

The Role Of Pharmacists In Managing Chronic Diseases

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Abstract

This essay describes several important roles for pharmacists in improving outcomes in managing chronic diseases. As medication management is the foundation of treating people with chronic diseases, pharmacists play important roles in reviewing patient therapeutic plans, collaborating with prescribers, and working with patients. A number of countries around the world are recognizing the need for better managed chronic diseases and the corresponding role of pharmacists to practice to the full extent of their education. These evolving roles increasingly recognize the impact on patient outcomes that trained pharmacists can have when effectively working as part of the team.

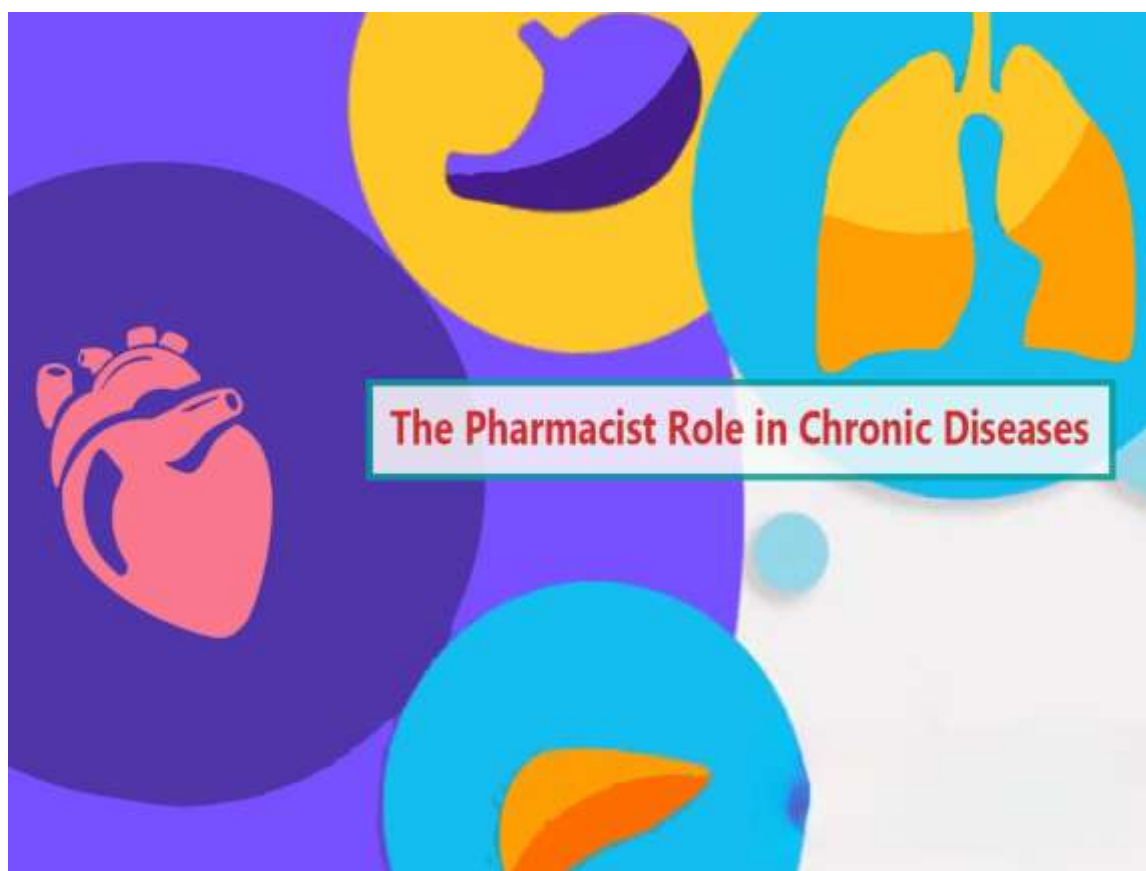
The essay describes how these and other roles for pharmacists evolved, while also noting some of the tensions in the move towards collaborative care models. Despite the tensions, however, patient outcome data is evident for the effectiveness of care in these models when pharmacists practice them to full scope. The global trend to empower and well-position pharmacists to provide care for patients with chronic conditions will likely grow as these care and economic data are more widely disseminated and as access to qualified pharmacists improves. This care consists of much more than just ensuring good medication use. The future will likely see these practices continue to develop.

1. Introduction

Chronic diseases like diabetes, hypertension, and other cardiovascular diseases have an insidious onset and long duration. These diseases lead to complications in affected individuals and decrease the quality of life. Recent evidence suggests that chronic diseases are prevalent in low- and middle-income countries as well. Although the pharmacological treatment of chronic diseases can lead to improved quality of life and exponential savings in healthcare costs in the long term, many patients do not adhere to therapy. Some patients either discontinue their medication or miss doses. Pharmacists are the most accessible healthcare professionals for individuals, and many consumers usually bypass PCPs and go to community pharmacists to obtain OTC and prescription drugs for their acute, self-identified problems. Both the WHO and the U.S. surgeon general recommend that

pharmacists take part in the medical care of individuals. These facts emphasize that pharmacists are essential and can contribute significantly to controlling chronic diseases in communities. (Anderson & Bury, 2024)

The development of this essay was designed to encourage policymakers, researchers, and patients to underscore the value of the pharmacist in chronic disease care and to deliberate the inclusion of a pharmacist in the medical team. In the next section, the roles of pharmacists will be explained, followed by the current evidence supporting their roles in chronic disease management and community care. The logistics and outcomes of involving pharmacists in chronic disease management are presented before a conclusion.



2. The Scope of Chronic Diseases

Chronic diseases vary from heart disease to asthma. While they are sometimes known as persistent medical conditions, they can often lead to deterioration and impairment over time if not well handled. According to the World Health Organization (WHO), these diseases "occupy fifteen of the fifteen leading causes of death" and

"contribute to about sixty percent of all deaths worldwide." Furthermore, chronic diseases are a significant burden on healthcare service providers across the world. Chronic patients may account for nearly 95% of pharmaceutical, nursing, and ambulatory care budgets.

The prevalence of chronic diseases varies by country, with the rate of people with at least one recognized long-term disorder in the United States, European Union, and Australia usually in the range of 17 percent or higher. When categories are illustrated, the most common chronic disorder is cardiovascular disease or breathing problems. Such a situation necessitates attention and needs to be managed as effectively and efficiently as possible. At the moment, a substantial amount of the cost of medical delivery in high-income countries is directly or indirectly linked to the treatment of chronic disorders. Numerous strategies have been developed to offer professional treatment for such illnesses, with remedies and therapies described in medical guidelines and clinical pathways. A range of non-professional treatments have also been developed, addressing healthcare-related behaviors including sick days, compliant treatment behavior, and domestic self-care. Pharmacists are possibly the most common example of primary care professionals, with four out of five regular consultations in general practice. (Stafoggia et al., 2022)

2.1. Definition and Types of Chronic Diseases

The very first thing to consider when meeting patients with chronic diseases is to be aware of the definition of such ailments. According to the WHO, if an indicated disease will last for over three months, it can be defined as chronic (or long-term). When it comes to the adverse consequences connected to chronic diseases, they need to be diagnosed and treated in an early way, as chronic or long-term ailments generally have a gradual onset and may be saved in the early phases of the onset of significant structural, practical, or psychological deterioration. Concerning the causality of chronic diseases, these might have numerous causes and not only a single proven fact. The possible medications for chronic diseases include lifelong medications that minimize the risk of further disease progression or complications. Furthermore, long-term medications are not obligatory, but if terminated promptly, a rapid ascent to their previous state is likely.

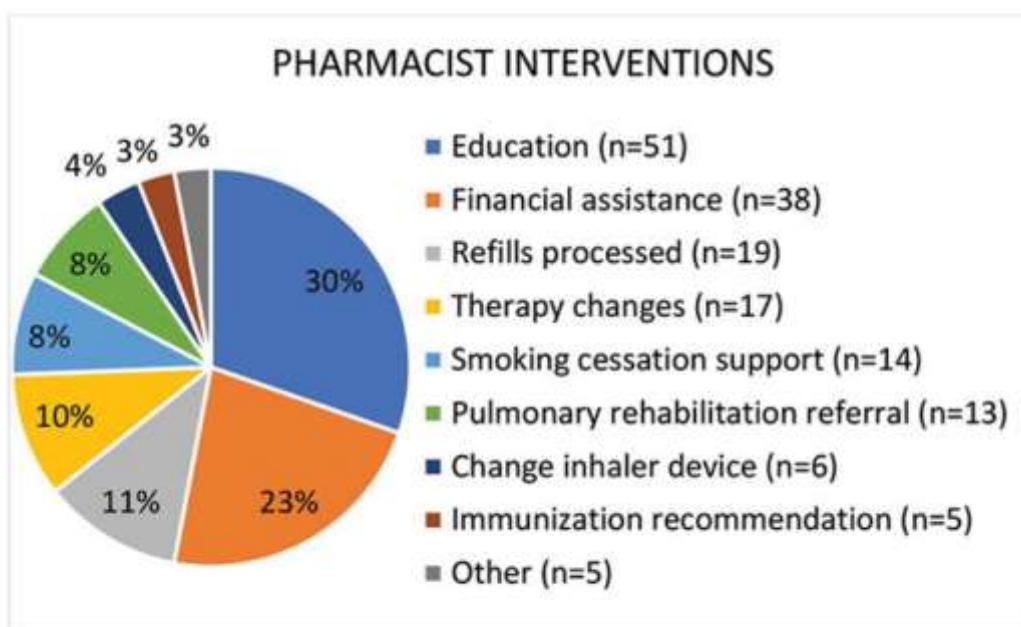
A set of chronic diseases have been addressed in this part, which are divided either by organs or causes of the diseases into the following: 1) respiratory diseases (such as upper or lower airway diseases); 2) heart diseases (e.g., diseases related to blood vessels); 3) psycho-neurological diseases and disorders (e.g., diseases of the brain and nerves, or psychological diseases); 4) digestive diseases; and 5) endocrine gland diseases, to name a few.

3. The Evolving Role of Pharmacists

Pharmacists are redefining their roles in the healthcare system as a consequence of pressure from practitioners who outsource a variety of services to the pharmacy, such as prescriptions that are subsequently identified in the pharmacy as OTC (over-the-counter) medicine. This is currently known as a professional pharmacy service, whose purpose is to provide cost-effective treatment for chronic diseases. Dual management in New Zealand, for example, follows the professional model of asthma control, a program in which pharmacists were involved. In addition, therapy has been effectively altered by a pharmacist fairy ward manager through the application of INR monitoring. The role of this pharmacist in the management of PM-mental therapy was determined by the number of his home visits, interactions with the patient, and the number of places where patients were provided with smoking cessation advice. Also, by contract, community pharmacists played a role in the management of influenza outbreaks. The management of patients using oral anticoagulants in UK discharge therapy varies across districts and may involve hospitals, GPs, or pharmacists. Any changes in roles may result from the implementation of the Community Pharmacy Contractual Framework and the Choice at Risk of Pain schedule in the UK. (Qazi et al., 2021)

Some countries have developed new codes of practice to better integrate the work of primary and community care organizations. An example of this is the BEST study, in which pharmacists were involved in a range of services, such as setting and controlling INRs, providing smoking cessation courses, and measuring coronary heart disease. Pharmacists have justified their roles based on educational attainment and the use of skills and knowledge in the management of chronic health problems. The history of chronic disease in the community can be: passive monitoring or care for people with special needs via a dispensation provided by the

provider; active intervention to prevent complications of chronic diseases; or a proactive approach to identifying and preventing chronic diseases. Some definitions of a chronic illness complicate the distinction between the disease itself and its impact, but a chronic illness or disease is regarded as a 'disease that affects living for a long time, even years. The experiences of pharmacists in various countries in managing chronic diseases, some of which are discussed here,. The new model of care for diabetes has been developed in New Zealand and will be implemented in the future in the RECIPE program. A high PAM means that a person feels comfortable with Atlas shifting, which helps them better themselves. Pharmacists may become more important in self-management advice that may be involved in the development of e-programs.



3.1. Historical Perspective

Historically, "in the nineteenth century, pharmacy was a profession—and pharmacists were professionals—founded on materials, medicine, and compounding services." A pharmacist was traditionally known as a drug molecule expert and was

expected to have their clinical knowledge "tested daily through the act of compounding and dispensing." Therefore, the traditional functions of a pharmacist were more based on the preparation of drugs from ingredients, the supply of drugs and chemicals, intellectual skills and abilities, and the manufacturing of drugs according to special requirements. Moreover, the pharmacist also had to ensure the availability of quality supplies. The early dispensing pharmacists were quacks who followed the traditional compounding of emollients, lotions, and potions suitable for application on the skin.

In recognition of this expanding role, the International Pharmaceutical Federation (FIP) has extended its definition of pharmaceutical care as "the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life." The pharmacist's role has evolved more towards health and disease prevention services, including the population's health prescription services, the provision of antibiotics for children for minor illnesses, the provision of health promotion and modification of health status using sophisticated dispensing methods, chronic disease management based on reducing comorbidity, and reducing the consumption of cigarettes and alcohol. In particular, professional services delivered to patients with chronic diseases have led to significant improvements. It is in this context that services provided by the pharmacist have facilitated the early identification of prevalent chronic diseases, their efficient management, and their safety in the community. There are no limitations on the type of chronic disease, and the complications that have been found could be managed by pharmacists. (Bates et al., 2020)

3.2. Current Practices

A diverse scope of pharmacist roles in managing patients with long-term medical conditions is featured in the literature. Firstly, pharmacists conduct medication reviews on an ad hoc, limited, or regular basis. During a medication review, pharmacists obtain and use information about a patient's medical history because consideration of a patient's health status can improve the appropriateness of prescribing. Secondly, guidance also identifies pharmacist input in supplying and/or managing a range of medicines to patients with long-term conditions. Thirdly, the inclusion of pharmacist-led clinics in mainly geographical settings

takes place. Pharmacists provide advice to patients on how to optimize their treatment, undertake clinical interventions, perform patient monitoring, and adjust pharmacological strategies according to agreed-upon treatment protocols. Patients with asthma, chronic obstructive pulmonary disease (COPD), diabetes, heart failure, hypertension, lipid regulation, and sleep disorders can attend these clinics. Based on patient clinical need, background, and the pharmacist's skills, a referral may only occur to either secondary or primary care. During appointments with patients, pharmacists draw upon the full spectrum of their knowledge as clinicians and experts in the art of self-care to provide patient-centered care, give lifestyle advice, check medication, monitor, and manage patients. With asthma, COPD, and diabetes, pharmacists may also perform diagnostic spirometry, manage inhaled devices, and provide support and advice. (Woit et al., 2020)

In many community pharmacies, the pharmacist-led management of a range of common clinical conditions features in the literature to a greater or lesser extent. These include analgesic prescribing for short-term conditions such as mild to moderate pain and moving beyond traditional OTC analgesia management, the management of acne and sleep disorders, the care of patients with asthma, COPD, diabetes, mental health, migraines, smoking cessation, and therapeutic dermatology. Psychiatric medicines feature in some CPA services undertaken by pharmacists in relation to mood and affect disorders and epilepsy. General comments are made about the management of hypertension, cholesterol, erectile dysfunction, stomach ulcers, and mild to moderate STIs. This role may also include the offering of extended pharmacy services. Pharmacists can also provide services for, for example, childhood vaccinations under the CPA. We only include here those brief descriptions that suggest the pharmacist's role includes seeing a patient to treat or manage a condition directly.

4. Pharmacists' Contribution to Chronic Disease Management

Though multiple healthcare professionals contribute to the care of patients with chronic diseases, pharmacists are particularly important. There are several critical ways that pharmacists help in the management of chronic diseases. One of the most direct activities that pharmacists engage in that is essential to effective chronic disease management is medication therapy management.

This includes adjusting drug regimens, educating patients about their medications, and assisting patients with adherence to therapy. Pharmacies can serve as a site for optimal communication between members of the patient's healthcare team. Additionally, pharmacists have important roles in educating patients about chronic disease and coaching them in the skills of self-management.

Pharmacists are also often involved in the management of specific chronic diseases, particularly those that are very medication-heavy, such as diabetes, asthma, or hypertension. In these capacities, pharmacists are often the professionals that patients are in most frequent contact with, particularly "ambulatory care" or "clinical" pharmacists who practice directly in the doctor's clinic. In these scenarios, pharmacists often engage in patient education, medication adjustments, laboratory monitoring, referrals to other providers, and communication with the patient's healthcare team. Finally, pharmacists across healthcare settings are increasingly involved in the development and evaluation of clinical practice guidelines, particularly in the area of medications and medication-related care. Pharmacists function as "drug experts" in these purviews, working with a diverse team of other health professionals to translate medical and practice issues into specific information about the pharmacist's role and responsibility in patient care. They also conduct practice-based research, using scientific reasoning to develop evidence for drug therapy to support guideline development.

4.1. Medication Therapy Management

Patients with chronic diseases often have comorbid conditions and are frequently treated by multiple healthcare providers, which can make the medication treatment plan difficult to understand and follow. Interpretation of data from the Institute of Medicine of the National Academy of Sciences indicates that at least 3.8 million avoidable adverse drug events occur each year because of inadequate TPM services, a significant portion of which could be reduced through pharmacist-delivered disease state management services. The Joint Statement on Comprehensive Medication Management (CMM) from the ASHP, ACCP, and national PAHO/NPC provides clarity and consensus on the responsibilities of a qualified pharmacist in providing CMM.

Generally speaking, upon the provision of these services, it was found that there was a decrease in the overall volume of healthcare resources and a significant decrease in the costs of care, mainly as a result of the decrease in the number of hospital admissions and ED visits. In sum, there was also a 21% increase in medication therapy adherence. Medication therapy management (MTM) has been described in the Centers of Medicare & Medicaid Services (CMS) final rules on MTM, and through the efforts of APhA under a cooperative agreement with CMS, it was defined as a service or group of services that optimizes pharmacotherapy for a patient through improved medication use, enhanced medication adherence, and reduced adverse drug events.

4.2. Patient Education and Counseling

According to different studies, the inability to adhere to the diet is a primary contributing factor to poorly controlled diseases. Several researchers stressed that dietary and weight management counseling may be helpful in controlling diseases. Sophisticated medications have been introduced for chronic diseases, and diet seems less important than before. However, it has been suggested that a poor diet could be responsible for poor control in a number of patients.

There are several roles that pharmacists can assume. They can provide patients with disease-related and medication-related information and dietary advice on the newly prescribed regimen. Most importantly, they can work with the patient continually to reinforce the education at the start and after his or her next appointment (follow-up) and to assess understanding and adherence. This serves to convey to the patient the importance of the drug in meaningful terms. Such counseling can help determine why a patient is not taking his or her medication. Supportive educational and counseling services thus aim at increasing "improvement" in various outcomes, particularly drug-related outcomes. Pharmacists may also be in the best position to refer patients to other healthcare professionals. Pharmacists need to develop effective methods for ensuring proper screening, documentation, and monitoring of services because they work within a team and can leverage other existing team resources. Overall, patient education and counseling are the cornerstones of ambulatory care interventions provided by pharmacists. Providing disease, medication, and dietary information and working on case

management provide pharmacists with the opportunity to assess patients. (Wickramasinghe et al., 2024)



5. Collaborative Care Models

It has long been understood that chronic diseases are complex. At their core, chronic diseases require constant vigilance by care providers and ongoing management by patients on a day-to-day basis, as well as interdisciplinary collaboration among care teams in many cases. This presents an opportunity for the evolution of the previously discussed pharmacists' care roles. Pharmacists have begun playing a central role in medication management with increased autonomy under collaborative care models that embrace the scope of care management required to support the patient population most affected by chronic disease.

Numerous models exist that bring interprofessional collaborators, especially pharmacists, onto chronic disease treatment teams in the role of care manager or coordinator. In these models, medication is perceived as one aspect of the total care regime that needs specific, regular management as it is the source of treatment for some conditions. It can both improve or complicate concurrent management of other conditions related to medicine, making each chronic illness more complex when assessing and treating the condition using the framework of Interprofessional Education Collaborative (IPEC). Team-based management can leverage all specialties for an effective result for common diseases or individuals with multiple, complex illnesses.

Pharmacists providing care in this new setting take on responsibility that has been defined by their professional governing organizations as provided by "ambulatory care specialists" and similar ultra-specialist job descriptions and practice definitions. Ranging from elevated roles in clinical service provision in primary care practices to working as "patient care coordinators," there are many collaborative care models that have been published or piloted across the United States between pharmacy and other healthcare practitioners—and more are in development across the country. These models exist in academic or proprietary healthcare settings, in community or outpatient practice settings, and alongside specialists from all domains of healthcare—from geriatrics to diabetes to transitions of care—and have already made direct-influence publications in quality-of-care outcomes in hypertension, diabetes, obesity, anticoagulation, and other chronic disease states. The net commonality of their characteristics is that each of them is a pharmacist. (Abdulrhim et al., 2020) (Khaira et al., 2020)

5.1. Interprofessional Collaboration

Interprofessional Collaboration.

One of the key components of chronic care models is interdisciplinary or collaborative care. This approach organizes care for patients with chronic diseases across multiple providers and within a variety of different health settings. The purpose of this approach is to ensure that patients can receive evidence-based, patient-centered care that will enhance the patient's experience, improve clinical outcomes, and lower costs of care.

The research study involved an on-site clinical pharmacy in a primary care clinic. This on-site clinical pharmacist coordinated care with the care team for the complex medical patients who have poorly controlled chronic conditions. In addition to prescribing medications and modifying any current drug therapy, the on-site clinical pharmacy would provide education to the patients and work with them to set self-management goals. The clinical pharmacy would also assess risk factors and refer patients to other healthcare providers for additional care as needed.

Older adults with chronic diseases are at a particularly high risk for medication-related problems, and these problems frequently result in medication misadventures. Currently, pharmacists within

the interdisciplinary team have a significant impact working with this elderly population, which has multiple chronic conditions. The goal of the pharmacy is to help increase the standard of care provided to elderly patients with chronic conditions. However, the pharmacist is involved with all patients with diabetes, congestive heart failure, and hypertension.

6. Pharmacists' Impact on Patient Outcomes

While several other healthcare professionals also play a significant role in patient-related clinical outcomes, increasingly, studies include the role pharmacists play in terms of chronic disease management in conjunction with their medication management expertise. Pharmacist intervention has been shown to be particularly significant in terms of changes in patient adherence and persistence. Readily "measurable" and accepted by healthcare professionals, it seems intuitive that cash patients would present a higher propensity to non-adhere/persist with their therapy than fully insured patients. This was evidenced by research on dyslipidemic patients in Henderson and Tierney's Purdue University-based retrospective claims data study conducted during the period 2009–2011, which revealed that 31 percent of dyslipidemic cash-paying patients per population did not fill/obtain any cholesterol fluctuating medication (CFM) prescription during the 365-day study period, compared to only six percent of those with Wright-Patterson Air Force Base insurance in the ORDER cohort.

In other research, investigational analysis was recently completed that quantified that non-treatment propensity and found that the fraction of patients who did not pick up at least one statin medication (the subsequently most used for cholesterol maintenance/fluctuation) three years post-overall date of adjudication approval in one commercial "self-insured" claims database (referred to as BCBS1) was 47 percent, in contrast to just 3 percent on the other commercial "self-insured" claims database (referred to as Insgroup). Moreover, it was revealed that more recently cured/attained impaired fasting glucose or type II diabetics picked up at least one anti-diabetic medication (predominantly a metformin medication) three years from adjudication approval, which was 19 and 30 percent, respectively, in these two commercial "self-insured" patient populations compared to 37 and 27 percent in the two commercial "fully

insured" cohorts. A survey was conducted on the commercial (self-insured and fully-insured) patients with diabetes; of those not receiving insulin, be it new-to-therapy, possibly non-adherent, or adherent, a combined 7953—1591, or 20 percent, were not picking up any oral agents, and it was the biggest opportunity for pharmacist intervention in the survey. The employer survey revealed that of the patients who did not pick up at least one anti-diabetic prescription (and despite the fact they are new to or uncontrolled on oral diabetic medications), only 69 percent own a glucometer. (Gupta et al., 2021)

6.1. Adherence and Persistence

Despite the potential of effective therapies, declining adherence and/or increased discontinuation of treatment can diminish their clinical effectiveness. Feasible and appropriate strategies, such as simplification, regular follow-up, patient education, or reminder systems, can be advantageous. Improving adherence often results in lower illness rates and corresponding resources, whereas lowering discontinuation contributes less directly. Here, the focus of medication use reviews (MUR) or clinical medication reviews (CMR) in various countries is on adherence and persistence. Regular follow-up and MUR/CMR by community or hospital pharmacists aim to ensure that, if needed, the patient remains compliant with the regimen for some period of follow-up, often 6 months or 12 months, in order to experience the benefits of it.

Adherence, persistence, and concordance are key elements of pharmaceutical care practices, and to date, there are already several excellent original reviews on how the pharmacist can contribute to preventing and decreasing the health problems associated with poor adherence. The field of medication adherence has been the object of gross inefficiencies, inequality of outcome, and a paucity of research and accrued knowledge. It is time for the individual to become less of an afterthought in service delivery. When the individual patient is not an assertive and informed partner in their own healthcare, the result is decreased value in healthcare costs, collateral contractual opportunities in which the pharmacist may do more for the individual, and the number of overall individual patient interactions. It is in these ratios that the impact of pharmacists tends to be minimized or not fully realized.

7. Barriers and Challenges

Pharmacists have long been in a position to take on the expanded responsibility of being involved in the care of patients as it relates to chronic disease management. Although there seems to be widespread support for this action, much of the private sector is resistant. Reasons for this could include a lack of reimbursement for clinical care, insufficient documentation of the clinical value of a pharmacist, and regulatory restrictions preventing pharmacists from performing clinical care activities. The over-prescription of medications, inappropriate use, and underutilization of medication as it relates to chronic disease management are a great cost to the state, the health care system, and society. Despite the fiscal impact, the political will to enact the suggested shifts in pharmacy regulations, practices, and education is lacking.

While the role of the pharmacist has significantly changed in the past 20 years and the laws that govern pharmacy practice have changed significantly as well, the majority of the changes relate to the dispensing of pharmaceuticals. The laws, regulations, and policy changes that define the practice act encompass many aspects of the pharmacist's role in medication therapy and within the provision of care, delivered through direct patient care, patient counseling, and the dispensing of pharmaceuticals. The patient care activities of pharmacists are encumbered by regulations, processes, and standards of practice that are barriers to implementation. Understanding and addressing these barriers are all necessary steps that need to be worked through. Pharmacists and other stakeholders in legislation must create a clear case and implement a plan that will increase the pharmacist's scope of practice within the realm of chronic disease management.

7.1. Regulatory and Policy Issues

6x: Regulatory and Policy Issues

7.1. Barriers to full participation in services by pharmacists. Categorizing and evaluating the responses to the three clinical vignettes highlighted many important elements that influence the involvement of pharmacists in managing chronic disease. Themes emerged that could be tentatively grouped into inhibitors and enablers of pharmacist involvement in the three clinical vignettes. Importantly, pharmacists from NSW were more likely to identify system enablers than pharmacists from any other state.

7.1.1. Inhibitors of pharmacist involvement in the management of chronic conditions. Current regulatory and policy issues in Australia can act as not only barriers but inhibitors for the capacity of pharmacists to engage in a broader role in the management of patients with chronic conditions and their general practitioner. The first inhibitor is the requirement in Australia for the vast majority of pharmacists to work under the direct or indirect supervision of a pharmacist, generally referred to as the need to work in a 'pharmacy'. Although land has been reserved for medical practitioners to operate a pharmacy within medical centers, this has not occurred in any significant way across Australia. Pharmacists in Queensland and WA commented frequently on their view that this limitation should be removed.

The second significant inhibitor was the provisions of the Health Insurance Act, which limit the clinical intervention by a pharmacist to the provision of a medication management review to a patient. Many respondents commented on the need for an expanded range of services to be available under this Schedule. Not all people who are at risk of being sub-optimally managed are provided with a mental health care service plan. A care plan is only done when a patient goes to the GP, notifying them they have been diagnosed with a chronic illness. Once a care plan is done, patients with chronic illnesses only require minor changes to their full medications, hence not requiring a medication review.

8. Future Directions and Innovations

Empirical evidence indicates that practice-based interventions have positive effects on improving the management of chronic diseases. With increased political and social recognition of the value of evidence-based, person-centred primary care; increased development and implementation of useful interventions; and further explanatory evaluations of interventions conducted, the role of pharmacists in managing chronic diseases has the potential to have further, substantial impacts. There are numerous arguments and some evidence to support the idea that pragmatic evaluations would boost the impact of research in this area on practice. This review also identified academic rigour as a key enabler of pharmacists to advance and/or cement their role in managing chronic diseases. As such, demonstrating an evidence-based approach sets the environment for further evaluation and a cycle that can support further, or more subtle, practice changes to

manage chronic diseases. Empowerment, policy, and/or strategic change could also support the person-centred model of care that has been identified as a pivotal enabler of chronic disease management interventions. (Nicholls et al., 2022)

Future research in chronic disease management may also include incremental practice changes designed to explore different facets of practice. These could include further education and/or training of pharmacists, patient care coordination, interprofessional problem-solving strategies, behavior change strategies, and further improvements in team integration and care coordination. Furthermore, this research might be focused on mixed or wider patient populations who present with a range of chronic diseases. Consideration should also be given to recent technological developments, therefore representing a shift in the way community-dwelling adults interact with healthcare professionals, which has seen the development of advanced, connected medication devices that provide comprehensive, real-time treatment metrics to both the patient and their healthcare professional. It is feasible that these devices may lead to enhanced quality patient care, particularly for those individuals managing chronic diseases. Therefore, whilst only speculative at this juncture, exciting possibilities may soon be available for use to advance pharmacy practice in the area of chronic disease management and warrant future research.

8.1. Technological Advancements

Advancements in technology have the potential to transform the way that pharmacists take care of patients with chronic conditions. While many of these tools have not yet made their way into pharmacy practice, a brief look at the technologies on the horizon will help provide perspective on the current role and potential future of the profession. Applications that involve AI and machine learning have the capability to streamline paper-ridden workflows, improve patient workflows, analyze large data sets, enhance health management, provide opportunities for decision support, and enable the development of risk-prediction models. Genomics is another exciting new area. Improved understanding of the genetic framework of pharmacogenomics and the genetic markers associated with disease states provides innovative standards of practice. Finally, telepsychiatry can deliver psychotherapy and medication management through guided patient care. Various

technologies can make use of AI and machine learning as they are developed further and break into the clinical world of chronic care.

With the advent of artificial intelligence and machine learning, we can also look to the possibility of risk-prediction modeling of the development of chronic conditions like lifestyle-based diseases, the need for chronic wound care, and the potential needs for the clinical management of chronic pain. These new high-touch roles for future "pharmacists" are only limited by our imaginations. Overwhelmingly, healthcare professionals are most accessible to the general public. But while high public visibility may suggest an enhancement in patient care for this population, we have not yet measured those factors downstream to test incipient models of care pertaining to the role and involvement of these professionals. Our knowledge of how patients with chronic conditions are responded to by this professional workforce will add new information and consolidate our understanding of pharmacy.

9. Conclusion

As of 2012, chronic diseases were responsible for approximately 60% of the global death toll. On average, 1 in 4 individuals in the US were living with two or more chronic conditions. Due to the prevalence of chronic diseases and the urgent need to address them, extensive research has been dedicated to their prevention, diagnosis, and medication management to effectively control disease complications and improve patient outcomes.

A pharmacist is an integral link in the management of chronic diseases, as they provide drug therapy and drug information to patients and other healthcare professionals. Other roles include monitoring and evaluating treatment effectiveness, determining therapy management as drug experts, and being responsible for preventive screenings, vaccinations, and patient education. With the rapid changes in the practice of pharmacy in the past few years, pharmacists have become active partners in managing chronic diseases.

Looking to the future, pharmacists are well-positioned to continue in the management of chronic diseases. For example, innovative models have emerged, such as the patient-centered medical home or accountable care organizations. There is potential to integrate the resources of a pharmacist into the healthcare team. A pharmacist can continue to actively participate in patient

education, self-management, and adherence strategies, monitor patients' conditions and medication regimens, serve as an additional point of access to care, and coordinate care by communicating and collaborating with healthcare providers such as primary care providers, specialists, and ancillary providers.

Pharmacists can utilize technology through EMR to implement chronic disease state management, where education and adherence interventions can be documented, lab recommendations developed, and follow-up recommendations sent to the healthcare provider. As the struggle to expand integration into chronic disease states continues, it can be hypothesized that the role of pharmacists will continue to be linked with chronic disease management for years to come. (Mohiuddin et al., 2021)

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