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Clinical pharmacist prescriber in primary care in Slovenia: prospective non-randomised interventional study focused on clinical outcomes and quality of life

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Introduction: Clinical pharmacist prescribers in primary care settings and their impact on patient-reported outcomes (PROs) and clinical outcomes have not been described outside English-speaking countries.

Aim: The aim of this prospective interventional pilot study was to assess the impact of pharmacist prescribers on clinical results and patient-reported outcomes (PROs), while describing their development, evaluation, and implementation in Slovenia.

Methods: This prospective, 6-month, interventional, non-randomised study started in November 2024 and concluded in June 2025 in four primary care settings in Slovenia. Clinical pharmacists reviewed medications of patients and additionally prescribed medications based on the Collaborative Practice Agreement (CPA). In this process, they cooperated with patients and general practitioners (GPs). Only patients with an established diagnosis for selected non-communicable chronic conditions were included. The primary outcomes were changes in PROs, including quality of life (assessed via EQ-5D-VAS), and the Medication Appropriateness Index (MAI). Secondary outcomes included the prescription acceptance rate by GPs (percentage) and adherence to treatment guidelines. Tertiary outcomes involved the number of prescriptions that met the predefined clinical outcomes.

Results: The study included 119 patients, with a mean age of 72.3 years (SD = 10.0). Quality of life improved from 63.6/100 (SD = 18.7) at baseline to 71.4/100 (SD = 15.9) at the end of the study (p = 0.000), with a corresponding QALY difference of 0.0252. The effect size (Cohen's d) was 0.448 (95% CI: 0.084 to 0.812. The number needed to treat (NNT) was 4.0. During the study, clinical pharmacists prescribed 264 prescriptions to 119 patients, resulting in an acceptance rate of 91.3%. Adherence to treatment guidelines improved significantly (29.8% vs. 90.9%; p = 0.000). The effect size, expressed as an

odds ratio (OR), was 25.7 (95% CI: 15.6–42.4). The number of prescriptions achieving the predefined clinical outcomes was significantly higher at the end of the study (70.8% vs. 6.4%; p = 0.000), with an OR of 33.9 (95% CI: 19.1–60.4). Deprescribing accounted for 25.3% of all protocols.

Conclusion: This study demonstrates that prescriptions made by clinical pharmacists in collaboration with GPs, as specified in the CPA, improved PROs and clinical outcomes for predefined conditions.

KEYWORDS

pharmacist prescriber, clinical pharmacy, family medicine, medicationreview, primary care

1 Introduction

Polypharmacy represents a significant burden in Europe and is highly prevalent, particularly among elderly patients in primary care. It often leads to poorer clinical outcomes and increased healthcare costs (Bennie et al., 2024; Maher et al., 2014; Midão et al., 2018). Two systematic reviews found a high prevalence of polypharmacy in primary care across Europe, raising concerns about psychotropic polypharmacy, particularly the notably high use of benzodiazepines in this population (Bennie et al., 2024; Midão et al., 2018).

A study involving 503 patients in general practice in Slovenia also demonstrated high polypharmacy use among the elderly (Gorup and Šter, 2017). Additionally, Maher et al. reported that approximately 50% of older adults (≥65 years) were prescribed at least one unnecessary medication. They identified a strong relationship between polypharmacy and adverse clinical outcomes and recommended increased collaboration with clinical pharmacists to promote rational medication use in this population (Maher et al., 2014).

In addition to medication-related problems, chronic conditions are a critical factor in optimizing medication management in primary care (Kessler et al., 2003; Lech et al., 2022). Despite significant efforts by general practitioners (GPs) and other healthcare professionals, there remains considerable room for improvement (Kessler et al., 2003; Lech et al., 2022; Smolders et al., 2009; Redon et al., 2016). Kessler and colleagues found that fewer than 50% of patients with depression in primary care receive adequate treatment (Kessler et al., 2003). Similar findings were reported in the Netherlands, where adherence to treatment guidelines for depression was only 42%, and for hypertension, only 40% of patients achieved adequate blood pressure control (Smolders et al., 2009; Redon et al., 2016).

Research on adherence to treatment guidelines for diabetes in primary care showed that only 56% of patients follow recommended management protocols (Alliabi et al., 2022). GPs often report poor communication with other specialists when managing chronic conditions. In Germany, most GPs indicated inadequate communication with psychiatrists, despite GPs being responsible for diagnosing and managing the majority of depression cases in primary care (Lech et al., 2022). In many countries, including Slovenia, the limited number of GPs may contribute to the suboptimal management of chronic diseases (European Health Information Gateway).

Collaboration between GPs and clinical pharmacists is an important strategy for reducing medication-related problems and optimizing treatment (Stuhec, 2021; Urbańczyk et al., 2023). This collaboration can involve both pharmacist prescribers and non-prescribers, with clinical pharmacists providing services such as medication reviews and medication reconciliation, which are nationally accepted and reimbursed in some countries (Stuhec, 2021; Urbańczyk et al., 2023). Medication reviews in general practice have been extensively studied in countries where they are already reimbursed, including the United Kingdom, the United States, and Slovenia (Stuhec, 2021; Komwong et al., 2018; Chisholm-Burns et al., 2010).

Unfortunately, in most Central European countries, such services are not reimbursed in general practice, with the exception of Slovenia. In Slovenia, clinical pharmacists conduct medication reviews—specifically, type 3 (advanced) medication reviews as defined by the Pharmaceutical Care Network Europe (PCNE)—on behalf of GPs with a referral paper. Since 2017, these services have been reimbursed by the national insurance. Research has demonstrated a positive impact, including reductions in polypharmacy, drug-drug interactions (DDIs), potentially inappropriate medications (PIMs), improved adherence to treatment guidelines, and enhanced quality of life (Stuhec, 2021; Urbańczyk et al., 2023). In Slovenia, clinical pharmacists provide medication reviews in almost all general practices within primary care ambulatory settings, representing a powerful approach for medication management. This collaboration supports GPs in managing polypharmacy and improving patient outcomes (Stuhec, 2021; Urbańczyk et al., 2023).

A pharmacist prescriber represents an additional step beyond the previously mentioned medication review. It has been well developed and implemented in the United Kingdom, where clinical pharmacists have been prescribing independently within their competencies. In New Zealand and the United States, clinical pharmacists collaborate as dependent prescribers, with the United States requiring a collaborative practice agreement (CPA) for such collaboration (Choe et al., 2018; American Pharmacists Association (APhA); Raghunandan et al., 2021; Carter et al., 2024). In the United Kingdom, there are over 2,000 pharmacist-independent prescribers in general practice, a development that began in 2006 from the earlier supplementary prescriber model. Pharmacists require additional education and training provided by approved organisations (Tonna et al., 2007; Cope et al., 2016). The role of pharmacist prescribers has been extensively researched in the United Kingdom, particularly in prescribing and deprescribing (Tonna et al., 2007; Alharthi et al., 2023).

A meta-analysis of 46 studies (37,337 participants) compared non-medical prescribing by nurses and pharmacists with standard care (Weeks et al., 2016). There was moderate certainty of evidence for studies assessing blood pressure at 12 months (mean difference

(MD) −5.31 mmHg, 95% confidence interval (CI) −6.46 to −4.16; 12 studies, 4,229 participants) and low-density lipoprotein (LDL) cholesterol (MD -0.21, 95% CI -0.29 to −0.14; 7 studies, 1,469 participants). High certainty evidence was found for glycated haemoglobin management (HbA1C) at 12 months (MD -0.62, 95% CI -0.85 to −0.38; 6 studies, 775 participants) (Weeks et al., 2016). The authors also compared prescribing by pharmacists to that by nurses (only one study), which showed substantial improvements in both groups after 6 months: 43.4% of participants in the pharmacist case manager group met both systolic blood pressure and LDL cholesterol target guidelines, compared with 30.9% in the nurse-led group (an absolute difference of 12.5%; number needed to treat = 8, p = 0.03) (McAlister et al., 2014). In a recent scoping review, encompassing 63 studies, researchers focused on non-medical prescribing, including pharmacists and nurses involved in mental health management in primary care. Both pharmacists and nurses prescribe antidepressants widely, though their practices differ. The authors concluded that more qualitative research is needed while the role is positive (Alsaeed et al., 2025).

In New Zealand, clinical pharmacists prescribe the most medications for infections and pain. The authors noted that around 50% of GPs are expected to retire within the next 10 years, creating opportunities for the development of pharmacist prescribers (Raghunandan et al., 2021). In New Zealand, clinical pharmacists can prescribe most medications as GPs do; no special CPA document is necessary, as in the US (Pharmacist Prescriber Scope of Practice). Similar developments are occurring in Canada and Australia; however, collaboration within CPA and/or community pharmacies remains limited and has not yet been implemented nationally (Nakhla et al., 2024).

The impact of clinical pharmacists in the medication review process has been extensively studied. Still, the development, implementation, and evaluation of pharmacist prescribers in general practice nationally have not been described outside the United Kingdom, United States, Canada, and New Zealand. Developing models and conducting pilot trials are essential steps for successful implementation.

In this context, we describe the development, evaluation, and implementation of pharmacist prescribers in Slovenia through a 6-month prospective interventional study. We hypothesise that this collaboration will positively affect patient-reported outcomes (PROs), adherence to treatment guidelines, and improve clinically predefined outcomes.

2 Materials and methods

2.1 Settings

This study was conducted at four primary care settings in Slovenia, located in both Slovenian cohesion regions: Ormoz, Nova Gorica, Ptuj, and Jesenice. In these settings, clinical pharmacists (also referred to as pharmacist consultants) provide medication reviews (specifically, type 3 or advanced medication reviews) on behalf of GPs, using a referral paper. (Stuhec, 2021; PCNE). Type 3 (advanced) medication reviews are based on a patient's history, relevant patient information, and clinical data. They address all critical aspects outlined by the PCNE, including drug-drug interactions, side effects, unusual dosages, adherence issues, drug-food interactions, effectiveness concerns, over-the-counter medication problems, unindicated medications, missing indications, and dosage issues (Stuhec, 2021; PCNE; Stuhec et al., 2019a).

Clinical pharmacists work daily in Slovenia in primary care settings alongside GPs and have access to complete patient records, including lab test results. Participating clinical pharmacists have established a strong collaborative relationship with GPs in these primary care settings and those serving the surrounding region, including nursing home settings (Stuhec, 2021).

In Slovenia, clinical pharmacists do not have prescription authority; instead, they recommend GPs based on their medication reviews. GPs then review the medication recommendations and make the final decision (Stuhec, 2021). Medication reviews conducted by clinical pharmacists are also recognized as pharmaceutical services under Slovenian legislation (Slovenian Pharmacy Act 2016) (Stuhec, 2021).

2.2 Development

Slovenia has a relatively low number of GPs compared to Western countries, a high percentage of elderly patients, and consequently, a high prevalence of polypharmacy (Stuhec, 2021). Additionally, family medicine and clinical pharmacy are well-developed fields at the European level, creating an opportunity for pilot trial development that promotes collaboration rather than competition between the two specialties (Stuhec, 2021).

This reimbursed service, medication review in Slovenia, served as the foundation for this study. We expanded the medication review service to include pharmacist prescribers with additional monitoring. Furthermore, the Ministry of Health of the Republic of Slovenia confirmed that a pilot trial of this collaboration was necessary (October 2023). This endorsement marked a significant milestone for the initiation of the pilot. With support from the Ministry of Health, the Health Insurance Institute of Slovenia, and the Slovene Chamber of Pharmacy, the Slovenian Professional College of Family Medicine agreed to participate in the pilot trial. The Association of Patient Organisations of Slovenia also expressed support through a letter of endorsement.

The joint working group consists of representatives from the Slovene Chamber of Pharmacy—clinical pharmacist specialists with experience in pilot trials—and representatives from the Slovenian Professional College of Family Medicine—family medicine specialists with pilot trial experience. In May 2024, the Ministry of Health announced a call for a research grant titled "Examining the Benefits and Risks of Dependent Prescribing Practice in the Context of Pharmaceutical Care," with a main funding amount of 70,000 EUR for 1 year. The project's aim was to assess the feasibility of expanding the current collaboration to include dependent prescribing in pharmacist-led clinics (evaluating treatment outcomes for predefined disease states) and to identify the systemic and legislative changes necessary to incorporate this new pharmaceutical competence into the Slovenian healthcare system. The working group applied for the grant through their

TABLE 1 Review of protocols, including predefined clinical outcomes and prescription authority.

Protocol number	Protocol	Predefined clinical outcomes based on	Prescription authority
1	Lipids not in target range (dyslipidemia diagnosis)	S-LDL target value	Initiation, Adjustments, Discontinuations
2	Neuropathic pain—therapy adjustment (neuropathic pain diagnosis)	Visual Analogue Scale [VAS] target score	Initiation, Adjustments, Discontinuations
3	Blood pressure not in target range (arterial hypertension diagnosis)	Blood pressure in mmHg target value	Initiation, Adjustments, Discontinuations
4	Diabetes—HbA1c not in target range (type II diabetes diagnosis)	HbA1c target value	Initiation, Adjustment, Discontinuation (only oral medications)
5	Depression remission not achieved (unipolar depression diagnosis)	Depression remission (Patient Health Questionnaire-9 [PHQ-9] target score)	Initiation, Adjustment, Discontinuation
6	Use of anti-dementia drugs (Alzheimer's dementia diagnosis)	Mini-Mental State Examination (MMSE) target score	Initiation, Adjustment, Discontinuation
7	Gout treatment (gout diagnosis)	Uric acid level target value	Initiation, Adjustment, Discontinuation
8	Adjustments based on renal and hepatic function (renal and/or hepatic insufficiency)	Adjustments according to the Summary of the Product Characteristics	Initiation, Adjustment, Discontinuation
9	Deprescribing to optimize therapy	Priscus list criteria adherence, Medications without indication	Adjustment, Discontinuation
10	Titration of asthma medications (asthma diagnosis)	Asthma Control Test target score	Adjustment only
Out of the protocol	Only medications specified by the general practitioners (GPs) in the CPA document were allowed— (medications that GPs in Slovenia can prescribe autonomously)		

affiliations: the Medical Faculty Maribor (University of Maribor) and the Medical Faculty Ljubljana (University of Ljubljana). They were successful and received funding from October 2024 to September 2025.

The joint working group, consisting of representatives from the Slovene Chamber of Pharmacy and the Slovenian Professional College of Family Medicine, prepared all necessary protocols, including the CPA document (available in Supplementary Data sheet 3) and protocols for the included medical conditions, including predefined outcomes (Supplementary Data sheet 4). GPs could authorize clinical pharmacists to prescribe either a single medication for a specific condition or all medications permitted for prescribing in Slovenia (as specified in the CPA). The participating GPs had the discretion to select these options. Clinical pharmacists could prescribe only after GPs confirmed diagnoses, and prescriptions had to be digitally signed by the GPs before dispensing (no emergency or acute prescriptions). Patients and GPs could withdraw from the collaboration at any time during the study.

Five clinical pharmacists with primary care experience were invited to participate in the trial. Each has more than 5 years of experience conducting medication reviews in primary care settings, which was essential for the pilot's success, given their established collaborative relationships.

The working group established primary outcomes for each condition. Each protocol includes a 6-month target value, a measurement scale, and relevant clinical guidelines. The focus was on clinical outcomes rather than solely medication-related problems and polypharmacy; therefore, specific outcomes and target values were defined in each protocol based on relevant guidelines (e.g., depression remission, target HbA1c levels). The CPA and protocols were also discussed with GPs from the practice and were further improved during the implementation process. The protocols and CPA document were finalized and presented to all clinical pharmacists and GPs before the pilot started. The CPA addresses ten main medical conditions (10 protocols), which are summarised in Table 1. All protocols had the same format, including target outcomes, guidelines and recommendations. We have attached four protocols, which were the most frequently used, in Supplementary Material-Data sheet 4 (protocols for arterial hypertension, dyslipidemia, depression, and deprescribing).

In 2024, the Slovenian National Medical Ethics Committee granted ethical approval (16 October 2024; N#0120-330/2024-2711-3), allowing the study to commence.

The Ethical Approval application, which the working group prepared and approved, included patient information, including consent forms. The consent form was approved by the Slovenian National Medical Ethics Committee, and only patients who signed the consent form were included in the study. Patients who did not sign the consent form received only a medication review without prescribing by clinical pharmacists.

The Ministry of Health of the Republic of Slovenia compensates participants, including clinical pharmacists, GPs, and researchers (grant number V3-24041).

2.3 Type of intervention and implementation

This prospective, interventional, non-randomized study started in November 2024 and concluded in June 2025. Clinical pharmacists

provided recommendations within the medication review and additional prescribing after each patient visit. The project was introduced at the outset in four different primary care settings. Before participating, every patient provided informed consent, and only those who signed the consent form were included. Clinical pharmacists conducted medication reviews and prescribed additional medications in a CPA, confirming the second appointment. They could prescribe medications on behalf of the GP, who specified which medication groups the pharmacists were authorized to prescribe in a CPA.

Throughout the study, clinical pharmacists monitored patients from the enrollment to the end of the pilot trial. Each patient was assessed at least three times: at enrollment (baseline), the second visit (after 2 months), and the last visit (6 months after the first). Pharmacists could contact patients more frequently, if necessary, but outcomes were only recorded at these three main points. Pharmacists prescribed medications in the same way GPs prescribe in Slovenia. Prescriptions were entered into the eSystem and confirmed by GPs, enabling drug dispensation at community pharmacies. GPs were required to specify the reason for any non-acceptance within the eSystem. Medication reviews were documented in the primary care setting's eSystem. Each patient received three medication reviews, and prescriptions were recorded within the eSystem, allowing GPs to confirm, modify, or reject the prescriptions. The patient was informed about the next visit through the e-Invitation or by the care setting's informant. Clinical pharmacists also notified patients that their prescriptions would be ready at the pharmacy in a few days. All five clinical pharmacists included in the pilot completed medication reviews using the standardized form approved by the Slovene Chamber of Pharmacy (Stuhec, 2021). Clinical pharmacists provided recommendations within the medication review and additional prescribing after the patient's visit.

2.4 Inclusion and exclusion criteria

Selection criteria were based on GP referrals. Only patients with an established diagnosis for various conditions were included. GPs primarily referred patients with some pharmacological issues, such as untreated conditions or variations in achieving target outcomes. Therefore, the study population was not focused on patients with polypharmacy, who are typically included in medication reviews in Slovenia. Instead, the working group concentrated on conditions that had not yet been treated and their clinical outcomes for established diagnoses (e.g., depression remission). The study included patients from all primary care settings involved in the pilot trial. Referrals were made solely based on the GP's referral paper, which included the CPA document. Both the patient and the GP had to sign the CPA. The population consisted of all patients referred to the clinical pharmacist. Each patient was included in the study only once.

The inclusion criterion was that the clinical pharmacist had made at least one suggestion to modify the therapy during the medication review (at least one prescription including deprescription). Only patients for whom all three medication reviews were completed and who completed the entire study period were included in the final analysis.

2.5 Outcomes

The patients' key characteristics (age, gender, number of medications, drug-drug interactions [DDIs], and potentially inappropriate medications [PIMs]) were assessed. DDIs were identified using the Lexicomp Online® database and categorized as X-type (contraindicated) and D-type (major). To identify PIMs in elderly patients, we referred to the latest Priscus List 2.0 (Mann et al., 2023). We also included the number of patients' visits to GPs' settings in the 3 months before and after the first medication reviews. Drug-related problems (DRPs) were categorized according to the Slovenian classification of drug-related problems (DRP-SLO-V1) (Horvat and Kos, 2016).

The primary outcomes were changes in PROs. PROs evaluated included quality of life (assessed via EQ-5D-VAS), quality-adjusted life years (QALYs), and the Medication Appropriateness Index (MAI). Effect size (Cohen's d) for differences in quality of life based on EQ-5D-VAS between study points and 95% confidence intervals (CIs) was calculated. The MAI was assessed during the study, excluding question N#10 (cost-effectiveness). Utility scores were derived from EQ-5D-VAS scores. Differences in QALYs were calculated using the trapezoidal rule. The Anticholinergic Burden score was also calculated using the Anticholinergic Burden Calculator (Hanlon et al., 1992; Anticholinergic Burden Calculator).

The secondary outcomes included the prescription acceptance rate by GPs (%), the description of prescriptions provided by clinical pharmacists, and adherence to treatment guidelines for the defined conditions. The effect size, expressed as odds ratios (OR) with 95% confidence intervals (CI), was calculated for adherence to treatment guidelines.

The tertiary outcomes were focused on predefined clinical outcomes. They included describing the protocols prescribed by clinical pharmacists, the acceptance rate (%), and the change in the number of prescriptions reaching the predefined clinical outcomes (end/baseline). The effect size as OR, with 95% CI, was calculated for adherence to the predefined clinical outcomes. These outcomes included: diabetes management (HbA1c and blood glucose), lipid levels (LDL-C), neuropathic pain (Visual Analogue Scale [VAS]), depression remission (Patient Health Questionnaire-9 [PHQ-9]), controlled blood pressure (measured in mmHg), cognitive function (Mini-Mental State Examination [MMSE]), gout (uric acid level), renal and hepatic dose adjustments (based on the Summary of Product Characteristics), asthma control (Asthma Control Test), and deprescribing (Priscus list). Based on the latest treatment guidelines, the working group confirmed target values for all outcomes included in the protocols before the study. It incorporated them into the pharmacists' prescriber protocols.

In addition to patient-reported outcomes (PROs) and clinical outcomes, we assessed the impact of pharmaceutical interventions on reducing treatment costs by conducting a simple cost-benefit analysis (CBA). Since Slovenian data were not available, we used data on the financial values of individual pharmacist interventions from a study by Lee et al., conducted in the United States (Lee et al., 2002). They included the following interventions: discontinuation of

X DDI, dose adjustments, discontinuation of duplication in therapy, initiation of medication for an untreated condition, discontinuation of medication without an approved indication, and other interventions such as drug discontinuation and initiation. These values were then adjusted to 2025 prices using the CPI Inflation Calculator. Total costs for medication reviews during the study were calculated based on data from the Health Insurance Institute of Slovenia: EUR 59 for the first medication review and EUR 41.3 for subsequent reviews; for patients on 10 or more medications, the cost was double that of EUR 59.

2.6 Data collection

Data collection began after the study started. The Working Group prepared a Microsoft Excel 2016 worksheet, which the researchers used to record the data. Data were collected from patients' medical records, Slovenian central digital prescription registry, and the eSystem across primary care settings. The three main research points corresponded to three medication reviews: at enrollment (time 0), after 2 months (first review), and after 6 months (second review). To ensure anonymity, we encrypted data for patients, clinical pharmacists, and GPs. Information about prescriptions was obtained from the eSystem and patients' charts.

Four researchers (M.K., A.B., M.S., B.K.), all experienced clinical pharmacists and researchers, collected and extracted data from November 2024 to June 2025. M.S. primarily conducted statistical analysis, and all authors approved the results.

Other researchers contributed to various aspects of the study, including reviewing, interpretation, and providing external review to help minimize bias.

2.7 Statistics

We used descriptive statistics to summarize the main characteristics of the study. Numerical results were expressed as sums, with standard deviations (SD), and minimum and maximum values where applicable. The Kolmogorov-Smirnov test was employed to assess normality. Based on the results, different statistical tests were selected: paired samples t-tests for normally distributed variables and the Wilcoxon signed-rank test for non-normally distributed variables.

The sample size was determined based on previous studies conducted in primary care settings, including a similar pilot trial in Ireland (Stuhec, 2021; Stuhec et al., 2019a; Cardwell et al., 2020) and a power analysis performed using G*Power® software. With an alpha level of 0.05, a power of 0.90 (1–β), and an effect size of 0.3, the calculated total sample size required was 115, accounting for a 20% attrition rate. Additionally, the Bonferroni correction was applied to adjust for multiple comparisons, setting a significance level of $p < 0.05$, which was modified to the adjusted p-value.

Effect sizes for continuous variables were calculated using Cohen's d, while for categorical variables, odds ratios (ORs) with 95% confidence intervals (CIs) and number needed to treat (NNT) were determined using Psychometrica®. Data analysis was performed using Microsoft Office Excel® 2016 and IBM SPSS Statistics version 26. This study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (von Elm et al., 2008). The EuroQol Group approved using EQ-5D-VAS for study purposes in November 2024.

3 Results

3.1 General results

This study included 126 patients who received medication reviews from clinical pharmacists, including prescribing based on the CPA document. In this study, 23 GPs participated and referred patients to clinical pharmacists. Four of five clinical pharmacists completed the study because one of them left and did not continue the project due to severe health problems. Of these, 119 patients with a mean age of 72.3 years (SD = 10.0) were eligible for the final analysis due to complete data sets (94.5%). Men accounted for 51.3% (N = 61) of participants, women for 48.7% (N = 58). The mean age of the patients at baseline was 72.3 years (SD = 10.0), and they had an average of 7.68 diagnoses (SD = 3.9).

On average, patients were prescribed 9.85 (SD = 4.8) medications at baseline, 10.2 (SD = 4.6) after the second visit, and 10.0 (SD = 4.5) medications at the end of the pilot trial. Clinical pharmacists provided 446 recommendations during medication reviews (mean per review: SD = 1.8; maximum 10, minimum 1) in the first medication review. GPs accepted 387 of these recommendations, resulting in an acceptance rate of 86.7%, and 348 recommendations were continued until the end of the study (89.9%). The Flowchart is presented in Figure 1.

At the baseline, patients had an average of 16 X-type DDIs (0.13 per patient, SD = 0.43) and 132 D-type DDIs (1.12 per patient, SD = 1.2). The number of X-type DDIs decreased non-significantly to 9 (0.08 per patient, SD = 0.350; p = 0.71). All X-type DDI interactions persisted until the end of the study. The number of D-type DDIs was reduced to 99 after the second visit (0.83 per patient, SD = 1.195) and increased slightly to 100 by the end of the study. The difference between the baseline and the last visit was statistically significant (p = 0.013), as was the difference between the baseline and the first visit (p = 0.009).

At baseline before medication review, patients had an average of 180 PIMs listed in Priscus (mean 1.86, SD = 1.6). This number decreased significantly following medication review, 138 PIMs (mean 1.42, SD = 1.40; p = 0.000) and further reduced to 128 (mean 1.32, SD = 1.09; p = 0.000) by the end of the study.

3.2 Primary outcomes

One hundred and nineteen patients were included in the quality of life study, as well as the MAI and anticholinergic Burden scores. Quality of life, according to the EQ-5D VAS, increased from 63.6/100 (SD = 18.7) at baseline to 68.5/100 (SD = 15.7) after the second visit, and to 71.4/100 (SD = 15.9) after the end of the study. The differences were statistically significant (baseline vs. 2 months; p = 0.001; baseline vs. 6 months; p = 0.000; and 2 months vs. 6 months; p = 0.002). The changes in quality of life over the study period are presented in Figure 2.

The calculated difference in QALYs was 0.0252 between baseline and the end of the study, 0.00408 between baseline and 2 months, and

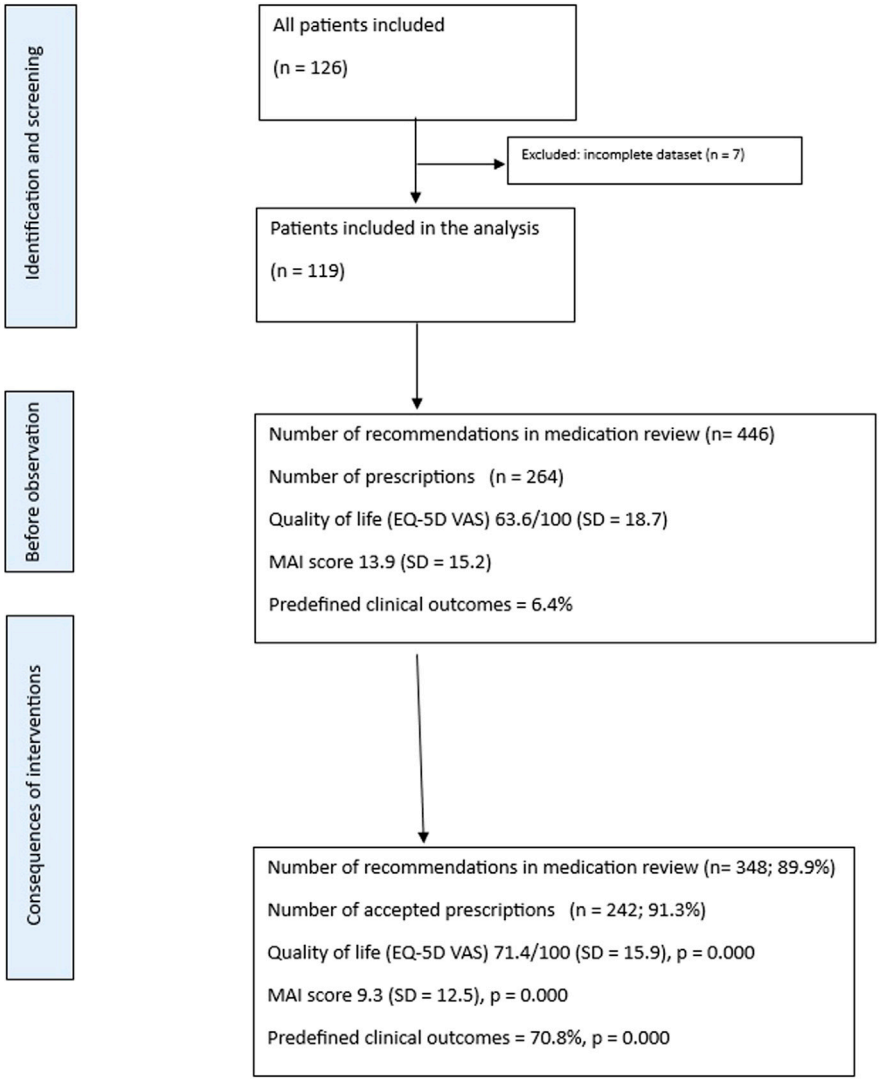

FIGURE 1
Flowchart.

0.02117 between 2 months and the end of the study. The effect size (Cohen's d) was 0.448 between baseline and the end of the study, with a 95% confidence interval (CI) of 0.084–0.812. The number needed to treat (NNT) was 4.0.

The average medication appropriateness index (MAI) score per patient decreased significantly during the study (p = 0.000 for all comparisons). The MAI score declined from 13.9 (SD = 15.2) at baseline to 10.7 (SD = 13.0) at 2 months and to 9.3 (SD = 12.5) at 6 months (end of the study). The differences were statistically significant (baseline vs. 2 months; p = 0.000; baseline vs. 6 months; p = 0.000; and 2 months vs. 6 months; p = 0.000). Changes in the mean MAI score per patient over the study period are shown in Figure 3.

The calculated effect size (Cohen's d) was −0.361 between baseline and the end of the study, with a 95% confidence interval (CI) of −0.723 to −0.002. The number needed to treat (NNT) was 4.9.

The Anticholinergic Burden score also decreased significantly during the study (p = 0.001 for baseline vs. 6 months; p = 0.000 for baseline vs. 2 months; p = 0.240 for 2 months vs. 6 months), from 3.3 (SD = 4.3) at baseline to 2.8 (SD = 3.6) at 2 months, and remaining at 2.8 (SD = 3.8) at 6 months.

The number of GP visits per patient was non-significantly lower in the 3 months before the study (mean 4.24, SD = 3.5) than in the 3 months after the study began (mean 4.20, SD 4.1).

Clinical pharmacists reduced costs by EUR 456,619 (including discontinuation of 7×DDIs, 145 dose adjustments, nine duplicate discontinuations, 67 initiations for untreated conditions, 48 non-approved medication discontinuations, and 282 other interventions). This results in a return on investment *(ROI)* of EUR 22.3 for every EUR 1 invested. Even with additional sensitivity analysis, including interventions priced 50% lower than the original estimates, the return on investment (ROI) would be approximately 10:1.

3.3 Secondary outcomes

Clinical pharmacists prescribed 264 prescriptions to 119 patients during the study (from 265 included in the

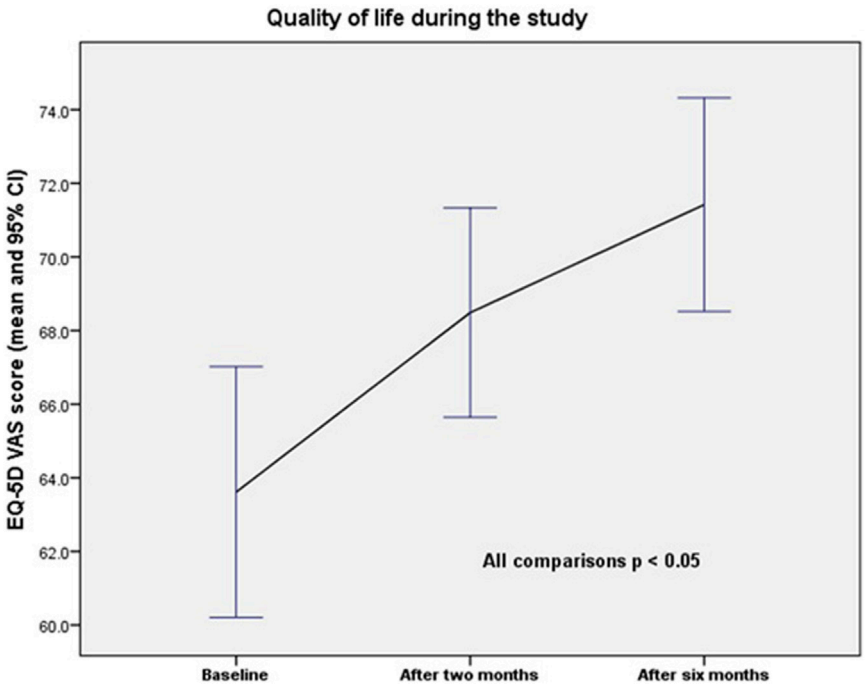

FIGURE 2
Quality of life during the study using EQ-5D VAS score.

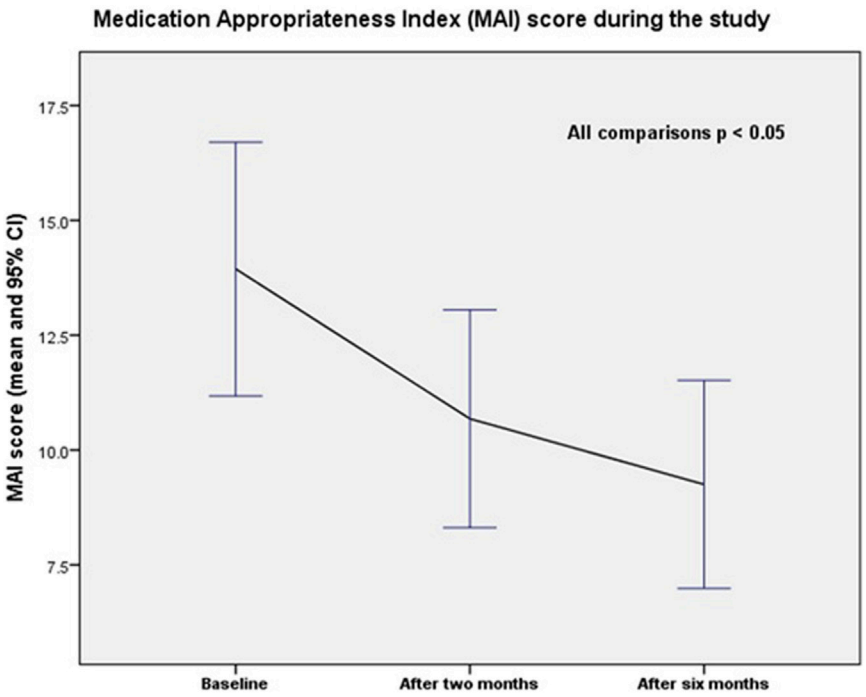

FIGURE 3
Medication Appropriateness Index (MAI) score during the study.

protocol), with a mean of 2.23 prescriptions per patient. GPs accepted 242 prescriptions issued by clinical pharmacists, resulting in an acceptance rate of 91.3%. The most frequently prescribed medications were rosuvastatin (28 prescriptions), followed by the rosuvastatin/ezetimibe combination (15 prescriptions) and pantoprazole (12 prescriptions). The most

common reasons for prescribing were dyslipidemia (56 prescriptions), deprescribing (48 prescriptions), arterial hypertension (52 prescriptions), diabetes (29 prescriptions), depression (22 prescriptions), neuropathic pain (14 prescriptions), and dementia (10 prescriptions).

According to the DRP (Drug-Related Problem) classification, 192 prescriptions (72.8%) addressed and resolved the problems, while 40 prescriptions (15.1%) involved partially solved issues, and 23 prescriptions (8.7%) had unresolved problems. By the end of the study, 222 prescriptions (83.8%) were continued, and GPs changed 27 prescriptions (10.2%). Adherence to treatment guidelines improved significantly during the study (72 vs. 236 prescriptions; 29.8% vs. 90.9%; p = 0.000). The effect size, expressed as an odds ratio (OR), for adherence was 25.7 (95% CI: 15.6–42.4).

According to the clinical pharmacists' final medication review, 204 prescriptions (77%) were positively evaluated in terms of reaching clinical outcomes, while 26 prescriptions (9.8%) were partially positive, and 15 cases (5.7%) were negative. Only 22 prescriptions were not accepted by GPs—in 10 cases, the patient did not want to take the new prescription; in six cases, there was no data; and in six cases, no reasons for the change were provided.

Clinical pharmacists prescribed new medications after the second visit in 69 cases, with only four prescriptions not maintained over 6 months, resulting in a 94.2% acceptance rate. All results relating to the secondary outcomes are summarised in Supplementary Material-Data sheet 1.

3.4 Tertiary outcomes

A total of 253 medications out of 264 were prescribed through the defined protocol. Only 11 prescriptions were issued outside the protocols (for nociceptive pain, osteopenia, and insomnia), as GPs specified these medications in the CPA. The majority of medications were prescribed (and also deprescribed) according to the deprescribing protocol (64 cases, 25.3%), followed by the dyslipidemia protocol (55 cases, 21.7%), arterial hypertension (32 cases, 12.6%), depression (25 cases, 9.9%), kidney and liver dose adjustments (21 cases, 8.3%), type II diabetes (23 cases, 9.1%), neuropathic pain (15 cases, 5.9%), dementia (9 cases, 3.6%), gout (6 cases, 2.4%), and asthma (3 cases, 1.2%).

Of the 253 medications prescribed through the protocols, GPs accepted 234, with only 18 prescriptions not accepted (acceptance rate: 92.5%). At the end of the study, 166 prescriptions accepted by GPs achieved the predefined outcomes for the conditions specified in the protocols (170 prescriptions, 73% of accepted prescriptions). According to the DRP classification, 169 prescriptions were resolved according to protocols (67%), followed by 49 prescriptions that were partially resolved (19%) and 27 prescriptions that remained unresolved (11%). Combining solved and partially resolved problems means that 86% of DRPs were addressed. The most common partially resolved problems were associated with improved outcomes when the target value was not achieved (e.g., a 5-point reduction on the PHQ-9, lower HbA1c levels). The number of prescriptions reaching the predefined clinical outcomes was significantly higher at the study's end than at baseline (170 vs. 16; 70.8% vs. 6.4%; p = 0.000). The effect size (OR) for adherence to treatment guidelines was 33.9 (95% CI: 19.1–60.4). The results were also statistically significant for arterial hypertension, deprescribing, dyslipidaemia, depression, and kidney and liver dose adjustments (p = 0.000), and less significant for neuropathic pain (p = 0.005) and diabetes mellitus (p = 0.034).

All of the tertiary outcomes are summarised in Supplementary Material-Data sheet 2.

4 Discussion

This is the first nationally supported study to include pharmacists as prescribers outside of English-speaking countries, and the first in Europe outside the United Kingdom focused on primary care. In this context, the results are broadly applicable to other healthcare systems, developing interprofessional collaboration between GPs and clinical pharmacists focused on clinical pharmacist prescribing.

A similar pilot project was undertaken in Europe, although only in the United Kingdom, when pharmacist prescribers were developed and integrated into the United Kingdom healthcare system in 2003 (Tonna et al., 2007). They initiated collaboration with the CPA document, which enabled clinical pharmacists to prescribe. This collaboration became a standard of care in the United Kingdom. The authors reported positive outcomes during development, including patient views and adherence to treatment guidelines (Tonna et al., 2007). Another paper reported that all stakeholders, including GPs, supported pharmacists as dependent prescribers. However, they also noted that GPs expressed concerns about pharmacists' independent prescribing. The authors suggested that pharmacists must develop new competencies and provide sufficient explanations to patients before the first consultation (Stewart et al., 2009). This development led to independent pharmacist prescribing, which was implemented in the United Kingdom in 2006, introducing additional competencies for independent prescribers (Tonna et al., 2007).

The first significant finding of our study is that pharmacist prescribers positively impact PROs, including quality of life and medication appropriateness. There is limited data on the impact of medication review on quality of life. One systematic review, including 31 randomised controlled trials, showed minimal effect on quality of life (Huiskes et al., 2017). The authors also noted the poor quality of the data and called for further studies on this topic (Huiskes et al., 2017). Previously, a small Slovenian prospective study, which included only 24 patients, also reported a positive impact of clinical pharmacists' interventions in medication review on quality of life (Stuhec et al., 2019b). The researchers found that, after 2 months in a Slovenian nursing home, the total number of PIMs and DDIs was significantly decreased, and quality of life increased (p < 0.05). The clinical pharmacist did not have prescribing rights but provided medication review, which has been reimbursed nationally since 2017 (Stuhec, 2021; Stuhec et al., 2019b). Our study demonstrated that medication reviews, including pharmacist prescribers, lead to improved quality of life. We also observed a very positive impact on the MAI, with a moderate effect size, consistent with a systematic review published on this subject (Riordan et al., 2016).

The second important finding relates to the high prescription acceptance rate by GPs (91.3%), indicating successful collaboration. This can be explained by the long-term cooperation between clinical pharmacists and GPs in these primary care settings, where clinical pharmacists have worked for many years as ambulatory pharmacists providing medication reviews (Stuhec, 2021). This acceptance rate was considerably higher than that observed for the medication review service in Slovenia (90% vs. 50%). We propose the main reason for this is the close collaboration with GPs and the active communication maintained throughout the study. By contrast, medication reviews in Slovenia, usually do not include subsequent monitoring of patients as was the case in our study (Stuhec, 2021). This collaboration is essential to expand prescribing rights to non-medical professionals, such as clinical pharmacists. Clinical pharmacists assisted GPs in taking over some tasks, which has also been positively reported in primary care settings in the United Kingdom (Hasan Ibrahim et al., 2022). In this study, the United Kingdom involved 203 general practices; approximately two-thirds of GPs (62.4%, n = 126) reported that pharmacists were qualified as independent prescribers, and 83.6% believed that clinical pharmacists possessed sufficient skills to provide safe and effective treatment. Most GPs (>85%) expressed largely positive attitudes towards collaboration with practice-based pharmacists and noted that this collaboration could enhance cooperation between GPs and pharmacists (Hasan Ibrahim et al., 2022).

In our study, we found that clinical pharmacists prescribed the most medications for dyslipidaemia, arterial hypertension, diabetes, and depression. Deprescribing also represented an important aspect of care. These results align with the US collaborative care model, which utilises the CPA document, where clinical pharmacists prescribe medications most frequently for these conditions (Choe et al., 2018; American Pharmacists Ass ociation (APhA); Finley et al., 2003). We also demonstrated that adherence to treatment guidelines improved significantly, which is consistent with our previous studies, including medication review in Slovenia (Stuhec, 2021).

The third important finding relates to clinical outcomes, which improved significantly during our prospective study. Clinical pharmacist prescribers achieved positive clinical outcomes in nearly 70% of patients, indicating noteworthy results. Our results are in line with previous studies on this type of collaboration (Weeks et al., 2016; Finley et al., 2003). Additionally, the findings showed a very high acceptance rate when pharmacists utilised protocols (92%), further indicating that protocols benefit pharmacists and GPs. This suggests that clinical pharmacist prescribers, in collaboration with GPs, could constitute an essential team for enhancing clinical outcomes. Improvements in clinical outcomes were observed across almost all protocols, particularly in diabetes, dyslipidaemia, depression, and arterial hypertension. In addition, collaboration with a clinical pharmacist resolved or partially resolved 86% of DRPs, indicating that, even when target outcomes were not fully achieved, this collaboration still led to significant improvements in many patients (e.g., patients with depression who showed a response but did not achieve remission). This suggests that a longer study may demonstrate an even higher proportion of patients reaching target outcomes.

In our study, clinical pharmacists monitored patients with complex comorbidities, often involving multiple medications. These findings are especially significant in this context and demonstrate that clinical pharmacists and prescribers can effectively manage various conditions and complex cases. Many patients with these comorbidities do not achieve the recommended target values (Kessler et al., 2003; Lech et al., 2022; Smolders et al., 2009; Redon et al., 2016; Shrivastav et al., 2018). Our study showed that clinical pharmacist prescribers improve the percentage of patients who reach target values across different conditions. This could be valuable for managing chronic conditions in Slovenia and beyond. For example, in depression treatment, clinical pharmacists helped 19/25 (76%) reach target values, compared with only 5% at baseline. This aligns with other studies showing that clinical pharmacists can effectively manage depression in primary care and improve its current management (Finley et al., 2003). Similar improvements were seen in our study for arterial hypertension, diabetes, and dyslipidemia, where clinical pharmacist prescribers increased the percentage of patients achieving target values to 70%, 40%, and 48%, respectively. This approach could be evaluated in future randomised prospective studies.

This study also shows that monitoring by clinical pharmacists is beneficial, as they are able to follow patients and assess long-term outcomes. In Slovenia, medication reviews are based on a single assessment rather than ongoing monitoring, which was the approach taken in our study (Stuhec, 2021). Our findings are consistent with the Committee of Ministers' Resolution CM/Res (2020)3 on the Implementation of pharmaceutical care for the benefit of patients and health services, which supports monitoring by clinical pharmacists (Committee of Ministers Resolution CM/Res, 2020). These results are therefore valuable for the implementation of medication reviews, which have been successfully introduced in Slovenia but could be further developed by shifting from single reviews to ongoing monitoring. Such a change would strengthen collaboration between GPs and clinical pharmacists. As we have shown, this could improve clinical outcomes. This would mean that subsequent appointments, after the initial one, would be initiated by the clinical pharmacist rather than the GP. This study also demonstrated positive pharmacoeconomic outcomes. Based on an additional sensitivity analysis—assuming intervention costs were 50% lower than the original estimates—the return on investment (ROI) would be approximately 10:1, thereby strengthening the case for reimbursement by the Health Insurance Institute of Slovenia. Financial coverage is crucial, and the Health Insurance Institute of Slovenia should therefore consider reimbursing this service (including additional reimbursement for prescribing).

In addition, the study revealed some other significant findings, such as the impact on the number of medications, PIMs, and DDIs. The number of medications did not change significantly, which could be attributed to GP referrals. GPs prescribed medications for known conditions but referred patients for whom they did not initiate new medications; therefore, pharmacists prescribed and monitored these patients. Conversely, the number of PIMs and type D DDIs decreased significantly, representing a positive outcome. In our study, clinical pharmacists also successfully deprescribed many medications, particularly proton pump inhibitors and benzodiazepines. Proton pump inhibitors are among the most prescribed medication groups worldwide and are often overprescribed. In this context, clinical pharmacist

prescribers play an essential role in rational deprescribing within this population (Muheim et al., 2021). The number of patients visiting the general practice did not significantly differ. However, this was limited to a 3-month monitoring period.

These results align with a study on pharmacist prescribers in the United Kingdom (Alharthi et al., 2023). In this study, researchers examined medications prescribed by clinical pharmacist prescribers in 284 of 370 residents across United Kingdom care homes. They analysed the relationship between the number of medicines stopped and various contextual factors (such as the number of residents cared for, pharmacist employment within the associated medical practice, previous care home experience, hours active within the trial, years of experience as a pharmacist, and prescriber status). The authors found that the number of residents and employment of pharmacist independent prescribers within a medical practice were positive predictors of deprescribing (Alharthi et al., 2023). The positive impact of clinical pharmacists on reducing PIMs and DDIs was previously demonstrated in medication reviews conducted in Slovenia (Stuhec, 2021).

This study has several limitations that should be acknowledged. Firstly, it was not a randomised controlled trial (comparison with usual care), which limits the generalisability of the findings. This design was chosen because the study population is multimorbid, with many medication-related issues, and is comparable in clinical characteristics to populations in real settings. Additionally, comparable pilot studies have also employed this approach (Cardwell et al., 2020). Moreover, we aimed to reflect real clinical situations with minimal exclusion criteria. Quality of life is a recommended outcome measure in elderly patients with multiple comorbidities, as it reflects daily clinical practice. This could also be considered one of the strengths of our study, as it included quality-of-life measurements, which are recommended in studies involving elderly patients with multimorbidity (Stuhec et al., 2019b). Another limitation relates to the relatively small effect size, which was influenced by the limited number of primary care settings and clinical pharmacists involved. However, sample size calculations mitigated this, ensuring sufficient statistical power for the study. We should also mention possible selection bias, as GPs referred patients to a clinical pharmacist prescriber. This was inherent to the nature of the pilot trial. Since pharmacist prescribers have not yet been studied at the national level, our starting point was the existing medication review service in Slovenia, which is already established. Additionally, selection bias may be associated with the four primary care settings chosen, which were selected based on previous good collaboration between clinical pharmacists and GPs in these institutions—an essential factor for conducting this pilot project. Another limitation relates to the prescription type, as GPs must confirm each prescription. This was one of the most significant limitations at the outset of the project, as clinical pharmacists do not have prescribing rights in Slovenia, and this should have been planned accordingly. The Slovenian National Medical Ethics Committee approved the ethical aspect of prescribing by clinical pharmacists, which was essential for this study. The study did not assess the level of trust between GPs and clinical pharmacists. We are currently conducting qualitative research, including semi-structured interviews with 16 participants (patients, GPs, and pharmacists). The findings will be published in a subsequent paper.

On the other hand, our pilot trial represents the first national pilot project on pharmacist prescribers in Europe outside the United Kingdom, providing essential information for all GPs and clinical pharmacists who aim to develop this type of collaboration across Europe and beyond. This pilot could serve as a basis for systemic reimbursement and legislative changes in Slovenia, enabling clinical pharmacists' prescribing rights, similar to those in the US. Additionally, we have developed a CPA document and protocols that could be implemented nationally and adapted for use in other countries. A further essential step is for the Slovene Chamber of Pharmacy to establish the necessary education and certification programmes for pharmacist prescribers in Slovenia. Similar competencies have already been developed for clinical pharrmacists in Slovenia (Stuhec, 2021).

In conclusion, this is the first national study describing the impact of pharmacist prescribers in primary care settings outside the United Kingdom. The study demonstrates that prescriptions made by clinical pharmacists in collaboration with GPs, as specified in the CPA, improved patient-reported outcomes (PROs) and clinical outcomes for predefined chronic non-communicable conditions and showed positive economic results. The results of this pilot are broadly applicable in different settings and could promote the development of collaborative practice models in many countries. Further qualitative research involving patients, GPs, and clinical pharmacists is necessary to gather additional insights, such as acceptability and enabling actions for systematic implementation in national healthcare systems.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/Supplementary Material.

Ethics statement

The studies involving humans were approved by Slovenian National Medical Ethics Committee granted ethical approval (16 October 2024; N#0120-330/2024-2711-3). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MS: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review and editing. AK: Writing – original draft, Writing – review and editing. MK: Writing – original draft, Writing – review and editing. AB: Writing – original draft, Writing – review and editing. BK: Writing – original draft, Writing – review and editing. DM: Writing – original draft, Writing – review and editing. SG: Writing – original draft, Writing – review and editing. EG: Writing – original draft, Writing – review and

editing. VH: Writing – original draft, Writing – review and editing. AS: Writing – original draft, Writing – review and editing. DR: Writing – original draft, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author MS declared that they were an editorial board member of Frontiers in Psychiatry. This had no impact on the peer review process and the final decision.

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Supplementary material

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References

Alharthi, M., Scott, S., Alldred, D. P., Holland, R., Hughes, C., Birt, L., et al. (2023). Pharmacist-independent prescriber deprescribing in UK care homes: contextual factors associated with increased activity. *Br. J. Clin. Pharmacol.* 89 (4), 1509–1513. doi:10.1111/bcp.15643

Alliabi, F. J. A., Jaber, A. A. S., Jallo, M. K. I., and Baig, M. R. (2022). Adherence of physicians to evidence-based management guidelines for treating type 2 diabetes and atherosclerotic cardiovascular disease in Ajman, United Arab Emirates. *BMC Prim. Care* 23 (1), 70. doi:10.1186/s12875-022-01672-4

Alsaeed, B. A., Hall, J., and Keers, R. N. (2025). Exploring non-medical prescribing for patients with mental illness: a scoping review. *BMC Psychiatry* 25 (1), 504. doi:10.1186/s12888-025-06938-6

American Pharmacists Association (APhA) Collaborative practice agreements and pharmacists patient care services. Available online at: https://www.aphafoundation.org/collaborative-practice-agreements (Accessed August 18, 2025).

American Pharmacists Association (APhA) Collaborative practice agreements and pharmacists patient care services. Available online at: https://www.aphafoundation.org/collaborative-practice-agreements (Accessed August 29, 2025).

Anticholinergic burden calculator. Available online at: https://www.acbcalc.com/ (Accessed August 25, 2025).

Bennie, M., Santa-Ana-Tellez, Y., Galistiani, G. F., Trehony, J., Despres, J., Jouaville, L. S., et al. (2024). The prevalence of polypharmacy in older Europeans: a multi-national database study of general practitioner prescribing. *Br. J. Clin. Pharmacol.* 90 (9), 2124–2136. doi:10.1111/bcp.16113

Cardwell, K., Smith, S. M., Clyne, B., McCullagh, L., Wallace, E., Kirke, C., et al. (2020). Evaluation of the general practice pharmacist (GPP) intervention to optimise prescribing in Irish primary care: a non-randomised pilot study. *BMJ Open* 10 (6), e035087. doi:10.1136/bmjopen-2019-035087

Carter, M., Chapman, S., Rogers, P., and Watson, M. (2024). Practice pharmacists and their influence on prescribing in UK general practice: a cross-sectional study. *Int. J. Pharm. Pract.* 32 (1), 69–75. doi:10.1093/ijpp/riad075

Chisholm-Burns, M. A., Kim Lee, J., Spivey, C. A., Slack, M., Herrier, R. N., Hall-Lipsy, E., et al. (2010). US pharmacists' effect as team members on patient care: systematic review and meta-analyses. *Med. Care* 48, 923–933. doi:10.1097/MLR.0b013e3181e57962

Choe, H. M., Lin, A. T., Kobernik, K., Rockey, N. G., Ashjian, E. J., Dorsch, M. P., et al. (2018). Michigan pharmacists transforming care and quality: developing a statewide collaborative of physician organizations and pharmacists to improve quality of care and reduce costs. *J. Manag. Care Spec. Pharm.* 24 (4), 373–378. doi:10.18553/jmcp.2018.24.4.373

Committee of Ministers Resolution CM/Res (2020). 3 on the implementation of pharmaceutical care for the benefit of patients and health services. Available online at: https://go.edqm.eu/ResPhCare20203 (Accessed August 29, 2025).

Cope, L. C., Abuzour, A. S., and Tully, M. P. (2016). Nonmedical prescribing: where are we now? *Ther. Adv. Drug Saf.* 7 (4), 165–172. doi:10.1177/2042098616646726

European health information gateway (2025). Copenhagen: World Health Organization. Available online at: https://gateway.euro.who.int/en/indicators/hlthres_71-general-practitioners-per-10-000/#id=27994 (Accessed August 29, 2025).

Finley, P. R., Rens, H. R., Pont, J. T., Gess, S. L., Louie, C., Bull, S. A., et al. (2003). Impact of a collaborative care model on depression in a primary care setting: a randomized controlled trial. *Pharmacotherapy* 23 (9), 1175–1185. doi:10.1592/phco.23.10.1175.32760

Gorup, E. C., and Šter, M. P. (2017). Number of medications or number of diseases: what influences underprescribing? *Eur. J. Clin. Pharmacol.* 73 (12), 1673–1679. doi:10.1007/s00228-017-2336-x

Hanlon, J., Schmader, K., Samsa, G., Weinberger, M., Uttech, K. M., Lewis, I. K., et al. (1992). A method for assessing drug therapy appropriateness. *J. Clin. Epidemiol.* 45, 1045–1051. doi:10.1016/0895-4356(92)90144-c

Hasan Ibrahim, A. S., Barry, H. E., and Hughes, C. M. (2022). General practitioners' experiences with, views of, and attitudes towards, general practice-based pharmacists: a cross-sectional survey. *BMC Prim. Care* 23 (1), 6. doi:10.1186/s12875-021-01607-5

Horvat, N., and Kos, M. (2016). Development and validation of the Slovenian drug-related problem classification system based on the PCNE classification V 6.2. *Int. J. Clin. Pharm.* 38 (4), 950–959. doi:10.1007/s11096-016-0320-7

Huiskes, V. J., Burger, D. M., van den Ende, C. H., and van den Bemt, B. J. (2017). Effectiveness of medication review: a systematic review and meta-analysis of randomized controlled trials. *BMC Fam. Pract.* 18 (1), 5. doi:10.1186/s12875-016-0577-x

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Koretz, D., Merikangas, K. R., et al. (2003). The epidemiology of major depressive disorder: results from the national Comorbidity Survey Replication (NCS-R). *JAMA* 289 (23), 3095–3105. doi:10.1001/jama.289.23.3095

Komwong, D., Greenfeld, G., Zaman, H., Majeed, A., and Hayhoe, B. (2018). Clinical pharmacists in primary care: a safe solution to the workforce crisis? *J. R. Soc. Med.* 111, 120–124. doi:10.1177/0141076818756618

Lech, S., Herrmann, W., Trautmann, S., Schwantes, U., Gellert, P., Behr, J., et al. (2022). Depression in primary care and the role of evidence-based guidelines: cross-sectional data from primary care physicians in Germany. *BMC Health Serv. Res.* 22 (1), 1279. doi:10.1186/s12913-022-08631-w

Lee, A. J., Boro, M. S., Knapp, K. K., Meier, J. L., and Korman, N. E. (2002). Clinical and economic outcomes of pharmacist recommendations in a Veterans Affairs medical center. *Am. J. Health Syst. Pharm.* 59 (21), 2070–2077. doi:10.1093/ajhp/59.21.2070

Maher, R. L., Hanlon, J., and Hajjar, E. R. (2014). Clinical consequences of polypharmacy in elderly. *Expert Opin. Drug Saf.* 13, 57–65. doi:10.1517/14740338.2013.827660

Mann, N. K., Mathes, T., Sönnichsen, A., Pieper, D., Klager, E., Moussa, M., et al. (2023). Potentially inadequate Medications in the Elderly: PRISCUS 2.0. *Dtsch. Arztebl Int.* 120 (1-2), 3–10. doi:10.3238/arztebl.m2022.0377

McAlister, F. A., Majumdar, S. R., Padwal, R. S., Fradette, M., Thompson, A., Buck, B., et al. (2014). Case management for blood pressure and lipid level control after minor stroke: PREVENTION randomized controlled trial. *CMAJ* 186 (8), 577–584. doi:10.1503/cmaj.140053

Midão, L., Giardini, A., Menditto, E., Kardas, P., and Costa, E. (2018). Polypharmacy prevalence among older adults based on the survey of health, ageing and retirement in Europe. *Arch. Gerontol. Geriatr.* 78, 213–220. doi:10.1016/j.archger.2018.06.018

Muheim, L., Signorell, A., Markun, S., Chmiel, C., Neuner-Jehle, S., Blozik, E., et al. (2021). Potentially inappropriate proton-pump inhibitor prescription in the general population: a claims-based retrospective time trend analysis. *Ther. Adv. Gastroenterol.* 14, 1756284821998928. doi:10.1177/1756284821998928

Nakhla, N., Leung, V., and Schwartz, K. L. (2024). Expansion of pharmacist prescribing could help improve health care access and quality. *Can. Fam. Physician* 70 (7-8), 441–443. doi:10.46747/cfp.700708441

PCNE PCNE statement on medication review 2013. Available online at: https://www.pcne.org/upload/files/150_20160504_PCNE_MedRevtypes.pdf (Accessed August 25, 2025).

Pharmacist prescriber scope of practice in New Zealand. Available online at: https://pharmacycouncil.org.nz/wp-content/uploads/2021/04/Pharmacist-Prescriber-Scope-of-Practice-reviewed-Oct-17.pdf (Accessed August 25, 2025).

Raghunandan, R., Marra, C. A., Tordoff, J., and Smith, A. (2021). Examining non-medical prescribing trends in New Zealand: 2016-2020. *BMC Health Serv. Res.* 21 (1), 418. doi:10.1186/s12913-021-06435-y

Redon, J., Mourad, J. J., Schmieder, R. E., Volpe, M., and Weiss, T. W. (2016). Why in 2016 are patients with hypertension not 100% controlled? A call to action. *J. Hypertens.* 34 (8), 1480–1488. doi:10.1097/HJH.0000000000000988

Riordan, D. O., Walsh, K. A., Galvin, R., Sinnott, C., Kearney, P. M., and Byrne, S. (2016). The effect of pharmacist-led interventions in optimising prescribing in older adults in primary care: a systematic review. *SAGE Open Med.* 4, 2050312116652568. doi:10.1177/2050312116652568

Shrivastav, M., Gibson, W., Jr, Shrivastav, R., Elzea, K., Khambatta, C., Sonawane, R., et al. (2018). Type 2 diabetes management in primary care: the role of retrospective, professional continuous glucose monitoring. *Diabetes Spectr.* 31 (3), 279–287. doi:10.2337/ds17-0024

Smolders, M., Laurant, M., Verhaak, P., Prins, M., van Marwijk, H., Penninx, B., et al. (2009). Adherence to evidence-based guidelines for depression and anxiety disorders is associated with recording of the diagnosis. *Gen. Hosp. Psychiatry* 31 (5), 460–469. doi:10.1016/j.genhosppsych.2009.05.011

Stewart, D. C., George, J., Bond, C. M., Diack, H. L., McCaig, D. J., and Cunningham, S. (2009). Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int. J. Pharm. Pract.* 17 (2), 89–94. doi:10.1211/ijpp/17.02.0003

Stuhec, M. (2021). Clinical pharmacist consultant in primary care settings in Slovenia focused on elderly patients on polypharmacy: successful national program from development to reimbursement. *Int. J. Clin. Pharm.* 43 (6), 1722–1727. doi:10.1007/s11096-021-01306-2

Stuhec, M., Gorenc, K., and Zelko, E. (2019a). Evaluation of a collaborative care approach between general practitioners and clinical pharmacists in primary care community settings in elderly patients on polypharmacy in Slovenia: a cohort retrospective study reveals positive evidence for implementation. *BMC Health Serv. Res.* 19 (1), 118. doi:10.1186/s12913-019-3942-3

Stuhec, M., Bratović, N., and Mrhar, A. (2019b). Impact of clinical pharmacist's interventions on pharmacotherapy management in elderly patients on polypharmacy with mental health problems including quality of life: a prospective non-randomized study. *Sci. Rep.* 9 (1), 16856. doi:10.1038/s41598-019-53057-w

Tonna, A. P., Stewart, D., West, B., and McCaig, D. (2007). Pharmacist prescribing in the UK - a literature review of current practice and research. *J. Clin. Pharm. Ther.* 32 (6), 545–556. doi:10.1111/j.1365-2710.2007.00867.x

Urbańczyk, K., Guntschnig, S., Antoniadis, V., Falamic, S., Kovacevic, T., Kurczewska-Michalak, M., et al. (2023). Recommendations for wider adoption of clinical pharmacy in Central and Eastern Europe in order to optimise pharmacotherapy and improve patient outcomes. *Front. Pharmacol.* 14, 1244151. doi:10.3389/fphar.2023.1244151

von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P., et al. (2008). The strengthening the reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J. Clin. Epidemiol.* 61 (4), 344–349. doi:10.1016/j.jclinepi.2007.11.008

Weeks, G., George, J., Maclure, K., and Stewart, D. (2016). Non-medical prescribing *versus* medical prescribing for acute and chronic disease management in primary and secondary care. *Cochrane Database Syst. Rev.* 11 (11), CD011227. doi:10.1002/14651858.CD011227.pub2

Pharmacist Prescriber Implementation in the Views of General Practitioners, Pharmacist Prescribers and Patients: Qualitative Study based on Pilot Trial in Slovenia

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Scope Statement

We have submitted the first qualitative study examining a pharmacist prescribing pilot outside Anglo-Saxon countries! Findings indicate broad support among stakeholders for implementing pharmacist prescribing in Slovenia, with implications for broader international applicability. A qualitative study design using semi-structured interviews was applied. These findings suggest that existing health programmes—such as the medication review service—could be expanded to incorporate longitudinal follow-up, thereby enhancing continuity of care and improving patients' safety in daily practice. We are sure that the paper will be highly cited, similar to previous papers on clinical pharmacy. We are sure that this paper fits well under the scope of this research topic - pharmacist and drug safety.

Conflict of interest statement

The authors declare a potential conflict of interest and state it below

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision

Credit Author Statement

Aleksander Stepanović: Writing – original draft, Writing – review & editing. **Alenka Kovacic**: Writing – original draft, Writing – review & editing. **Ana Banovic Koscak**: Writing – original draft, Writing – review & editing. **Barbara Koder**: Writing – original draft, Writing – review & editing. **Danica Rotar Pavlic**: Writing – original draft, Writing – review & editing. **Dunja Mahoric**: Writing – original draft, Writing – review & editing. **Eva Gorup Cedilnik**: Writing – original draft, Writing – review & editing. **MARJETKA KORPAR**: Writing – review & editing. **Matej Stuhec**: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Spela Bernik Golubic**: Writing – original draft, Writing – review & editing. **Vesna Homar**: Writing – original draft, Writing – review & editing.

Keywords

Pharmacist Prescribers, qualitative study, family medicine, medicationreview, Patients

Abstract

Word count: 301

Introduction: Pharmacist prescribing is not well established outside Anglo-Saxon countries. Qualitative evidence is required to support its integration into healthcare systems. Aim: This qualitative study, employing semi-structured interviews, explored the perspectives of general practitioners (GPs), patients, and clinical pharmacist prescribers regarding the implementation of pharmacist prescribing in Slovenia. Methods: A qualitative study design using semi-structured interviews was applied. A working group developed and piloted the interview guide. Pharmacist prescribers, GPs, and patients involved in a pharmacist prescribing pilot trial in Slovenia were invited via email. Recruitment continued until data saturation was achieved. Purposive sampling was used for recruitment. Interviews were conducted between May and August 2025, recorded, and transcribed in MAXQDA. Data were analysed thematically using the Consolidated Framework for Implementation Research (CFIR). The research team agreed upon final coding. The COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist was applied to ensure methodological rigour. Results: Seventeen participants were interviewed: four pharmacist prescribers, five patients, and eight GPs. Across all groups, participants expressed positive experiences with integrating pharmacist prescribers into the Slovenian healthcare system. Patients valued enhanced monitoring by clinical pharmacists and perceived improved quality of prescribing and clinical outcomes. GPs highlighted effective collaboration, particularly through medication review, as a foundation for pharmacist prescribing. Pharmacist prescribers reported professional satisfaction with monitoring and prescribing responsibilities. GPs and pharmacist prescribers expressed satisfaction with the collaborative practice agreement (CPA) developed in Slovenia and considered dependent prescribing the most appropriate model for initial implementation. Reported barriers included the absence of legislation, reimbursement mechanisms, and structured education. Both pharmacist prescribers and GPs emphasised the need for additional competencies for pharmacist prescribers in Slovenia. Conclusions: This is the first qualitative study examining a pharmacist prescribing pilot outside Anglo-Saxon countries. Findings indicate broad support among stakeholders for implementing pharmacist prescribing in Slovenia, with implications for broader international applicability.

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During the preparation of this manuscript/study, the authors used Grammarly to improve the linguistic clarity and accuracy of the manuscript.

Pharmacist Prescriber Implementation in the Views of General Practitioners, Pharmacist Prescribers and Patients: Qualitative Study based on Pilot Trial in Slovenia

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Keywords: pharmacist prescribers; qualitative study; family medicine; medication review; patients

Abstract

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Methods: A qualitative study design using semi-structured interviews was applied. A working group developed and piloted the interview guide. Pharmacist prescribers, GPs, and patients involved in a pharmacist prescribing pilot trial in Slovenia were invited via email. Recruitment continued until data saturation was achieved. Purposive sampling was used for recruitment. Interviews were conducted between May and August 2025, recorded, and transcribed in MAXQDA. Data were analysed thematically using the Consolidated Framework for Implementation Research (CFIR). The research team agreed upon final coding. The COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist was applied to ensure methodological rigour.

Results: Seventeen participants were interviewed: four pharmacist prescribers, five patients, and eight GPs. Across all groups, participants expressed positive experiences with integrating pharmacist prescribers into the Slovenian healthcare system. Patients valued enhanced monitoring by clinical pharmacists and perceived improved quality of prescribing and clinical outcomes. GPs highlighted effective collaboration, particularly through medication review, as a foundation for pharmacist prescribing. Pharmacist prescribers reported professional satisfaction with monitoring and prescribing responsibilities. GPs and pharmacist prescribers expressed satisfaction with the collaborative practice agreement (CPA) developed in Slovenia and considered dependent prescribing the most appropriate model for initial implementation. Reported barriers included the absence of legislation, reimbursement mechanisms, and structured education. Both pharmacist prescribers and GPs emphasised the need for additional competencies for pharmacist prescribers in Slovenia.
Conclusions: This is the first qualitative study examining a pharmacist prescribing pilot outside Anglo-Saxon countries. Findings indicate broad support among stakeholders for implementing pharmacist prescribing in Slovenia, with implications for broader international applicability.

1. Introduction

Pharmacist prescribing is a well-established practice predominantly in Anglo-Saxon countries, particularly in the United Kingdom (UK). In the UK, pharmacist prescribers were first integrated into the healthcare system in 2004 as dependent (supplementary) prescribers, and in 2006 as independent prescribers. Similar developments have occurred in New Zealand, Australia, Canada and the United States [1, 2]. Within the UK, pharmacist prescribing is particularly well integrated in primary care settings, including general practices [3]. The Collaborative Practice Agreement (CPA) is a key document that formalises the professional relationship between physicians, pharmacist prescribers, and patients within the framework of supplementary prescribing [1, 2].

In contrast to the UK, where non-medical prescribing rights have been widely extended to nurses and pharmacists - particularly through independent prescribing - prescribing rights in the United States, Canada, and Australia are generally more restricted and vary by jurisdiction. For example, nurse practitioners in certain regions of the US and Canada have near-autonomous prescribing authority, while pharmacists' prescribing rights differ considerably between regions and states [4, 5, 6, 7].

Further qualitative and cross-sectional studies are warranted to inform the development of pharmacist prescribing within healthcare systems [7]. In the UK, the evolution of pharmacist independent prescribing in primary care was preceded by supplementary prescribing in 2002. A study investigated the implementation of supplementary prescribing using telephone interviews with nine pharmacist prescribers, eight GPs, and 18 patients across six Health Board areas in Scotland [8]. Participants were generally supportive of supplementary prescribing; however, several barriers were identified. Patients reported no concerns but expressed uncertainty about what to expect during their first consultation, which initially led to apprehension. Pharmacist prescribers and GPs raised concerns regarding sustainable funding, limited professional support networks, and insufficient continuing professional development opportunities. Pharmacist prescribers strongly favoured progressing to independent prescribing, whereas GPs were more cautious, citing inadequate pharmacist prescribers'

clinical skills [8]. These findings highlight the need for pharmacists to demonstrate clinical competence to gain broader professional acceptance and underscore the importance of integrating robust clinical training within pharmacy curricula.

A subsequent study surveyed 203 general practices across Northern Ireland, focusing on clinical pharmacists qualified as independent prescribers—a standard of care since 2006 in the UK [3]. GPs expressed positive attitudes towards clinical pharmacists in prescribing roles. Approximately two-thirds of GPs (62.4%) reported that clinical pharmacists were qualified as independent prescribers, with 76.2% actively prescribing for patients. Most GPs indicated that pharmacist prescribers consistently possessed the clinical skills (83.6%) and knowledge (87.0%) required to deliver safe and effective care [3]. Respondents reported that collaboration with pharmacist prescribers improved clinical outcomes and strengthened interprofessional partnerships, increasing GP confidence in team-based care.

More recently, a 2024 qualitative study conducted remote semi-structured interviews with 20 independent pharmacist prescribers working in primary care and mental health settings [9]. The findings revealed that pharmacist prescribers frequently experienced low confidence in prescribing practice, particularly in mental health management. Both primary care and mental health pharmacists cited inadequate undergraduate training and limited postgraduate support as key challenges [9].

A systematic review of 65 studies further explored stakeholder views and experiences of pharmacist prescribing. The majority of studies originated from the UK (n = 34), followed by Australia (n = 13), Canada (n = 6), and the USA (n = 5) [10]. Twenty-seven studies examined pharmacists' perspectives, with fewer addressing those of patients (n = 12), physicians (n = 6), the general public (n = 4), nurses (n = 1), policymakers (n = 1), and multiple stakeholder groups (n = 14). Across contexts, stakeholders reported predominantly positive attitudes towards pharmacist prescribing, regardless of the stage of implementation. Key benefits included improved access to healthcare services, enhanced patient outcomes, optimised use of pharmacists' expertise, increased pharmacist job satisfaction, and reduced physician workload. Reported barriers included insufficient organisational support, limited diagnostic skills among pharmacists, restricted access to patient records, and funding constraints [10]. These findings suggest that strengthening clinical competence and addressing organisational barriers are central to successful implementation.

Outside Anglo-Saxon countries, pharmacist prescribing remains very limited. In Slovenia, clinical pharmacy services are expanding in ambulatory and primary care settings and are reimbursed nationally [11]. Clinical pharmacists typically review medications and monitor patients, but lack prescribing rights. Evidence suggests that these services reduce medication-related problems and improve patients' quality of life [11, 12]. These developments provide a favourable foundation for implementing pharmacist prescribing in Slovenia, including the introduction of supplementary (dependent) prescribing, which is currently in progress [13].

To date, no qualitative study based on a national pilot trial has explored the perspectives of key stakeholders—patients, GPs, and pharmacist prescribers—on pharmacist prescribing outside the Anglo-Saxon context. Such research is essential to inform the broader implementation of pharmacist prescribing across Europe and beyond. The present study, therefore, aimed to investigate stakeholder perspectives on the introduction of pharmacist prescribing in Slovenia, employing a semi-structured qualitative study design.

2. Materials and methods

2.1. Participants

This study included participants from the Slovenian national pilot trial of pharmacist prescribers. The pilot trial was conducted across four primary care settings in 2024-2025 and involved 23 GPs, four pharmacist prescribers, and 119 patients. Pharmacist prescribers had already provided type 3 medication reviews in these settings for several years, establishing collaboration between pharmacist prescribers and GPs. Medication review type 3 by clinical pharmacists has been reimbursed in Slovenia since 2016 [11].

Within the pilot trial, pharmacist prescribers were authorised to prescribe medicines in collaboration with GPs, based on the CPA document and disease-specific protocols [13]. They provided medication reviews, issued prescriptions, and monitored patients for six months, until the conclusion of the trial [13]. The aim of the pilot was to evaluate the clinical and humanistic outcomes of this collaboration and to assess its potential for wider implementation in the Slovenian healthcare system [13]. The quantitative results of the pilot trial were positive, including quality of life and clinical outcomes and are reported in a separate publication [14].

For the present study, a dedicated working group of five pharmacist prescribers and four GPs was established. All members brought both research experience and clinical expertise, including backgrounds as professors, practising clinical pharmacists, and GPs.

2.2. Study design

A qualitative study design using semi-structured interviews was employed. Recruitment continued until data saturation was achieved, using purposive sampling. Following the guidance of Francis et al., approximately ten interviews were considered sufficient to ensure an appropriate sample size and data saturation [15]. The researchers included four pharmacist prescribers, five patients, and eight GPs (17 participants). Four to five participants were recruited from the four primary care settings. Two primary care settings were located in the eastern regions of Slovenia, and two were in the western areas.

The working group developed and piloted the interview guide. To explore perceptions of barriers and facilitators, the updated Consolidated Framework for Implementation Research (CFIR) constructs were applied, while remaining open to the emergence of new inductively derived themes [16]. The COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist was used to ensure methodological rigour and an appropriate study design [17]. In 2024, the Slovenian National Medical Ethics Committee granted ethical approval (October 16, 2024; N#0120-330/2024-2711-3).

2.3. Recruitment

Pharmacist prescribers, GPs, and patients involved in a pharmacist prescribing pilot trial in Slovenia were invited to participate via email and telephone. All participants provided signed consent to take part in the study. Based on their activity in the pilot trial, the researchers decided to include all four pharmacist prescribers and eight GPs. GPs from each primary care setting were invited: those who had referred the highest number of patients to the pharmacist prescriber and those with the second lowest number of referrals. This strategy was designed to balance perspectives and capture reasons for high and low referral rates to the pharmacist prescriber. The pharmacist prescribers selected patients individually. Only patients without significant health impairments that could affect interview participation were invited.

2.4. Interviews and Data Collection

The interviews were conducted between May and August 2025, recorded, and transcribed in MAXQDA®. The working group developed the interview questions based on previous papers and experiences from the Slovenia pilot trial. Semi-structured questions were designed to minimise reporting bias. The working group prepared a set of common and group-specific questions. General questions focused on demographic data, including age, experience, setting, location, and gender. Specific questions addressed experiences, satisfaction with the service, implementation, outcomes, education, and reimbursement. The draft proposal was piloted among members of the research group. It was then discussed at working group meetings, where the final interview questions were confirmed. All working group members voted to approve the final version in February 2025. The complete list of questions is provided in Supplementary File 1.

All interviews were conducted by two researchers who had not participated in the pilot trial (one GP, Eva Gorup, and one clinical pharmacist, Dunja Mahoric) under the supervision of the other working group members. Both researchers have an interest and experience in qualitative research in primary care. Interviews were conducted by telephone or Zoom, audio-recorded, and transcribed into MAXQDA®. Data were collected online (at participants' homes) or in primary care centres (patients). Each interview began with an explanation of the study objectives, followed by collecting participants' background information, including their care setting and professional roles and responsibilities. Subsequently, questions were posed regarding pharmacist prescribing and its implementation. Interviews concluded with a discussion of perceived barriers to implementation.

Both researchers conducted one pilot interview with a GP (a working group member) before conducting subsequent participant interviews. Each interview lasted between 20 and 60 minutes. To minimise reporting bias, a second researcher was present at each interview to take comprehensive notes and manage the recording. No prior relationship was established between the researchers and the participants before the study commenced. GPs and pharmacist prescribers knew that Eva Gorup and Dunja Mahoric worked within the Slovenian healthcare system. Still, they had not collaborated with them during the pilot trial in primary care settings. No follow-up interviews were undertaken.

2.5. Data Analysis

Data were analysed thematically using the CFIR. Interviews were imported into MAXQDA® and transcribed using the built-in transcription function. Participants were assigned numerical identifiers. Codes and themes were generated from the transcript data within MAXQDA® and manual checking.

Two researchers (Eva Gorup and Dunja Mahoric) independently coded the transcripts. Coding was guided by the five CFIR domains (intervention characteristics, inner setting, outer setting, characteristics of individuals, and process). The analysis followed a systematic, iterative process beginning with data familiarisation, generation of initial codes, identification of preliminary themes, refinement of these themes, and finally defining and naming the themes to inform the study report. The researchers derived themes from the data. In cases of disagreement, the researcher, MS, served as the final decision-maker. Discrepancies were solved based on the negotiated census (calculation was not used). The working group met to ensure consistency between the data and the findings, and the research team reached consensus on the final coding framework. A coding tree was applied throughout the analysis.

Participants did not review the transcripts or codes. Two researchers double-coded to ensure trustworthiness. Demographic data are presented in tabular form, while codes and identified barriers are reported in tables and narrative text.

3. Results

Seventeen participants were interviewed: four pharmacist prescribers, eight GPs, and five patients. The table presents participant characteristics. Interviews lasted an average of 30 minutes.

Table. Participants characteristics

Pharmacists (n=4, PH1-PH4)		
Gender	Female Male	3 1
Location	Eastern Slovenia Western Slovenia	2 2
Years of experience as pharmacist	≤10 years 11-20 years ≥20 years	0 4 0
Family physicians (n=8, GP1-GP8)		
Gender	Female Male	6 2
Location	Eastern Slovenia Western Slovenia	4 4
Years of experience as family physician	≤10 years 11-20 years ≥20 years	2 4 2
Patients (n=5, PT1-PT5)		
Gender	Female Male	1 4
Location	Eastern Slovenia Western Slovenia	2 3
Patient age	Between 58 and 83 years	

We mapped the emerging codes according to CFIR domains (Supplementary File 2—codebook). The COREQ checklist is included in Supplementary File 3-COREQ.

3.1. Innovation

3.1.1. Innovation source

Pharmacist prescribers were familiar with international models of pharmacist prescribing.
PH2: "...I am familiar with dependent prescribing abroad and independent prescribing, mainly in the UK... and New Zealand."

3.1.2. Evidence-based

Pharmacist prescribers described following the pre-prepared protocols when prescribing for specific clinical conditions and diseases. They stressed that both the pharmacist prescribers and GPs follow the same guidelines in prescribing:
PH1: "Both GPs and pharmacist prescribers use the same guidelines. We read the same guidelines. So here I don't think there is a difference."

3.1.3. Adaptability/acceptability

All interviewed stakeholders viewed pharmacist prescribing as positive. Pharmacist prescribers noted that, with the system of clinical pharmacists already working with primary health care clinics and doing medication reviews, the basics necessary for establishing pharmacist prescribers were already present.
PH1: "Slovenia is a country that already has clinical pharmacists in primary care settings… [so] this system is already in place."
GPs repeatedly stated they found the intervention acceptable and were even enthusiastic about it.
GP4: "I believe this is the future."
At the same time, they believed not every GP would feel the same:
GP1: "We younger [GPs] find it somewhat easier to accept this collaboration than our older colleagues, or maybe the more experienced people don't need as much help."
GP3: "There will have to be a big mindset shift, necessary for all of us. But that could be positive for us and the patients."
They described how their perspective shifted during the pilot:
GP1: "I think once things started to develop, we all realised this is something positive."
They stressed that GPs' participation had to be voluntary and up to the level at which they felt comfortable.
GP4: "I support it, but it has to be consensual, in the sense that the GP has to agree to it."
GP5: "I think it's good for the GP to have a sort of an overview of it, not just completely letting it go over to the pharmacist prescriber."
The patients also voiced general approval.
PT5: "I liked it a lot. It's an advantage."
One patient described that they found the pharmacist's intervention more acceptable because the GP referred them to the pharmacist prescriber:
PT3: "I think it's good that the GP refers you to the pharmacist prescriber. [You have] more trust… because your GP knows this person."

3.1.4. Complexity

Participants described various issues that made the intervention more challenging to implement. The pharmacist prescribers encountered logistical difficulties that made the prescribing process more complex.

PH3: "My biggest barrier is that I'm not at the primary care settings all the time… if nothing else, you can discuss things over coffee breaks… Right now, everything is discussed in meetings… which means additional burden for me."

GPs didn't view the innovation as complex. Some felt that it did require some more time from them:

GP7: "All the same, it did take a little more of my time."

3.1.5. Relative advantage

Both patients and pharmacist prescribers believed that the innovation was advantageous:

PT5: "This is faster. So, you don't need the GP."

The pharmacist prescribers stressed that the most significant shift was in offering continuous pharmaceutical care:

PH3: "The biggest benefit of this project is moving from one-time pharmaceutical advisory to… actually continuous pharmaceutical management, which is a big step forward. It is priceless… to see the patient's response, how this actually looks."

The GPs also noticed the advantages of the continuous care:

GP7: "She [the pharmacist prescriber] monitored those patients more regularly than I in my clinic… we usually hand over this responsibility to the patient. Call when you run out of meds. Call… so we can do lab control. But now all this was done by the pharmacist prescriber, which was great."

GP6: "I think this might help with patients telling some more about any supplements they're taking or anything… if they go and see someone several times, not just once."

3.2. Outer setting

3.2.1. Legislation

Pharmacist prescribers were keenly aware that, according to current legislation in Slovenia, they did not have the prescribing authority.

PH4: "Currently, the legislation does not allow prescribing for pharmacists… A change of legislation will be needed… as well as the division of responsibility between a pharmacist prescriber and a GP."

GPs mentioned the need for a report from the pharmacist prescriber they collaborated with. They also stressed that the legislation should permit the pharmacist prescribers to be able to access patient data:

GP3: "I believe it's very important that they have access to all patients' medical data, because that's the only way it's going to be safe."

Patients agreed with that:

PT3: "I think it's important that the pharmacist prescribers have access to my data."

3.2.2. Professional responsibility

Pharmacist prescribers accepted that prescribing would mean more responsibility for them.
"If we implement this system in Slovenia, the responsibility for the pharmacist is certainly going to be bigger."
Some GPs felt that if a pharmacist prescribed a drug, pharmacist prescribers would have to carry the full responsibility.
GP1: "I think everyone is responsible for their own prescribing."
However, some were not so sure, mainly because of the difference between the dependent and independent prescribing:
GP6: "In a way, everyone should be responsible for prescribing. But still, the pharmacist prescriber is part of our team; they are not GPs, so I don't know how that would work." And:
"For now, we still have the complete picture and responsibility and the last word on whether to send the prescription out."
The patients were less interested in the division of responsibility between GPs and pharmacist prescribers:
PT3: "I don't care if it's Ms. X [pharmacist prescribers] who prescribes, or the GP, the main thing is that it works."

3.2.3. Patient acceptance and expectations

Pharmacist prescribers felt that patients needed an explanation about the new pharmacist role:
PH3: "Sometimes… some people had doubts, they wondered whether they'd still be able to go to their GP. We must let everyone know that we don't interfere with GP-patient relationships, but it's just the pharmacist's support."
PH1: "I think it's important [the patients] are informed enough about the pharmacist prescriber role."
They believed there was additional benefit for the patient, however:
PH3: "GPs are also busy. … They don't manage to explain some [drug-related] things so clearly to [patients]. So I think it was some additional empowerment for patients."
However, all stakeholders believed the patients accepted the new service well.
GP 1: "The patients were pleased with one more expert focused on medications."
GP2: "Patients saw this as an added value."
GP5: "Patients were thrilled because she really focused/took her time with them."
Pt3: "I liked it a lot."

3.2.4. Quality of care

Pharmacist prescribers believed the ability to prescribe would improve access to healthcare for patients:
PH1: "With this, we improve access to healthcare."
GPs believed pharmacists' prescribing helped process cases more quickly:
GP6: "I think everything went quicker. Before, I asked for a review, which took me a few days to deal with. However, we spoke on the phone and immediately dealt with it."
However, they also believed that having pharmacist prescribers on the team improved the quality of prescriptions.

GP4: "It turned out to be a powerful tool in good care for our patients."
GP6: "I think two heads are better than one. Everybody has their point of view, everyone knows the patient from another angle."
There were other ways in which, according to this, prescribing improved the quality of care:
GP1: "[The patients] had some time from my referral… to think about additional questions [for the pharmacist prescriber]."
GP5: "If we both, the GP and the pharmacist prescribers, say the same, the patient finds it easier to accept, they may trust some change more."
One GP did add a caveat:
GP8: "I see a bigger impact on quality of care than on the quantity of work done."

3.3. Inner setting

3.3.1. Collaboration between pharmacist and GPs

The pharmacist prescribers and GPs stressed that they have collaborated and had a good experience.
PH2: "This collaboration is based on mutual trust from before."
GP2: "We already collaborated well before in a medication review form, if I needed advice for any patient about any medications."
All pharmacist prescribers also mentioned they felt accepted by the GPs and were an equal part of the team.
PH4: "All the GPs who collaborated with me were interested… motivated to collaborate."
PH2: "I always felt well and that they accepted me as an equal."
One of the GPs stressed that the pharmacist prescribers and she worked as a team, mutually encouraging each other towards better results:
*GP7: "We encouraged each other, which was also good. She [said] I think we should try to go on here [*referring to increasing medication dose*], and I said yes, I think so too, and we agree. Great, let's go on."*
GPs had different opinions on which patients should be referred to pharmacist prescribers for prescribing. Patients with newly discovered chronic diseases would need a GP visit first:
GP7: "With those you just discovered, you usually have to do some other things alongside. You may have to give them a referral to something. You have to do a clinical examination. … So maybe this would be less useful than with someone who has had [a disease] for a while and you realise it's not optimally managed."
One GP preferred to refer simpler patient cases:
GP8: "These were the cases where I would probably do it quicker. Though it was nice to have them done by someone else, it was nice to have them do the follow-up, so increasing and decreasing [the dosage]. … I didn't refer any complicated cases, but specifically some cases I wanted to have optimized."
While others would preferentially refer more complicated cases:
GP1: "I think it's like referring to secondary care. You could refer everyone who has stomach troubles to a gastroenterologist, or you can solve things in your own clinic and not crowd other clinics."

Finally, several GPs pointed out that pharmacist prescribing played a different role in different patients:

GP3: "These are two different areas. One is prescribing and one is advising."

The GPs were not convinced that, at the moment, as things were set up, the pharmacist prescribing was time-saving for them:

GP8: "Really, there is no time saving, because you have to think about it, write the referral, and you still have to keep an eye on it."

GP1: "Just signing [and not having to write] the electronic prescription doesn't present a relief. But if someone did it from beginning to end, that would be a relief."

Both GPs and pharmacist prescribers were confident that collaboration was necessary; however:

GP3: "I think [collaboration] is essential for them and us. [The pharmacist prescriber] and I often spoke about that, that she only now, when she collaborates with us, sees through our eyes."

PH1: "I completely understand that in the beginning, when there is a new task and competencies… that some GPs are more reserved about it… But I think the opposite, this strengthens the GP's role."

The patient also felt GPs and pharmacist prescribers collaborated well, hinting at a sense of safety and more streamlined care:

PT5: "I believe they collaborated well."

PT3: "She consulted my GP and told me what is best for me. So I didn't need to go see my GP as well."

3.3.2. Communication

Communication between stakeholders was an essential part of the pilot project, and took both time and effort.

PH3: "In the beginning, we had a lot of direct contact, to arrange who would call the patients and things like that…"

GPs felt communication - knowing what was prescribed and why - was essential to be comfortable with pharmacist prescribing.

GP1: "I have no problem with it [pharmacist prescribing] as long as I get some report… so I can see why they did it."

GPs also appreciated direct, immediate communication with the pharmacist prescribers:

GP6: "We had no problem... The pharmacist prescribers have a constantly available cell phone, and you can get them immediately."

GP3: "She [the pharmacist prescriber] always called that she prescribed something… She always let me know and explained why she decided that way."

A GP noted that sometimes communication was difficult because of physical distance:

GP4: "There are some communication barriers, because we are not together in the office."

The pharmacist prescribers did feel that communication from the GPs' side was not sufficient:

PH4: "I couldn't easily follow, when someone did get the prescription and when they started taking medications… the communication was inadequate."

Both GPs and pharmacist prescribers believed that communication should be recorded and traced in electronic medical records. This would make it easier to follow patients and coordinate care.

GP4: "A problem of this communication in a wider sense is that this information should be saved in the long run… We need long-term follow-up and a suitable note in the chart."

PH3: "We need an implementation of this into electronic records… so that when you open up the patient, you can see that they are collaborating with a pharmacist prescriber."

The patients were delighted with pharmacists taking the time to communicate with them:

PT3: "I like that she calls every so often, and we can talk."

PT1: "She also called me once a month to see how things went."

The pharmacist prescribers felt they also needed to communicate and share experiences to help each other in complex cases.

PH3: "I think we share experiences. That's very welcome… Sometimes it means a lot to consult someone."

3.3.3. Available resources (Technical and administrative support)

The pharmacist prescribers stated they would require better support, not only administratively but also technically, to make appointments with patients.

PH2: "Technical support… could improve communication between GPs and pharmacist prescribers, and support making appointments, maybe some things could be done automatically." And: "The pharmacist prescriber should have a chance to keep a chart that the GP could also see."

PH3: "I missed some nationwide software or application. We still create reports outside these applications… we must retype a lot."

GPs agreed:

GP4: "If the reports were in the national electronic record, everyone who met this patient would be able to open it and see it."

3.3.4. Process structure

Each team adjusted the pharmacist prescribing process to their existing working collaboration. GPs interwove the referrals to pharmacist prescribers into their daily work and worked out pathways to refer patients in their clinics and a way to review the pharmacist's recommendations.

3.3.5. Effectiveness

Both GPs and pharmacist prescribers considered the effectiveness of pharmacist management in the pilot study. Both groups were realistic, stressing that it was not to be expected that management could be optimized for every patient.

PH4: "It's impossible to optimize everything how we want it."

PH3:" I think there were a few more complex cases. Maybe it didn't go the way we wanted. We pharmacist prescribers must get used to the fact that sometimes patients aren't the way we want."

Some GPs and pharmacist prescribers believed that the intervention might improve patient adherence. GPs also felt it was beneficial because another health professional gave the patients the same information they did, giving them more confidence.

GP5: "For example, for neuropathic pain, I found it really good because I think they [the patients] need to hear information about it more than once to really trust the drug, and so that went really well and I was happy."

However, one GP commented that they would have liked for the pharmacist prescribers to manage more patients if they wanted to relieve the GP clinics in any way:

GP8: "I don't see a huge advantage, because the quantity is too small… We have to prescribe enormous amounts of meds in a working day, and here the pharmacist prescribing doesn't even show up… It would be different if [the pharmacist prescribers] were there just for my patients."

The patients also found pharmacist prescriber interventions effective:

PT4: "[It was good.] Before, I kept swallowing those drugs, without results."

3.4. Characteristics of individuals

3.4.1. Motivation (attitudes towards prescribing/responsibility)

Pharmacist prescribers were keenly aware of the increased responsibility that would come with additional competencies.

PH1: "If this system gets implemented in Slovenia, the pharmacist's responsibility will naturally be bigger."

PH3: "In some cases, this [confirming prescriptions by the GP] is good, because we still have some other opinion backing us, we feel safer."

However, practice enabled them to feel more confident:

PH4: "You carry more responsibility, but the longer the pilot went, the less I worried about it."

3.4.2.Trust in the pharmacist

Both GPs and patients had gained trust in the pharmacists' skills.

PT1: "I trust her one hundred per cent."

One patient did add that new symptoms would prompt a consultation with the GP rather than the pharmacist prescriber:

PT3: Only if I had something new, some complication, something different, then I would first talk it over with the GP…"

The GPs were confident that pharmacist prescribers could adequately prescribe therapies for conditions where the effect of treatment was easily measurable:

GP1: "I believe pharmacist prescribers could manage therapies for conditions requiring regulation of clinical parameters, such as hypertension, statins, diabetes, gout, and possibly some psychiatric treatments."

One GP stressed that they felt the pharmacist prescriber was paying more attention to adjusting treatment to individual patients than sometimes other GPs did:

GP2: "At present, I sometimes trust pharmacist prescribers more than certain specialists, because prescriptions are often given indiscriminately when patients enter or leave a hospital. With pharmacist prescribers, the approach seems much more individualized."

3.4.3. Knowledge and expertise

On the whole, patients believed the pharmacist prescribers were experts in medications and felt safe with their expertise:

PT2: "The pharmacist prescriber can explain side effects better than the physician."

The GPs believed pharmacists to be both experienced and knowledgeable in their field, and were keen to exchange experiences with them.

GP6: "Our pharmacist prescribers have a lot of experience, covering all the GPs in our area…"

GP2: "I usually accepted most [of the pharmacist's recommendations], because she has more pharmacological knowledge… I learned a lot from her."

They did underscore some limitations, since pharmacist prescribers might not confidently diagnose new conditions, and might not be able to perform a differential diagnosis of some symptoms:

GP3: "I only maybe have some reservations about titrating medications for asthma or COPD… Sometimes people can have dyspnea, and it's basically an infection… this needs some more diagnostics, not just titration of therapy."

Pharmacist prescribers themselves were well aware that they needed extensive knowledge, additional education, and a lot of practice. However, they were not equally confident in all areas.

PH2: "Patients are very different… It depends on which group of patients you prescribe for, and which area you are more expert in. It's not the same for everything."

And

PD4: "Practice is most important… the more cases you do, the easier it gets."

But they also enjoyed the challenges of learning new knowledge and skills.

PD2: "Now I understand their workload [GPs]. I see what it means to persuade a patient. And also, when writing reports, you really [should] focus on the key aspects of therapy—those urgent changes or elements that truly stand out."

3.4.4. Interprofessional relationships

Both GPs and pharmacist prescribers established the collaboration based on a good interpersonal relationship that had existed since before the project. GPs, in particular, stressed that they could hand over some of the prescriptions because they trusted the pharmacists they worked with.

GP4: "It seems there has to be a sort of individual trust. I completely trust our colleague [pharmacist prescriber]... she is a top expert, she goes beyond… This trust has to be built."

GP5: "I have excellent experience with our [pharmacist prescriber]... has a lot of knowledge… But I can't say what others are like."

PH4: "I really feel accepted in this healthcare centre… we built trust between ourselves and are equal partners."

3.5. Process

3.5.1. Engagement

Patients at first engaged in the pilot on the instigation of their GP, but were happy to participate further after they realised what it was about:
PT4: "At first, I didn't know what this was about, who it was meant for. But then… I had a feeling people knew what they were doing."

3.5.2. Monitoring and evaluation

Pharmacist prescribers appreciated the chance to follow up with the patients and monitor the effectiveness of their prescriptions. They found it rewarding and believed that it upgraded the quality of management, though they also felt the length of the pilot study was too short to achieve marked improvements in some of the quality indices.
PD4: "*We had a chance to do a follow-up, and so we were a lot more involved in optimisation of the therapy, which is certainly an upgrade. In fact, I think this is an essential step forward*."
GPs and pharmacist prescribers felt that objective quality indices should be monitored to ensure safe prescribing.

3.5.3. Sustainability

Though they supported the innovation and believed it was safe and useful, GPs were worried about the long-term sustainability of this approach, mainly because they worried there were too many patients for the current process of pharmacist prescribing:
GP2: "*I don't know if this is sustainable in the long-term. I don't think so*."
They believed access to pharmacist prescribers would have to be limited in some way:
GP1: "*If we just open the door… for everything, this will be a lot of work for the pharmacist prescribers.*"
Pharmacist prescribers stressed the need for technical and administrative support if they wanted to expand the scope of their work. Still, both agreed that many more pharmacist prescribers would be needed to ensure sustainable implementation.
GP8: "*The problem is because we have so much of this [prescribing] to do… If we wanted to go on with this, yes, we would need a great deal more of these pharmacist prescribers.*"

3.5.4. National implementation

Both pharmacist prescribers and GPs believed national implementation of pharmacist prescribing would have to be gradual, and probably at first dependent.
PD4: "I think the support would be greater if at first it were dependent prescribing."
GP7: "For us GPs, it will be difficult to let go of control."
The pharmacists saw challenges related to training pharmacists and increasing the number of pharmacists who could prescribe. They stressed the need for a national program that would support the implementation and provide technical and administrative support.
They also underlined the challenge of getting GPs on board.
PD2: "Where the medication review has already been well implemented, and they are collaborating well with the GPs, they'd be open to it."
GP1: "Maybe it would help if the GPs who didn't participate in the study got some… positive introduction… and that this can eventually become part of every healthcare centre."

Both pharmacist prescribers and patients also saw the possibility of collaboration with nurses who are part of the primary healthcare teams in Slovenia, doing preventative check-ups and monitoring well-controlled chronic disease patients. During such a check-up, a chronic patient would, in their vision, get a consultation with the pharmacist prescriber and have therapy optimized depending on laboratory tests and other results. Collaboration with nurses would also help with referral and monitoring patients.

PT4: "Once yearly, I have a preventative check-up… and when they have [blood] results, they could also give it to the pharmacist prescriber to see what can be done."

Both GPs and pharmacist prescribers expected the protocols for individual diseases to be refined further with practice. GPs, in particular, noted that there would have to be gradual progress in competencies for different diseases with exact protocols.

GP6: "Maybe we should start with some areas that are easier to manage… You have to get used to it, and when it starts to run smoothly, you see how good it is."

One GP, however, was worried that it would be difficult to manage just a single illness or permit prescription of a single medication class in a multimorbid patient with many illnesses and medications.

GP3: "The patient is a whole, I'm not sure if we can divide this so strictly."

According to the stakeholders, every implementation would ultimately require building collaboration between individual GPs and pharmacist prescribers.

GP5: "I'm not sure if something general will go through. You must [manage] collaboration between a specific GP and a pharmacist prescriber."

4. Discussion

Based on the national clinical pilot trial, this study represents the first qualitative investigation of pharmacist prescribing conducted outside Anglo-Saxon countries. Previous studies in similar settings did not involve pharmacists as prescribers, but rather captured only the opinions of participants who had no direct experience with pharmacist prescribers in primary care [18]. A mixed-methods study from Austria included community and hospital pharmacists, demonstrating that community pharmacists frequently used clinical judgement in urgent situations. More than 88% of included pharmacists supported an expanded scope of practice, particularly in continuing contraceptive prescriptions, managing chronic diseases, and treating infections using point-of-care testing. Hospital pharmacists reported limited implementation of prescribing frameworks, hindered by institutional inertia, staff shortages, and restricted access to patient data. The authors concluded that additional training and policy support were needed [18]. Similarly, in France, community pharmacists are authorised to dispense certain antibiotics without a prescription after completing a mandatory five-hour training programme [19]. Despite these positive examples, there remains a paucity of studies examining clinical outcomes and qualitative data on pharmacists prescribing outside the Anglo-Saxon countries.

This study has important practical implications. All stakeholders—patients, pharmacist prescribers, and GPs—expressed positive experiences. Pharmacist prescribers in this pilot programme developed their roles from the medication review service, which has been a standard of care in Slovenia since 2016 and provided a foundation for prescribing activities and long-term monitoring [11, 20]. GPs and patients reported trust in the pharmacist prescribers' competence and prescribing decisions. Comparable findings have been reported in the UK, where most GPs agree that pharmacist prescribers possess the skills and knowledge

required for independent prescribing [3, 8, 21]. Patients' perceptions were also mainly positive in the UK in a study focused on pharmacists and nurses independent prescribers, where researchers reported some barriers, including competencies, organisational factors and support from colleagues [21]. Both independent prescribers and GPs (n = 25) strongly agreed that independent prescribing improved patient care quality [21]. Stakeholders in this study confirmed that a pilot trial was essential to generate real-world data before wider implementation and attributed their positive perceptions to long-standing collaboration through medication review services, which have already been evaluated qualitatively, quantitatively, and economically in Slovenia [11, 22]. Based on these findings, researchers in our study incorporated additional patient monitoring and prescribing by clinical pharmacists. This information is particularly valuable for countries seeking to develop pharmacist prescriber roles.

A second key finding relates to clinical outcomes, including sustained patient monitoring. All participants highlighted improved treatment outcomes and enhanced access to healthcare services. This was shown quantitatively in our previous clinical study involving 191 patients [14]. Both patients and GPs highlighted the value of more comprehensive monitoring beyond the standard medication review, noting that this approach was particularly beneficial. GPs and patients emphasised the benefits of long-term follow-up. This qualitative evidence suggests that pharmacists, working collaboratively with GPs, can effectively monitor patients and optimise therapy [14]. These results align with the Committee of Ministers' Resolution CM/Res(2020)3 on the implementation of pharmaceutical care to benefit patients and health systems [23]. Therefore, medication review and longitudinal follow-up until the next consultation are crucial service enhancements, particularly in Slovenia, where clinical pharmacists currently perform reviews without ongoing monitoring [11, 20]. Pharmacist prescribers and GPs highlighted the value of including clinical data, laboratory tests, and patient outcomes in future monitoring processes. Similar findings have been reported in the UK, where a systematic review of non-medical prescribing concluded that prescribing is more readily integrated into practice when it forms part of the overall patient care pathway. Conversely, when prescribing involves the creation of entirely new professional roles, adoption tends to be slower and requires more time to become widespread [24].

Legislation and regulatory frameworks emerged as major determinants of implementation. Both GPs and pharmacist prescribers acknowledged that clinical pharmacists in Slovenia do not yet have prescribing rights and recognised this as a critical step before systemic implementation. GPs emphasised that the responsibilities of pharmacist prescribers should be more clearly defined to facilitate successful systemic implementation. Patients also indicated that the role of pharmacist prescribers should be clearly communicated to them to enhance understanding and engagement with the service. The UK followed a similar trajectory, with prescribing rights emerging from early pilot programmes [8]. The next step could involve the Ministry of Health proposing legislative amendments to grant provisional (dependent) prescribing rights to clinical pharmacists, clearly defining their professional responsibilities. Stakeholders also stressed the need to train a sufficient workforce to meet service demand, a challenge mentioned in implementation research from the UK [25]. A coordinated, staged approach to workforce development would help establish pharmacist prescribing as a sustainable solution to healthcare workforce pressures in Slovenia and internationally.

The pilot utilised a CPA model, enabling pharmacists to initiate, discontinue, or switch medications for 10 therapeutic groups and prescribe all medications within the GP's scope [14]. This model is comparable to New Zealand and the United States [2, 26]. GPs and pharmacist prescribers considered this model appropriate and recommended that prescribing privileges should not be overly restrictive.

Stakeholders supported national implementation but identified education and training as key barriers. Similar concerns were reported in UK implementation studies [3]. The Slovenian system should therefore define competencies for pharmacist prescribers, building on existing competencies for medication review developed by the Slovenian Chamber of Pharmacy [11]. GPs identified this as a barrier, emphasising that pharmacist prescribers must demonstrate appropriate clinical competencies. Similar UK studies have highlighted this requirement, including those involving supplementary (dependent) pharmacist prescribers [8]. In the UK, standards for education and training have been established, and by 2026, all pharmacy graduates will qualify with independent prescribing competencies [27]. Slovenia should adopt a similar approach, potentially drawing on New Zealand's model (dependent prescriber), where pharmacists must complete postgraduate qualifications and maintain clinical competencies [2, 26]. Reimbursement was also identified as a barrier, similar to the UK [8]. Pharmacist prescribers and GPs proposed that the Health Insurance Institute of Slovenia negotiate a payment model for pharmacist prescribing, potentially linked to the existing medication review reimbursement (approximately €50 per review) [11].

Motivation, trust, and interprofessional relationships were also key findings. GPs and patients expressed high levels of trust in pharmacist prescribers, consistent with findings from the UK [8, 21]. Notably, our study's GPs and pharmacist prescribers emphasised the key role of existing collaborative relationships (the pharmacists had already been working with primary care teams in the medication review form before the study). These interprofessional relationships built trust, enabling them to transfer competencies confidently. Therefore, the first step in expanding pharmacist prescribing may be to extend the pharmacist network – in a medication review role – to all primary healthcare teams in Slovenia, and gradually develop a network of pharmacist prescribers from there.

GPs valued improved access to care, noting that consultations with other specialists often involve long waiting times. Pharmacist prescribers could help fill this service gap. GPs also reported good communication with pharmacist prescribers—an area that can be challenging with other specialists, such as psychiatrists. For instance, only 22% of German GPs report satisfactory communication with psychiatrists, which they consider a barrier to effective depression management [28]. Both pharmacists and GPs identified restricted access to patient data as a persistent obstacle. The Ministry of Health is addressing this issue, and starting in 2025, all clinical datasets will be available to clinical pharmacists. They will also be required to upload medication reviews to the central electronic health record, making them accessible to patients, physicians, and pharmacists.

Strengths and Limitations

This study has several important practical implications, particularly for the development of pharmacist prescribers and the integration of long-term patient monitoring in Slovenia. These findings suggest that existing health programmes—such as the medication review service—could be expanded to incorporate longitudinal follow-up, thereby enhancing continuity of care. The most significant implication is the strong stakeholder support for pharmacist prescriber development, which provides a robust foundation for the Ministry of Health of the Republic of Slovenia to implement this service nationally.

Nevertheless, some limitations should be acknowledged. Participants were recruited from pilot trial sites, which may have introduced selection bias; however, this approach was chosen to ensure participants had direct experience with pharmacist prescribing. In addition, the use of semi-structured interviews limited the sample size but enabled rich, in-depth exploration of stakeholder perspectives, which may not have been captured through a cross-sectional survey with a standardised questionnaire. Finally, the study focused exclusively on pharmacist prescribers in primary care, excluding those working in hospitals or community pharmacies. This reflects the pilot project's primary care focus, where medication review services have been established and reimbursed since 2016.

Conclusion

This is the first qualitative study of pharmacist prescribing based on a national pilot trial conducted outside Anglo-Saxon countries. The results indicate strong support from GPs, pharmacist prescribers, and patients for the introduction of pharmacist prescribing in Slovenia. Addressing barriers—including education, legislation restrictions, and limited electronic health record options will be essential for successful national implementation.

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9. References:

1. Tonna AP, Stewart D, West B, McCaig D. Pharmacist prescribing in the UK - a literature review of current practice and research. J Clin Pharm Ther. 2007; 32(6): 545-556.
2. Raghunandan R, Marra CA, Tordoff J, Smith A. Examining non-medical prescribing trends in New Zealand: 2016-2020. BMC Health Serv Res. 2021; 21(1): 418.
3. Hasan Ibrahim AS, Barry HE, Hughes CM. General practitioners' experiences with, views of, and attitudes towards, general practice-based pharmacists: a cross-sectional survey. BMC Prim Care. 2022; 23(1): 6.
4. Canadian Institute for Health Information. Nurse practitioner scopes of practice vary across Canada's provinces and territories. Canada: Canadian Institute for Health Information (2020). Available online at: https://www.cihi.ca/en/nurse-practitionerscopes-of-practice-vary-across-Canadas-provinces-and-territories (accessed 29.8.2025).
5. Sachdev G, Kliethermes MA, Vernon V, Leal S, Crabtree G. Current status of prescriptive authority by pharmacists in the United States. J Am Coll Clin Pharmacy. 2020; 3: 807–17.
6. Nakhla N, Leung V, Schwartz KL. Expansion of pharmacist prescribing could help improve health care access and quality. Can Family Physician. 2024; 70: 441–3
7. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 2009; 4: 50.
8. Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. Int J Pharm Pract. 2009; 17(2): 89-94.
9. Alsaeed BA, Hall J and Keers RN. Evaluating pharmacist independent prescribing for patients with mental illness in community care: a qualitative study. Front. Psychiatry. 2025; 16: 1637132.
10. Jebara T, Cunningham S, MacLure K, Awaisu A, Pallivalapila A, Stewart D. Stakeholders' views and experiences of pharmacist prescribing: a systematic review. Br J Clin Pharmacol. 2018; 84(9): 1883-1905.
11. Stuhec M. Medication reconciliation and seamless care led by clinical pharmacists in Slovenia: a national reimbursed program ensuring safe and effective transition of care. Int J Clin Pharm. 2025; 47(2): 239-246.
12. Stuhec M, Zorjan K. Clinical pharmacist interventions in ambulatory psychogeriatric patients with excessive polypharmacy. Sci Rep. 2022; 12(1): 11387.
13. Stuhec M. Case Report: Clinical pharmacist prescriber in depression treatment in primary care settings: clinical case focused on prescribing practice. Front. Psychiatry 2025; 16: 1677152.
14. Stuhec M, Kovacic A, Korpar M, Banovic Koscak A, Koder B, et al. Clinical pharmacist prescriber in primary care in Slovenia: prospective non-randomised interventional study focused on clinical outcomes and quality of life. Front. Pharmacol. 2025; 16: 1690480.
15. Francis JJ, O'Connor D, Curran J. Theories of behaviour change synthesised into a set of theoretical groupings: introducing a thematic series on the theoretical domains framework. Implement Sci. 2012; 7: 35.

16. Damschroder LJ, Reardon CM, Widerquist MAO, Lowery J. The updated Consolidated Framework for Implementation Research based on user feedback. Implement Sci. 2022; 17(1): 75.
17. Skolarus TA, Lehmann T, Tabak RG, Harris J, Lecy J, Sales AE. Assessing citation networks for dissemination and implementation research frameworks. Implementation Sci. 2017; 12(1): 97.
18. Rose O, Egel C, Pachmayr J, Clemens S. Pharmacist-Led Prescribing in Austria: A Mixed-Methods Study on Clinical Readiness and Legal Frameworks. Pharmacy. 2025; 13(5): 130.
19. French Directorate for Legal and Administrative Information. Tonsillitis and Cystitis: Pharmacists May Dispense Antibiotics Without a Prescription Under Certain Conditions. Available online: https://www.service-public.fr/particuliers/actualites/A17229 (accessed 29.8.2025).
20. Stuhec M, Flegar I, Zelko E, Kovačič A, Zabavnik V. Clinical pharmacist interventions in cardiovascular disease pharmacotherapy in elderly patients on excessive polypharmacy : A retrospective pre-post observational multicentric study. Wien Klin Wochenschr. 2021; 133(15-16): 770-779.
21. Hindi AMK, Seston EM, Bell D, Steinke D, Willis S, Schafheutle EI. Independent prescribing in primary care: A survey of patients', prescribers' and colleagues' perceptions and experiences. Health Soc Care Community. 2019; 27(4): e459-e470.
22. Nabergoj Makovec U, Tomsic T, Kos M, Stegne Ignjatovic T, Poplas Susic A. Pharmacist-led clinical medication review service in primary care: the perspective of general practitioners. BMC Prim Care. 2023; 24(1): 6.
23. Committee of Ministers Resolution CM/Res. 3 on the implementation of pharmaceutical care for the benefit of patients and health services (2020). Available online at: https://go.edqm.eu/ResPhCare20203 (accessed 29.8.2025).
24. Graham-Clarke E, Rushton A, Noblet T, Marriott J. Non-medical prescribing in the United Kingdom National Health Service: A systematic policy review. PLoS One. 2019; 14(7): e0214630.
25. Edwards J, Coward M, Carey N. Barriers and facilitators to implementation of non-medical independent prescribing in primary care in the UK: a qualitative systematic review. BMJ Open. 2022; 12(6): e052227.
26. Pharmacy Council New Zealand. Available online: https://pharmacycouncil.org.nz/wp-content/uploads/2021/04/Pharmacist-Prescriber-Scope-of-Practice-reviewed-Oct-17.pdf (accessed 29.8.2025).
27. General Pharmaceutical Council (GPhC, our Regulator) Standards for the education and training of pharmacist independent prescribers. Available online: https://www.pharmacyregulation.org/students-and-trainees/education-and-training-providers/standards-education-and-training-pharmacists (accessed 29.8.2025).
28. Lech S, Herrmann W, Trautmann S, Schwantes U, Gellert P, Behr J, et al. Depression in primary care and the role of evidence-based guidelines: cross-sectional data from primary care physicians in Germany. BMC Health Serv Res. 2022; 22(1): 1279.

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Case Report: Clinical pharmacist prescriber in depression treatment in primary care settings: clinical case focused on prescribing practice

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Introduction: Pharmacotherapy of depression represents a significant challenge in the management of depression in primary care. Although effective treatments have been available, many patients are still not adequately managed. Clinical pharmacists represent one of the possible strategies in the management, although this practice is rarely seen outside the United Kingdom and the United States.

Aim: The aim of the case was to evaluate the impact of clinical pharmacist prescribers on depression treatment.

Methods: A longitudinal, observational, case-based medication review by a pharmacist prescriber was conducted for a 63-year-old Slovenian patient in a primary care ambulatory setting. The review included three structured medication review assessments performed by a clinical pharmacist prescriber at defined intervals: first observation, two months post-intervention, and six months after first observation. The pharmacists conducted medication reviews and prescribed medications like physicians, operating within a collaborative practice agreement as dependent prescribers. Predefined outcomes included diabetes management (HbA1c and blood glucose), lipid levels (S-LDL), pain (Visual Analogue Scale [VAS]), depression (Patient Health Questionnaire-9 [PHQ-9]), and quality of life (assessed via EQ-5D-VAS). The patient's complete medication regimens were reviewed, focusing on dosage appropriateness, indication matching, potential drug-drug interactions, and medication adherence.

Results: A 63-year-old male Slovenian patient diagnosed with depression, type 2 diabetes with polyneuropathy, and hypothyroidism underwent two medication reviews between December 2024 and July 2025. The pharmacist prescribed amitriptyline and semaglutide (accepted by the patient's physician). Notable improvements were observed in glycemic control (HbA1c reduced from 9.9% to 8.2%), and quality of life (EQ-5D-VAS score improved from 30/100 to 80/100). Depression symptoms also resolved, with the PHQ-9 score improving from 11 to 4.

Conclusions: This case study demonstrates that interventions by a clinical pharmacist prescriber during the medication review process resulted in improved clinical outcomes in the treatment of depression, as well as enhanced quality of life. It represents an important contribution to the development of pharmacist prescribing roles in depression management within primary care settings outside of the United Kingdom and the United States.

KEYWORDS

depression, pharmacist prescriber, clinical pharmacy, ambulatory care, medication review

1 Introduction

Major depressive disorder (depression) represents a significant global disease burden (1). According to the World Health Organization (WHO) report, depression is especially prevalent in primary care, where its burden is increasing significantly. WHO projections indicate that by 2030, depression will be the leading cause of disease burden worldwide (2). Depression rates in Central Europe, including Germany, have been rising. In Germany, the 12-month prevalence of unipolar depression is estimated at approximately 7.7%, with major depression accounting for around 6.0% of the population (3).

Although effective pharmacological and non-pharmacological treatment options are available, many patients still do not receive adequate care (4). According to a study by Kessler and colleagues, fewer than 50% of patients with depression in primary care receive adequate treatment (4). The study reported that 51.6% of patients with 12-month depression received healthcare treatment, and of these, only 41.9% received adequate care (4). Similar challenges exist in Germany, where most general practitioners (GPs) report poor communication with psychiatrists. GPs are responsible for diagnosing and managing the majority of depression cases in primary care, with 64.1% of outpatient incidental depression patients receiving treatment exclusively from GPs. A significant barrier to effective depression management in primary care is the lack of collaboration between GPs and psychiatrists (5).

Furthermore, adherence to depression treatment guidelines is often poor. For example, in primary care in the Netherlands, adherence to treatment guidelines was only 42% (6). German researchers have emphasized the urgent need for collaborative healthcare models to address obstacles arising from fragmented mental health care systems. In cases of inappropriate treatment or progression of depression, patients are at risk of developing treatment-resistant depression (TRD), which is significantly more challenging to manage. TRD often requires augmentation strategies, such as the addition of lithium, antipsychotics, or esketamine (7, 8).

Furthermore, depression is two to three times more prevalent among individuals with multimorbidity. The presence of multiple chronic conditions complicates depression management and often limits adherence to clinical guidelines, which are typically not designed with this patient population in mind. A systematic review included 40 studies that found a weak but statistically significant association between the number of chronic conditions and the severity of depressive symptoms [$r = 0.26$ (95% CI 0.18–0.33), $p < 0.001$] (9).

These limitations and existing gaps in the treatment of depression, particularly in patients with multimorbidity, highlight the pressing need for more effective, interdisciplinary collaboration in primary care. Involving a broader range of healthcare specialists, including clinical pharmacist prescribers, may provide a valuable strategy to enhance treatment outcomes and address current deficiencies in care delivery. Traditionally, psychiatrists have treated depression, but its high prevalence has shifted much of the treatment responsibility to the primary care level (2, 4). In some countries, including Slovenia and Germany, most antidepressants and other related medications are prescribed by general practitioners (GPs) (5, 10). In this context, primary care represents a crucial setting for collaboration between GPs and clinical pharmacists in treating depression (10).

Clinical pharmacists collaborate with GPs in various ways, including conducting medication reviews and, in some cases, prescribing (11, 12). The authors of the position paper highlighted that clinical pharmacists are not adequately integrated into mental health care, including the treatment of depression, and proposed the establishment of nationally reimbursed services to address this gap. In several European countries, the role of clinical pharmacists in depression management remains underrecognized, and they are often not included as members of multidisciplinary care teams. In this context, the authors emphasized the importance of implementing reimbursed clinical pharmacy services, citing Slovenia as an example where clinical pharmacists provide medication reviews at the national level. Additionally, they referred to the United Kingdom, where pharmacist prescribers are an established part of the primary care system (12).

Numerous trials have demonstrated that clinical pharmacists can improve adherence to treatment guidelines through medication reviews, even when they do not have prescribing authority (10). Medication reviews by clinical pharmacists are among the most effective strategies to optimize depression treatment. For instance, a study by Stuhec and Lah showed that interventions through

medication reviews in Slovenian ambulatory settings in a primary health center led to a 40% increase in adherence to depression treatment guidelines—a significant improvement (n=30 patients) (13). The acceptance rate of GPs was 55%, and most of the recommendations were based on medication switching and dose adjustments (13). These studies demonstrate that clinical pharmacists' medication reviews in ambulatory settings within primary health centers contribute to improved treatment outcomes and may support more effective management of depression. Pharmacist prescribers represent an important additional resource, potentially enhancing care through further prescription, either independently (without prior approval) or dependently (in collaboration with a physician's permission).

Although prescribing has traditionally been the domain of physicians, this role has expanded to include other healthcare professionals such as clinical pharmacists and nurses (14). Clinical pharmacists have been recognized as independent prescribers in the United Kingdom for over 20 years (15). In the United States, clinical pharmacists prescribe medications through various protocols (e.g., Collaborative Care Agreements), allowing them to prescribe for depression in some regions (16). Pharmacist prescriber roles are also being developed in Australia, New Zealand, and Slovenia (10, 17).

The European Society of Clinical Pharmacy (ESCP), in its position paper, emphasized the need for clinical pharmacists to develop the competencies required for prescribing in mental health, including depression, across Europe and beyond (12). They noted that pharmacist prescribing in mental health remains underdeveloped, except in the UK and certain parts of the US (12).

In this context, the main aim of this paper is to present a case of a patient with depression in which a pharmacist prescriber provided medication review, additional dependent prescribing, and ongoing monitoring. A secondary aim is to present the rationale for the global development of such services. We acknowledge that this case description does not constitute a full study but serves as an important starting point for the development of the pharmacist prescriber role.

2 Methods

A longitudinal, observational, case-based medication review by a clinical pharmacist was conducted for a 63-year-old Slovenian patient in a primary care ambulatory setting. Patients were referred to the pharmacist prescriber by GPs based on clinical complexity, such as the presence of depressive symptoms and multimorbidity, as well as medication-related problems, including critical drug-drug interactions and polypharmacy. The review included three structured medication review assessments performed by a clinical pharmacist at defined intervals: first observation, two months post-intervention, and six months after first observation. The pharmacists conducted medication reviews and prescribed medications like physicians, operating within a collaborative practice agreement as dependent prescribers. Predefined outcomes included diabetes management (HbA1c and blood glucose), lipid levels (S-LDL), pain (Visual Analogue Scale [VAS]), depression (Patient Health Questionnaire-9 [PHQ-9]), and quality of life (assessed via EQ-5D-VAS). The patient's complete medication regimens were reviewed, focusing on dosage appropriateness, indication matching, potential drug-drug interactions, and medication adherence.

The patient is part of a national pre-post prospective study involving clinical pharmacist prescribers working in primary care ambulatory settings in Slovenia. The clinical pharmacist prescriber conducts a medication review (advanced medication review, type 3 according to the Pharmaceutical Care Network Europe-PCNE) and may initiate or adjust therapy as needed (extra service to medication review) (10, 11). Medication reviews type 3 (advanced medication review) have been reimbursed in Slovenia and recognized as a pharmacist service since 2017, but clinical pharmacists do not have prescribing rights (10). Medication review type 3 is based on a patient's medication history, relevant patient information, and clinical data. It addresses all critical aspects outlined by the PCNE, including drug interactions, side effects, unusual dosages, adherence issues, drug-food interactions, effectiveness concerns, over-the-counter medication problems, unindicated medications, missing indications, and dosage issues (10, 11). This study researched clinical pharmacists prescribers. In this study, clinical pharmacists can prescribe medications under a collaborative agreement, which must be approved by both the GP and the patient before prescribing and monitoring begin. Consent for participation in the study may also be cancelled by the patient or the physician for the duration of the study.

Clinical pharmacist prescribers may prescribe and monitor medications listed in the collaborative practice agreement until the third patient visit (six months after the initial visit). After each prescription by the clinical pharmacist prescriber, the GP must approve the prescription, making this a pharmacist-dependent prescribing model. GPs make a final decision on all prescription acceptance. In 2024, the Slovenian National Medical Ethics Committee granted ethical approval for the study (N#0120-330/2024-2711-3). Informed consent was obtained from this patient. The CARE guidelines were followed in the preparation of this manuscript.

3 Case report

A 63-year-old Slovenian male patient with a diagnosis of major depressive disorder, type 2 diabetes mellitus complicated by peripheral polyneuropathy, obesity (body weight >120 kg), and hypothyroidism underwent three structured medication reviews on 4 December 2024, 11 February 2025, and 3 July 2025. His medical history included major depressive disorder, angina pectoris, hypertension, insomnia, neuropathic pain, and type 2 diabetes. Laboratory results collected during the first pharmacist visit showed a normal complete blood count, normal liver enzymes, and normal liver function tests. However, the serum creatinine level was elevated, and the glomerular filtration rate (GFR) was calculated at 46 mL/min. The patient also had elevated levels of

glycated hemoglobin (HbA1c, 9.9%) and triglycerides (4.97 mmol/L; normal 0.6-1.7 mmol/L). There was no history of dementia or smoking.

Patient was treated with multiple medications, including pregabalin 300 mg daily, quetiapine 25 mg at bedtime, vortioxetine 15 mg daily, furosemide 40 mg daily, pantoprazole 20 mg daily, levothyroxine 25 mcg daily, aspirin 100 mg daily, perindopril/indapamide 8 mg/2.5 mg daily, rosuvastatin/ezetimibe 20 mg/10 mg daily, dapagliflozin/metformin 5 mg/1000 mg twice daily, two types of insulin (as part and glargine), trimetazidine 35 mg twice daily, and fenofibrate 250 mg daily. The GP was not fully satisfied with the clinical outcomes (e.g., depression, elevated HbA1c and polyneuropathy) and referred the patient to the clinical pharmacist in December 2024 for medication review. In addition, the GP specified in the collaborative practice agreement that clinical pharmacists could prescribe, modify or discontinue all medications within the medication list, including medication initiation if necessary and monitor patients for up to 6 months.

At the initial visit (4 December 2024), clinical pharmacists conducted a comprehensive medication review and initiated changes to pharmacotherapy. Modifications were prescribed due to suboptimal therapeutic outcomes in the management of depression, diabetes, and pain. Depression symptoms were assessed using the PHQ-9, with a score of 11 indicating the absence of remission. Health-related quality of life was evaluated using the EQ-5D Visual Analogue Scale (VAS), with a score of 80/100, and pain was assessed using the VAS, with the patient reporting severe pain intensity (VAS score: 10/10).

Based on the assessment, the clinical pharmacist initiated amitriptyline at 25 mg twice daily with a plan to titrate to 50 mg twice daily and semaglutide at 3 mg daily, increasing to 7 mg daily after two weeks. Quetiapine was discontinued. The patient's GP accepted all proposed medication changes.

At the follow-up visit on 5 February 2025 (two months after the initial consultation), the clinical pharmacist reassessed treatment outcomes and conducted a second medication review. The patient reported marked improvements, particularly in depressive symptoms and pain. Objective improvements included a reduction in HbA1c from 9.9% to 8.2%, an increase in estimated GFR from 46 to 63 mL/min, improved quality of life (EQ-5D-VAS score 80/100), and decreased pain intensity (VAS score: 5/10). The PHQ-9 score decreased from 11 to 4, indicating remission of depressive symptoms. No additional pharmacological changes were recommended at this visit. However, the clinical pharmacist provided counselling on the importance of adherence to fenofibrate therapy, as the patient reported inconsistent use, which was reflected in elevated triglyceride levels (9.5 mmol/L).

A third medication review was conducted at the third visit on 5 July 2025 (six months after the initial consultation). The patient reported sustained improvement compared to the baseline visit, with outcomes consistent with those observed at the second visit. Glycemic control improved (HbA1c: 8.8% vs 9.9% at baseline), and depressive symptoms remained in remission with a PHQ-9 score of 4. Pain intensity further decreased (VAS score: 3/10). The EQ-5D-VAS score was 80/100 at the third visit. Triglyceride levels improved significantly, decreasing to 2.8 mmol/L. No further pharmacotherapy adjustments were deemed necessary. A summary of the case report, including key outcomes, is presented in the Table 1.

4 Discussion

This case report highlights the potential for clinical pharmacist prescribers to contribute to improved clinical outcomes, which constitutes the primary objective in the management of depression. In Slovenia, clinical pharmacists have been integrated into the healthcare system since 2017, where their role primarily focus on medication review without prescribing (10). In this context, the present case introduces a novel approach compared to previous Slovenian studies (10), where clinical pharmacists were limited to

TABLE 1 Summary of the case report: key dates, medications, and clinical outcomes.

Outcome scales	Medication review N#1	Medication review N#2	Medication review N#3
Date	4 December 2024	4 December 2024	4 December 2024
Medication Changes	Pharmacist initiated amitriptyline at 25 mg twice daily with a plan to titrate to 50 mg twice daily and semaglutide at 3 mg daily, increasing to 7 mg daily after two weeks. Quetiapine was discontinued. Accepted by the general practitioner.	No additional pharmacological changes were recommended at this visit. However, the clinical pharmacist provided counselling on the importance of adherence to fenofibrate therapy.	No changes. No additional pharmacological changes were recommended.
Levels of glycated hemoglobin (HbA1c)	9.9%	8.2%	8.8%
Patient Health Questionnaire-9 (PHQ-9) score	11/27 (no remission)	4/27 (remission)	4/27 (remission)
EQ-5D Visual Analogue Scale (VAS) score	10/10	5/10	3/10
EQ-5D visual analogue scale (EQ-5D-VAS) score	30/100	80/100	80/100
Triglyceride levels	4.97 mmol/L	9.5 mmol/L	2.8 mmol/L

conducting medication reviews, and the role of pharmacist prescribers had not yet been described. The integration of pharmacist prescribers represents a significant advancement in collaborative care within primary care settings. Future studies will involve a larger number of patients managed by pharmacist-dependent prescribers, which will also open the way for investigating the role of pharmacist-independent prescribers in clinical practice.

Patients with depression frequently present with multimorbidity, and this complex case illustrates how clinical pharmacists—through medication review, ongoing monitoring, and prescribing—can support GPs in achieving favorable clinical outcomes. In this case, both depression and type 2 diabetes with associated polyneuropathy improved, with remission achieved. In addition, the patient and the GP reported that quality of life improved significantly by approximately 50%. The positive impact of clinical pharmacist interventions on quality of life was also demonstrated in our previous study involving 24 patients, in which clinical pharmacists monitored patients without having prescribing authority (18). The case also demonstrates significant clinical improvements, as the patient's quality of life increased by 50% on the EQ-5D-VAS, which exceeds the threshold for clinical significance (19). This improvement was further supported by clinical remission on the PHQ-9 and was corroborated by the patient's self-reported improvements.

The prevalence of pain in patients with depression is estimated to be approximately 65%, according to a pooled analysis of multiple studies (20). This highlights the complexity often encountered in primary care and underscores the potential role of clinical pharmacists in optimizing pharmacotherapy. In this case, the clinical pharmacist prescribed amitriptyline, an antidepressant, following clinical guidelines for pain and depression treatment (21). Additionally, semaglutide was prescribed to support glycemic control and weight management, particularly relevant for this patient with obesity (weight >120 kg) and type 2 diabetes. The intervention significantly reduced HbA1c levels, consistent with evidence-based recommendations for using GLP-1 receptor agonists in this patient population (22). The pharmacist prescriber also educated the patient on medication adherence, which contributed to a significant decrease in the patient's triglyceride levels by the final visit. The patient had not taken fenofibrate between the first and second visits, which explained the elevated triglyceride levels observed at that time.

Evidence from primary care settings suggests that medication reviews conducted by clinical pharmacists in the context of mental health care are associated with favorable outcomes, including reductions in polypharmacy, fewer drug-drug interactions, and enhanced adherence to treatment guidelines (13, 14). In addition to conducting medication reviews, clinical pharmacists are authorized to prescribe guideline-recommended pharmacotherapy and to monitor patients longitudinally in some countries. This model of care remains novel in many European countries, where medication prescribing and monitoring have traditionally been the sole responsibility of physicians. Notably, the United Kingdom has been recognized for expanding the scope of clinical pharmacists, including prescribing for depression (23). This case highlights that pilot trials involving pharmacist prescribers are also feasible and valuable in countries where clinical pharmacists do not yet have prescribing rights. In Slovenia, where this service is currently in development, a pilot trial has been approved and conducted. In contrast, clinical pharmacy in other Central European countries has not reached the same level of advancement as in Slovenia (24). In Slovenia, three key clinical pharmacy services—delivered in ambulatory primary care, hospital outpatient settings, and through seamless care models—are reimbursed by the national insurance company and well-established, providing a crucial foundation for the development of pharmacist prescribing roles (23). Notably, clinical pharmacy services in Slovenia are more developed than in some wealthier neighboring countries, such as Italy and Austria (24).

A 12-month pilot study conducted in Scotland involving 75 patients demonstrated that clinical pharmacists, acting as independent prescribers, were able to initiate and modify pharmacological treatment for depression and generalized anxiety disorder (GAD) without requiring direct referral to GPs. Pharmacological interventions included antidepressants and anxiolytics. The study reported clinical remission or treatment response in most patients, with reductions in PHQ-9 and GAD-7 scores by 45% and 50%, respectively. Pharmacists prescribed treatment following diagnoses established by GPs (23). In a randomized controlled trial conducted in a primary care setting in the United States, Finley et al. evaluated the outcomes of 75 patients managed by clinical pharmacist prescribers compared with 50 patients receiving standard care. Pharmacists operated as dependent prescribers under a collaborative practice agreement in an ambulatory care environment. After six months, the intervention group demonstrated significantly higher medication adherence rates than the control group (67% vs. 48%; odds ratio = 2.17; 95% CI: 1.04–4.51; $P = 0.038$). Patient satisfaction scores were significantly greater in the intervention group, and provider satisfaction was also high. Although clinical improvement was observed in both groups, the between-group difference was not statistically significant (25). Another study in the United States evaluated the impact of clinical pharmacists acting as dependent prescribers under collaborative practice agreements. This prospective, nonrandomized proof-of-concept study was conducted from July 2006 to December 2007 and included 151 patients with depression. Statistically significant reductions were observed in PHQ-9 scores from baseline to endpoint (11.5 ± 6.6 to 5.3 ± 4.7; $P < 0.0001$). The clinical response rate was 68%, with a remission rate of 56%. Moreover, the intervention was associated with a reduction in projected annual healthcare costs per patient (16).

Comparable findings were reported by Adler et al. in a 6-month randomized study involving 533 patients with depression and/or dysthymia in U.S. primary care settings (26). In this trial, clinical pharmacists provided in-person and telephone consultations, supporting GPs and patients in selecting, dosing, and adjusting antidepressant therapy. Antidepressant utilization rates at six months were significantly higher in the intervention group than in controls (57.5% vs. 46.2%; $P = 0.03$). However, differences in symptom severity did not reach statistical significance (26).

In addition to the studies previously mentioned, a meta-analysis examining the impact of pharmacists on depression treatment has been published, including 12 studies and a total of 2,133 patients (18). The results demonstrated a significantly higher number of patients with good adherence in the pharmacist intervention group compared to usual care (relative risk = 1.39; 95% CI: 1.11–1.75), as well as improved medication adherence scores (standardized mean difference = 0.32; 95% CI: 0.07–0.56). However, no statistically significant differences were observed in clinical rating scales or quality of life measures (27). The meta-analysis did not restrict inclusion to studies where pharmacists were authorized to prescribe medications; instead, it included a wide range of pharmacist-led interventions, including medication therapy management, adherence counselling, and educational support related to depression and antidepressants.

Several limitations of this case should be acknowledged. The findings from a single case cannot be generalized, which represents a significant limitation of this study. The findings are derived from a single case report, and further studies with larger sample sizes are necessary to confirm these results. The follow-up period was limited to six months, as defined by the scope of a pilot trial approved by the Slovenian National Medical Ethics Committee. Additionally, clinical pharmacists in this case did not have independent prescribing authority, as such rights are not currently granted in Slovenia. This limitation may have constrained the potential impact and evaluation of the intervention. This case should be replicated in studies with larger sample sizes to confirm the findings.

Nonetheless, the case highlights several positive aspects. Over the past decade, the role of clinical pharmacists in Slovenia has expanded significantly, with the introduction of reimbursed clinical pharmacy services such as medication reviews and reconciliation. Incorporating prescribing rights would represent a logical step in enhancing medication review services. This case demonstrates that clinical pharmacists, collaborating with GPs, can effectively monitor patients and contribute to improved treatment outcomes. These findings align with the Committee of Ministers' Resolution CM/Res (2020)3 on the Implementation of pharmaceutical care for the benefit of patients and health services and with the principles endorsed by the European Society of Clinical Pharmacy (28, 29).

This case also highlights that established and reimbursed medication review services within the country provide a necessary starting point for the development of pharmacist prescriber roles. General practitioners are already familiar with clinical pharmacy practices, including medication reviews, and have established effective team-based collaboration with ambulatory clinical pharmacy services in primary care settings.

5 Conclusion

This case report demonstrates that an ambulatory clinical pharmacist prescriber can effectively contribute to improved clinical outcomes in the treatment of depression through collaborative care with GPs in primary care settings. Such collaboration has the potential to address existing treatment gaps and enhance patient monitoring in depression management. Although these findings are encouraging, a larger-scale clinical study is necessary to confirm or refute these results.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Slovenian National Medical Ethics Committee granted ethical approval for the study (N#0120-330/2024-2711-3). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MS: Writing – original draft, Writing – review & editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

1. Kessler RC, Ruhm CJ, Puac-Polanco V, Hwang IH, Lee S, Petukhova MV, et al. Estimated prevalence of and factors associated with clinically significant anxiety and depression among US adults during the first year of the COVID-19 pandemic. *JAMA Netw Open*. (2022) 5:e2217223. doi: 10.1001/jamanetworkopen.2022.17223

2. WHO report. Global burden of mental disorders and the need for a comprehensive, coordinated response from health and social sectors at the country level . Available online at: https://apps.who.int/gb/ebwha/pdf_files/eb130/b130_9-en.pdf (Accessed 29.7.2025).

3. Jacobi F, Höfler M, Strehle J, Mack S, Gerschler A, Scholl L, et al. Erratum zu: Psychische Störungen in der Allgemeinbevölkerung. Studie zur Gesundheit Erwachsener in Deutschland und ihr Zusatzmodul "Psychische Gesundheit" (DEGS1-MH) [Erratum to: Mental disorders in the general population. Study on the health of adults in Germany and the additional module mental health (DEGS1-MH). In: *Nervenarzt*, (Germany: Springer Nature) vol. 87. (2016). p. 88–90.

4. Kessler RC, Berglund P, Demler O, Jin R, Koretz D, Merikangas KR, et al. The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *JAMA*. (2003) 289:3095–105. doi: 10.1001/jama.289.23.3095

5. Lech S, Herrmann W, Trautmann S, Schwantes U, Gellert P, Behr J, et al. Depression in primary care and the role of evidence-based guidelines: cross-sectional data from primary care physicians in Germany. *BMC Health Serv Res*. (2022) 22:1279. doi: 10.1186/s12913-022-08631-w

6. Smolders M, Laurant M, Verhaak P, Prins M, van Marwijk H, Penninx B, et al. Adherence to evidence-based guidelines for depression and anxiety disorders is associated with recording of the diagnosis. *Gen Hosp Psychiatry*. (2009) 31:460–9. doi: 10.1016/j.genhosppsych.2009.05.011

7. Maina G, Adami M, Ascione G, Bondi E, De Berardis D, Delmonte D, et al. Nationwide consensus on the clinical management of treatment-resistant depression in Italy: a Delphi panel. *Ann Gen Psychiatry*. (2023) 22:48. doi: 10.1186/s12991-023-00478-7

8. Fiorillo A, Demyttenaere K, Martiadis V, Martinotti G. Editorial: Treatment resistant depression (TRD): epidemiology, clinic, burden and treatment. *Front Psychiatry*. (2025) 16:1588902. doi: 10.3389/fpsyt.2025.1588902

9. Read JR, Sharpe L, Modini M, Dear BF. Multimorbidity and depression: A systematic review and meta-analysis. *J Affect Disord*. (2017) 221:36–46. doi: 10.1016/j.jad.2017.06.009

10. Stuhec M. Clinical pharmacist consultant in primary care settings in Slovenia focused on elderly patients on polypharmacy: successful national program from development to reimbursement. *Int J Clin Pharm*. (2021) 43:1722–7. doi: 10.1007/s11096-021-01306-2

11. PCNE. PCNE statement on medication review 2013 . Available online at: https://www.pcne.org/upload/files/150_20160504_PCNE_MedRevtypes.pdf (Accessed 25.6.2025).

12. Stuhec M, Hahn M, Taskova I, Bayraktar I, Fitzgerald I, Molitschnig L, et al. Clinical pharmacy services in mental health in Europe: a commentary paper of the European Society of Clinical Pharmacy Special Interest Group on Mental Health. *Int J Clin Pharm*. (2023) 45:1286–92. doi: 10.1007/s11096-023-01643-4

13. Stuhec M, Lah L. Clinical pharmacist interventions in elderly patients with mental disorders in primary care focused on psychotropics: a retrospective pre-post observational study. *Ther Adv Psychopharmacol*. (2021) 11:20451253211011007. doi: 10.1177/20451253211011007

14. Stuhec M, Zelko E. A collaborative care model between general practitioners and clinical pharmacists in a community health centre setting in depression treatment. *Psychiatr Danub*. (2021) 33:1261–6.

15. Stewart DC, George J, Bond CM, Diack L, McCaig JD, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int J Pharm Pract*. (2009) 17:89–94. doi: 10.1211/ijpp.17.02.0003

16. Finley PR, Bluml BM, Bunting BA, Kiser SN. Clinical and economic outcomes of a pilot project examining pharmacist-focused collaborative care treatment for depression. *J Am Pharm Assoc*. (2011) 51:40–9. doi: 10.1331/JAPhA.2011.09147

17. Raghunandan R, Marra CA, Tordoff J, Kiser SN. Examining non-medical prescribing trends in New Zealand: 2016-2020. *BMC Health Serv Res*. (2021) 21:418. doi: 10.1186/s12913-021-06435-y

18. Stuhec M, Bratović N, Mrhar A. Impact of clinical pharmacist's interventions on pharmacotherapy management in elderly patients on polypharmacy with mental health problems including quality of life: A prospective non-randomized study. *Sci Rep*. (2019) 9:16856. doi: 10.1038/s41598-019-53057-w

19. Del Corral T, Fabero-Garrido R, Plaza-Manzano G, Navarro-Santana MJ, Fernández-de-Las-Peñas C, López-de-Uralde-Villanueva I, et al. Minimal clinically important differences in EQ-5D-5L index and VAS after a respiratory muscle training program in individuals experiencing long-term post-COVID-19 symptoms. *Biomedicines*. (2023) 11:2522. doi: 10.3390/biomedicines11092522

20. Li JX. Pain and depression comorbidity: a preclinical perspective. *Behav Brain Res*. (2015) 276:92–8. doi: 10.1016/j.bbr.2014.04.042

21. Finnerup NB, Attal N, Haroutounian S, McNicol E, Baron R, Dworkin RH, et al. Pharmacotherapy for neuropathic pain in adults: a systematic review and meta-analysis. *Lancet Neurol*. (2015) 14:162–73. doi: 10.1016/S1474-4422(14)70251-0

22. ElSayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. Pharmacologic approaches to glycemic treatment: standards of care in diabetes-2023. *Diabetes Care*. (2023) 46:S140–57. doi: 10.2337/dc23-S009

23. Buist E, McLelland R, Rushworth GF, Stewart D, Gibson-Smith K, MacLure A, et al. An evaluation of mental health clinical pharmacist independent prescribers within general practice in remote and rural Scotland. *Int J Clin Pharm*. (2019) 41:1138–42. doi: 10.1007/s11096-019-00897-1

24. Urbańczyk K, Guntschnig S, Antoniadis V, Falamic S, Kovacevic T, Kurczewska-Michalak M, et al. Recommendations for wider adoption of clinical pharmacy in Central and Eastern Europe in order to optimize pharmacotherapy and improve patient outcomes. *Front Pharmacol*. (2023) 14:1244151. doi: 10.3389/fphar.2023.1244151

25. Finley PR, Rens HR, Pont JT, Gess SL, Louie C, Bull SA, et al. Impact of a collaborative care model on depression in a primary care setting: a randomized controlled trial. *Pharmacotherapy*. (2003) 23:1175–85. doi: 10.1592/phco.23.10.1175.32760

26. Adler DA, Bungay KM, Wilson IB, Pei Y, Supran S, Peckham E, et al. The impact of a pharmacist intervention on 6-month outcomes in depressed primary care patients. *Gen Hosp Psychiatry*. (2004) 26:199–209. doi: 10.1016/j.genhosppsych.2003.08.005

27. Bunchuailua W, Samprasit N, Kotirum S, Kapol N. Impact of pharmacist activities in patients with depression: A systematic review and meta-analysis of randomized controlled trials. *Ann Pharmacother*. (2022) 56:556–64. doi: 10.1177/10600280211041274

28. Committee of Ministers Resolution CM/Res. 3 on the implementation of pharmaceutical care for the benefit of patients and health services (2020). Available online at: https://go.edqm.eu/ResPhCare20203 (Accessed 29.7.2025).

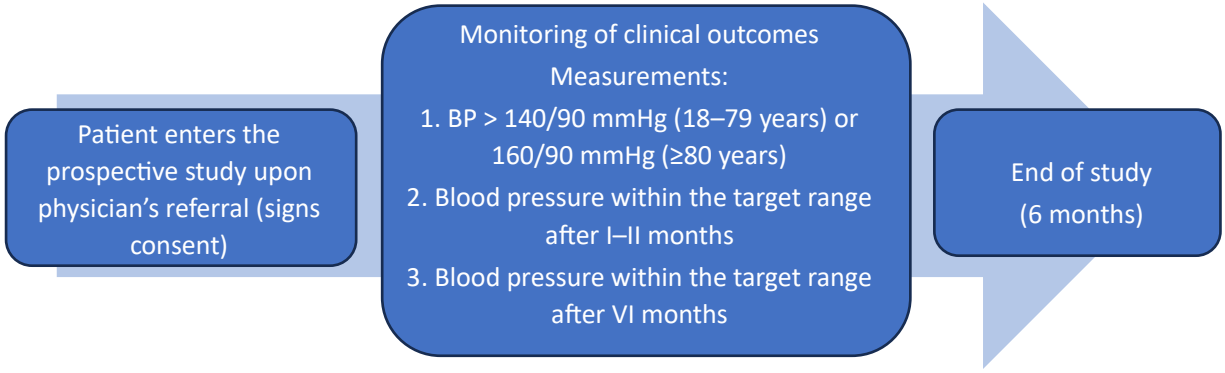
29. Fujita K, Halvorsen KH, Sato N, Jazbar J, Modamio P, Waltering I, et al. Pharmaceutical Care Network Europe definition of quality indicators for pharmaceutical care: a systematic literature review and international consensus development. *Int J Clin Pharm*. (2024) 46:70–9. doi: 10.1007/s11096-023-01631-8

Arterial Hypertension – Protocol

Treatment goals:

Achieving an individually determined target blood pressure range (Outcome N#1)
Improving quality of life (Outcome N#2)

Process:



Outcomes of monitoring and measurement methods

Clinical monitoring outcome	**Target BP values**	**Measurement time (t)**	**Variable**
Controlled blood pressure (Outcome N#1)		0, 1, 2, 6 months	Δ difference, % of patients with uncontrolled BP
Humanistic monitoring outcome			
Quality of life (Outcome N#2)	EQ-5D	0, 2, 6 months	Number (absolute), Δ
Additional: Treatment in accordance with the 2023 Guidelines for the management of arterial hypertension	State before	State after	Δ difference in the number of patients treated in accordance with the guidelines and %

Tasks of the pharmacist

The clinical pharmacist may prescribe a new medicine (antihypertensive) and adjust doses (in accordance with the Protocol) as well as additional medicines, if necessary and permitted by the Protocol. The pharmacist may also consult the patient by phone. Included are patients with an established diagnosis of arterial hypertension, newly diagnosed patients, and those whose prescribed therapy has not achieved target blood pressure values considering age and comorbidities (Table 1).

Tabela 1: Target blood pressure values (European Guidelines fo hypertention management 2023)

Age (y)	Target SBP (mmHg)					Target DBP (mmHg)
	Arterial blood pressure	+ Diabetes melitus	+ Chronic kidney disease	+ Coronary disease	+ Stroke/Transient ischaemic attack	
18-65	120-130	120-130	< 130	120-130	120-130	70-79
65-79	< 140	< 140	< 140	< 140	< 140	70-79
80 or more	140-159	140-159	140-159	140-159	140-159	70-79
Target DBP (mmHg)	70-79	70-79	70-79	70-79	70-79	

SBP – systolic blood pressure; DBP – diastolic blood pressure; AH – arterial hypertension; DM – diabetes mellitus; CKD – chronic kidney disease; CVI – ischemic stroke; TIA – transient ischemic attack; 1 – if well tolerated 130/80 mmHg; 2 – if well tolerated 130-139/80 mmHg.

In the consultant pharmacist's office, the clinical pharmacist measures blood pressure on both upper arms (3 measurements at 1-minute intervals, average of the last 2). In elderly patients or those with comorbidities/complications, standing measurements are also performed to rule out orthostatic hypotension.

After pharmacotherapy optimization, the patient performs home BP measurements for 7 (or minimum 3) consecutive days in the morning and evening (average of two measurements at 1-minute intervals). During follow-up visits in the consultant pharmacist's office, the clinical pharmacist reviews home BP measurements and measures BP in the office.

If the pharmacist and/or the patient assess that the condition has significantly worsened, the pharmacist refers the patient to a physician.

Guidelines

Guidelines: 2023 ESH Guidelines for the management of arterial hypertension. Available at:

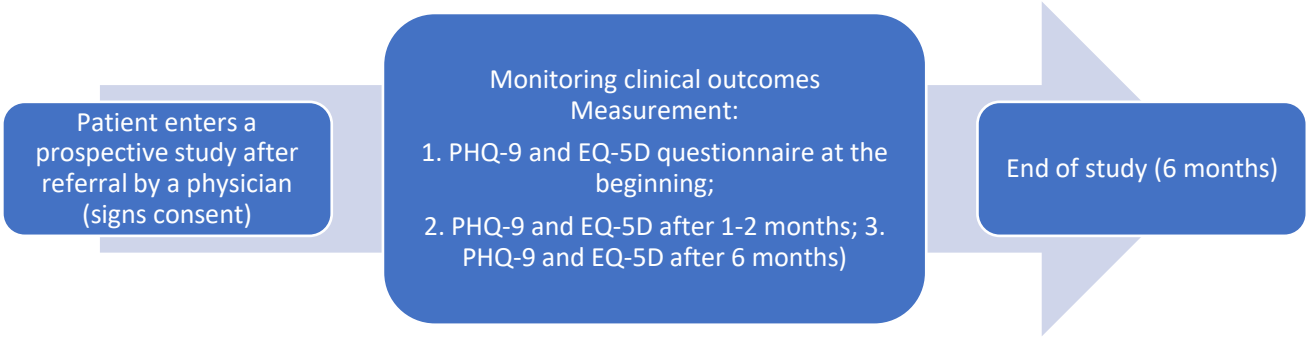
https://journals.lww.com/jhypertension/fulltext/2024/01000/2023_esh_guidelines_for_the_management_of_arterial.29.aspx

Depression – Protocol

Treatment Goals:

Achieving remission (Outcome N#1)
Achieving response to treatment (Outcome N#2)
Improving quality of life (Outcome N#3)

Process:



Outcomes of monitoring and measurement methods

Clinical Outcome Monitoring	Questionnaire	Measurement Time (t)	Variable
Achieving Remission (Outcome N#1)	PHQ-9 score less than 5	0, 1, 2, 6 months	Number of points (absolute), Δ difference, % of patients in remission
Achieving Response (Outcome N#2)	PHQ-9 score less than 10	After 1 month	Number of points (absolute), Δ difference, % of patients responding
Humanistic Outcome Monitoring			
Quality of Life (Outcome N#3)	EQ-5D	0, 2, 6 months	Number of points (absolute), Δ A difference in the number treated in accordance with guidelines and %
Additional: Treatment in accordance with NICE 2022 guidelines	/	Pre-treatment	Post-treatment

Tasks of the pharmacist

The clinical pharmacist can prescribe a new drug (antidepressant) and modify dosages (in accordance with the Protocol) and additional drugs, if this is necessary and the Protocol allows it. The pharmacist can also consult the patient by telephone. Included are patients who have an established diagnosis of depression and who are not in remission and/or do not respond to treatment. If the pharmacist and/or patient determines that the condition has significantly worsened, the pharmacist refers the patient to a physician.

Guidelines

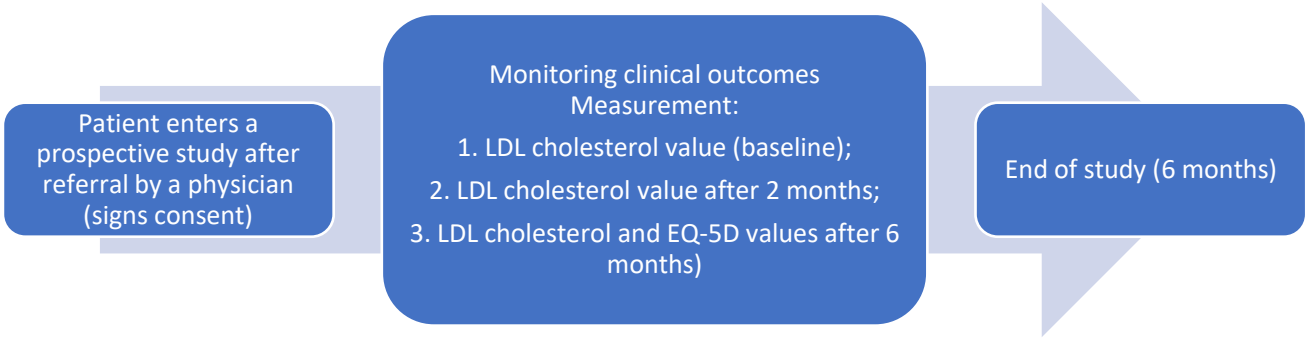
Guidelines (NICE 2022): Available at https://www.nice.org.uk/guidance/ng222

Dyslipidemia - Protocol

Treatment Goals:

Achieving individually determined target LDL values (Outcome N#1)
Improving quality of life (Outcome N#2)

Proces:



Outcomes of monitoring and measurement methods

Clinical Outcome Monitoring	**Questionnaire**	**Measurement Time (t)**	**Variable**
Achieving target LDL values (Outcome N#1)	/	0, 2, 6 months	Δ difference, % of patients who achieved the target LDL cholesterol value
Humanistic Outcome Monitoring			
Quality of Life (Outcome N#2)	EQ-5D	0, 2, 6 months	Number of points (absolute), Δ Δ difference in the number treated in accordance with guidelines and %
Additional: Treatment in accordance with guidelines	/	Pre-treatment	Post-treatment

Tasks of the pharmacist

The clinical pharmacist can prescribe a new drug (statin, ezetimibe) and/or modify dosages (in accordance with the Protocol). The pharmacist can also consult the patient by telephone. Included are patients who have an established diagnosis of dyslipidemia and who have not reached the target LDL cholesterol value based on the estimated cardiovascular risk (CVR) . The target LDL value in certain patients in secondary prevention may be lower than <1.4 mmol/L and is individually determined based on risk factors.

Guidelines

ESC Guidelines for the Prevention of Cardiovascular Diseases 2021; Available at: https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/CVD-Prevention-Guidelines

Deprescribing – Protocol

Treatment Goals:

1. Medication is prescribed in accordance with a clear indication - (Outcome N#1)
2. Medications are prescribed in accordance with Priscus recommendations - (Outcome N#2)
3. Improvement in quality of life (Outcome N#3)

Process:

Outcomes of monitoring and measurement methods

Clinical Outcome Monitoring	**Methods**	**Measurement Time (t)**	**Variable**
Medication is prescribed in accordance with a clear indication - (Outcome N#1)	SmPC, documentation	0, 2, 6 months	Absolute difference, Δ difference, % of patients prescribed in accordance with recommendations
Medications are prescribed in accordance with Priscus recommendations - (Outcome N#2)	Priscus 2.0 list (Table 2)	0, 2, 6 months	Absolute difference, Δ difference, % of patients prescribed in accordance with recommendations
Humanistic Outcome Monitoring			
Quality of Life (Outcome N#3)	EQ-5D	0, 2, 6 months	Number of points (absolute), Δ

***SmPC (Summary of Product Characteristics). Definition: Deprescribing means stopping or reducing the dose.**

Tasks of the pharmacist

The clinical pharmacist can prescribe a new medication, modify dosages (in accordance with the Protocol), and prescribe additional medications if necessary and the Protocol allows it. The pharmacist can also consult the patient by telephone. Patients who have an established diagnosis and for whom deprescribing needs to be carried out are included.

If the pharmacist and/or patient determines that the condition has significantly worsened, the pharmacist refers the patient to a physician.

Guidelines

- Summaries of Product Characteristics (SmPC).
- Priscus 2.0 list. Mann NK, Mathes T, Sönnichsen A, Pieper D, Klager E, Moussa M, Thürmann PA. Potentially Inadequate Medications in the Elderly: PRISCUS 2.0. Dtsch Arztebl Int. 2023 Jan 9;120(1-2):3-10. https://pmc.ncbi.nlm.nih.gov/articles/PMC10035347/

Collaborative Practice Agreement (CPA) document. The form is signed only at the beginning of cooperation. The physician, patient, and/or pharmacist may revoke the form at any time. The form is part of the patient's documentation. A copy is kept by the pharmacist.

Patient's full name and personal identification number:	The form is attached to the referral for the consultant pharmacist. Communication between the physician and pharmacist is reciprocal.
Physician (full name and signature): Date:	Consultant pharmacist (full name and signature): Date:
The consultant pharmacist may, within the framework of the agreement, prescribe/discontinue medication and monitor pharmacotherapy (the authorization applies to all). The physician indicates what the consultant pharmacist is authorized to do (please mark below):	The consultant pharmacist prepares the ePrescription, which the physician reviews (approves, modifies, or cancels). The pharmacist records each consultation in the medical record, available to the physician. The pharmacist may also order laboratory tests related to the planned or prescribed therapy.
□ All pharmacotherapeutic groups of medicines from the list (Annex – mandatory to mark)	The consultant pharmacist may prescribe all medicines included in the list (all items in the Annex below) and optimize treatment for the specified indications. In this case, the pharmacist will review all groups and prescribe medication. The physician may mark one, several, or all groups.
□ Individual medications within these groups (Annex – mandatory to mark chosen groups)	Enter here only if you authorize the pharmacist solely for a specific medication within one of the groups, not the entire group (otherwise mark the entire medicine group from the Annex).
□ Specific medicationsa not included in the Annex but within the expertise of the consultant pharmacist	Please specify the medicication, indication, and monitoring method in detail (for groups or medicines not included in the Annex).
Specify particular details you wish to transfer to the consultant pharmacist:	E.g., allergies, when to necessarily call the physician, drug non-responsiveness, and other specifics.

Annex: List of pharmacotherapeutic groups or conditions that the consultant pharmacist may prescribe (MUST be marked with an X):

1.	□	**ALL GROUPS listed (numbers 2–11) – I authorize the pharmacist for prescribing, monitoring, and optimization of all groups**
2.	□	Lipids not within target range (initiation and titration of oral medications) – diagnosis: dyslipidemia
3.	□	Neuropathic pain – adjustment of therapy (initiation and titration) – diagnosis: neuropathic pain
4.	□	Blood pressure not within target range (initiation and titration) – diagnosis: arterial hypertension
5.	□	Diabetes – HbA1c and/or blood glucose not within target range (initiation and titration) – diagnosis: type II diabetes
6.	□	Depression remission not achieved (initiation and titration) – diagnosis: depression
7.	□	Medications for dementia drugs (initiation and titration) – diagnosis: dementia
8.	□	Drugs for gout treatment (initiation and titration) – diagnosis: gout
9.	□	Dose adjustment according to renal and hepatic function – diagnosis: chronic kidney and/or chronic liver disease
10.	□	Deprescribing (within the framework of therapy optimization)
11.	□	Titration of medications for asthma treatment – diagnosis: asthma

- The pharmacist may prescribe those medicines within individual groups as a general practitioner may