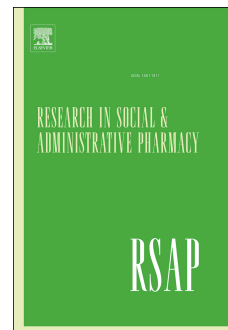


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An overview of systematic reviews

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**The outcomes of pharmacist-led pharmaceutical care within community pharmacies:
An overview of systematic reviews**

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Declarations of interest:

None.

Abstract

Background: Community pharmacists' practice has shifted from product-oriented to patient-oriented in recent decades with the goal of achieving the optimal use of medications while enhancing the patient's quality of life. The impact of pharmaceutical care services provided by community pharmacists is yet to be determined.

Objective: This study aimed to summarize the findings from secondary literature on pharmacist-led pharmaceutical care interventions and their impact on clinical, economic, humanistic, and behavioral outcomes of patients attending community pharmacies.

Methods: An overview of systematic reviews, with or without meta-analysis, was conducted using PubMed, Embase, and Cochrane library databases. Articles published up until October 2023 were identified. The following data were extracted: eligible study details, the country in which the study was conducted, year, population, interventions, and resulting outcomes.

Results: Out of 310 publications, 90 full-text articles were evaluated for eligibility, and 29 studies that evaluated the impact of pharmacy services provided within the community pharmacies were selected. The articles covered patients with or without health conditions. Interventions were diverse, focusing on a patient-centered approach, varying between collaborating with other healthcare professionals to achieve desired health outcomes or collaborating with patients through education and counseling and promoting healthier lifestyles. Improving patients' medication adherence and understanding of their conditions resulted in better clinical and behavioral outcomes. While evidence on economic and humanistic outcomes is less conclusive, some studies suggest that these services can lead to cost savings, improved quality of life, and patient satisfaction.

Conclusion: Pharmacy services provided by community pharmacists can lead to an improvement in clinical and behavioral outcomes. While there is some evidence indicating benefits in economic and humanistic outcomes, this evidence is less consistent and should be interpreted cautiously. This umbrella review highlights the importance of further research to strengthen the evidence base and guide the integration of pharmacy services into healthcare systems worldwide, supporting the shift to a patient-centered approach.

Keywords: Pharmaceutical care, community pharmacy, pharmacist-led interventions, outcome, umbrella review

Introduction

Community pharmacy services have evolved from simply dispensing medications to becoming primary care providers that focus on a patient-centered approach to optimize medication use and therapy management.¹ In 1990, Helper and Strand presented the earliest 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.”² Since then, many more elaborated definitions have been developed, including the American Society of Health-System Pharmacist’s ‘ASHP’s’ “The mission of the pharmacist is to provide pharmaceutical care. Pharmaceutical care is the direct, responsible provision of medication-related care for the purpose of achieving definite outcomes that improve a patient’s quality of life.”³

Currently, there is a constant increase in the need for medical staff due to the reliance on general practitioners.⁴ Over one-in-five of the world population will be over 65 years of age by 2050, and about 30% of them will be in polypharmacy. Hence, the sensitivity to drug-related problems will significantly increase.⁵ Additionally, the prevalence of people affected by type 2 diabetes will be 16.8% by 2050, caused by family predisposition or a sedentary lifestyle. Morbidity, mortality, and the risk of developing cardiovascular disease are estimated to increase accordingly. However, a 1% decrease in mean HbA1c is associated with a 21% reduction in complications among patients.⁶ Along with type 2 diabetes, blood pressure in hypertension patients is the primary cause of mortality. Blood pressure is not well monitored; only between 20 and 30% of people diagnosed with hypertension manage to control their blood pressure.⁷ Moreover, asthma patients lack the ability to control their symptoms due to the incorrect use of inhalers.⁸ Lastly, in regard to vaccination, there is a decrease in the overall percentage of vaccination coverage among the public.⁹ Based on the aforementioned challenges, governments in most developed countries encouraged the involvement of community pharmacies in the primary care of patient health with the incorporation of various pharmacy services in the healthcare system.⁴

A number of systematic reviews have assessed the outcomes of specific pharmacy services delivered by community pharmacies. Therefore, the objective of this study is to assemble and synthesize extracted information from systematic reviews to offer a comprehensive overview of the current pharmacy services provided by community pharmacists and their clinical, economic, humanistic, and behavioral impact. In this study, we aim to provide stakeholders with an overall view of the extended services of pharmaceutical care and evaluate their effectiveness. Importantly, this will help facilitate the decision-making process for integrating these services into healthcare systems.

Methods

An umbrella review was performed and reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines.¹⁰

Search strategy and data sources

The search strategy was designed in consultation with a librarian specialized in health science to identify systematic reviews and meta-analyses related to the impact of community pharmacist-led pharmaceutical care on clinical, economic, humanistic, and behavioral outcomes. MeSH terms and multiple synonyms were combined using Boolean operators for community pharmacists, community pharmacies, different pharmaceutical care services, and different outcomes, which aimed to enhance the retrieval of relevant references.

PubMed, Embase and Cochrane library databases were searched on October 11, 2023. The complete search query for each database can be found in the Supplementary Appendix 1. No restrictions on the date of publication or language were applied. Covidence software was then used to merge references and remove duplicates.

Eligibility criteria

The inclusion factors were based on the recognized PICO (population, intervention, comparator, and outcomes) tool (table 1).¹¹

Table 1: inclusion factors

Population	Adults and children receiving interventions led by community pharmacists
Intervention	Pharmaceutical care interventions that are carried out, led or overseen by community pharmacists and performed in community pharmacies setting
Comparator	No intervention, standard care, or usual care
Outcome	Clinical, economic, behavioral, and humanistic outcomes

The settings of interest for this overview were community pharmacies, where pharmacists provide direct services to the general public. In order to allow for a more comprehensive and meaningful synthesis of findings that can lead to a better understanding of the impact of

community pharmacist interventions within the community pharmacy setting, reviews of studies that included other settings such as hospitals, clinics, inpatient ambulatory, and nursing homes were included only if they had a significant representation of the community pharmacy setting.

The population included in this review was individuals of all ages receiving interventions led by community pharmacists.

All types of pharmacy services that aimed at promoting medication safety and management, disease prevention, and healthier lifestyles were included, such as medication review, therapy management, education and counseling, smoking cessation and weight management programs, immunization services, screening, and telepharmacy.

This review considered research that addressed one or more of the following outcomes: Clinical outcomes (Disease-specific and non-disease-specific), Humanistic outcomes (patient well-being and satisfaction), Economic outcomes (cost-effectiveness, downstream health care costs), and Behavioral outcomes (medication adherence, smoking cessation, and other factors that contribute to sustaining a healthier lifestyle).

Study selection

Articles were reviewed by three reviewers (F.R., C.C., and C.R.) using Covidence software. Two reviewers (F.R. and C.C.) independently identified potentially relevant studies based on their titles and abstracts; a third reviewer (C.R.) was consulted to settle discrepancies. One reviewer (F.R.) analyzed selected articles based on the full text for eligibility, with a second reviewer (C.R.) reviewing articles when eligibility was unclear.

Verification of systematic reviews and meta-analyses for duplication

A manual check for overlaps between the systematic reviews included and the meta-analyses were conducted to prevent duplication of evidence. lists of studies from both sources were compiled and a detailed comparison was performed. This process involved reviewing reference lists and comparing data manually. No overlaps between the systematic reviews included in our review and the studies featured in the meta-analyses were found.

Data extraction

A standardized table was constructed to collect information on the first author, publication year, country, study population, interventions, comparison group, and outcomes. To emphasize the subjective experience and perception of the patient, the humanistic and behavioral outcomes have been combined into a single category. Data extraction from eligible studies was performed by one reviewer (F.R.). The tabulated data were then checked and confirmed by a second reviewer (C.R.). (supplementary appendix 2, Table 2 Characteristics of the included studies).

Data synthesis

The included studies were heterogeneous regarding the type of interventions and the measurement of outcomes; some studies contributed to a qualitative insight into their results. Therefore, a narrative synthesis approach was used to present the findings in order to provide a comprehensive overview.

Quality appraisal

The quality appraisal of the included studies was not performed. In fact, studies were heterogeneous in terms of populations, interventions, and outcomes. This made it challenging to apply a consistent quality assessment. In addition, this overview aimed to identify interventions and their impact and provide a broad overview of the existing evidence rather than assess the quality of the included articles.

Results

The search strategy yielded 310 abstracts after excluding duplicate references (Figure 1). The dates of the article searches ranged between January 1999 and October 2023. After the initial screening of the title and abstract, 220 references were excluded. The remaining 90 references were screened for inclusion based on the full text; studies that did not meet the inclusion criteria were excluded. 29 systematic reviews met the inclusion criteria and only 10 of these reviews included a meta-analysis. The main health conditions covered by the eligible studies were diabetes,^{12,13} hypertension,¹⁴ cardiovascular diseases,^{15,16} hyperlipidemia,¹⁷ asthma,^{8,18} chronic obstructive pulmonary disease (COPD),¹⁹ and depression,^{20,21} in addition to studies with more than one chronic disease.^{22–28} Other populations, such as travelers,²⁹ smokers,^{30,31} and overweight people,³² were identified in studies. Interventions varied between education and counseling, medication review, therapy management, follow-up, immunization,³³ and disease screening.³⁴ Other topics were additionally identified, such as travel health management²⁹ and the use of technology.^{35,36} Most of the retrieved articles were conducted in high-income countries, as defined by the World Bank.³⁷, and were relatively recent, with 60% of the included studies being published in the last three years. Studies were analyzed and discussed based on the interventions.

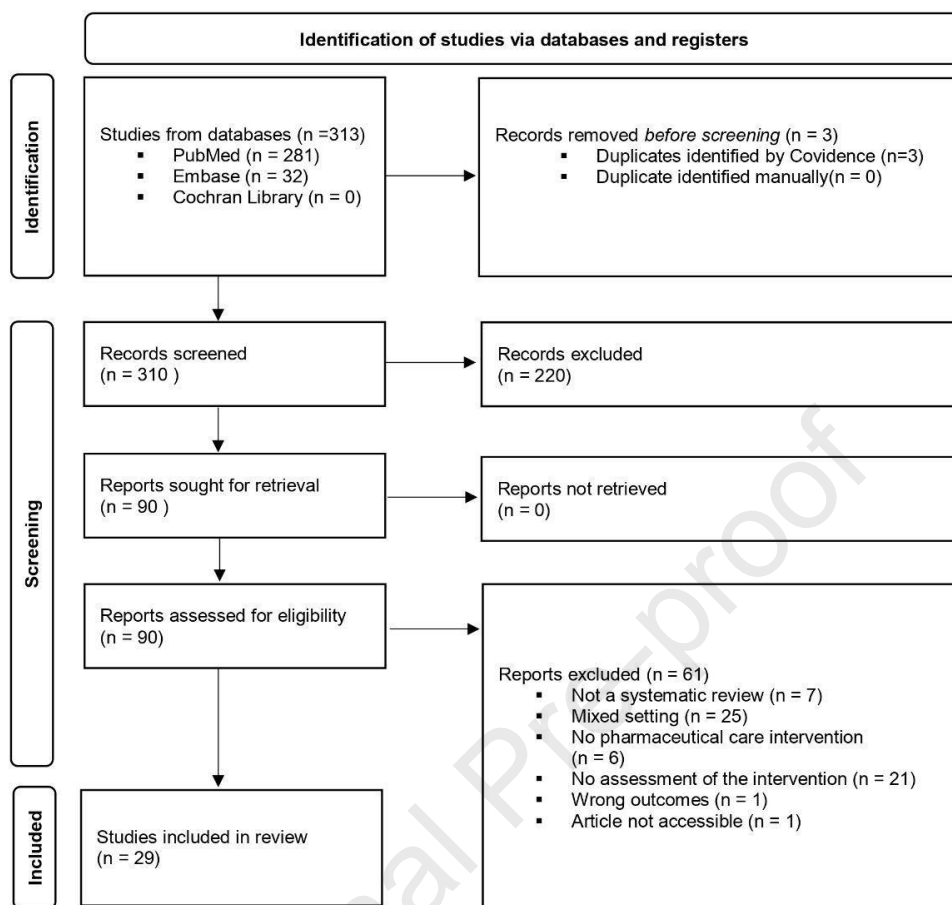


Fig 1. Flow diagram of literature search and selection

Counseling and patient education

Sixteen studies included patient education as part of the pharmacy services provided, either independently, as in 4 articles,^{17,24,27,38} or with multiple interventions.^{8,12–16,19,21,25,26,29,39}

Two articles focused on patients with diabetes.^{12,13} Coutureau et al. interventions aimed to increase patients' knowledge about their disease, treatment, and possible complications. The pharmacist intervention resulted in better glycemic control with a reduction of 0.067 units (95% CI = [−0.87; −0.48], $p < 0.0001$).¹³ Similarly, for AL Assaf et al., increased medication adherence was also reported as an outcome.¹² Both studies support the importance of pharmacist education interventions in improving diabetes management.^{12,13}

Two articles focused on patients with respiratory diseases such as asthma and COPD.^{8,19} HU et al. and Mahdavi et al. reported on patient education interventions that included introducing pathological information and ensuring that patients had proper inhalation techniques. These interventions resulted in correct inhaler use, which is critical for better symptom control.^{8,19} In addition to clinical and behavioral outcomes, Mahdavi et al. demonstrated that patient

adherence and the correct use of inhalers resulted in improved quality of life, emotional well-being, and social interaction.⁸ In fact, the overall health of patients with respiratory disease significantly improved after receiving pharmacist-assisted care.^{8,19}

Oñatibia-Astibia et al. Interventions were provided to patients with hyperlipidemia to increase medication adherence. Educational counseling focused on drug indication, dosage, the importance of adherence, and potential adverse effects of statin therapy. In addition, information was printed to summarize the counseling visit. Other strategies, such as mobile phone reminders, were used to address persistent non-adherence. The main outcome of the pharmacist interventions was a significant improvement in patient adherence.¹⁷

Among patients with depressive disorders, Rubio-Valera et al. reported that pharmacists' written or visual educational support to patients either initiating or continuing antidepressant treatment leads to improved adherence. However, no effect on patients' clinical status was observed.²¹

Four studies covered more than one chronic condition. These included hypertension, cardiovascular disease, dyslipidemia, diabetes, asthma, and depression.^{14-16,24} The educational interventions focused on teaching patients about their medications and disease states. Al-Arkee et al., Ifeanyi Chiazor et al., and Milosavljevic et al. found that these interventions significantly increased patients' knowledge and understanding of their disease, which resulted in improved treatment adherence.^{15,16,24} The prior three studies, along with Cheema et al., demonstrated the clinical impact of the interventions on blood pressure, Total cholesterol, HbA1c, and rate of severe exacerbation of asthma.^{14-16,24} However, Milosavljevic et al. did not find a clinical impact on patients with diabetes or depression.²⁴

Ashkanani et al. highlighted the potential role of pharmacists in helping patients suffering from sleep disorders. Both pharmacological and non-pharmacological therapies were mentioned in the article. Non-pharmacological treatment involved education about sleep hygiene and cognitive-behavioral therapy for insomnia (CBT-I). As a result, pharmacists were able to positively impact patients' quality of life by increasing patient education and awareness of sleep disorders.³⁸

Other population groups also received educational interventions.^{29,39} For individuals traveling, as reported in Bhuvan KC et al., pharmacists provided written or verbal travel health counseling on prescriptions or medications for travel, such as altitude medications, self-medication for travelers' diarrhea, and antimalarials, along with advice tailored to the traveler itinerary. These interventions resulted in high levels of satisfaction.²⁹ In Lambert et al., the intervention focused on patients receiving antibiotics. Educating patients about the proper use of antibiotics, their dosage, potential side effects, and the risk of antimicrobial resistance (AMR) led to improved dispensing practices and patient adherence.³⁹

According to Rajiah et al., pharmacist counseling during the dispensing of prescribed and non-prescribed medications had a major impact on health outcomes through quality medication use and medication adherence. Patients were empowered to make decisions

about their medication management and made better decisions about self-medication based on pharmacist recommendations.²⁷

Two articles assessed the economic outcomes of education and counseling interventions.^{25,26} Perraudin et al. concluded that the education and coaching program provided by community pharmacists did not have a consistent impact on treatment outcomes; however, disease support services and telephone-based counseling services tended to be cost-effective.²⁵ In contrast, Price et al. demonstrated that educational support for patients with chronic diseases such as diabetes, hypertension, and cardiovascular disease improved health outcomes at a lower cost.²⁶

Medication review, therapy management, collaboration, and follow-up:

Sixteen articles included therapy management and medication reviews as part of pharmacy services.^{8,12–16,18,19,21–23,25,26,28,39,40} These studies focused on patients with chronic conditions who may need assistance in optimizing their medication use.

In managing diabetes, the two articles Al Assaf et al. and Coutureau et al. evaluated the pharmacist's role in medication management, such as identifying drug-related problems (DRP), collaborating with the primary care physician when needed, and providing a customized medication-taking method. Both articles showed improved glycemic level control as a result of the intervention.^{12,13}

Dokbua et al., Hu et al., and Mahdavi et al. focused on patients with asthma and COPD. The involvement of pharmacists in the management of respiratory diseases had a great impact on symptom control, exacerbation frequency, and health-related quality of life. In fact, pharmacists provide the necessary support to patients, enabling them to self-manage their disease. In addition, they identify DRPs and report them to the primary care physician. Intervention was shown to be particularly important for patients with poor asthma control.^{8,18,19}

Pharmacist follow-up has shown benefits for patients with depressive disorders, as seen in Rubio-Valera et al. Patients managed their adherence through pharmacist follow-up via self-report, pharmacy records, or electronic pill containers. Additionally, pharmacists played a crucial role in managing and monitoring toxicity and adverse effects.²¹

Five studies focused on the management of patients with long-term conditions.^{14–16,22,28} Al-Arkee et al., Al-Babtain et al., Cheema et al., Ifeanyi-Chiazor et al., and Tasai et al. included patients with hypertension, dyslipidemia, heart failure, diabetes, asthma, and elderly patients on multiple medications. Interventions consisted principally of medication review, identification and resolution of emerging DRP, and subsequent collaboration with the prescriber to address any potential risk to patient safety. All of these studies reported improvements in patient adherence to their medications, resulting in positive clinical outcomes such as improvements in blood pressure, total cholesterol, and glycemic levels. Al-Babtain et al. and Tasai et al. reported no effect on mortality or quality of life.^{22,28} Concerning

the economic outcomes, Tasai et al. found a reduction in emergency department visits and hospitalization rates.²⁸

Lambert et al. found that pharmacist follow-up with patients on antibiotic therapy helped reduce overall antibiotic use. Additionally, using of pictograms on antibiotic containers improved patient satisfaction with the treatment process.³⁹

Monitoring of patients with tuberculosis (TB) symptoms was reported in Wong et al. Pharmacists could participate in the TB care cascade through referrals and in Directly Observed Treatment Short-course (DOTS) programs. As a result, the interventions improved adherence to treatment and prevention of the development of drug resistance.⁴⁰

Three studies reported on the economic outcomes of medication review services.^{23,25,26} Malet-Larrea et al. evaluated therapy management services, including medication review and chronic disease management. Hence, they found that the services resulted in improved patient health at a lower cost and reduced healthcare costs.²³ Perraudin et al. found that during medication reviews, pharmacists were able to identify DRPs and refer them to the prescriber with recommendations, which resulted in cost savings. However, they reported that medication reviews were unlikely to be cost-effective for patients with chronic pain.²⁵ Finally, Price et al. reported that medication reviews resulted in cost savings, particularly for older patients with chronic conditions. Blood pressure monitoring and feedback to primary care physicians was cost-effective for patients with hypertension, even though inconsistent results were reported regarding patients with diabetes.²⁶

Primary prevention: Immunization

Three studies reported the involvement of community pharmacists in the vaccination process, either by vaccinating patients or recommending the necessary vaccines.^{19,29,33}

Burson et al. evaluated the implementation of pharmacy-based immunization services (PBIS). This study reported both behavioral and economic outcomes. In fact, PBIS improved vaccination rates among at-risk patients, including in the underserved population, through active communication with patients. In addition to increasing the number of vaccinated patients, these services tended to be cost-effective for the healthcare system. Community pharmacy vaccination services tended to be less costly than physician office services for influenza and pneumococcal vaccination. However, zoster vaccination was less costly to the healthcare system in the physician's office.³³

In Hu et al., pharmacists were part of long-term health management for patients with COPD; this management included encouraging patients over 65 years of age to receive the influenza vaccine during the influenza season to avoid any risk of acute exacerbation of symptoms. As a result of the pharmacists' reminders and expertise, the proportion of patients with COPD who received the influenza vaccine increased.¹⁹

The immunization services provided by the community pharmacist went beyond routine immunizations; in Bhuvan KC et al., travelers also benefited from pre-travel risk assessments

provided by the pharmacists, which included the administration of routine and travel-specific vaccines. Patients were highly satisfied with this travel health service, which provided a single point of care for all their travel health and immunization needs. In addition, these services have proven to be highly acceptable to the community.²⁹

Secondary prevention: Screening, smoking cessation, weight management.

Pharmacists provided screening services in five articles.^{19,20,25,34,40} The early detection and testing services included tests to detect possible infections^{25,34,40}, tests to identify a potential health condition^{19,20,25}, or both.

Albasri et al. evaluated the implementation of point-of-care testing (POCT) in community pharmacies. In the context of malaria, the use of POCT reduced the overall use of antimalarial drugs and the risk of receiving inappropriate antimalarial treatment. Furthermore, POCT was used for lipid monitoring, which showed significant reductions in total cholesterol and LDL. However, there was no impact on the use of POCT for HbA1c and International Normalized Ratio (INR) control.³⁴

In Hu et al., pharmacists were able to effectively identify patients at high risk for COPD by observing their health status, information, and medication history. Patients first had to complete screening questionnaires to assess their risk; then, high-risk patients were referred to a physician for further management.¹⁹

Miller et al. described the capacity of pharmacists to use a validated screening tool to identify depression in undiagnosed individuals. Pharmacists were able to identify patients with depression positively and, in some cases, refer them to a physician for further evaluation. Pharmacists identified the presence of depression in patients with pre-existing chronic conditions such as diabetes, highlighting the importance of recognizing and addressing mental health issues in the management of chronic diseases.²⁰

Perraudin et al. evaluated screening services for untreated sleep apnea and chlamydia trachomatis infections. Both screening services were found to have a positive economic impact and were generally cost-effective, highlighting their value in secondary prevention.²⁵

Finally, Wong et al. highlighted the importance of community pharmacies in the management of TB in high-risk countries through the STOP-TB strategy, which supported early diagnosis and treatment of TB. After screening, pharmacists were able to refer patients to TB facilities and support them throughout their treatment course.⁴⁰

In regards to promoting healthier lifestyles, pharmacists provide weight management and smoking cessation services to patients. For patients with pre-existing chronic conditions, alongside other pharmacy services, AlAssaf et al. and Coutureau et al. reported the involvement of pharmacists in motivating diabetes patients to control their diet and providing them with the necessary support in terms of diet and exercise, resulting in a positive impact on HbA1c levels.^{12,13} Cheema et al. reported that alongside education and counseling, pharmacists provided patients at risk of cardiovascular diseases the necessary education to

manage weight, alcohol consumption, and smoking cessation.¹⁴ In addition, Hu et al. reported that pharmacists provided COPD secondary prevention strategies, such as informing patients about the risks of smoking and encouraging smoking cessation, along with weight management and diet, which could reduce the incidence and progression of the disease. A positive impact on patients' quality of life was reported.¹⁹

Gordon et al. supported the role of pharmacists in promoting weight loss through multicomponent interventions such as physical advice, free access to exercise classes, behavior change techniques such as goal setting and self-monitoring using food and activity diaries, and encouragement to develop a social support structure. Modest but significant changes in body weight were reported at six months. No effects on lipid levels were reported.³²

Two articles focused entirely on smoking cessation services provided by community pharmacists.^{30,31} They reported a change in smoker behavior. Carson-Chahoud et al. described that the interventions consisted of counseling and intensive behavioral therapy, with or without the use of pharmacotherapy, such as nicotine replacement therapy (NRT). Several psychological theories were used, including disruption of learned associations between cues and smoking behavior, the Pharmacist's Action on the Smoking Scheme (PAS), and personalized counseling based on the stage-of-change model. The results were successful in supporting abstinence.³⁰ In Saba et al., the interventions consisted of counseling and advice in individual or group sessions. They reported the use of individualized and tailored advice generated by computer software to support smoking cessation and the use of the PAS model to maintain abstinence, which therefore reported a significant impact on its success rate. Furthermore, this study highlighted the use of biochemical validation of abstinence as an additional motivation to maintain abstinence.³¹

In addition, Carson-Chahoud et al., Perraudi et al. and Price et al. provided an economic outcome of this service. All three of these articles showed that the smoking cessation program offered in the community setting was cost-effective.^{25,26,30}

The use of technology

An emerging non-traditional care provided by community pharmacists has been recognized within two of the included articles, which is the utilization of technology to provide the patient with the assistance that is needed.^{35,36} Alfian et al. presented the use of digital health technology (DHT), such as mobile health (m-health) and electronic health (e-health), to provide patients with remote counseling and monitoring. Patients with COVID-12 received remote advice on self-medication, which led to an improvement in symptoms with a reduction in adverse effects. Children with asthma were also counseled on the use of inhalers, which led to better disease control with a decrease in parent-administrated doses of inhalers. For patients with diabetes or those on anticoagulant therapy, no significant impact was reported following the use of e-health. However, for cancer patients, the use of DHT helped them with pain management. The overall results of using DHT in pharmacy services showed a high level of patient satisfaction.³⁵ Furthermore, in Dat et al., pharmacists could counsel

patients in areas with limited healthcare resources. In addition, pharmacists were capable of providing clinical pharmacovigilance for medications despite the need for a higher level of technological proficiency. For patients with COVID-19, pharmacists were effectively helpful in providing drug utilization counseling and home delivery of medications to avoid contact and risk of contamination during quarantine.³⁶

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Discussion

Based on the authors' knowledge, the present review is the first umbrella review to synthesize the existing evidence from systematic reviews and meta-analyses on the impact of community-based pharmacy services provided by community pharmacists. It provides an overview of 29 included articles related to community pharmacist-led services and their impact on clinical, economic, humanistic, and behavioral outcomes. The findings of this article provide meaningful insight into the community pharmacy practice since the evolution of pharmacists' roles from the traditional dispensary role to more patient-centered care. A summary of the available evidence, identification of limitations of the evidence, limitation of the review process, and implications for practice and policy will be addressed.

Summary of the evidence

This review found that community pharmacists can be involved in managing a wide range of chronic diseases through various pharmacy services. These services showed effectiveness in one or more aspects of patient or healthcare system outcomes.

Regarding clinical impact, pharmacy services led to important changes in patients' disease-specific and non-disease-specific outcomes. Disease-specific outcomes included reductions in HbA1c in patients with diabetes; reductions in total cholesterol, systolic blood pressure, and diastolic blood pressure in patients with cardiovascular disease; and further improved symptom control and reduced exacerbations in patients with asthma and COPD. In contrast, the clinical impact on a patient with hyperlipidemia or depression was less demonstrated in the included articles. In addition, the pharmacist reduced the use of antibiotics in countries where the antibiotic is dispensed without a prescription. As a non-disease-specific outcome, pharmacists were able to detect patients' COPD at an early stage, along with identification of undiagnosed depression and various infections such as malaria and chlamydia. No conclusive reduction in mortality was reported.

Behavioral impact was the most highlighted outcome of pharmacy services provided in community settings. Primarily, patients who received personalized counseling and education from pharmacists had better medication-taking behavior, which is crucial for treatment success.²⁴ As mentioned earlier, for patients with COPD, the correct use of inhaler devices was crucial for symptom control. Secondly, patients were more willing to receive the necessary vaccines after being given the appropriate pharmacist recommendation. Thirdly, pharmacists played an important role in smoking cessation through the various programs offered to smokers. Fourthly, patients suffering from insomnia were assisted to improve their sleep hygiene, resulting in a lifestyle change. Finally, patients with or without comorbidities benefited from weight management support.

Humanistic outcomes were less documented. Outcomes such as improvements in patient satisfaction, health-related quality of life, and patient well-being were reported in less than one-in-three of the included articles.

In addition to the aforementioned outcomes, economic outcomes were the most underrepresented in the articles, with a total of only two publications with complete economic evaluations of pharmacist services. Within these articles, counseling and patient education were reported to be cost-effective in one article, unlike medication reviews, which reported cost-effectiveness in both articles. Furthermore, smoking cessation programs and screening services were cost-effective in both articles. Regarding therapy management, hypertension management, and diabetes management were cost-effective. All interventions aimed at improving patient adherence were proven to be cost-effective. In other publications, various interventions targeting patients with asthma have been reported to reduce healthcare utilization. For instance, the Therapy Program for Patients with Chronic Diseases was associated with lower financial costs compared to no intervention.

Limitations of Evidence and Implication for Future Research

Authors faced limitations in studies. First of all, some articles presented vague explanations of the interventions. Moreover, there were no sufficient explanations mentioned about the training programs that pharmacists follow before providing the services. Secondly, little evidence was found on the economic impact of the interventions; in addition, the two economic evaluations mentioned in this review included various interventions rather than focusing on one intervention. This is a limitation for healthcare decision-makers, as they need the economic evaluation to help them support their decisions when implementing these services. Along with the economic aspect, the humanistic side was less documented in the articles. The humanistic aspect holds as much importance as other aspects that were discussed in detail, highlighting the essential well-being of patients, in addition to their satisfaction. Thirdly, studies were thought to lack detailed descriptions of patient's characteristics. It was challenging to draw a conclusion about the impact of pharmacy services on health equity. Lastly, it is important to note that most studies were conducted in high-income countries, leading to the results of this review not fully addressing pharmacy services in middle- and low-income countries. Despite the rising number of studies assessing the impact of pharmacy services provided by community pharmacists, the authors state that these research gaps should be addressed in future research.

Limitations of the review process

This review has several limitations. Due to the umbrella review methodology, the publications included were limited to secondary literature. More evidence from recent primary studies may have been missed because they have not yet been included in a systematic review. This umbrella review is affected by heterogeneity due to the wide range of populations, interventions, and outcomes included in the review. Therefore, the quality of the included studies was not assessed, and the results of this review should be interpreted with caution because this review is subject to publication bias, as it is likely that articles with positive results were more frequently published. Most studies were conducted in high-income countries; pharmacy services in middle- and low-income countries could not be efficiently identified. Finally, this review was not registered in Prospero despite its follow-up of the PRISMA statement.

Implications for practice and policy

The study's findings demonstrated the significant impact of pharmacy services provided in community settings on patient health outcomes. Pharmacists can provide various services and help patients at different levels to manage their health. Pharmacists are encouraged to continue their professional development through training and continuing education courses to improve their skills in providing pharmacy services. Therefore, Policymakers are encouraged to support expanded pharmacist participation in primary care, along with appropriate reimbursement, to support the optimal use of healthcare professionals for improved public health. Furthermore, despite the potentially valuable role of pharmacists in community settings, there is still a need to improve pharmaceutical services in LMICs. The limited number of studies identified underlines the need to introduce these services in LMICs.

Conclusion

This umbrella review article was conducted to gather information from previous systematic reviews to provide a comprehensive synthesis of the outcome of pharmacy services provided by community pharmacies. The findings support the effectiveness of pharmacy services in the community setting, illustrated through achieving the best use of medicine along with promoting public health. Pharmacy services demonstrated a positive impact, particularly on clinical and behavioral outcomes. While there is some evidence of benefits in economic and humanistic outcomes, these findings are less consistent and warrant further research. In consideration, this umbrella review highlights the need for policymakers worldwide to support the shift towards a patient-centered approach. Future research should continue to explore the effectiveness and cost-effectiveness of pharmacy services, especially in diverse settings and populations, to strengthen the evidence base and further advance pharmaceutical practice.

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Protocol

A protocol was not registered in PROSPERO for this umbrella review.

Conflicts of interest:

None of the authors have any competing interests that might affect the study results.

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Authors contributions

Ranim Fares: Conceptualization, Methodology, formal analysis, Investigation, Data curation, Writing-original draft, Review & editing, Visualization.

Bardiau Marjorie: Methodology, validation, resources, writing – Review & editing

Cindy Chaballe: Methodology, Reviewing.

Robin Cruneneberg: Conceptualization, Methodology, Data Curation, Writing-Review & Editing, Supervision, Project Administration.

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Supplementary Appendix 1. : the complete search query for each databasePubMed 281

((((((((((((((((("Pharmacies"[Mesh]) OR (community pharmacy)) OR (community pharmacies)) OR (retail pharmacy)) OR (retail pharmacies)) OR (local pharmacy)) OR (local pharmacies)) OR (supermarket pharmacy)) OR (supermarket pharmacies)))) OR (independent pharmacy)) OR (independent pharmacies)) OR (chain pharmacy)) OR (chain pharmacies)) OR (drug store)) OR (retail drug store)) AND (((("Pharmacists"[Mesh]) OR (community pharmacist)) OR (retail pharmacist)) OR (local pharmacist)) OR (neighborhood pharmacist))) AND (((((((((((((((((((("Pharmaceutical Services"[Mesh]) OR "Medication Therapy Management"[Mesh]) OR "Medication Reconciliation"[Mesh]) OR "Medication Review"[Mesh]) OR "Patient Medication Knowledge"[Mesh]) OR "Medication Adherence"[Mesh]) OR (patient counseling)) OR (patient advice)) OR (patient education)) OR (medication safety)) OR (medication counseling)) OR (medication adherence)) OR (preventing medication errors)) OR (over-the-counter counseling)) OR (over-the-counter drugs)) OR (health professional self-care advice)) OR (professional self-care advice)) OR (pharmacist counseling)) OR (pharmacist advice)) OR (pharmacist involvement)) OR (pharmacist consultation)) OR (pharmacist care)) OR (pharmacist led care)) OR (pharmaceutical care)) OR (health promotion)) OR (disease prevention)) OR (disease detection)) OR (immunization)) OR (vaccination)) OR (interprofessional collaboration)) OR (interprofessional communication)) OR (disease screening)) OR (symptomatic diagnosis))) AND (((((((((((((((("Outcome and Process Assessment, Health Care"[Mesh]) OR (patient outcome)) OR (health outcome)) OR (clinical outcome)) OR (economic outcome)) OR (health impact)) OR (impact)) OR (role)) OR (value)) OR (health benefits)) OR (benefits)) OR (humanistic outcome)) OR (healthcare utilization)) OR (healthcare utilization)) OR (traitement outcome)) OR (cost-benefit)) OR (Qol))) AND (((("Systematic Review" [Publication Type]) OR "Systematic Reviews as Topic"[Mesh]) OR "Meta-Analysis as Topic"[Mesh]) OR "Meta-Analysis" [Publication Type]))

Embase 32

('pharmacies'/exp OR 'community pharmacy' OR 'community pharmacies' OR 'retail pharmacy' OR 'retail pharmacies' OR 'local pharmacy' OR 'local pharmacies' OR

'supermarket pharmacy' OR 'supermarket pharmacies' OR 'independent pharmacy' OR 'independent pharmacies' OR 'chain pharmacy' OR 'chain pharmacies' OR 'drug store' OR 'retail drug store') AND ('pharmacists'/exp OR 'community pharmacist' OR 'retail pharmacist' OR 'local pharmacist' OR 'neighborhood pharmacist') AND ('pharmaceutical services'/exp OR 'medication therapy management'/exp OR 'medication reconciliation'/exp OR 'medication review'/exp OR 'patient medication knowledge'/exp OR 'medication adherence'/exp OR 'patient counseling' OR 'patient advice' OR 'patient education' OR 'medication safety' OR 'medication counseling' OR 'medication adherence' OR 'preventing medication errors' OR 'over-the-counter counseling' OR 'over-the-counter drugs' OR 'health professional self-care advice' OR 'professional self-care advice' OR 'pharmacist counseling' OR 'pharmacist advice' OR 'pharmacist involvement' OR 'pharmacist consultation' OR 'pharmacist care' OR 'pharmacist led care' OR 'pharmaceutical care' OR 'health promotion' OR 'disease prevention' OR 'disease detection' OR immunization OR vaccination OR 'interprofessional collaboration' OR 'interprofessional communication' OR 'disease screening' OR 'symptomatic diagnosis') AND ('outcome and process assessment, health care'/exp OR 'patient outcome' OR 'health outcome' OR 'clinical outcome' OR 'economic outcome' OR 'health impact' OR impact OR role OR value OR 'health benefits' OR benefits OR 'humanistic outcome' OR 'healthcare utilization' OR 'healthcare utilization' OR 'traitement outcome' OR 'cost benefit' OR qol) AND ('systematic reviews as topic'/exp OR 'meta-analysis as topic'/exp OR term:it)

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((((((((((((((((((([mh Pharmacies]) OR ("community pharmacy")) OR ("community pharmacies")) OR ("retail pharmacy")) OR ("retail pharmacies")) OR ("local pharmacy")) OR ("local pharmacies")) OR ("supermarket pharmacy")) OR ("supermarket pharmacies")))) OR ("independent pharmacy")) OR ("independent pharmacies")) OR ("chain pharmacy")) OR ("chain pharmacies")) OR ("drug store")) OR ("retail drug store")) AND (((([mh Pharmacists]) OR ("community pharmacist")) OR ("retail pharmacist")) OR ("local pharmacist")) OR ("neighborhood pharmacist")) AND (((((((((((((((((((([mh "Pharmaceutical Services"]) OR [mh "Medication Therapy Management"]) OR [mh "Medication Reconciliation"]) OR [mh "Medication Review"]) OR [mh "Patient Medication Knowledge"]) OR [mh "Medication Adherence"]) OR ("patient counseling")) OR ("patient advice")) OR ("patient education")) OR ("medication safety")) OR ("medication counseling")) OR ("medication adherence")) OR ("preventing medication errors")) OR ("over-the-counter counseling")) OR ("over-the-counter drugs")) OR ("health professional self-care advice")) OR ("professional self-care advice")) OR ("pharmacist counseling")) OR ("pharmacist advice")) OR ("pharmacist involvement")) OR ("pharmacist consultation")) OR ("pharmacist care")) OR ("pharmacist led care")) OR ("pharmaceutical care")) OR ("health promotion")) OR ("disease prevention")) OR ("disease detection")) OR (immunization)) OR (vaccination)) OR ("interprofessional collaboration")) OR ("interprofessional communication")) OR ("disease screening")) OR ("symptomatic diagnosis")) AND (((((((((((((((([mh "Outcome and Process Assessment, Health Care"]) OR ("patient outcome")) OR ("health outcome")) OR ("clinical outcome")) OR ("economic outcome")) OR ("health impact")) OR (impact)) OR (role)) OR (value)) OR ("health benefits")) OR (benefits)) OR ("humanistic outcome")) OR ("healthcare utilization")) OR ("healthcare utilization")) OR ("traitement outcome")) OR (cost-benefit)) OR (Qol))) AND (((("Systematic Review":pt) OR [mh "Systematic Reviews as Topic"]) OR [mh "Meta-Analysis as Topic"])) OR Meta-Analysis:

Supplementary appendix 2: Table 2. Characteristics of the included studies

Eligible study		Population	Interventions	Comparator	Economic	Outcomes		Summary of main findings
Study ID Number of studies included	The country in which the study was conducted					Clinical	Humanistic/Behavioral	
Al-Arkee et al. 2023 8	Canada, the Netherlands, the United Kingdom, Germany, Australia, the USA, and China	patients with cardiovascular disease Including dyslipidemia, heart failure, hypertension	Multicomponent interventions include patient education, adherence counseling, and medication review.	Usual care	-	Mean systolic blood pressure, total cholesterol, and low-density lipoprotein cholesterol change	Medication adherence improvement	The study demonstrated positive impacts on systolic blood pressure and total cholesterol levels. Furthermore, there was a decrease in low-density lipoprotein cholesterol levels. The interventions were successful in achieving a substantial enhancement in medication adherence.
Al Assaf et al. 2022 21	The United Kingdom, France, USA, Australia, Brazil, New Zealand, Malaysia, Iran, Pakistan, India, Ethiopia, South Thailand, Cyprus, and Jordan	Adult patients with type 2 diabetes mellitus	Education, counseling, physician collaborative care model, family support, motivational interview, simplicity of complex medication regimes, and self-management support intervention	Usual care	-	Mean HbA1c change	Medication adherence	Many pharmaceutical care approaches appear effective in improving knowledge about diabetes, increasing patient adherence, and controlling glycemic levels. Improvement was achieved through counseling (68.75%), education (61%), and medication management, as well as telephone-based interventions (68.75%) that reminded patients to refill their prescriptions on time.
Al-Babtain et al. 2022 40	The USA, Canada, the Netherlands, Australia, the UK, Spain, Germany, Iran, Jordan, Croatia, Iraq, Malta, Portugal,	The following patient groups are included: individuals with chronic illnesses such as hypertension, diabetes, dyslipidemia, and asthma,	Face-to-face, telephone, or combined medication review, either with or without collaboration with the patient's general practitioner.	Usual care, no intervention, and interventions undertaken by other healthcare professionals.	-	Disease-specific outcomes include systolic blood pressure, diastolic blood pressure, lipid profile, fasting glucose, HbA1c, and cardiovascular risk. Non-disease-specific outcomes consist of drug-related	Medication adherence, Quality of Life	The result has demonstrated the favorable effects of medication review programs for patients with long-term conditions. These programs play a crucial role in recognizing drug-related issues. The review programs have resulted in substantial improvements in clinical outcomes, including decreased systolic blood pressure (MD -1.68; 95% CI -3.18, -0.18), HbA1cs (MD -0.61; 95% CI -0.96, -0.25, P 0.0008), and TC levels (MD -0.18; 95% CI -0.32, -0.05; p = 0.008; I2 = 0%). As well as medication adherence (0.48 ± SD 0.65). Although there was inconclusive evidence of a

	Italy, and Denmark	as well as elderly patients.				problems, adverse drug events, mortality, emergency department visits, hospital admissions, and hospital readmissions.		reduction in mortality, there was a positive impact on the hospitalization rate and emergency department visits.
Albasri et al. 2020 13	USA, Canada, Australia, New Zealand, Ghana, Nigeria, India, and Uganda	Patients of all ages	Utilization of point-of-care-testing	Usual care	-	Antimalarial medication use, measurement of lipid, HbA1c, and INR.	-	The implementation of pharmacist-led point-of-care testing (POCT) resulted in the reduction of the use of antimalarial medications (RR 0.58, 95% CI 0.54 to 0.62) and improved management of lipid profiles (TG -21.68, 95%CI -34.74 to -8.61mg/dL; I ² =0%). However, no substantial influence on the INR (95% CI -0.74% to 16.71%; I ² =99%) or HbA1c levels (-1.02%, 95%CI -2.59% to 0.54%; I ² =96%), was observed.
Alfian et al. 2023 16	Low-and middle-income countries, such as Egypt, China, United Arab Emirates, Turkey, Malaysia, Iran, Jordan, Korea, Nigeria, and Thailand.	Patients with COVID-19, hypertension, diabetes, cancer, CVD, asthma, and other chronic diseases	Counseling, education, and reminders using digital health technologies.	Standard care	-	The management of adverse side effects, COVID-19 symptoms, asthma control, HbA1c levels, and oral anticoagulant monitoring.	Medication adherence, Patient's satisfaction	The utilization of a DHT has been associated with improved pain relief, decreased incidents of breakthrough cancer pain (p < 0.001), and decreased occurrences of adverse reactions (p < 0.05) in cancer patients. Additionally, the employment of DHT has resulted in better management of COVID-19 symptoms (AOR = 4.03; 95% CI: 2.54–5.87) and enhanced monitoring of asthma in children (p = 0.0134). However, no substantial impact on the administration of oral anticoagulant therapy or diabetes management was observed. Despite this, patients reported a high level of satisfaction (83.97%) with the use of DHT for pharmaceutical care.
Ashkanani et al. 2023 34	Australia, USA, Canada, the United Kingdom, France, Switzerland, Japan, Italy, Norway, New Zealand, the Netherlands, and Taiwan.	Patients suffering from sleep disorders	Education, counseling, screening services	N/A	-	-	Quality of life, change in lifestyle	The interventions undertaken by pharmacists resulted in significant improvements in patients' lifestyles, particularly in reducing insomnia severity and enhancing sleep hygiene and control. Additionally, the screening of high-risk patients for sleep disorders facilitated access to medication, thereby reducing the potential for a range of adverse health outcomes. Furthermore, increased patient awareness and knowledge about sleep disorders and their management contributed to an overall improvement in the quality of life for those affected.

Burson et al. 2016 47	USA	Adults	Vaccination	Vaccination in physician offices	Cost-effectiveness	-	Vaccination rates	Various interventions, including direct communication with customers, personalized letters, and educational interventions, have collectively contributed to a rise in vaccination rates and a decline in healthcare utilization. No conclusive impact on socioeconomic disparities was demonstrated.
Carson-Chahhoud et al. 2019 7	The United Kingdom, Australia, USA, Qatar, and Italy	Smokers	Advice and intensive behavioral therapy	Usual care, less intensive smoking cessation programs	Cost-effectiveness	-	Smoking abstinence	The advantages of receiving more extensive smoking cessation support have been identified (RR 2.30, 95% CI 1.33 to 3.97; $I^2 = 54\%$). Additionally, cost-effectiveness findings supporting community pharmacist interventions have been presented.
Cheema et al. 2014 16	Australia, Canada, Portugal, Spain, Thailand, the USA, and the United Kingdom	Patients with hypertension	Education on disease management, identifying DRP, collaboration, advice on lifestyle	Usual care	-	Systolic blood pressure and diastolic blood pressure, identifying DRP, and decrease in cardiovascular risk factors.	Improvement in adherence to antihypertensive medication	The interventions have led to a clinically significant decrease in both systolic (95% CI -3.8 to -8.4 mmHg, $P < 0.00001$) and diastolic (95% CI -1.5 to -3.4 mmHg, $P < 0.00001$) blood pressure. Approximately 38% of drug-related issues were addressed by pharmacists through recommendations to prescribers and patients. Moreover, there was an enhancement in medication adherence within the intervention group, increasing from 56% to 68%. Additionally, as a secondary outcome, a decrease in total cholesterol (-0.52 mmol l^{-1} ($P < 0.001$)) and HbA1c (-0.5 and 1.0%) levels was observed in the intervention group.
Coutureau et al. 2022 12	United Kingdom, Spain, Belgium, France, Australia, the United States of America, Brazil, Malaysia, Indonesia, Iran, and Pakistan	Patients with type 2 diabetes	Education, medication review, collaboration	Usual care	-	Mean change in HbA1c values, systolic blood pressure	-	Pharmacists' intervention resulted in a successful reduction of HbA1c levels -0.67 (95% CI = $[-0.87; -0.48]$, $p < 0.0001$), but there was no significant improvement in systolic blood pressure -0.22 (IC 95% = $[0.54, 0.11]$, $P = 0.19$).
Dat et al. 2023 39	The United States, Canada, Spain, Germany,	Mixed population	Patient consulting and monitoring, checking prescriptions, and dispensing drugs.	Traditional pharmacies	Travel costs	-	Better services in underserved regions, patient satisfaction Quality of life	Certain studies have demonstrated improved patient satisfaction and travel cost savings through telepharmacy consultations. Remote counseling and treatment management have enhanced the quality of life and clinical monitoring for

	Denmark, the United Arab Emirates, the Kingdom of Saudi Arabia, and Australia							patients with chronic conditions. The implementation of remote pharmacy services has resulted in high patient satisfaction and early access to medications for COVID-19 patients during home isolation.
Dokbua et al. 2018 12	Australia, Canada, Denmark, Germany, New Zealand, the United Kingdom, and the United States.	Patients with asthma	Providing self-management support service and establishing action plan goal setting	Usual care	Healthcare system utilization	Asthma symptom control/level of severity	Health-related Quality of life medication adherence,	Improved asthma control (SMD=0.46; 95% CI=0.09-0.82) was observed among patients who received self-management support services. A higher quality of life, 0.23 (95% CI=0.12-0.34), and increased adherence to treatment 0.44 (95% CI=0.27-0.61) were observed.
Gordon et al. 2011 10	USA, the United Kingdom, Switzerland, Spain, and Denmark.	Overweight patients	Physical activity advice, dietary advice, behavioral change component	N/A	-	Blood pressure, lipid levels, blood glucose	weight loss	this study demonstrated a moderate but significant weight loss (1.1 to 4.1 kg in 12 months) resulting from pharmacist management and interventions. There were no significant changes among the studies regarding lipid levels or blood glucose.
Hu et al. 2020 25	The United Kingdom, Belgium, Australia, Canada, Spain, the USA	Patients with chronic obstructive pulmonary disease	Prevention, screening, therapy management, and long-term health management, education, vaccination	Usual care	Health costs	Frequency of exacerbation, severity of symptoms, hospitalization rate	Patients' technique in using inhalation devices, adherence, smoking cessation, vaccination rate, patient education, patient satisfaction	The primary behavioral outcomes that were observed were an improvement in the utilization of inhalation devices, an increase in medication adherence, a positive influence in aiding patients to quit smoking, and a rise in vaccination rates. Pharmacist services improved patients' satisfaction with pharmacy services. A 6-month counseling, lifestyle advice, smoking cessation advice, and physician referral for COPD patients resulted in a reduction in healthcare costs.
IfeyanyiChiazor et al. 2015 27	United Kingdom, Brazil, USA, Spain, Australia, Belgium, Turkey, Nigeria, Canada, and	Patients with diabetes, hypertension, dyslipidemia, and smokers	Patient education, patient follow-up, identification of DRP, collaboration with another healthcare professional	Usual care	-	Change in mean blood pressure, triglyceride, HbA1c	Patient knowledge, lifestyle modification, quality of life	This study indicates that pharmaceutical interventions have proven effective in improving clinical outcomes, including blood pressure (from 7.8 to 17.7 mm Hg) and diabetes management (from 0.2% to 2.2%). Additionally, such interventions have enhanced the quality of life and increased patients' knowledge and understanding of their conditions.

	the Netherlands								
Bhuvan Kc et al. 2023 9	USA, Canada, and the United Kingdom	Travelers	Vaccination services, pre-travel risk assessment, counseling, recommendation for travel-related medication	N/A	-	-	Patient satisfaction, vaccination rate	The satisfaction of travelers with the pharmacy's travel health services was found to be high. 94-100% of patients reported being either satisfied or very satisfied with the services provided. Community pharmacists have effectively given influenza and tetanus shots and have more recently played a significant role in the large-scale distribution of COVID-19 vaccines. (acceptance rate range: 48%–94.2%)	
Lambert et al. 2022 17	Europe, Asia, North America, and Africa	Patients on antibiotic treatment	Education and follow-up	N/A	-	side effects and overall use of antibiotics	Antibiotic dispensing practice, adherence, patient satisfaction	this study has demonstrated that multicomponent educational interventions have led to a notable enhancement in antibiotic prescribing practices (up to 30% more advice given) while simultaneously reducing the incidence of adverse effects. These interventions have resulted in a substantial decrease in overall antibiotic use(-53% OTC), accompanied by an increase in patient satisfaction (risk difference 0.04 [-0.02, 0.10]).	
Mahdavi et al. 2021 21	Australia, Canada, Germany, New Zealand, Belgium, Denmark, France, India, Italy, Spain, and the United Kingdom	Patients with asthma	Patient education, follow-up, and monitoring programs	N/A	-	Asthma control and severity	Quality of life, medication adherence	The pharmacist played a crucial part in improving asthma symptom control 0.14 (95% CI, 0.02 to 0.27; I ² = 41.5%; p = 0.021), enhancing quality of life -0.241 (95% CI, -0.362 to -0.121; I ² = 66.3%; p < 0.001), and optimizing inhaler use, resulting in better medication adherence(risk of non-adherence-0.22 (95% CI, -0.67 to 0.24; I ² = 74.4%; p = 0.345).	
Malet-Larrea et al. 2016 17	Europe, Canada, Australia	Patients with chronic conditions such as diabetes, CVD, respiratory illness, and depression.	Medication therapy management services, medication review, managing chronic conditions	Usual care	Saving costs to the healthcare system	-	-	Pharmacist's interventions can improve health outcomes with less financial expense, resulting in cost savings to the healthcare system.	
Miller et al. 2020 10	USA, Japan, and Australia	Adults having symptoms of depression	Depression screening, referral	No intervention	-	Identifying undiagnosed depression	-	Using a validated screening tool, pharmacists were able to identify patients with undiagnosed depression.	
Milosavljevic et al. 2018	USA, Australia, Belgium,	Patients with hypertension, diabetes,	Education and counseling	Usual care/ no intervention	-	Change in mean HbA1c, blood pressure, respiratory	Patient's adherence	Pharmacist-led interventions resulted in an improvement in patient adherence to their medication, leading to clinical improvements in lipid and respiratory symptoms. However,	

26	and the Netherlands	asthma, and depression				symptoms, depression symptoms		the impact on diabetes or depression symptoms was not conclusive.
Oñatibia-Astibia et al. 2021 5	Europe, Australia, and North America	Patients diagnosed with hypercholesterolemia	Education, counseling	N/A	-	LDL, HDL, triglyceride	Patient adherence	The patient demonstrated a significant improvement in medication adherence (OR = 1.67; CI 95% ; 1.38-2.02; P < 0.001; I ² = 54%) following pharmacist interventions, yet no substantial influence on lipid profile was observed.
Perraudin et al. 2016 21	The United Kingdom, the Netherlands, Spain, Belgium, France, and Denmark	Mixed population	medication review, medicines management, educational, and coaching programs. Collaboration with the practitioners. Smoking cessation, screening	Usual care, no intervention	Cost-effectiveness	-	-	The results regarding medication review, medicine management, and educational programs were unclear. However, pharmaceutical care services, disease support services, and telephone-based advisory services showed an improvement in adherence and were cost-effective. Collaboration with practitioners was demonstrated to be cost-effective in targeting specific errors in prescriptions. Additionally, the program for smoking cessation and screening led by pharmacists was found to be cost-effective.
Price et al. 2023 75	Canada, the United Kingdom, USA, Australia, Netherlands, Spain, Ireland, Finland, Jordan, Malaysia, Singapore, Thailand, Belgium, Brazil, Chile, Denmark, Indonesia, Italy, Japan, Nigeria, Sweden, and Taiwan.	Individuals with a specific condition and/or medication	Medication review, T2DM management, screening, hypertension management, adherence services, warfarin therapy management, smoking cessation	Usual care, other services	Cost-effectiveness	-	-	A majority of the studies indicate that medication review interventions, particularly those targeting elderly patients with polypharmacy, prove to be cost-effective. Interventions designed to manage type 2 diabetes were found to be cost-effective, with particular emphasis on patient education, collaboration with other healthcare providers, medication review, and early detection. Out of the six interventions provided by pharmacists to manage hypertension, three were reported to be cost-effective. These interventions include patient education, monitoring of blood pressure, and collaboration with general practitioners. All interventions aimed at improving patient adherence were found to be cost-effective, particularly those provided to patients initiating chronic disease medication. Smoking cessation programs offered in pharmacies were also found to be cost-effective.
Rajiah et al. 2021 19	The United Kingdom, the United States of America, Australia,	Adult patients	Pharmacist-patient collaboration, counseling	N/A	-	Quality use of medicine	Adherence, patient decision	Effective patient-pharmacist interactions have a significant impact on achieving desired health outcomes, particularly through shared decision-making with the patient(95% CI 47–85; p = 0.00). Interventions by pharmacists have resulted in improved medication adherence and better medication use.

	Saudi Arabia, Malta, Hungary, Canada, Bosnia-Herzegovina, Thailand, North Cyprus, and Kuwait.							The impact of counseling during dispensing has also been proven to be positive.
Rubio-Valera et al. 2011 6	The USA, the Netherlands, and Australia.	Patient with depressive disorder	Patient education, monitoring, and management of adverse effects	Usual care	-	-	Medication adherence	Pharmacist interventions resulted in increased patient compliance with antidepressant medications 1.64 (95% CI 1.24 to 2.17), which could potentially lead to a reduction in depressive symptoms.
Saba et al. 2014 5	The USA, the United Kingdom, and Sweden	Smokers	counseling to promote smoking cessation	Standard or usual care	-	-	Smoking cessation	A counseling intervention provided by community pharmacists, which involved the use of computer software to generate individualized behavioral advice or following the Pharmacist's Action on Smoking model or the stage-of-change model, was found to result in improved abstinence rates 3.21 (1.81–5.72) RR (95% CI)
Tasai et al. 2021 4	Denmark, Germany, the Netherlands, Northern Ireland, Portugal, the Republic of Ireland, Sweden, New Zealand, Spain, and the USA.	Patients who are aged 65 years of age or older	Medication review	Usual care	-	Hospitalization, emergency department visits	Medication adherence, Quality of Life	The outcomes of the medication review intervention provided by the pharmacist were not found to result in any notable improvement in the quality of life. A tendency to reduce hospitalization following the intervention was observed (RR = 0.88; 95% CI = 0.78–1.00). However, a decrease in emergency department visits (RR = 0.68; 95% CI = 0.48–0.96) was noted, along with improved medication adherence (15.2% and 12.2%, P = 0.028).
Wong et al. 2023 16	Nigeria, Tanzania, Bolivia, Dominican republic, the USA, Pakistan, Spain, India, Myanmar,	patients of all ages	Referral to TB facilitates screening, treatment monitoring	Usual care, no intervention	-	TB detection, TB control	-	The provision of TB treatment monitoring by community pharmacists resulted in a notable improvement in patient outcomes. Additionally, community pharmacists played a crucial role in decreasing the prevalence of undetected TB by offering TB screening services within their pharmacies. Furthermore, pharmacists contributed to appropriately referring suspected TB patients to TB facilities for further medical investigation.

Cambodia,
Vietnam.

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