Patient Preference and Adherence

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REVIEW

Pharmacist-Led Interventions to Improve Medication Adherence Among Patients with Multimorbidity: A Scoping Review

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Background: Patients with multimorbidity tend to have multiple medications or polypharmacy to achieve optimal outcomes, which may result in non-adherence to medication. Medication non-adherence in this population is relatively higher than in patients with a single disease because of more complex medication regimens and greater adverse drug reactions. Providing interventions is an essential solution in changing patients' behavior towards medication adherence among patients with multimorbidity. Pharmacists could help patients achieve optimal outcomes by optimizing medication use, including improving medication adherence. This scoping review aims to identify evidence of the effectiveness and characterize pharmacist-led interventions in improving medication adherence among patients with multimorbidity.

Methods: A systematic search was conducted to identify relevant studies on PubMed, Scopus, CENTRAL, and through hand searching. Randomized controlled trial design studies performing interventions to improve medication adherence led by pharmacists among patients living with multimorbidity were included. We focused on original search with the key concepts of "multimorbidity", "pharmacists", and "medication adherence". Narrative synthesis was used to extract and synthesize the data.

Results: Twelve studies that included participants with multimorbidity were reviewed. Nine of all twelve studies showed improvement of medication adherence in the intervention group with a p-value <0.05, while three other studies indicated no significant difference between the intervention and control groups. All of the studies employed personalized interventions. Interventions used could be divided into counselling sessions, medication management, or using a supporting tool as a reminder of drug administration.

Conclusion: In nine out of twelve studies, interventions led by pharmacists were found to be effective in improving medication adherence in patients with multimorbidity. Effective interventions showed significant improvement in medication adherence in the intervention group compared with the usual care group. These interventions included counselling sessions, medication management, and the use of a supporting tool to remind patients about drug administration.

Keywords: multimorbidity, pharmacists, intervention, medication adherence

Introduction

Multimorbidity is known as the co-existence of two or more chronic illnesses in one person.[1] Having multiple conditions is quite common, and such multimorbidity has been rising in prevalence over the years.[1] The global prevalence of multimorbidity is 37.2%, with the subgroup study showing that multimorbidity is more prevalent in women (39.4%) than in men (32.8%) and is more common in adult populations above 60 years (51%).[2] There are different patterns in multimorbidity, namely concordant and discordant.[3] For the concordant clustering pattern, cardiometabolic clustering is a long-reported pattern in the general population.[3] Cardiometabolic diseases, such as hypertension, diabetes, and chronic heart disease (CHD), are known as the three most prevalent patterns due to the overlapping etiology, risk factors, and

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bidirectional interactions.[4] A study in the UK showed that the most common diseases among multimorbid patients were hypertension (18.2%) and depression or anxiety (10.3%).[5] Another study from Indonesia stated that hypertension is the most common disease (23.2%) in all combinations of multimorbidity.[6] Another study also identified that one of the patterns of multimorbidity with high prevalence includes cardiovascular and cardiometabolic disease, where cardiovascular and complex patterns are the leading causes of death.[7]

Patients with multimorbidity tend to have multiple medications or polypharmacy to achieve optimal outcomes, which can lead to medication non-adherence.[8] According to a meta-analysis of individuals with multimorbidity, the prevalence of medication non-adherence was calculated at 42.6%.[9] Due to more complicated regimens and greater side effects, individuals with multimorbidity are more susceptible to medication adherence issues than those who have just a single disease due to a greater number of drugs or polypharmacy and more complicated drug regimens, coupled with side effects.[10] This condition can lead to medication non-adherence.[11] Giving an intervention is an essential solution in changing patients' behavior towards medication adherence among patients with multimorbidity.[12] Pharmacist could help patients achieve optimal outcomes by optimizing medication use, reducing drug-related problems (DRPs), and increasing knowledge, thus improving patients' quality of life through pharmacist-led interventions.[13] Among patients with chronic diseases, pharmacist-led interventions, particularly counseling with behavioral components and tailored strategies, could significantly improve medication adherence in chronic disease,[14] where patients with multimorbidity would benefit from personalized care.[15] Several types of interventions to improve medication adherence in people with multimorbidity have been carried out before, some of which are self-management, medication review, and electronic health interventions, where interventions with self-management and medication review showed better effectiveness in improving medication adherence among people with multimorbidity.[12]

A review published prior to 2010 concluded that there was insufficient evidence of successful interventions to improve medication adherence in multiple chronic conditions, and psychosocial therapies were lacking.[16] Given the significant advances in treatment and technology over the past five years, an update of the evidence is necessary. Other reviews aimed to select standardized interventions delivered by healthcare professional collaborations to improve medication adherence in people with multimorbidity; however, this study does not indicate whether one intervention is more effective than another.[17] Another systematic review among people with multimorbidity was conducted, with most of the included interventions delivered by healthcare professionals other than pharmacists.[18,19] One of these studies stated that patients with mental-physical multimorbidity may benefit from interventions that manage and coordinate healthcare processes to improve patients' medication adherence.[18] The other study stated that medication adherence in elderly adults with many comorbidities may be improved by self-management and electronic health treatments.[19] The existing interventions to improve medication adherence could be effective, depending on the type of intervention for different conditions of multimorbidity; however, some of them could be less effective as the evidence for effective interventions was weak. This scoping review aims to identify evidence of the effectiveness and characterize pharmacist-led interventions in improving medication adherence among patients with multimorbidity.

Materials and Methods

This review was performed using the Joanna Briggs Institute definition for scoping review.[20] The Preferred Reporting Items for Systematic Reviews extension for Scoping Reviews (PRISMA-ScR) guidance was provided as the guide for conducting this scoping review.[21] The PRISMA-ScR checklists were available in Supplementary Data 1.

Eligibility Criteria

Original articles produced in the English language from 2011 up to September 2025 were reviewed. Articles will be eligible if they meet all the following inclusion criteria: (1) Randomized controlled trial design studies performing interventions to improve medication adherence led by pharmacists among patients living with multimorbidity; (2) Published in English; (3) Interventions targeting patients with multimorbidity; (4) published between 2011 onwards. Multimorbidity is defined as the coexistence of two or more chronic illnesses in one person.[1] Studies involving the use of two or more drugs that might be interpreted as a treatment for two or more long-term illnesses were taken into consideration. Articles will be excluded if: (1) they are qualitative, opinion articles, conference presentations, books,

letters, editorials, reviews, dissertations/theses, or abstracts; (2) they do not report medication adherence as a primary or secondary outcome; (3) the population targeted patients aged below 18 years old were also excluded.

Search Strategy

Articles were identified via searches of the electronic databases PubMed, Scopus, CENTRAL, and through hand searching. The PCC Framework (Population, Concept, Context) was used in this search strategy. Population: patients with multimorbidity, who have two or more chronic disease conditions. Concept: Any pharmacist-led intervention with medication adherence included in the outcome. Context: general healthcare settings. We limited our final search strategy to include only articles from 2011 onwards based on the earliest date of relevant articles. The full search strategy can be found in Supplementary Data 2.

Study Selection

The study selection of the articles was performed by two independent reviewers (SS and SDA). One author (SS) assessed the potential eligibility evaluation based on screening after the titles and abstracts. SS obtained and assessed the full texts of publications that might be eligible. The abstract and full-text screening were further independently verified by a second party (SDA). Any disagreements among the reviewers (SS and SDA) were resolved using consensus.

Data Extraction

One reviewer independently conducted the data extraction according to the predefined criteria. The following data from each included article were extracted: data setting and year, sample size and selection criteria, type of disease, adherence measurement, intervention, follow-up and duration, outcome measured, and funding.

Synthesis Method

A narrative synthesis of all reviewed studies was conducted to search for evidence for the effectiveness of pharmacist-led interventions in improving medication adherence among patients with multimorbidity.

Results

Search Results

Records were identified from databases: 1032 from PubMed, 440 from Scopus, 164 from CENTRAL, and 10 through hand searching, including grey literature. After eliminating duplicates, 1223 studies were screened for the title and abstracts according to inclusion and exclusion criteria. Following screening of titles and abstracts, 127 full texts were examined, resulting in 12 studies included in this scoping review. The study selection process is described in the PRISMA-ScR flow diagram in Figure 1.

Study Characteristics

All twelve studies that included participants with two or more chronic conditions were reviewed. For the data setting, five studies were performed in Asian regions,[22–26] two in Europe,[27,28] four in America,[29–32] and one in Africa.[33] The population included mainly was adults, with eight studies including an adult population at least 18 years old,[22–25,27,31–33] three studies included a specific elderly population (at least 65 years or 75 years old)[28–30] while one study did not mention the specific population.[26]

Type of Disease

For the type of chronic conditions, six studies included patients with hypertension and diabetes mellitus,[22–24,26,30,31] two studies included patients with hypertension, diabetes mellitus, and dyslipidemia[29,32,] two studies included patients with chronic kidney disease conditions,[25,33] while two other studies only mentioned patients with chronic polypharmacy.[27,28]

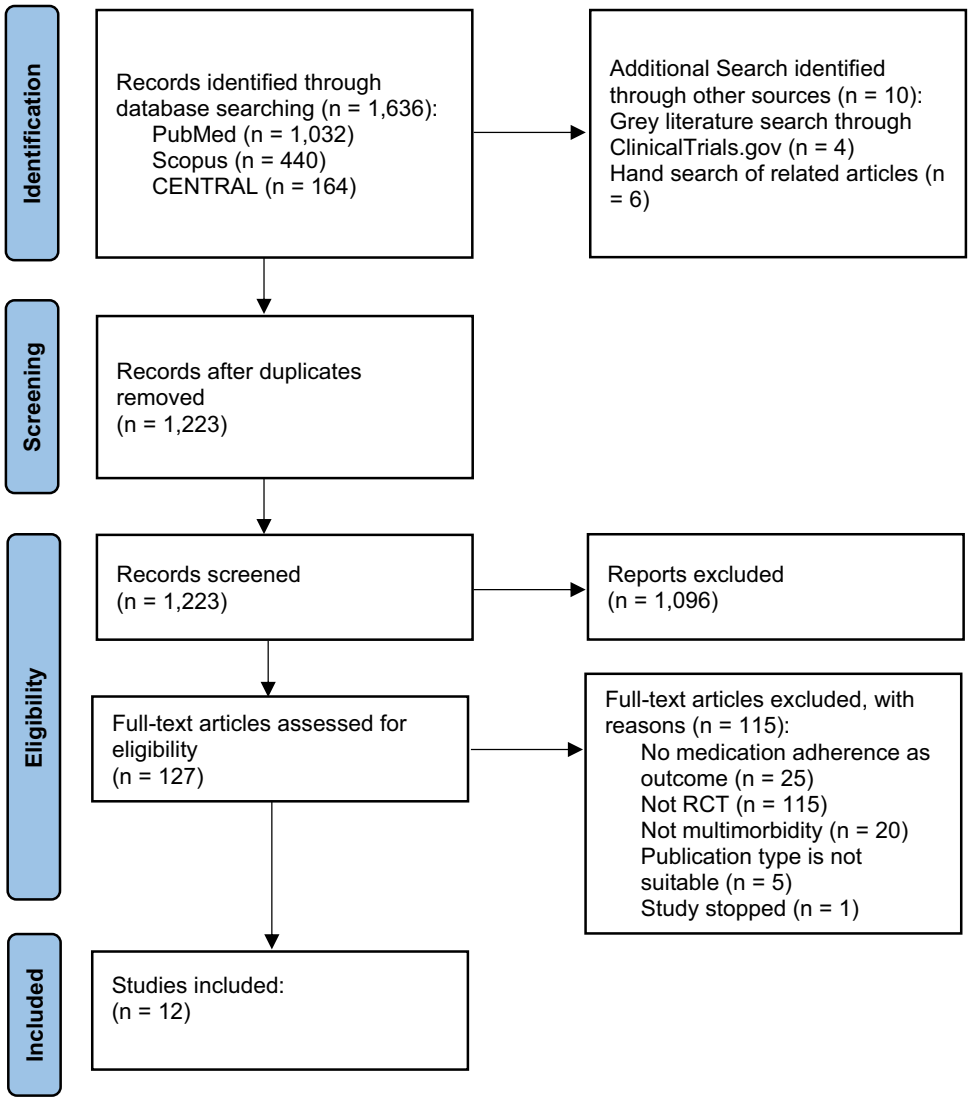

Figure 1 PRISMA-ScR flow diagram of the study selection.

Adherence Measurements

Nine studies use a questionnaire for adherence measurements, some of which were the Medication Adherence Report Scale (MARS-5),[23] 8-item Morisky Medication Adherence Scale (8-MMAS),[22,27,31] Morisky-Green Test (MGT),[24] 4-item Morisky-Green-Levine (MGL) scale,[33] Brief Medication Questionnaire (BMQ),[25,26] and the Chilean Medication Adherence Questionnaire.[29] Alongside the questionnaire, the study also employed objective methods, including the Medication Possession Ratio (MPR) and the Daily Polypharmacy Possession Ratio (DPPR).[27] Two studies used pill counts as a method for adherence measurements.[28,32] One study used the group-based trajectory method (GBTM).[30]

Interventions and Comparators

All of the studies employed personalized interventions. Interventions in ten studies were delivered through face-to-face appointments,[22–29,31,33] with two studies also included home visits,[22,28] and four studies also included telephone interviews for the follow-up sessions.[22,24,27,30] Interventions used could be divided into counselling sessions, medication management, or using a supporting tool as a reminder of drug administration.

1. Counselling
   Counselling was delivered as educational counselling[22–27,29–31,33] and also motivational counselling.[23,30] Information provided in educational counselling was information about the disease and its management,[26,33] types of drugs used by the patient, usage and dosage, precautions, adverse reactions, clinical targets, and the treatment methods for adverse reactions,[24] a possible misconception of the drugs,[26] also the purpose of their medications and potential drug-related problems.[33]
2. Medication Management
   Medication management interventions may include medication reviews, following a plan for drug adjustments, as assessed by a pharmacist. In performing a medication review, the pharmacist assessed any potential DRPs and developed an individualized plan for the patients.[22,25,27–29,33] The pharmacist also asks for advice from general practitioners for a medication adjustment plan. If necessary, a medication adjustment plan was then created considering the safety, efficacy, and adherence barriers.[22]
3. Supporting Tool
   Interventions to improve medication adherence also used a supporting tool for drug administration. One of the studies used digital health medication dose reminders. Components of the digital health offering include a wearable sensor (patch), an ingestible sensor pill that can be co-encapsulated with a medication, and a web portal that enables medical staff to access data from the digital health offering.[32]

Comparators of all studies were usual care applied in each healthcare setting. The usual care mentioned refers to the care that a healthcare provider typically provides to their patients, excluding any intervention.

Effect of Interventions on Medication Adherence

Nine of all twelve studies showed significant improvement of medication adherence in the intervention group with p-value <0.05.[22–26,29–32] Three other studies indicated no significant difference between the intervention and control groups in medication adherence.[27,28,33]

1. Counselling
   Eight out of ten studies included counselling showed an improvement in medication adherence. For the two remaining studies, one had no significant difference in adherence between the two groups due to the unintentional selection of patients with high medication adherence and low levels of experience among recruited pharmacists,[27] and the other one due to the absence of more intensive individualized follow-ups.[33]
2. Medication Management
   Half of the studies included medication management showed an improvement in medication adherence.[22,25,29] One study employed a polymedication check, which did not reveal any significant differences.[27] Two studies with medication review and therapy management also did not show any significant difference.[28,33]
3. Supporting Tool
   A study using digital health medicine dose reminders has been shown to enhance medication adherence, particularly in individuals with lower adherence. The study found that the mean overall adherence for all patients was 86 ± 12%, and the mean on-time adherence was 69.7 ± 19.7%.[32]

Result of Syntheses

Results of syntheses are summarized in Table 1.

Discussion

Medication adherence is a vital aspect to achieve optimal clinical results and to prevent disease progression or long-term complications. Improving medication adherence can be achieved by providing targeted interventions, which may be an essential solution in changing patients' behavior towards medication adherence among those with multimorbidity. This review synthesised data from twelve studies with multimorbidity patients to search for evidence of the effectiveness and to

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Table 1 Data Extraction of the Study

First Author	Year	Setting	Sample Size	Selection Criteria for Multimorbidity	Type of Diseases	Adherence Measurement	Intervention	Duration and Follow-Up	Outcome Measurement	Funding
Alfian SD, et al[23]	2021	Bandung, Indonesia (community health centers)	89	At least 18 years old, diagnosed with T2DM using at least one antihypertensive drug	Diabetes Mellitus type 2, hypertension	Medication Adherence Report Scale (MARS-5)	Tailored pharmacist-led intervention: counselling protocol	Duration: 3 months Follow-up: 1 month after the baseline session.	On the MARS-5 scale, the intervention increased medication adherence by 4.62 points (95% CI 0.93 to 8.34, P value = 0.008)	Indonesia Endowment Fund for Education
Li Y, et al[22]	2021	Zunyi, China (community health centers)	588	Adult hypertensive patients with comorbidity or confusion with medication	Hypertension and chronic conditions such as diabetes	8-item scale developed by Morisky (MMAS-8)	Medication review, medication adjustment plan, monthly medication chart	Duration: 6 months Follow-up: once every 3 months.	Individuals in the intervention group were more likely to follow prescription instructions (P < 0.001), take their drugs regularly (P < 0.001), and not need to adjust their treatment plan (P = 0.02)	National Natural Science Foundation of China
Martínez-Mardones F, et al[29]	2023	Santiago, Chile (National System of Health Services)	291	Individuals over 65 with a moderate to high risk of cardiovascular disease, five or more drugs, type 2 diabetes, hypertension, or dyslipidemia	Hypertension, type 2 diabetes, or dyslipidaemia	Medication adherence questionnaire provided by the Chilean Ministry of Health (Chilean MAQ)	Medication review with follow-up (MRF): drug therapy or disease management advice	Duration: 12 months Follow-up: four face-to-face visits over 12 months	Medication adherence varied significantly (OR 6.60, 95% CI 1.36 to 31.9, P = 0.001)	No extramural funding was used to support this work.
Messerli M, et al[27]	2016	Switzerland (community pharmacies)	450	Age > 18, ≥4 prescribed medications for ≥3 months	Not mentioned; only mentioned chronic polypharmacy	Medication Possession Ratio (MPR) and Daily Polypharmacy Possession Ratio (DPPR), 8-item Morisky Medication Adherence Scale (German version, 8-MMAS-D)	'Polymedication Check' (PMC)	Duration: 28 weeks Follow up: in 0, 2, 16, 28-week periods	**MPR** There was no significant trend for improved adherence rates in the intervention group. For 212 out of 1,020 treatments (20.8%), the MPR was less than 80% (intervention N = 96 (19.5%) and control group N = 116 (22.0%), p = 0.318) **DPPR** The mean DPPR for all eligible study participants was 87.3 (N = 293, SD = 14.250). The DPPR in D-CH (mean = 88.38, SD = 14.270) was significantly higher compared to that of F-CH (mean = 84.86, SD = 13.972) (p = 0.01) in both intervention and control group. Both regions had no significant improvement in DPPR through the intervention. **8-MMAS-D** Moderate adherence (Scores 6–8) was observed in 89 cases (22.3%) in the control group and 83 patients (20.8%) in the intervention group. There were 154 patients with high adherence, including 78 from the intervention group (39.4%) and 76 from the control group (37.6%). There was no discernible difference in adherence between the two groups (p = 0.817).	The study was developed as an investigator-initiated project and partly funded by the Swiss pharmacists' association, pharmaSuisse

Mohan A, et al[30]	2023	Texas, US (hospitals)	720	Older populations (≥65 years old) who have both diabetes mellitus and hypertension	Hypertension, diabetes mellitus	Group-based trajectory modelling (GBTM)	The telephonic motivational interviewing (MI)	Duration: 12 months Follow up: 6- and 12-month periods.	Within a year of the intervention's implementation, patients in the intervention group were more likely to be adherent than controls (β = 0.06; p = 0.02 and OR: 1.46; 95% CI 1.05–2.04, respectively)	The National Heart, Lung, and Blood Institute (NHLBI)
Wang W, et al[24]	2022	Shandong, China (hospital)	80	18–65 years old patients with a diagnosis of hypertension and type 2 diabetes	Diabetes Mellitus type 2, hypertension	Morisky-Green test (MGT)	Medication education: education material, a WeChat account for live discussion, and a telephone follow-up	Duration: 3 months Follow up: once a month.	When compared to the usual group, the medication adherence was significantly increased in the pharmaceutical care group (90.0% vs 52.5%, P < 0.001)	The 2018 Key Project of Communication of Science and Technology Innovation Project, National Medical Economic Information Network of the Chinese Pharmaceutical Association
Moorhead P, et al[32]	2017	United States (outpatient setting)	57	People who were 18 years of age or older, had uncontrolled hypertension, were taking at least two antihypertensives, and had uncontrolled type 2 diabetes, some of whom were also taking statins	Hypertension, diabetes mellitus type 2, hyperlipidemia	Average adherence to each medicine	Digital health (DH) medication dose reminders	Duration: 12 weeks Follow up: 4 and 12 weeks	Efficacy of dose reminders to improve adherence: DH device reminder messages were linked to a 16 ± 16% increase (75 ± 18% when seeing vs 59 ± 24% when not seeing mobile dose reminders) in medication taking if not taken before dose reminder. The mean overall adherence for all subjects was 86 ± 12%; the mean on-time adherence was 69.7 ± 19.7%. The likelihood of taking medication was positively correlated with seeing the dose reminder (log odds ratio [OR] 2.43, 95% CI 1.58–3.28; P < 0.001), mean daily adherence (log OR 0.598, 95% CI 0.404–0.792; P <0.001 for every 10% increase in adherence)	Proteus Digital Health
Olesen C, et al[28]	2014	Aarhus, Denmark (the National Health Insurance Population Register)	253	Individuals ≥65 years of age with at least five current prescription drugs taken	Not mentioned; only mentioned the type of drugs	Pill-count (PC)	Medication Review	Duration: 1 year Follow up: 3, 6, and 9 months.	There was no significant difference in the mean treatment non-adherence rate over 1 year between the pharmaceutical care and the control groups; that is, 11% of patients receiving pharmaceutical care were non-adherent compared to 10% in the control group. A separate analysis of cardiovascular drugs did not show a significant difference between the groups. In the group receiving pharmaceutical care, non-adherence rates were 14% in the first half-year and 19% in the last (OR 1.46; 95% CI 0.91–2.35).	The Danish Ministry of Health and the Association of Danish Pharmacies

(*Continued*)

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Table 1 (Continued).

First Author	Year	Setting	Sample Size	Selection Criteria for Multimorbidity	Type of Diseases	Adherence Measurement	Intervention	Duration and Follow-Up	Outcome Measurement	Funding
Okoro et al,[33]	2022	Nigeria (hospital)	147	Patients aged 18 to 85 years who were diagnosed with CKD at stages one to four	CKD	4-item Morisky-Green-Levine (MGL) scale	Face-to-face group education and recommendation, medication review, and medication adherence text message reminders (individualized after 6-month and 12-month follow-up)	Duration: 12 months Follow-up: 6 and 12 months	At 6 months, there was a clinically significant improvement in adherence in the intervention arm compared to the usual care arm. However, the difference was not statistically significant (mean adherence score: 0.7 ± 1.0 in both arms, P = 0.955). At 12 months, the adherence score in the intervention arm was slightly lower than in the usual care arm in the per-protocol analysis (0.5 ± 1.0 vs 1.0 ± 1.5, P = 0.051), indicating a decline in adherence over time. However, the intention-to-treat analysis showed no significant difference between the two arms (0.7 ± 1.0 vs 0.7 ± 1.1, P = 0.955).	Tertiary Education Trust Fund
Wickramasinghe, et al[25]	2025	Sri Lanka (hospital)	256	Patients diagnosed with CKD stage 4 or 5	CKD	Brief Medication Questionnaire (BMQ)	Four counselling sessions, Educational Resource, medication labelling, and review (personalized)	Duration: 12 months Follow-up: 12 months	The total Brief Medication Questionnaire (BMQ) score was significantly lower in the IG (3 [2–4]) compared to the CG (5 [4–5]), with p <0.001, indicating better adherence in the IG	The National Research Council of Sri Lanka (NRC Grant No: 15–048)
Malik et al,[26]	2022	Pakistan (community pharmacies)	80	Patients diagnosed with diabetes mellitus (Type I or II) and hypertension with an HbA1c value ≥7% and BP greater than 140/90 mmHg	Hypertension and Diabetes Mellitus	Brief Medication Questionnaire (BMQ)	Community pharmacist counselling (Individualized)	Duration: 6 months Follow-up: every 15 days	Medication adherence improved significantly among patients with diabetes and hypertension in the intervention group. Diabetes Medication Adherence: Significant improvement was observed in the Regimen Screen, Belief Screen, and Recall Screen ($p \leq 0.05$). No significant difference was found in the Access Screen ($p \geq 0.05$). Hypertension Medication Adherence: Significant improvement was observed in the Regimen Screen and Recall Screen ($p \leq 0.05$). No significant difference was found in the Access Screen and Belief Screen ($p \geq 0.05$).	Not mentioned

Contreras-Vergara, et al[31]	2022	Mexico (hospital)	103	Patients with a diagnosis of type 2 diabetes mellitus and systemic arterial hypertension	Type 2 diabetes mellitus and systemic arterial hypertension	8-item Morisky Medication Adherence Scale (MMAS-8)	Pharmacist-delivered education (individualized)	Duration: 6 months Follow-up: 0, 3, 6 months	Intervention Group: The percentage of patients with high adherence increased significantly from 8.7% at baseline to 43.5% ($p < 0.001$). The percentage of patients with low adherence decreased to 10.9%. Control Group: Medication adherence levels remained essentially unchanged, with only 2.3% achieving high adherence at 6 months.	Not mentioned

Abbreviations: T2DM, Type 2 Diabetes Mellitus; OR, Odds Ratio; CI, Confidence Interval.

characterize the pharmacist-led interventions in improving medication adherence among patients with multimorbidity. All of the population included were adults, with some studies specifying the elderly population, as chronic conditions were associated with an increased age. In high-income countries such as the European region or the United States, some of them use advanced services, such as standardized terms for interventions, such as Medication Review with Follow-up (MRF), Motivational Interviewing (MI), or Polymedication Check (PMC), which use a more structured method to optimize the use of medication. A previous study stated that in many low- and middle-income countries (LMICs), the capacity and experience to develop continuing professional development (CPD) for pharmaceutical services, such as enhancing patients' medication adherence, are limited.[34] This may be the reason why interventions in high-income countries are more advanced and structured. For the type of the disease, half of the study focused only on type 2 diabetes mellitus and hypertension, as they are included as chronic conditions with the highest rates of noncompliance with medication.[35]

All the studies performed tailored interventions that assessed the adherence problem before individualizing them. The pharmacist gathered information about patients' non-adherence behaviors, then established individualized interventions and created an individualized plan based on predictors of lower adherence trajectories. In several studies, the pharmacist also assessed for drug-related problems in each patient as baseline information for medication management.[22,27–29] Two studies screened and checked for adherence problems and then provided an adherence protocol to support the pharmacy staff in deciding which intervention could be applied, using the adherence intervention wheel[23,27] or polymedication check protocol.[27] For the follow-up sessions, the pharmacist evaluated the intervention through a telephone interview, a follow-up consultation, or a messaging mobile app. Previous reviews on patients with cardiovascular diseases showed that tailored interventions are a vital part of improving medication adherence. Tailored interventions involve an integrated process of identifying non-adherent patients, detecting barriers to medication adherence, and providing solutions tailored to those barriers. These interventions are key to delivering tailored interventions to patients' specific barriers to medication adherence.[36] Another previous study also showed that patient-tailored treatment programs in clinical practice can improve adherence by considering individual patients' characteristics, thereby resolving long-standing non-adherence issues in patients with multimorbidity.[37]

Interventions to improve medication adherence delivered by pharmacists were significantly more effective than those offered by other healthcare professionals.[38] Pharmacists, as healthcare professionals specializing in the use of medication, are well-suited to educate patients about their medications. The patient's medication types, dose and usage, safety measures, adverse responses, clinical goals, and adverse reaction management techniques were all covered in the educational counseling,[24] also the purpose of their medications and potential DRPs.[28] Educational counselling in most of the studies provided for their individualized problems, as the pharmacist assessed any gaps in patients' knowledge and then delivered educational consultation or clarified any misconceptions. Individualized educational counselling could also be provided only for those who needed it (eg, patients who had risk behaviors).[22] Easy-to-understand texts, comics, music, videos, and other popular science works could be used as educational resources to give personalized medicine advice.[24]

Pharmacist-led interventions used in these articles could be divided into counselling sessions, medication management, or using a supporting tool as a reminder of drug administration. In counselling sessions, the pharmacist provided educational counselling and/or motivational counselling to each patient about the use of their medication. In educational counselling, pharmacists provided individualized education plans to address risk behaviors and improve patients' knowledge about the diseases and medication adherence.[22] One study provided educational counselling along with other strategies like integrating medication routines into daily activities to address issues about forgetfulness and lack of knowledge, as they were the most common barriers identified.[23] Other than educational counselling, some of the studies also provided motivational counselling. Motivational counselling was used to identify and address adherence barriers such as lack of motivation, concerns about side effects, and misconceptions about the necessity of antihypertensive drugs.[23] Pharmacist counselling enhanced treatment awareness and dispelled misconceptions, leading to better adherence.[25] Previous meta-analysis about the association of pharmacist intervention counselling with medication adherence also reported that pharmacist educational counselling significantly increases medication adherence compared to no counseling.[39]

Other than counselling sessions, other studies also used medication management as an intervention. Medication review, as one component of medication management, is often used in these articles to improve adherence. A medication

review is defined as an evaluation of a patient's medications to optimize medication use and improve health outcomes, involving the detection of drug-related problems and the recommendation of interventions.[27] Two studies[22,29] used medication review as the primary intervention, followed by individualized educational counselling if needed. The results showed that there was a significant improvement in medication adherence. One study also reported that participants in the intervention group did not need to modify their treatment regimen ($P < 0.001$).[22] Other three studies that used medication management showed no significant difference in the intervention group. One study[28] used only medication review as an intervention, showed that the adherence rate was high in both intervention and control groups, and there was no significant difference in treatment non-adherence between the pharmaceutical care group and the control group. However, this study did not measure baseline treatment adherence, as adherence rates were considered equal in both groups due to the randomization method. Other than that, this study used pill counts as an adherence measurement tool and had a 6-month follow-up period, which can introduce bias to the results. Patients might have purchased new pill boxes that were not displayed to the pill-counting nurse just before the 6-month appointment, or they might not have informed the nurse of a change in the practitioner's prescribed dosages. In another study, pharmacists reviewed all medicines currently used by the patient and provided a structured face-to-face counselling session, showing that there was no significant trend for improved adherence rates in the intervention group. This study identifies several probable reasons for the lack of a substantial difference in medication adherence between the intervention and control groups, including high baseline adherence, selection bias resulting in the unintentional selection of patients who were already well-organized and had established therapies, motivational bias, and a short study duration. The other study, which included both medication review and pharmacist counseling, suggests that the lack of a significant difference in medication adherence between the intervention and control groups may be due to the absence of sustained, intensive, and individualized follow-ups for the intervention group. None of these three studies mentioned that the probable reason for the lack of a significant difference is the method used for the intervention.

Lastly, only one study used a reminder tool for the intervention group. This study found that digital health medication dose reminders offer benefits in improving medication adherence, particularly for patients with lower adherence.[32]

Strengths and Limitations

This is the first review to search for evidence of the effectiveness and to characterize the pharmacist-led interventions in improving medication adherence among patients with multimorbidity, to the best of the authors' knowledge. Nevertheless, this scoping review has several limitations. First, it is possible that not all studies on interventions intended to enhance medication adherence among patients with multimorbidity were located during searches of research papers, because of the difficulty in identifying the term multimorbidity in research papers. For example, several studies only used the term chronic illnesses included in the survey, but did not use the terms multimorbidity or comorbidity. Second, interventions to improve medication adherence in this population are frequently combined, which may have a potential for overlap in classification. Third, no critical appraisal of the included studies was conducted, consistent with the methodological framework of scoping reviews. As a result, the strength and quality of the evidence could not be evaluated, and the findings should be interpreted with caution. Fourth, the review was limited to studies published from 2011 onwards, which may have excluded earlier research that could provide additional insights into the topic. Finally, the synthesis was descriptive in nature, focusing on mapping and summarizing the existing literature on pharmacist-led interventions to improve medication adherence, without conducting a quantitative analysis. This approach limits the ability to conclude the magnitude or direction of effects across studies. In future studies, the use of quantitative approaches, such as meta-analysis, should be considered to allow for a more rigorous synthesis of the evidence. This would enable researchers to draw stronger conclusions about the magnitude and direction of effects across pharmacist-led interventions aimed at improving medication adherence studies, providing clearer insights into the effectiveness and impact of interventions in this area.

Implications for Research and Practice

This scoping review identified that the studies were most likely performed on individualized interventions based on the individual's behavior or medication problems. In nine out of twelve studies, it was found that interventions led by

pharmacists are most likely effective in improving medication adherence among patients with multimorbidity. Nevertheless, several studies did not consider patients' baseline adherence levels, resulting in no significant improvement in adherence being reported. Future studies should evaluate the adherence baseline and choose specific study populations who may benefit from a medication adherence improvement intervention program. There are also several implications in practice, especially in clinical pharmacist practice. Current health facilities primarily focus on patients with single diseases and do not adequately consider those with more complex conditions, such as multimorbidity. This review can serve as a valuable resource for pharmacists in developing effective intervention programs to enhance medication adherence in this population. Pharmacists, being specialists in pharmaceuticals, are ideally positioned to help patients understand the necessity and rationale behind drug administration. Pharmacist educational counseling may enhance patients' comprehension of the necessity and rationale for medication adherence. In the context of medication management, a pharmacist could provide a medication review to assess patients' drug-related problems and provide a supporting tool to help patients adhere to their medications.

Conclusion

In nine out of twelve studies, interventions led by pharmacists were found to be effective in improving medication adherence in patients with multimorbidity. These interventions included counselling sessions, medication management, and the use of a supporting tool to remind patients about drug administration. Effective interventions showed significant improvement in medication adherence in the intervention group compared with the usual care group. However, their impact remains variable due to differences in the type of pharmacist-led intervention. In future studies, the use of quantitative approaches, such as meta-analysis, should be considered to allow for a more rigorous synthesis of the evidence.

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Disclosure

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