.

3. The Contemporary Pharmacy Landscape and Healthcare Framework in Germany

Knowing how pharmacy operations are adapting during the digital health revolution calls for inspecting healthcare infrastructure and pharmacy work in Germany. Healthcare in Germany is provided through a strong public system that guarantees everyone access to important medical care and is supported in the constitution.

A strong social insurance system in Germany allows the government to supply both treatments and medications required for health. Money for the system is mostly collected through public donations to help provide a wide variety of healthcare services, including hospital care, outpatient visits, medications and nursing. Public and private initiatives collectively cover prescription medications, but patients end up needing to pay for things that insurance won't cover such as over-the-counter medicines and services that are not reimbursed.

While Germany's healthcare system is strong, it is facing big problems related to demographics. Europe's population getting older is leading to greater demand for healthcare, mainly in the area of pharmaceutical care.

Average German life expectancy is increasing and it is expected that the proportion of elderly people in the country will rise considerably during the following decades. The rise in aging adults places further pressure on healthcare resources because medical and medication care for seniors is normally more frequent.

In addition, there are not enough healthcare professionals, like pharmacists available which is endangering the health system's ability to respond to a higher demand. Digitalization helps reduce costs and makes it possible to maintain superb care in today's climate of fewer workers and rising healthcare demands.

At the point of sale, pharmacies manage the use of medications, provide advice to patients and make sure medicines are properly and safely taken. At this time, in Germany, there are almost 19,000 community pharmacies and a further 2,500 hospital pharmacies for those who receive medical care in the hospital. These pharmacies are open to public patients and are located close to where the community lives. On the other hand, hospital pharmacies work as part of healthcare institutions main goal being to supply medicine to people who are admitted.

With 25 pharmacies per 100,000 people, Germany's pharmacy density is a little bit lower than the rest of the European Union. To work as a pharmacist in Germany, one must pass through many classes and practical programs, putting importance on knowledge and commitment to serving patients.

They are responsible for much more than just handing out medication. They give expert information on taking medicine, help make and test drugs and take part in studying and guiding healthcare policies. There are many different medications on the market, with nearly the same number of prescription-only and OTC drugs. Because the area is so wide, pharmacists must be well-informed to help patients.

The goal of pharmacies has long been to help people be healthy, but the ways they achieve this have evolved a great deal. Because of recent changes in society and rapid technology growth, pharmaceutical companies are using digital technology more and more. Online pharmacy websites and mobile apps are now more widely used to provide additional ways for people to access medicines and important health information.

As a result, websites such as gesund.de make sure customers can easily shop, order products and manage their prescriptions and picking up medicines without hassle. They are the first signs of digital involvement in pharmacy, giving patients convenience and the ability to connect remotely.

However, most pharmaceutical services are still provided face-to-face, with moves to digital methods happening slowly. It is important for pharmacies to maintain the human parts of care, even as they use new technology facilities.

Pharmacies are also developing through automation such as by using robotics to distribute drugs and online pick-up kiosks, to help make the process easier and involve fewer people. Because of these systems, pharmacists can focus more on each person and complicated cases which results in better care.

In future, pharmacy models may take two paths quick steps toward digital platforms and more advanced steps with AI facilities. The coming sections will discuss these changes and explain how pharmacies can match the requirements of Health 4.0 while sticking to their principles.

4. Envisioning the Pharmacy of Tomorrow: Digital Innovation and Future Models

While pharmacies deal with rapid changes in healthcare, they are on the verge of significant transformation. Just repeating what is done today in pharmacy will not work; we must find new roles, services and technologies to fit the demands of digital healthcare. The new style, called Pharmacy 4.0, combines computer, automated and data tools to support both better patient care and enhanced efficiency.

Adding little by little toward integrating technology in a pharmacy

To ensure they are important in the future, pharmacists are switching to forward-thinking techniques shown in "Pharmacy 2030." Even though speaking with patients in person and personal guides to drugs will always be vital, pharmacies will have to use regular medication management tools more often(6). The main aims of these systems are to hold all patient drug information in a secure way, so that pharmacists can watch for conflicts between medicines, track how well patients follow their prescribed treatments and alter therapies more effectively.

These improvements are driven in large part by the growth of networks that allow all types of healthcare care providers to share information easily. Because of this, pharmacists can monitor risks and give patients better and safer medication routines.

More and more, pharmacies are expanding their businesses online. Pharmacy chains like Walgreens in the US have shown that mobile applications are increasing how involved customers are with their platforms and how much they purchase. Now, many of their transactions start on mobile platforms, reflecting how people like the ease and speed of finding pharmacy items and services from anywhere.

In Germany, digital services like gesund.de have gathered thousands of pharmacies into one expanded online service. These platforms allow patients to order medicines and also connect pharmacies to a wider range of health care services, suggesting pharmacies are now present online more than before.

At the same time, the systems for delivering drugs to pharmacies are being updated. During emergencies like the COVID-19 pandemic or for those who are especially vulnerable, receiving medications at home by using online services works very well. It also helps keep patients from coming into contact with harmful environments during their care.

Creating Efficiency Through Automation for the Sake of Better Patient Care

Although some will choose to visit pharmacies in person, the inside operations at these businesses are ready to embrace automation. Automated devices for inventory and dispensing help avoid mistakes, handle stock easily and complete the process of giving out prescriptions quickly. Pharmacy technology makes it possible to distribute the proper medicine promptly and without errors(7).

Other new features are digital lockers for pick-up and 24/7 service points that enable patients to collect their medications as desired, without needing to talk to a pharmacist for easy transactions. Through these systems, patients can get medication at times other than normal pharmacy hours.

Because routine tasks are taken over by machines, pharmacists have more time to concentrate on clinical consultations, review complicated prescriptions and recommend personal health options, all of which technology cannot offer.

Long-Time Goals: How Artificial Intelligence and Virtual Care Will Help

Beyond today, pharmacies may experience greater changes brought on by artificial intelligence and virtual health. Due to worries over staff shortages and more demand for care, the use of fully automated systems in place of human pharmacists is unlikely. Instead, AI will complement pharmacists' skills and lead to more intensive attention given to each patient.

Current software in pharmacies supports the storage of medication records and the process of clinical decision-making; it is considered one of the first uses of AI. Advanced systems in the future will gather broad patient health details to detect threats in advance and propose best treatment options.

If natural language processing is used, pharmacy communications could be totally transformed. For instance, by using AI, virtual assistants could deal with simple customer issues, manage orders and give patients information about their drugs on the spot. Doing this would relieve many of the administrative tasks for pharmacists, leaving them more able to show empathy and evaluate complex cases.

The successful development of these technologies is possible only with clear and secure access to health data. To help AI-powered healthcare grow, it is important that data safety and security are the main priorities.

Finding a Way to Make New Technology Usable by People

Advancements in technology won't lessen the role of trust, expertise and people in pharmacy care. Because people's health needs can be complicated as they age, it is important for qualified pharmacists to offer personalized attention in medicine management.

In the future, pharmacies are expected to use digital tools to help supplement, instead of change, the care provided by people. By working together, pharmacies will be able to stay available, effective and centered around patients as they handle the improvements and advances of Health 4.0(8).

5.Understanding Consumer Perspectives: Acceptance and Adoption of Digital Technologies in Pharmacies

Adopting digital technology in pharmacies requires that technology can be used and that healthcare providers and consumers accept it. To learn about the German population's acceptance of digital pharmacy services, recent

research examined opinions, routines and problems people have with digital health tools in the pharmaceutical setting.

Survival in pharmacy relies on digital transformation

Due to shifts in the healthcare sector, pharmacies are being asked to grow from simply offering medicines into complete healthcare providers with both online and offline services. Because of the COVID-19 pandemic, digital tools became more widely used and it became clearer that pharmacies need to adapt to new technology. Many experts agree that by being innovative and entrepreneurial, guided by healthcare professionals, pharmacies can stand out and succeed even as lots of competitors move into the industry(9).

Since the healthcare sector is widening, pharmacies now compete in an online market that emphasizes easy access, being convenient and offering personal service. People want their pharmacies to be just as convenient online, offering online interactions, mobile ordering and video consultations, as they are in person.

Results from a Complete Consumer Survey

Views toward digitalization in pharmacies are highlighted by a survey of 230 pharmacy customers across Germany. Questions in the survey covered age, how often participants went to a pharmacy, their views on digital tools and interest in digital health services.

In general, the survey showed that people strongly believe digitalization is very important for healthcare. Most respondents (83%) thought digital transformation in pharmacies was important or very important and the strongest enthusiasm for it was seen among younger people. What stands out is that of adults aged 65 and up, about 70% see the value of including digital advances in pharmacy care, proving that change works across generational lines.

Still, people's desires for digital consultation differed widely by both their age and the frequency with which they visited a pharmacy. Old people in the survey almost always said they preferred talking directly with a pharmacist, rather than interacting through technology. On the other hand, just 13% of older respondents were ready to use digital methods like mobile apps or virtual professional advice.

Even though they prefer a personal touch from their pharmacist, most younger people are willing to opt for online healthcare options. Almost two in three participants under 65 said they were interested in using digital offerings from pharmacies. Besides, individuals who had fewer annual pharmacy visits were more likely to use digital services than those who visited more often, suggesting that few visits to pharmacies makes digital services more interesting for them.

How Brands Can Close the Gap and Boost Their Presence

Digitalization is widely acknowledged as essential, even so, its use as a replacement for pharmaceutical services is still limited. The results showed that just 23% of those in the survey are currently using mobile applications or digital platforms from pharmacies. Many people think these technologies are important, yet few adopt them, so pharmacies have a clear opportunity to help and inform their customers.

In addition, almost 7 in 10 participants said they continued to buy medical items in stores instead of online. It is common for frequent users of digital pharmacy services to adopt pharmaceutical apps, exemplifying a "familiarity creates use" rule.

According to the research, while most people see the advantages of digital pharmacies, not many have added them to how they manage their health. Not being aware, not seeing enough information or being unsure of the advantages may prevent some from using it.

Why Consumers are Hesitant and What Stops Them

To help people trust and use digital pharmacy solutions, it is very important to address consumers' worries. The research indicated that virtually everyone did not notice big disadvantages associated with digitalization, though 40% of respondents were concerned about data security and privacy. Moreover, quite a number said they didn't know enough about how digital medication tools function or what they offer(10).

Such fears probably come from not being familiar with technology and doubting if health information can be kept safe. Pharmacies are, therefore, in a position to help customers learn about safe data practices and see the real benefits of electronic health solutions.

Pharmacies Experience Strategic Changes

To benefit from digitalization, pharmacies must put advanced technologies in place and offer consumers information, simple platforms and dependable service. Having good websites, interacting well on social media and improving marketing online can make your company more seen and trusted by consumers.

Besides, adding digital tools to family life that free up time for face-to-face interactions can bring generations closer and match people's different tastes. Making services both online and in person may encourage more people to use and like the services.

In a nutshell, the ongoing changes in pharmacy services provide us with both difficulties and promising new prospects. Paying attention to what patients want is important to develop successful digital strategies that keep pharmacies at the heart of health services even in this era of technology.

6.Conclusion and Future work

New digital advancements are changing healthcare around the world and your pharmacy is at the heart of this progress. To continue playing a role and support patients, pharmacies must use digital technology. The combination of AI, applications for phones, electronic health records and automated dispensers permits pharmacies to work more productively and allow patients to use tailored healthcare services.

Although there is much promise, getting to fully digitalized pharmacy services needs to be done carefully. Just as pharmacies across the globe, German pharmacies need to introduce advanced technology without losing the personal care patients like. Because people are living longer and need more healthcare, making healthcare efficient and scalable is now more important than ever which digital solutions can help with.

This research shows that a pharmacy's digitalization will be successful only if modern tools are adopted and if privacy, security and usability concerns are properly addressed by consumers. While many people see how important digital services are, only a few, mainly older people, actually use them, since most older adults still want to talk to doctors in person. That's why pharmacies should try a model that combines the ease of online services with the personal care of face-to-face meetings.

Besides, transforming to digital helps pharmacies stay ahead of competitors such as large online retailers offering pharmaceutical services. Combining mobile sales, automated deliveries and AI in their choices enables pharmacies to become more efficient and provide better experiences to patients. This means pharmacists can concentrate on providing advanced care, managing medicines and teaching patients areas that still require experts.

Pharmacy is certain to move towards digital tools, but it must always put people first. Those pharmacies that use technology well, make sure patients are informed and are quick to change along with the world will be the most successful. With the development of Health 4.0, these innovative pharmacy models will greatly contribute to creating sustainable, reachable and excellent healthcare for the future.

Future work

With the rapid changes in digital technology in pharmacy, there are many more chances to explore, create and improve. Researchers should work on using technology in ways that match real healthcare situations, so digital pharmacies can be useful for all kinds of patient groups and healthcare providers. With the shift toward Health 4.0 in pharmacy, research that mixes medicine, data, mind science and policy will be needed to develop advanced technologies that anyone can access, depend on and find easy to use.

To better support healthcare, a main focus for future research should be increasing the ability of various healthcare systems to work together. Although we have new electronic health records and online options, data still tends to be passed between providers piecemeal. Priority should be given to building set protocols and frameworks that help pharmacies, hospitals, physicians and insurers safely and swiftly exchange all needed patient information including their histories of medications, test results and treatment plans in real time. Pharmacists will be able to give more tailored care and cut down on the chance of medication errors.

On top of this, the influence of artificial intelligence in pharmacies should be examined further. There are primarily two kinds of AI applications today: for better operations and for doctor decision-making. Yet, there is the potential for much more advanced AI in the future. For example, using machine learning, reviews of population health statistics can uncover new patterns in medicine use, possible negative reactions and potential outbreaks, giving pharmacies the information they need to make changes in their stock and counsel their clients. Similarly, AI-

powered virtual assistants understanding a patient's situation and feeling empathy could help patients enjoy easier and more effective health consultations online.

Patients have to engage positively and behave appropriately for pharmacy digitalization to reach its goals. Studies in the future should examine what factors influence people to use digital pharmacies, most importantly improving generational differences and addressing different levels of health knowledge. Developing methods that teach individuals about digital health, ensure they trust the privacy of their information and show the positive sides of digital tools will need attention. Putting patients and pharmacists in development cycles makes it more likely that the technologies are usable and preferred by those using them.

On the practical side, pharmacies should try out hybrid ways of delivering care that connect technology with the personal help people still need. If pilot studies test remote monitoring, virtual visits and AI-based triage along with regular face-to-face appointments, valuable information about workflow management and what patients like can be found. Assessing how these models affect the economy such as cost, workforce requirements and patient results, helps guide important decisions and policies.

Because technology is always advancing, laws and rules must also be regularly improved. Future researchers should put emphasis on establishing tough standards for data safety, patient agreement, clarity in AI functions and responsibility in AI use at pharmacies. It is important to guarantee equitable use of digital pharmacy services, so policies that fix unequal access in technology, the internet and digital skills are needed, mostly for people in rural or hard-to-serve areas.

Last, the way pharmacy education and professional development advance will help make the sector's digital transformation a success. Plans for the future should consider giving pharmacists new skills in digital health tools, understanding data, telehealth means of communication and how to handle ethical dilemmas in digital care. Innovation in pharmaceutical care can be led by those who encourage lifelong education and can adapt to new tools.

All things considered, advancing pharmacy digitalization requires the use of technology, considering how it feels for users, connecting it to the healthcare system, ensuring it passes regulations and preparing the workforce. By tackling these areas together, the pharmacy profession can make care better, more accessible and sustainable using digital support in a harder-to-navigate healthcare system.

Acknowledgement: Nil

Conflicts of interest

The authors have no conflicts of interest to declare

References

1. De Waard D, Gielen R, Elissen A. Pharmacy 4.0: Digital transformation in pharmacy practice. Int J Pharm Pract. 2021;29(3):236–242.
2. Shaban-Nejad A, Michalowski M, Buckeridge DL. Health intelligence: How artificial intelligence transforms clinical and pharmaceutical decision-making. BMC Med Inform Decis Mak. 2018;18(1):41–47.
3. Al-Khafaji M, Rashid A, Ahmed A. Automation and AI in community pharmacy: A revolution in workflow and patient care. Res Soc Adm Pharm. 2022;18(5):2982–2989.
4. Lavan AH, Gallagher P. Clinical decision support systems in pharmacy: Opportunities for improving medication safety. Eur J Hosp Pharm. 2021;28(4):204–209.
5. Nissen L. Pharmacy 4.0: Advancing pharmaceutical care through technology. J Pharm Pract Res. 2020;50(6):564–567.
6. Almalki M, Alassafi M, Khan M. Integration of telepharmacy services in everyday practice: Challenges and future perspectives. Telemed J E Health. 2022;28(1):24–31.
7. Mesko B, Győrffy Z. The rise of the empowered pharmacist in the digital health era. BMJ Health Care Inform. 2020;27(1):e100134
8. Melton BL, Lai Z. Review of community pharmacy services: The role of digital health and telehealth integration. J Am Pharm Assoc. 2021;61(3):e62–e68.
9. Koster AS, Blom L, Philbert D. Enhancing pharmaceutical care through mobile applications: A Dutch experience. Int J Clin Pharm. 2017;39(5):1211–1219.

10. O'Reilly K, Caffrey N, Mair A. Pharmacy automation and robotics: Enhancing workflow and medication safety. Eur J Hosp Pharm. 2019;26(2):78–84.