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Review Article

A Comprehensive Review of Improvements in Clinical Pharmacy: Integration of AI, Pharmacovigilance, Telepharmacy, Legalization, and Multidisciplinary Collaboration for Enhanced Healthcare Delivery

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Abstract

Clinical pharmacists once limited to medication prescriptions, have expanded their responsibilities to encompass patient-centered care, pharmaceutical care, and the optimization of chronic disease management. With improvement in technology, including the integration of electronic health records and tele-pharmacy, pharmacists now play a pivotal role in remote patient consultations and pharmacovigilance, enhancing medication safety and efficacy, and multidisciplinary collaboration of different specialties in seeking patients' health. The review also delves into the legal and ethical frameworks required to support these improvement, emphasizing their impact on healthcare delivery. Additionally, the collaboration between pharmacists and microbiologists in antimicrobial therapy, particularly in addressing microbial resistance, has strengthened patient outcomes, and pharmaceutical care by filling gaps between the diagnostic and therapy parts to avoid possible therapy failure and economic useless bleeding out of resources. The future of clinical pharmacists in primary care is particularly promising, with emerging initiatives such as pharmacist prescribing and "Pharmacy First" services, demonstrating their increasing impact on patient care. It predicts safer and more efficient medication protocol planning between cooperative medical teams with different specialties for common and oriented targets.

Introduction

Clinical pharmacy approaches focus on the direct interaction between pharmacists and patients to optimize medication therapy. Pharmacists work with healthcare teams to ensure accurate medication lists during transitions of care and develop treatment plans [1]. Certified clinical pharmacists have cut their way into healthcare teams in hospitals with multiple responsibilities. First, Pharmacists focus on Patient-Centered Care by monitoring patients continuously with chronic conditions, such as diabetes, hypertension, and asthma [1]. Reviewing patients' medications is important to identify potential problems and optimize therapy. They also, counsel patients on proper medication use, side effects, and lifestyle modifications. Second, Pharmaceutical Care is under clinical pharmacists' responsibility because they have the scientific knowledge to go through medication regimens and evaluate for efficacy, safety, and modification [2]. They monitor and control medication dosage depending on each patient's condition as they consider genetic factors and manage predictable and unpredictable adverse drug reactions to evaluate the effectiveness of medication therapies.

Over decades, Clinical pharmacists have made their way into the healthcare system through many phases. Starting as a separate unit responsible for only medication prescriptions, they have now become a cornerstone in each step of the patient therapy plan. In the technology era, clinical pharmacists integrated electronic health records for easy access to patient records and tele-pharmacy, which provides remote patient care and consultation, enabling efficient communication between the medical team and patients' requests without the need for hospital admission [3]. Digital techniques enabled the pharmacovigilance aspect through the E-reporting of detected defects and unwanted adverse drug reactions of each drug. Many e-programs are designed to facilitate access through multiple information related to the pharmacology of the drugs and the calculation of patients' doses based on database algorithms with AI integration [4]. Clinical pharmacy is not an arbitrary approach, but clinical pharmacists work under international guidelines and legalities, especially the digital integration program. The presence of legalities builds trust relationships with pharmacists' online services, ensures private data protection, and assures safe and efficient consultation.

In seek of continuously enhance efficiency and cooperation between healthcare system members, microbiologists share responsibilities with clinical pharmacists to adjust medication protocol regarding antimicrobial therapy, especially in case of microbial resistance cases [5]. Diagnostic and medication therapy failure could be avoided by the role of microbiologists in the healthcare team through consultation with the medical team and discovering new diagnostic tools to replace possible errors of retired old methods through dedicated research and scientific approach.

Primary care has changed dramatically recently, with pharmacists successfully joining general medical practices. Pharmacists are crucial in primary care networks, and their potential must be recognized as healthcare evolves. This article explores the future of clinical pharmacists in primary care, based on recent trends and expert views. The future for clinical pharmacists in general practice looks bright. Initiatives like pharmacist prescribing and new community pharmacy contracts will allow pharmacists to play a much bigger role in patient care. The success of pharmacists in primary care has led to innovative services like "Pharmacy First" for minor ailments, demonstrating their valuable contributions to healthcare. In conclusion, the outlook for clinical pharmacists in general practice and primary care is promising. Their expertise, dedication, and commitment to patient care have established them as essential members of the primary care team.

1. Review Methodology

1.1 Data sources and search strategy

The literature review utilized a comprehensive search strategy to identify relevant studies and articles using databases from their inception to 2024 [6]. The primary electronic bibliographic databases accessed included PubMed, Scopus, Web of Science, and Google Scholar, which are well-regarded for their extensive medical, pharmaceutical, and health sciences research coverage. Additionally, specific databases such as MDPI, Nucleic Acids Research Database, BMJ Open, American Journal of Pharmaceutical Education, Canadian Pharmacists Journal, and Frontiers in Cellular and Infection Microbiology were consulted to gather specialized information. Statistical data and reports were sourced from NHS Digital, the Centre for Pharmacy

Postgraduate Education, and the General Pharmaceutical Council. The search strategy used keywords and MeSH terms related to pharmaceutical care, drug-related problems, clinical pharmacist interventions, digital health, and antimicrobial stewardship. The reference lists of the identified studies for full-text screening were manually reviewed to identify any additional studies meeting the review criteria that were not electronically identified.

1.2 Eligibility criteria

Specific inclusion and exclusion criteria were established to ensure the appropriate selection of studies from extensive resources and databases. The inclusion criteria were as follows: (1) Studies involving improvement in online and digital applications in clinical pharmacy; (2) Studies that provide a comparative analysis of potential or achieved outcomes of these improvements versus traditional methods; (3) Improvements that highlight the significance of clinical pharmacists within institutional organizations and public health; (4) Studies focusing on the role of other specialties, such as microbiologists, in enhancing collaboration and communication between medical staff and clinical pharmacists; (5) Studies published in English and conducted in advanced countries, to facilitate comparison with the model of the Memorial Hospital of Soad Kafafi.

1.3 Outcomes

This literature review encompasses a diverse array of 30 studies focused on various aspects of pharmaceutical care, digital transformation, pharmacovigilance, antimicrobial stewardship, telepharmacy, regulatory frameworks, and educational development within the pharmacy field. The review includes both qualitative and quantitative research methodologies. For instance, some studies utilized modified Delphi methods to develop complexity tools for pharmaceutical care, while others employed electronic screening methods to identify inpatients at risk of drug-related problems. Additionally, there are systematic approaches to developing electronic patient prioritization tools. The review also highlights the integration of advanced technologies, such as the use of artificial intelligence in pharmacy practice and the development of digital health platforms. Furthermore, it examines the role of clinical microbiology laboratories in antimicrobial stewardship and the impact of telepharmacy during the COVID-19 pandemic. By categorizing these studies into distinct themes, this review provides a comprehensive overview of the current improvements and challenges in the pharmacy sector, offering valuable insights for future research and practice.

2. Improvement in Clinical Pharmacy

2.1 Telehealth and online pharmacy improvements in pandemic management

The digital transformation of the pharmaceutical sector is fundamentally transforming the provision of healthcare services through the integration of artificial intelligence, blockchain technology, and telehealth methodologies. The digital evolution within the pharmacy industry signifies a critical transition in the administration and experience of healthcare services. This progression transcends mere ephemeral trends; it fundamentally reconfigures the healthcare paradigm. The implementation of digital technologies is redefining various dimensions of healthcare, encompassing patient engagement and medication adherence, which in turn facilitates improved healthcare outcomes In the domain of online pharmacies and telehealth, digital health technologies have played a crucial role in managing the COVID-19 pandemic through mechanisms such as surveillance, contact tracing, diagnosis, treatment, and preventive measures [7].

These innovative technologies ensure that healthcare services, encompassing pharmacy operations, are delivered with enhanced efficacy, thereby addressing the pertinent challenges related to accessibility and timely care provision. The significance of telemedicine and electronic pharmacies has been underscored in their capacity to improve access to healthcare on a global scale. By facilitating remote consultations and the delivery of pharmaceuticals, these platforms are rendering healthcare services more attainable, particularly in areas where traditional healthcare infrastructure is either limited or overburdened. Similarly, telehealth provides extensive resources tailored for both patients and providers in the United States, highlighting initiatives such as the Affordable Connectivity Program and Lifeline designed to bolster access. The Health Resources and Services Administration augments telehealth initiatives through support services, empirical research, and technical assistance, thereby reflecting a notable outreach impact. The Office for the improvement of Telehealth (OAT) under the auspices of the Health Resources and Services

Administration (HRSA) is dedicated to enhancing access to high-quality healthcare through the integration of telehealth services within the United States. It extends support for direct services, research endeavors, and technical assistance, evidenced by over 6,000 technical assistance requests directed to Telehealth Resource Centers and approximately 22,000 patients benefiting from these services. On an international scale, in the United Kingdom, the National Health Service (NHS) leads the charge in digital health and care, creating substantial opportunities for innovation via comprehensive data management [8].

Support for digital health encompasses various developmental stages, commencing with discovery phase collaborations involving organizations such as the Biotechnology and Biological Sciences Research Council (BBSRC) and the Intelligent Data Analysis (IDA) research group, progressing through development facilitated by networks like Catapults and the Clinical Practice Research Datalink (CPRD), and culminating in delivery with organizations such as the Academic Health Science Networks (AHSNs) and Digital Health London. Regulatory entities, including the Medicines and Healthcare Products Regulatory Agency (MHRA) and the National Institute for Health and Care Excellence (NICE), are tasked with ensuring safety and efficacy. This collaborative ecosystem integrates academic, healthcare, and industry stakeholders, with the overarching aim of enhancing health and care services through technological advancement and innovation [8].

2.2 Technological Improvement in Pharmacovigilance

pharmacovigilance integrates pharmacogenetics into routine clinical practice to optimize therapeutic outcomes. Patient-specific genetic profiles guide drug safety surveillance, ensuring personalized treatment plans [9]. Advanced computational tools, such as data mining and AI, enhance real-time monitoring and decision-making processes in pharmacovigilance [10].

Technological advancements, including generative AI and electronic health records (EHRs), are revolutionizing pharmacovigilance by improving real-time signal detection, automated reporting, and data integration. These innovations enhance the efficiency and responsiveness of pharmacovigilance systems. Additionally, wearable devices offer continuous monitoring and a wider range of data for analysis, leading to more accurate and timely safety monitoring. The integration of these technologies marks a significant advancement in addressing the challenges of pharmacovigilance in personalized medicine [11].

2.3 Patient-Centric Innovations

Patient-centered care models are revolutionizing pharmacy practices by integrating innovative technologies like intelligent pillboxes and mobile health applications. These tools significantly enhance medication adherence and chronic disease management, particularly for conditions such as diabetes and cardiovascular diseases. Intelligent pillboxes provide timely reminders and track medication intake, ensuring patients adhere to their prescribed regimens. Meanwhile, mobile health applications offer features like symptom tracking, medication reminders, and educational resources, fostering better self-management and patient engagement. These advancements are not only improving health outcomes but also reducing healthcare costs by promoting consistent and effective disease management [12].

2.4 Model-Informed Drug Development (MIDD)

MIDD is a transformative approach that integrates mathematical modeling and simulation to optimize drug development processes. By using quantitative systems pharmacology (QSP) and physiologically based pharmacokinetic (PBPK) models, MIDD enhances trial design, dose selection, and effectiveness evaluations. Notably, the FDA has employed MIDD to guide regulatory decisions, including rapid vaccine development during the COVID-19 pandemic [13]. This intricate instrument has fundamentally altered the landscape of contemporary drug discovery and development initiatives. In the past decade, the utilization of Model-Informed Drug Development (MIDD) methodologies has emerged as a prevalent strategy within drug development and applied pharmacotherapy endeavors across industry, academia, and, significantly, within global regulatory bodies (e.g., FDA, EMA, ICH, PMDA, and NMPA) [13],[14],[15]. It is noteworthy that no less than 90% of all pharmacological agents sanctioned by the US FDA have their research foundations rooted in MIDD principles [12]. Most recently, the deployment of these methodologies has proven to be vital for the expedited development of

vaccines and therapeutic interventions in response to the COVID-19 pandemic [16].

3. Legalization in Clinical Pharmacy

3.1 Regulatory Frameworks for Digital Tools

Regulatory frameworks play a pivotal role in legitimizing online pharmacy practices and telehealth services. The EU has implemented standardized guidelines to ensure patient safety and trust in online pharmacies [16]. Similarly, FDA guidelines on AI applications in drug safety monitoring provide a foundation for integrating advanced technologies into pharmacology [13].

Telepharmacy faces several regulatory challenges that impact its implementation and effectiveness. These include navigating diverse regulatory frameworks, such as licensing, data privacy laws, and telemedicine legal reforms, which require standardized systems for safety and compliance. Providers must manage complex licensing and credentialing processes that vary by jurisdiction, creating barriers to consistent care. Ensuring data privacy and security is crucial, necessitating adherence to laws like HIPAA and robust cybersecurity measures to prevent breaches. Additionally, the lack of standardized reimbursement models can hinder the adoption of telepharmacy services, affecting their sustainability. Ongoing legal reforms in telemedicine and telepharmacy add to the uncertainty, requiring providers to stay informed and compliant with changing regulations. Addressing these challenges involves harmonizing policies, investing in secure infrastructure, and keeping providers updated on legal requirements [17]

3.2 Ethical and Privacy Considerations

Ensuring patient privacy and securing health information are crucial in telepharmacy. The transmission of health data over the internet poses risks of breaches and unauthorized access. Telepharmacy providers must implement strong cybersecurity measures, such as encryption, secure communication channels, and strict access controls, to protect patient data. Failure to do so can lead to significant legal liabilities and a loss of patient trust [18].

Compliance with privacy regulations, like the Health Insurance Portability and Accountability Act (HIPAA) in the United States, adds complexity. These regulations require rigorous standards for protecting personal health information, necessitating investments in secure systems and processes by telepharmacy providers. Additionally, staff must be trained in privacy and security protocols to prevent accidental breaches [19].

Despite these measures, patients may still worry about the confidentiality of their health information. Addressing these concerns through transparent communication about data protection practices and ensuring compliance with the highest privacy standards is essential for gaining patient trust and participation.

4. Clinical Services in Clinical Pharmacy

4.1 Tele-pharmacy During Crises

Tele-pharmacy emerged as a critical service during the COVID-19 pandemic. Remote consultations and cloud-pharmacy care systems facilitated continued healthcare delivery while minimizing exposure risk [7]. Countries like Saudi Arabia and the Philippines successfully implemented tele-pharmacy solutions to address accessibility challenges.

4.2 Integration of AI in Clinical Services

AI-driven tools enhance drug development and patient management by predicting adverse drug reactions and optimizing therapy. For example, supervised machine learning models have been used to analyze medical imaging features, standardize results, and reduce human errors [22].

4.3 Expansion of E-Health Platforms

Digital platforms like MedEssist enable pharmacists to manage vaccinations, medication reviews, and chronic disease monitoring. These platforms reflect a broader trend towards digital-first, customer-centric healthcare solutions [23].

5. Microbiological Integration into Clinical Practice

5.1 Microbiologists Role in Stewardship Program

Clinical microbiology collaborates with the clinical pharmacy unit by introducing a stewardship program that participates directly in improving health care service in both patients' prognosis, hospital stay period, and economic aspects. Stewardship program applied by clinical microbiologists to select the most optimal

antibiotic for each patient case regarding the specified dose and therapy duration to obtain the best possible outcomes of treatment, avoiding minimal toxicity and lessening the risk of resistance or at least slowing down resistant cases rate due to misuse. There is a reflection on the economic aspect of reducing morbidity and mortality rates of resistant pathogenic microorganisms and reducing the cost burden of long-term hospital stays for patients [24]. Clinical microbiologists are an essential part of the Stewardship program, working together with a multidisciplinary team that includes infectious disease physicians, certified clinical pharmacists, infection control specialists, and hospital epidemiologists. Clinical microbiologists are entitled to multiple and essential roles in the healthcare area including the following tasks:

5.1.1 Clinical consultation:

He guides the operation of selecting the appropriate procedure of culture sampling, laboratory tests selection, designing a schematic diagram of proper antimicrobial drugs, and dosing according to test results and clinical patient history. The Infectious Disease Society of America (IDSA) spots the light on the significance of integrating clinical microbiology in health care teams, especially in cases of anti-microbial resistance, ICU hospitalized patients, and pandemics [26]. Positive outcomes were spotted on better prognosis and, reducing mortality rates and economic value by reducing consumption of non-specific and non-appropriate antibiotic dose regimens. Also, reducing over-utilization of diagnostic testing which in turn reduces healthcare system costs to each patient.

5.1.2 Scientific Experimentation:

Clinical microbiologists oversee each specific case to adapt and create new diagnostic tests or schematic therapy algorithms according to diverse local patients' needs. Combating pandemics such as Covid 19 needed scientific oversight to adjust therapy and testing algorithms according to the local needs of patients as specimen criteria, Medication cost, and clinical history of each patient [27].

5.1.3 Verification

Verification of tests and continuous evaluations is needed systemically and detect possible errors due to the low specificity of tests and emerging of new methodologies which must be studied, verified, and implemented in schematic diagnosis with the retirement of old and non-conclusive methods. Medical microbiologists always keep up with new methodologies and do experimental research to verify new tests and compare the efficiency and specificity with old ways [27]. Rushing to use new tests without proper verification could affect both economic and diagnostic efficiency.

5.1.4 Supervision

Supervision of medical staff and technician to assess their laboratory skills and keep pace with scientific advances. He plays a significant role in constructing highly trained staff with at least minimum accreditation requirements and modifying quality assurance levels [28].

5.2 Total Automated Laboratory Effect

The recent global pandemic of Covid 19 has explained the major significance of rapid detection, control, and prevention of infection in decreasing mortality rates and improving healthcare services in clinical hospitals [24]. Clinical Microbiology laboratories in hospitals perform a wide range of methodologies varying in complexity of pathogen detection. Methodologies include (Microscopic identification, culture growing, Serological tests, and proteomic analysis of antigens) which require highly trained and certified medical microbiologist leaders to guide diagnostic operations and avoid errors of laboratory technicians who perform tests in multiple hospitals [25].

Total laboratory automation (TLA) and the application of AI represent an improvement in diagnostic workflow that accelerates clinical decision-making and has positive outcomes regarding patient treatment more than manual handling in conventional methods. There are two laboratory automation systems available represented by: the BD Kiestra™ system, and the WASPLab® system [29].

5.2.1 Inoculation

Automation techniques improved the quality of inoculation processes in multiple factors as the efficiency of time by consistent mode that is independent of human errors and operator variability. WASP automated streaking produces a higher number of single colonies subjected to forward identification and AST, so there is a reduction in subculturing and shortening of time. The BD

Kiestra™ system with rolling magnetic bead streaking offers more accuracy in isolation, especially in polymicrobial samples [29].

5.2.2 Incubation and Results Interpretations

TLA systems in closed incubators with continuous imaging and result tracking promote faster growth compared to conventional incubators that are frequently opened. Real-time systems in LA incubators enhance workflow by allowing technicians to efficiently interpret results and share them with physicians, eliminating the time-consuming process of examining plates individually [31].

5.2.3 ID and AST

Implementation of TLA improves efficiency produced by MALDI-TOF/MS identification of pathogen strains. WASP system and BD KiestraTM system introduced an automated device that facilitates the automated picking of MALDI-TOF target isolates and significantly reduces TAT for positive blood culture [30]. In conventional AST, we can implement TLA for continuous imaging and measurement of zone diameter for each disk to increase efficiency and avoid operator variability or personnel errors.

6. Investigation Model: Clinical Pharmacy Process at Soad Kafafi Hospital

In this study, I examined the Memorial Hospital of Soad Kafafi as a model for clinical pharmacy practice in Egypt.

6.1 Medication Reconciliation During Admission

Upon admission, a comprehensive review of the patient's medication history is conducted. This includes documenting all current and past medications, such as prescription drugs, over-the-counter medications, and supplements. The accuracy of dosages, routes, and frequencies is verified, and any discrepancies are resolved. The initial assessment also evaluates the patient's clinical condition, allergies, renal and hepatic function, and potential drug-related issues. Any medication-related concerns requiring follow-up are documented.

6.2 Inpatient Care

During inpatient care, a thorough review of prescribed therapies is performed to assess their appropriateness, effectiveness, safety, and adherence. Therapeutic drug levels are monitored for medications with a narrow therapeutic index. The process includes suggesting alternatives for inappropriate medications, adjusting dosages, and recommending additional therapies when necessary. Adverse drug reactions (ADRs) and drug interactions are identified and addressed. Patient monitoring is a collaborative effort with the healthcare team, with ongoing updates to therapy plans based on lab results and clinical progress.

6.3 Patient Education

Throughout the hospital stay, patients are educated about new medications, including their purposes, potential side effects, and proper usage. Techniques for administration, such as insulin injections or inhaler use, are taught if applicable. During discharge planning, it is crucial to ensure the patient fully understands the discharge medication list, with an emphasis on adherence. Any barriers to compliance, such as cost or complexity, are addressed to promote successful medication management after discharge.

6.4 Discharge

At discharge, a final medication reconciliation is conducted to verify that the discharge prescription is accurate and consistent with the inpatient regimen and the patient's condition. Any changes made to medications during the hospital stay are clarified. Handoff communication ensures that updated medication information is shared with the patient's primary care provider, community pharmacist, or other relevant members of the outpatient care team. Follow-up plans are arranged, including scheduling lab tests or appointments if needed and providing resources or contact details for further assistance to support the patient’s continued care.

7. The Future of Clinical Pharmacists in General Practice:

Clinical pharmacists are poised to become a vital component of primary care, enhancing medication management and patient safety through their expertise and collaborative approach.

7.1 The Integration of Pharmacists: A Success Story:

With more than 8,500 pharmacists now practicing in general healthcare settings, their role has become essential in patient care. They offer a specialized skill set that enhances the work of other healthcare professionals, improving both the quality and efficiency of services in primary care environments. According to data from NHS England, 8,576 pharmacy professionals are currently serving in general practice and Primary Care Networks (PCNs) across England. This includes 4,440 pharmacists supported by the Additional Roles Reimbursement Scheme (ARRS). When factoring in those employed directly by practices, the total reaches 6,089 pharmacists, along with 1,859 pharmacy technicians and 628 advanced pharmacist practitioners [32].

7.2 The Evolution of Recruitment Strategies

The recruitment of pharmacists into general practice has developed over time, with programs like the Additional Roles Reimbursement Scheme (ARRS) fostering greater collaboration between pharmacists and primary care teams. Although there were initial concerns from some pharmacy organizations about recruitment methods, the advantages of integrating pharmacists into Primary Care Networks (PCNs) have been widely recognized. Notably, data from the Centre for Pharmacy Postgraduate Education (CPPE) reveals that by March 2023, 4,875 pharmacists had completed the primary care pharmacy education pathway since its introduction in September 2019 [33]. This pathway is designed to equip pharmacists with the skills and training needed to thrive in primary care environments.

7.3 The Impact on Community Pharmacy

The integration of pharmacists into general practice has been widely welcomed in primary care settings, though concerns have emerged regarding its potential impact on community pharmacy. However, it is crucial to acknowledge that pharmacists add value to both environments, and efforts should focus on ensuring a balanced workforce distribution across various healthcare sectors. Data from the General Pharmaceutical Council (GPhC) shows a significant growth in the pharmacy register in England, with 52,805 pharmacists registered as of May 2023 [34]. This reflects the expanding workforce within the pharmacy profession, which spans both community and primary care settings**.**

7.4 Securing the Future of Primary Care Pharmacists

Looking forward, the outlook for clinical pharmacists in general practice is bright. Initiatives like pharmacist prescribing and the redesign of the community pharmacy contract present significant opportunities for pharmacists to take on an even more prominent role in patient care [35]. Additionally, the achievements of primary care pharmacy professionals have paved the way for innovative services such as the 'Pharmacy First' minor ailments service, showcasing the valuable contributions pharmacists make to the healthcare system.

7.5 Embracing Integration and Collaboration

As we move forward, collaboration across healthcare sectors will be crucial in unlocking the full potential of pharmacists in primary care. By promoting a culture of integration and teamwork, we can ensure that patients receive comprehensive care that meets their varied needs. With 54.5% of learners in the primary care pharmacy education pathway coming from a community pharmacy background, there is clear evidence of a smooth transition for pharmacists into primary care roles, highlighting the importance of collaboration between different healthcare environments [33].

Conclusion

The integration of AI, precision pharmacovigilance, and digital health platforms is revolutionizing clinical pharmacy. These innovations hold the potential to enhance patient outcomes and improve operational efficiency, but they also necessitate strong legal and ethical frameworks. To build a robust healthcare system, the inclusion of specialties such as microbiology in clinical settings has become increasingly important to reduce medical errors, particularly in diagnostics and infection control. As the pharmacy sector continues to evolve, embracing this improvement will be crucial for delivering sustainable and effective healthcare. In conclusion, the future of clinical pharmacists in general practice and primary care looks promising. With their expertise, dedication, and commitment to patient care, pharmacists have become indispensable primary care team members. By fostering integration, collaboration, and innovation, we can fully harness the potential of pharmacists to transform healthcare delivery and improve patient outcomes. As we navigate the challenges of

modern healthcare, it is vital to continue recognizing pharmacists as essential pillars of primary care.

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