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The Impact of Community Pharmacist-Led Population Health Initiatives on Chronic Disease Management and Healthcare Utilization Reduction in Rural Communities

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Abstract- ***Background: Although rural communities are disproportionately affected by chronic disease, they are also clearly suffering from the chronic shortage of health-care providers. Community pharmacists are increasingly being recruited as key stakeholders to lead population health initiatives as they serve as the most accessible health care access points in many rural communities, but the scope of these initiatives, their impact on chronic disease care and health utilization has not been comprehensively understood and mapped.***

Objective: To bring together the latest available evidence to explore, define and synthesise contemporary community pharmacist led population health initiatives in rural areas, their mechanisms, and the potential health-economic, health system and humanistic outcomes, including health-care utilization and cost.

Methods: A systematic review was performed using a scoping framework developed by Arksey and O'Malley and reporting standards recommended in the PRISMA-ScR guidelines, which included mapping peer-reviewed literature up to and including 2024 into systematic reviews, economic analyses, randomised trials and rural programme evaluations. Twenty sources are charted, with the setting, the type of interventions and the mechanisms and the outcome domain.

Results: Pharmacist-led initiatives were grouped (medication therapy management, telehealth and telepharmacy, screening and risk reduction, and collaborative care). In these, interventions were shown to impact positively on adherence to medication, disease control, and quality of life and a slowly expanding and body of evidence were used to show relationships with reduced health-service usage and positive health-economic effects. Reimbursement, staffing and infrastructure issues specific to rural practice influenced implementation.

Conclusion: Community pharmacists can effectively be utilised as part of a viable and viable approach towards underpinning rural chronic disease management and reducing the burdens facing rural health systems. They can only be realized if they receive a flexible and sustainable reimbursement, receive investment in a telepharmacy infrastructure, and get consistent measurement of utilization and cost outcomes.

Keywords: Community Pharmacy; Rural Health; Chronic Disease Management; Medication Therapy Management; Health-Care Utilization; Population Health; Scoping Review

I. INTRODUCTION

The most prevalent cause of morbidity and mortality, as well as health spending in most health systems, are non-communicable diseases (NCDs) including cardiovascular disease, diabetes, chronic respiratory disease and their common risk factors. They are complex in nature, are managed in a longitudinal way and rely to a great degree on medications it is the quality of management that can make it a matter of life or death for patients not to experience the financially-expensive complications of these conditions and acute exacerbations, which result in hospitalisation. Combined with the typical demographic mix of older, poorer and sicker in rural areas, compared to the population in urban areas, a significant structural disadvantage has existed that is hard to overcome: lack of providers, longer distances, and earlier onset of chronic diseases. Net outcome is a lack of alignment between the level of care needed for chronic diseases, and the ability of the rural health system to provide it.

In this context the role of the community pharmacist is indeed important. Many people are more likely to see a clinically trained individual at the pharmacy than a physician: In many rural areas, the pharmacy is often the closest health care facility (without an appointment) and the only place where they are likely to see a trained professional if they do not schedule a visit with a doctor. This combined with an increased knowledge of medication management and increased access for all, has led to the growing interest in community pharmacists playing a role in population

health management, where the pharmacist is not just dispensing prescribed drugs but also involved with directly managing chronic conditions, providers including screening for risk, coordinating and educating patients. It is the general theory that the pharmacist led intervention can provide an alternative, or complement, to limited physician resources and can lead to better outcomes at lower cost and pressure on the rural health care system.

The proof that complements this proposition has come in rather quickly, with some sources more reliable than others. Evidence shows that SDCM has a profound impact on clinical outcomes (Greer et al., 2016) and therefore, the process of assessing the value of pharmacist interventions in managing cardiovascular disease and medication adherence is just beginning with economic analyses (Jacob et al., 2022). However, a large proportion of this evidence comes from urban and/or mixed environments and specifically how community pharmacist-led work is carried out in rural communities, where both the need and the impediments to implementation are most likely to be high, is still less of a focus in the literature. Published literature on rural settings is quite diverse in terms of design, intervention and outcome, from randomised trials to one site programme evaluations and has yet to be fully mapped.

1.1 The Extreme Conditions Of This Situation Calls For a Scoping Review

A scoping review aims to draw a picture of the breadth and scope of a complex and disorganized evidence base rather than focus on a more narrowly defined set of trials and instead map out the concepts and mechanisms at work, facilitating identification of gaps for future research and policy. This review therefore aims to map the current evidence regarding population health initiatives implemented by rural community pharmacists, with focus on a specific aspect of those initiatives chronic disease care management and to examine the effects of such initiatives on the utilization and costs of health care.

1.2 Understand the context and read the questions carefully

The review questions were based on three questions. To begin, what kind of and which community health-related programs have pharmacists conducted in their rural practices? Secondly, how do these efforts impact chronic illness care delivery? Third, clinical, humanistic and health system outcomes (such as health-care use and cost) and the obstacles to implementation have been reported. The purpose of these questions is in total, to generate a comprehensive picture of the pharmacist in the rural setting, focused on his/her contribution towards population health.

II. METHODS

2.1 Protocol and framework

The scoping review methodology used was that of Arksey and O'Malley, a methodology refined to chart broad evidence bases, following similar principles to those used for systematic reviews, and the reporting was done in a similar fashion to the PRISMA extension for SRs. Research process was structured into 5 stages: identification of research question, identification of relevant studies, selection of studies, charting the data and collation and summary of research results. The analytic goal was descriptive breadth—a mapping of the spectrum of initiatives or activities, mechanisms of action, and effects of those activities that various programs produce—but not to approximate a single pooled effect.

2.2 Information Sources and Search Strategy

Literature was found by conducting structured search of PubMed, Scopus, Embase, CINAHL and Cochrane Library using the keywords recommended by the research question, followed by hand-searching of references. Combined terms were used in the search, which included both the population (community pharmacist, pharmacy) and the setting (rural, underserved, remote), concept (chronic disease management, medication therapy management, population health), and the desired outcomes (health-health care utilization, hospitalization, cost, adherence, disease control). A literature search was conducted for literature up to and including 2024.

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2.3 Concepts of Eligibility, Exclusion and Selection in Studies

Studies were eligible if they involved an intervention(s) led by a community pharmacist and provided information about chronic disease management or population health and sufficiently were relevant to rural and/or underserved settings and reported at least one clinical, humanistic/patient outcome, utilization prior to phases 4 or 5, or economic outcome. The aim of the mapping was to provide various types of studies, including systematic reviews, meta-analysis, economic evaluation, randomised trials, non-randomised trials, cohort studies, programme evaluation, and implementation qualitative studies. Pharmacist led records were only included if they included chronic care, or else if they were only discussing the acute or inpatient care. Twenty sources were charted in this synthesis, through the selection workflow.

2.4 Create Data Charts and Synthesize the Data

Details of the authors, the year of publication, design, setting, type of therapy employed, type of mechanism, as well as reported clinical, humanistic, utilization and economic outcomes were recorded on a structured data template. This evidence was then arranged thematically with a descriptive thematic synthesis, based on the three review questions. In order to organize the results and facilitate the synthesis, a conceptual logic model was constructed connecting factors in the rural context and pharmacist-led efforts, behavioural and care-coordinating mechanisms with proximal clinical outcomes, and net impacts (as a result of reduced utilization and cost) with distal clinical outcomes. This conceptual model is depicted in Figure 1 and is summarized below.

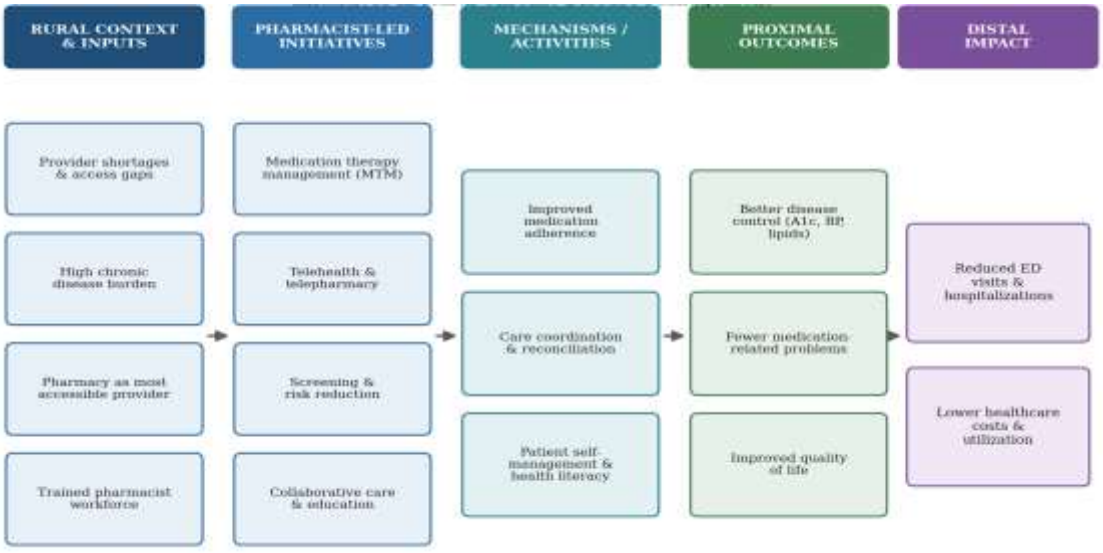

Fig 1: Conceptual Framework: Community Pharmacist-led Population Health Initiatives in Rural Chronic Disease Management

III. THE RURAL CONTEXT: BURDEN, ACCESS AND THE PHARMACIST'S PLACE

Any discussion of Pharmacist-led population health in rural communities needs to start with the structural issues that necessitate population health initiatives in rural communities. The prevalence of chronic diseases is greater in rural populations due to higher demographic and epidemiological characteristics like poverty, greater occupational risk factors, and inactivity, and is compounded by a weaker, older health workforce in rural areas. A lack of physicians and therefore timely access to primary care results in poorly managed chronic conditions: patient education on the importance of proper self-management is often missing, optimal drug usage is rarely maximised and monitoring is irregular. The deficits manifest directly

as the types of use of an ED or hospital which have led to the acute aggravations and complications that pharmacist-led interventions are designed to lessen therefore, the utilisation outcomes.

In this context, the Community Pharmacy is a readily available and trusted site of care. There are cases in which the rural pharmacist has been suggested as a chronic disease manager, based on three observations. First, the geographic and temporal accessibility of the pharmacy is sometimes not afforded by physician services, such that low barrier, and frequent, contact with the pharmacy can be made. Second, the pharmacist has the clinical knowledge and skills, which are at the heart of chronic disease management, in medication selection, dosage and adherence, and monitoring. Third, a regular 'ruthless' need to make medication prescription calls produces an understanding that supplies a cadence of contact which may be utilized for ongoing management. These potential benefits are explored in the evidence presented below, in terms of what initiatives have been put in place to utilise them and the outcomes of these activities.

Early on it is important to realize that important dynamics between the local environment and the forms these initiatives take should not be overlooked, either during their conception or during their execution. Those same providers struggles result in limited resources to provide pharmacist-led care, and the geographic dispersion of physicians has a similar effect on a pharmacist's reach (unless technology is put in place to extend it). For this reason, telehealth and telepharmacy are used often in the rural literature (these concepts are discussed in greater detail below): they are solutions needed to bring those accessible, but distant, pharmacists into contact with the dispersed rural patient. In short, it is not just the setting, but a factor that has influence on which initiatives can be considered and be effective in the rural context.

There is a big monetary impact on this mismatch. Unmanaged chronic disease comes out to play in acute disease decompensation hypertensive, diabetic emergencies, worsening heart failure/worsening chronic respiratory disease and other acute complications - which demands expensive acute services often provided far away at referral hospitals in far-flung areas after long ambulance journeys. Episodes are not only a clinical failure, but in some instances a financial cost which a chronic disease properly managed could prevent. Avoiding preventable acute care is not only desired, but in some instances, is even a necessity for being a viable rural health system due to the thin-margin nature of their operations and fragile institutional viability. The logical rationale of the population health aspect of pharmacist-led programs cannot, then, be divorced from their economic sense; the purpose of these programs is to prevent “downstream” events that result economically from poor control through the health care system which are costly and unnecessary.
Similarly important is the issue of trust, and continuity. Rural areas often had disjointed care, with the rotation of cover doctors and/or long journeys to see a doctor who is not involved in their care. In contrast, the community pharmacist is a familiar and virtually constant face – one they see month after month as their medicines are dispensed. This continuity itself is a clinical strength and promotes a therapeutic relationship and a patient's knowledge of him or herself over time, which is essential to chronic disease management. It also puts the pharmacist in a good situation to recognize early progression of problems or non-adherence that an episodic provider may overlook. This relationality is the purpose of accessibility as well as spatial and temporal and forms the foundation of the relational aspect of many of the initiatives that have been studied in this review.

IV. NATURE AND RANGE OF PHARMACIST-LED INITIATIVES

A review of the literature found that community pharmacist-led programs targeting the health of the population in rural and underserved areas can be categorized into four different but overlapping areas: medication therapy management programs, telehealth and telepharmacy programs, screening programs, and risk reduction programs, and collaborative models. These categories are not mutually exclusive (in fact some programmes can include several of these categories, though the second column in the

conceptual framework in Figure 1 represents the second category), but help to identify parts of the intervention landscape, and are closely connected to the second column of the conceptual framework in Figure 1.

Medication therapy management (MTM) is the oldest of the programs. MTM is a comprehensive medication review by a pharmacist when the medication(s) reach a stage of maturity, application of medication related problem identification and resolution, and creation of a personalised care plan. Familiarity with MTM in a large, integrated health system showed that pharmacist delivered medication management could be scaled up and could effectively be used in systematic ways to detect and manage drug therapy problems throughout a chronic-disease population (Ramalho de Oliveira et al., 2010). In rural areas, MTM has been modified to fit local limitations and is specifically targeted to diabetes and hypertension among those high prevalence chronic conditions, structured academic-community collaborations have been shown to result in tangible improvements in health-related outcomes for rural individuals, including clinical outcomes (Warholak et al., 2019).

A special consideration should be put on the academic-community partnership model due to one of the key bottlenecks in the PKBS model the inability of rural pharmacies to provide complex clinical services independently. These collaborations, between a university or academic health centre and community-based pharmacies serving rural populations, provide training, protocols and supervisory resources that are not available in the under-resourced rural setting and community pharmacies, through partnerships providing local access and relationships with patients, that are not available in the academic centre. One such partnership which provides rural patients with a diabetes and hypertension clinic with medication management and tertiary prevention services was evaluated in the short term of 4 years and was found to be able to provide tangible clinical benefit over the long term, not as a pilot to be tried and tested, but as a hybrid model (Warholak et al., 2019). The durability of the model, given the rural literature, which offers many examples of models that were launched and without sustaining effects over time; a model that creates the capacity of the model is valuable for this reason.

The second is the telehealth and telepharmacy services, often prominent in the rural area, where the absence of another obvious barrier is the distance. Bingham et al (2021) conducted a systematic review of tele intervention for adherence to medication therapy in patients with diabetes, hypertension or dyslipidaemia, with the findings of medication adherence support being deliverable through tele interventions and remotely by the pharmacist. During the COVID-19 pandemic these models have started to gain momentum quickly: When in-person chronic care management was no longer feasible, these services were swiftly restructured to be delivered remotely, and hence showed that they are a flexible solution but also a valuable and resilient pathway of care to provide care to medically underserved communities in rural areas (Como et al., 2020).

The third category is screening and risk reduction, and it illustrates the pharmacist's position in the earlier (preventive) phases of the continuum of a chronic disease. Cardiovascular risk reduction clinics run by pharmacists have been adopted in the least physiological areas of the country, where community populations have little access to preventive care because they lack providers and resources in the areas they live, enabling the identification and management of cardiovascular risk factors in these areas (Haynes et al., 2011). The fourth model collaborative care places the pharmacist in a team with physicians and other services. When the pharmacist is part of a coordinated care model, it enhances the impact on the pharmacist's contribution to reduce utilization of health services, and to improve patient outcomes as compared to stand alone interventions (Matzke et al., 2018).

The use of technology that enables the effort to make it possible to provide pharmacist-led service over a distance can be seen in all four of the above columns in the rural literature. The delivery modality of telepharmacy and telehealth is not just another service being offered, it's the way that MTM or

adherence counseling, screening follow-up and collaborative consultation services can be provided for patients who are unable to attend in person. A systematic review of telehealth interventions in adherence across three key chronic conditions diabetes, hypertension and dyslipidaemia found that the technology maintained the effectiveness of interventions in the delivery of these chronic conditions effectively (Bingham et al., 2021); the surge in government shifting to a remote, pandemic era approach to chronic care management to underserved rural populations saw that the modality works well to continue care during times of in-person delivery collapse (Como et al., 2020). The above rural experience is a reminder that it's not about in-person care versus online, but about how both can be joined to get the most outreach possible with the best quality.

4.2 A Typology of Initiatives Directed by the Pharmacist and Implemented on the Ground In Rural Areas

The charted evidence identified by the Color Code's activities was put into tabular format in Table 1, along with the content that most commonly addressed chronic conditions and the core activities and primary sources identified for each of those chronic conditions. Unlike other typologies, categories here are more analytic and not mutually exclusive: the highest level of rural programs do not exclude the use of MTM, telehealth, screening, or collaborative care, and specifically consider their combined interrelatedness in a service design.

Table 1: Typology of community pharmacist-led population health initiatives in rural and underserved settings

Initiative category	Core activities	Conditions targeted	Representative sources
Medication therapy management	Comprehensive medication review; identification and resolution of drug therapy problems; personalised care planning; adherence support.	Diabetes; hypertension; dyslipidaemia; polypharmacy	Ramalho de Oliveira et al. (2010); Warholak et al. (2019); DeBoer et al. (2021)
Telehealth & telepharmacy	Remote consultation; telephonic adherence support; virtual monitoring; remote MTM delivery to dispersed patients.	Diabetes; hypertension; dyslipidaemia	Bingham et al. (2021); Como et al. (2020)
Screening & risk reduction	Cardiovascular and metabolic risk screening; point-of-care testing; risk-factor counselling and referral.	Cardiovascular risk; diabetes prevention	Haynes et al. (2011); Steed et al. (2019)
Collaborative care & education	Pharmacist–physician collaborative practice; diabetes education; transitions-of-care coordination; medication reconciliation.	Diabetes; hypertension; COPD; CKD	Matzke et al. (2018); Yao et al. (2018); Redmond et al. (2018)

V. MECHANISMS DISCUSSES HOW THE PHARMACIST-LED INITIATIVES HAVE IMPROVED A COMMUNITY'S CHRONIC DISEASE MANAGEMENT

It is just as crucial to learn what works as well as understanding that it does; otherwise it cannot be transferred. Three mechanisms emerged from the reviewed evidence (also listed in the third column of the conceptual framework): increased adherence to medication, better care coordination and care reconcilation, and better patient self-management/health literacy. These mechanisms represent the closest that can be specified to the levers of the structural benefits of the community pharmacy in terms of acting on clinical sensitivity.These mechanisms are the closest possible levers to the effects of the community pharmacy's structural benefits on clinical sensitivity.

The best documented mechanism for medication adherence is sense of obligation. Not taking

medication as prescribed generally it's a major contributor to poor control of chronic disease and explains lots of unnecessary resource use is a core issue and it's a pharmacist's common contact and understanding of the medications which make them well placed to fix it. Regarding pharmacist led care, a systematic review and meta-analysis of pharmacist intervention counselling revealed that pharmacist counselling for patients' adherence was shown to be associated with a positive effect for medication adherence and quality of life and was deemed to be a reliable measure of pharmacist care that is clinically relevant (Kelly et al., 2023). Within the rural and underserved context the mechanism is realized both face-to-face and via remote means and further extends the pharmacist's reach to those who may otherwise not have frequent contact with a pharmacist (Bingham et al., 2021).

The second mechanism is medication and care coordination, important especially at transitions of care that are a common area where adverse events happen and patients get re-admitted to the hospital. One Cochrane review summarised the evidence regarding the effectiveness of medication reconciliation in enhancing transitions of care across care settings, due to the gaps in the medication record that can occur as patients transition (Redmond et al., 2018). The responsibility for coordinating patients' care by a pharmacist, previously performed by the physician, is particularly important in rural settings where patients could be discharged from the hospital back to a community with fewer resources for follow-up (Matzke et al., 2018).

The third pathway is that of empowerment of patient self-management and health literacy. So much of chronic disease control will rely upon what the patient does between the healthcare visits, and educating a patient gives him or her the knowledge and confidence to support self-management. Combined diabetes education and pharmacist intervention, for example, in a rural primary-care environment, provides an example of this mechanism, and resulted in better outcomes for rural patients with diabetes when combined with structured education delivered by the pharmacist and educated about medication management (Yao et al., 2019). The impact of community pharmacy health promotion interventions more generally, and patient education within this broader context, has been explored, examining the impacts on professional practice or health outcomes (Steed et al., 2019).

VI. DESCRIBE THE INTERACTION F MECHANISMS AND HOW IT AFFECTS THEM

Modes of actions are not mutually independent but amplify each other. The effectiveness of improved adherence is more lasting when accompanied by adherence understanding and the effectiveness of care coordination is more effective when accompanied by adherence support and understanding. The most effective rural community-based strategies seem to involve all three of these strategies concurrently; review/optimize medications, coordinate across providers/transitions and educate patients to self-manage their own conditions. This synergy has led to the expectation that multi-component programmes would be more successful than single-component programmes as evidenced by the chronic disease literature, which generally holds true (Greer et al. 2016).

VII. EDUCATIONAL OUTCOMES

There are many pieces of comparable evidence that support a clinical case for community pharmacists to be part of a chronic disease management program. There is extensive comparable evidence to support a clinical case for community pharmacist involvement in a chronic disease management program. A systematic review of the base of evidence for pharmacist-led chronic disease management (CDM) compared the combined outcomes of pharmacist-led CDM with usual care for a range of chronic diseases found there was evidence of improvement in key intermediate clinical outcomes, such as glycaemic control, blood pressure and lipids; with no evidence of harm, thus demonstrating the clinical credibility of the model (Greer et al., 2016). This is the work foundation of the rural literature: whether and how pharmacist-led care is effective clinically in general, or if one could adapt it and access it in rural settings.

There is evidence that substantiates this in each condition. High quality evidence was found to support the ability of structured pharmacist intervention to alter the patient receptivity to a positive trajectory of a chronic disease for people with diabetes – specifically a trial with a diabetes pharmacist in which monitoring of diabetes-related outcomes was improved was found in people with type 2 diabetes (Korcegez et al., 2017). A pharmacist-led comprehensive medication management programme for individuals with diabetes resulted in better diabetes care in a rural health-care setting, revealing the clinical effect seen in trial settings can be achieved in the real-world setting of a rural practice (DeBoer et al., 2021). One of the most obvious trends that can be seen on the charted literature is the coming together of the evidence in the area of diabetes from trials with programme-evaluation.

The situation is no different in the field of cardiovascular disease. harmaceuticals are able to achieve a synthesis of effectivenesseventuated interventions involving pharmacists in cardiovascular diseases showed improvements in blood pressure levels, lipid parameters and cardiovascular risk regardless of the intervention type (Omboni & Caserini, 2018). Pharmacist-led CVRR can also be achieved, even in some of the most remote and deprived communities, where it has not previously been available, and can thus reach populations who would not have access to it. (Haynes et al., 2011) The pharmacist-led management has been extended beyond the cardiovascular and metabolic disease to chronic respiratory and renal disease, as health-service utilization was impacted by pharmacist-led management of COPD (Makhinova et al., 2023) and scoping evidence mapping led by the pharmacists for adherence in chronic kidney disease (Nguyen et al., 2023).

The expansion into respiratory and renal disease represents an important news front being trod for the first time as it indicates a widening of the pharmacist's population health scope of practice from the only conditions where research to date has been concentrated the cardiometabolic diseases. COPD is a paradigmatic rural condition with factors including smoking, occupational exposures, often under diagnosed and a leading cause of emergency presentations that is pharmacist managed to impact on health-service utilization, indicating a potential to generalise the findings from COPD in health-service utilization benefits from the pharmacists' management (Makhinova et al., 2023). The chronic kidney disease is another disease in which adherence is a key therapeutic challenge and the pharmacist's expertise is directly relevant to the care of patients with the disease, and pharmacist-led adherence interventions with patients with chronic kidney disease identified a potential future space of practice (Nguyen et al., 2023). It is a trajectory of progressive extension of the evidence from the well-established cardiometabolic core of a chronic disease, towards the wider disease experience among rural populations.

People gain these clinical benefits along with humanistic outcomes, in particular health-related quality of life. Patients' adherence outcomes also improved in the meta-analysis of pharmacist intervention counselling but with a additional positive impact on quality of life the benefits of pharmacist-led care go beyond biomarkers (Kelly et al., 2023). For the rural population health case, this humanistic dimension is important as keeping a patient well managed within their local community to avoid the disruption, cost, and risk to the patient when into short stay care doesn't measure up to a value-of-life measure as clinical endpoint; rather, it's a perception of a value of life.

7.1 The Health Care Utilization and Economic Outcomes Were Not Determined

Important contributions from this review are likely to be the calls for attention to the distal effects of pharmacist-led programmes on health-care utilization and cost, which are the population health and health system case for such programmes. Interventions by pharmacists would not only make a clinical impact but also and here in resource-challenged, rural systems it becomes especially important be economically and systemically worthwhile, just in terms of reduced numbers of people requiring ED visits and hospitalisation, and fewer overall costs of better chronic disease management.

There has been significant economic evidence development. The economic literature was reviewed and synthesised as part of a Community Guide, which helped strengthen the economic case for pharmacist interventions in cardiovascular disease, in favour of good cost-effectiveness (Jacob et al., 2022). In addition to the direct utilization outcome evidence is the case study on interventions for pharmacists working with chronic obstructive pulmonary disease (COPD) that measured the impact of the interventions on health-service utilization, as this type of utilization-focused evidence becomes a growing requirement for the field (Makhinova et al., 2023). The integrated pharmacist care model was also shown to impact on health-service utilization, along with patient outcomes, further supporting the pharmacist-physician care model's impact on health-system resource utilization (Matzke et al., 2018).

A review of the Cochrane Review research, however, addressed the impacts of pharmacists' non-dispensing services on outcomes, health service use and costs in low and middle-resourced settings, where the pharmacist's role in delivering population health services is likely to be most under-resourced which highlights the relevance of the pharmacist role in population health in a global context, beyond the high-income environment in which evidence regarding its effects has been gathered to date (Pande et al. 2013). Overall these sources signal a consistent (though evolving) message that initiatives involving pharmacists have been linked to positive utilization and cost-implications, the rigor, and measurement consistency, of which varies between the studies.

There are a number of points in the economic evidence, that are worth emphasising. The first signal from the economy is that improved adherence, leading to better risk factor control, is likely to prevent cardiovascular events and when translated to real dollars, incur significant economic savings from decreased clinical costs and lost productivity due to lower rates of cardiovascular death and disability (Jacob et al., 2022). A reduction in utilization is a major absolute savings when a disease occurs with the greatest frequency and cost which is what heart and blood vessel disease provides particularly for people living in rural areas. Second, the usage evidence is only solid when measured directly as an outcome, instead of being inferred, e.g. for the chronic obstructive pulmonary disease evaluation where a primary outcome was the use of health services (Makhinova et al., 2023). This type of direct measurement is a key factor in gaining the trust and acceptance of both payers and policymakers in the field, and is a known limitation.

Thirdly, it is important that the economic argument for rural pharmacist-led work is viewed within systems not in terms of the individual pharmacist. Many of the benefits, avoided emergency visits, avoided hospitalization, etc., do not benefit the payer's bottom line or the health system in general but the one that provides the service, in this case the pharmacy's. That's because this mismatch can occur between where the costs of the delivery are incurred and where the savings are realised, and account for why interventions that can be shown to be cost-effective at the system level can be financially unsustainable at the level of the individual clinic (or the pharmacy that has to deliver them as part of the clinical service). Understanding this distinction is crucial to maximising system-level value from pharmacist-led efforts and making it possible for a portion of this to be captured and shared in the form of payments.

Table 2 collates the findings found on the charted evidence by domain, direction of effect and main source(s) of evidence for each domain. The table provides a visualization of the strength of clinical and humanistic evidence as well as the comparative and inscribed (but increasing) lack of rigorous utilization and economic measurement.

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Table 2: Outcomes of community pharmacist-led initiatives across clinical, humanistic, utilization, and economic domains

Outcome domain	Specific outcomes	Direction	Representative sources
Clinical	Glycaemic control (A1c); blood pressure; lipid profile; cardiovascular risk; disease control.	Improved	Greer et al. (2016); Korcegez et al. (2017); Omboni & Caserini (2018); DeBoer et al. (2021)
Humanistic	Medication adherence; health-related quality of life; patient self-management.	Improved	Kelly et al. (2023); Bingham et al. (2021); Yao et al. (2018)
Utilization	Emergency department visits; hospitalizations; health-service use; transitions of care.	Reduced	Makhinova et al. (2023); Matzke et al. (2018); Redmond et al. (2018)
Economic	Cost-effectiveness; cost savings; resource use in CVD and LMIC settings.	Favourable	Jacob et al. (2022); Pande et al. (2013)

VIII. BARRIERS AND FACILITATORS TO IMPLEMENTATION HAVE BEEN DISCUSSED

Evidence translation for sustained rural practice is influenced by a number of barriers and facilitators that in significant ways are unique to the context of the health system in the case of the translation model in this study, the Pharmacy and rurality. Foremost among the barriers is reimbursement. Cognitive services to address this are often provided by a pharmacist without any compensation or without sufficient compensation and the “business modeling” issue is a key factor of why interventions work well at the local level but often fail to scale up. Pharmacists' barriers to implementation of MTM services have been found directly in the evaluations, which outlined the challenges of reimbursement, time and operations that prevent pharmacists from providing cognitive services for this MTM despite the presence of a well-defined clinical case (Lounsbery et al., 2009). This is particularly severe in rural pharmacies where, because of low commercial margins and the need to pay high wages to get staff, there is very little information available.

Resources and availability exacerbate the reimbursement issue. However, the same prevalence of rural provider shortages that underpin value of a pharmacist-led program hinder pharmacist time and healthcare workers available to provide this care and the geographic spreading of rural residents reduces access unless technology helps bring them together. Telepharmacy and telehealth are the significant agents in this regard, and their quick implementation in the COVID-19 outbreak proved their viability, as well as their effectiveness as a tool to access populations that are underserved, which include the rural population (Como et al., 2020; Bingham et al., 2021). However, the infrastructure broadband, devices and digital literacy that goes along with telehealth is not the same across the board in a rural setting, and that which could mitigate the distance barrier can be limited by a digital divide.

In addition to using medications as the primary means of treatment, the expanded role of a rural pharmacist in population health questioning the scope, training, and acceptability. Willingness to provide service to underserved groups and practical and professional barriers to bring the pharmacist's services into new areas emerged as qualitative evidence of the rural community pharmacists' perceptions of implementing mental health interventions. Those that rise to the surface in the literature are the polar opposites of the barriers noted: sustainable reimbursement, adequate staffing and time, reliable telehealth infrastructure, clear collaborative-practice frameworks, and training that will help to prepare pharmacists for a broader role in population health.

IX. DISCUSSION

This scoping review aimed to chart the current landscape of community pharmacist-led community-

based population health interventions in rural areas in three broad categories: community population health interventions category, how the interventions work, and outcomes. There were three main observations. First, the evidence is consistent that pharmacist-led chronic disease management is clinically effective, and creates strong signals across diabetes, the blood pressure related conditions (hypertension and dyslipidaemia) and cardiovascular risk, with the literature specific to rural settings demonstrating similar benefits as identified in trials (Greer et al., 2016; Korcegez et al., 2017; DeBoer et al., 2021). I will say right off the bat, but the clinical case is well-ripened and convincing.

Second, the components of these programs adherence, care coordination and self-management are understood to be reinforcing and their mechanisms of action are increasingly moving to telehealth mechanisms, which are well suited to the rural environment. While the positive nature of telepharmacy's presence in the rural literature does not suggest that it has not already been integrated, it does indicate a good match with the problem distance is the universal rural barrier, and overcoming this distance seems to be a focus of telepharmacy interventions in the rural domain (Bingham et al., 2021; Como et al., 2020). This understanding, by means of its mechanism, contributes to the confidence of transferability of the observed benefits not just idiosyncratically, but in general.

Thirdly, and most importantly for the population health perspective, there is growing evidence that pharmacist-led programs can reduce health-care use and positively impact health-care systems economically; however, data in this area is less consistently measured than with respect to the clinical evidence (Jacob et al., 2022; Makhinova et al., 2023; Pande et al., 2013). It is in this context that the rural population health case will be won or lost: rural health systems are resource constrained, and the value of keeping patients well managed in their communities (rather than the costly, disruptive acute care their sub-optimal management brings) is a utilization (and cost) value. The work's methodological priorities, therefore, are the maturation and development of utilization and economic measurement.

The last point to be made cross sectionally is regards equity. The target populations of these reviewed initiatives understood the rural, the underserved, the often poorer, and the 'older' are the very ones that traditional health-care delivery has the least success meeting. Community pharmacists go where health care systems don't, where that is the only place that will reach these people. So, population health powered by a pharmacist is not merely about the benefits of a system that's more effective and efficient for individuals or populations, but also about health inequity: bringing clinical effectiveness beyond the reach of the community. This equity function has been vividly illustrated during the COVID-19 pandemic when care was interrupted during this period and services were provided by the pharmacist through a remote chronic care management approach to care for vulnerable citizens in under-resourced rural areas (Como et al., 2020). With an emphasis on disparities being an ever more important equity issue, the equity rationale for investing in rural projects that involve pharmacists should be weighed against the clinical and economic arguments.

9.1 The implications for practice and policy are discussed

Several implications follow. In practice, the evidence base might suggest that emphasizing MTM, telehealth, screening, and collaborative care is achieved in comprehensive rural pharmacy service models that involve all three mechanisms, not solely on single component interventions. The evidence indicates three priorities for policy; these are indicated by the arrows in the figure. One of those is the payment reform the universal obstacle in the literature is lack of payment sustainability for pharmacist cognitive services which is a pre-requisite for scale (Lounsbery et al., 2009). The second is funding for telepharmacy infrastructure, namely the basics of telepharmacy services such as broadband and digital-literacy infrastructure. The third is the establishment of collaborative-practice models that formalize the pharmacist's role as part of the rural

health care team thereby enhancing the pharmacist's role by coordination (Matzke et al., 2018).

The limitations of this review are due to the design and scope of the review. Because it is a scoping review, it does not assess the methodological quality of the studies included and therefore not the relative efficacy of the individual interventions, but gives an overview of the extent of the evidence. The selected literature is diverse in research orientation, design, and setting, and not all of it is written exclusively in a rural context; some offer some basic information or some transferable evidence that is used here in the rural context. The literature included was limited to that published prior to 2024, and the level of utilization and economic measurement varied across studies, limiting conclusions on what is most at the heart of the population health argument: institute.

9.2 Directions for Future Research are Offered

We propose the below 4 research gaps: First, the field must employ a standardised, rigorous approach to measuring health-care utilization and health-care cost outcomes that are more pertinent to rural pharmacist-led efforts and moves through the pie chart to become a credible signal. Second, pragmatic trials and robust evaluations of programmes located specifically in rural areas are needed to support a more weighty evidence base focused specifically on the rural context, where much of the evidence available tends to be single-site programme evaluations. Third, implementation research should explore the potential for integrating reimbursement models, telehealth technology and practices and collaborative-practice arrangements to create a sustainable pharmacist led health initiative in low resource, rural settings. Fourthly, studies need to be widened beyond the most common cardiometabolic conditions to the broader spectrum of chronic diseases, in which the role of a rural pharmacist is much less well defined: the mental health system, renal health, and respiratory health (Makhinova et al., 2023; Nguyen et al., 2023; Sherry et al., 2022).

X. CONCLUSION

Rural population has a high burden of chronic diseases and health professionals are in a structurally low supply, with community Pharma obtaining the easiest access to residents in many rural areas is the point where the industry can help fill the void. Community pharmacist-centered population health programs, regardless of the delivery model (medication therapy management, telehealth and telepharmacy, screening and risk reduction, collaborative care), have demonstrated consistent population health benefits including positive impact on control of chronic conditions, medication adherence and quality of life, and are increasingly associated with lower health-care utilization and positive economic outcomes. The benefits are attained by clear and complementary mechanisms that are well understood and sharable: adherence, coordination, and self-management; mechanisms with clear remote delivery potential, especially in remote, rural communities. Structural challenges, not clinical, stand in the way of this potential: Remuneration for rural delivery is often not sustainable; lack of support for rural workforce and infrastructure; and digital divide, which can impede the delivery of many telehealth solutions on which rural delivery relies. Through this, we need to think about changing reimbursement policies to increasingly ecognize the role of rural pharmacist-led initiatives, investing in infrastructure for telepharmacy, ensuring that the pharmacist is part of collaborative practice teams, and, most importantly, tightly defining and measuring the utilization and cost outcomes that represent the population health case. The accessibility the greatest strength of the community pharmacy is one of the most surmountable strategies to improve chronic disease management and take strain out of rural health systems.

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