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Original Research

Pharmacists' Recommendations to Reduce Drug Therapy Problems in Nursing Home Residents

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Abstract

Objective: Comprehensive Medication Management Services (CMM) are clinical services based on pharmaceutical care, and represents a patient-centred approach in which the pharmacist takes the responsibility for the patient's needs. This study aimed to describe drug therapy problems among nursing home residents, identified through pharmacists' provision of CMM, and assess physicians' acceptance of pharmacists' recommendations. **Methods:** A cross-sectional observational study was conducted from February 2018 to January 2019 in a nursing home in Croatia. Utilizing the Pharmacotherapy Workup method by Cipolle et al., pharmacists assessed and classified DTPs related to indication, effectiveness, safety, and adherence. Recommendation included medication discontinuation, dose adjustments and patient education. **Results:** Sixty residents were included in the study. Median age was 79.9 (IQR 66.1 – 96.7) years. On average, residents used 7 (IQR 2–16) medications and had 5 (IQR 1–12) comorbidities. In total, 141 DTPs were identified (4.3 ± SD2.35 per resident). The most prevalent DTP was" additional drug therapy needed" (n =55; 39%), falling into the effectiveness category. The pharmacists suggested 133 modifications for the identified DTPs. Physicians accepted a total number of 112 recommendations (84.21%). C**onclusion:** The high prevalence of DTPs identified and substantial acceptance of pharmacists' recommendations strongly suggests the need to incorporate CMM services within long-term care facilities with intent to improve quality of care. The results demonstrate that pharmacists are pivotal in optimizing therapeutic outcomes through effective medication management.

Keywords: drug therapy problem; elderly; pharmacists' recommendation

INTRODUCTION

A prominent demographic trend of increase in number of adults who will reach old age is evident around the world[1]. Croatia's population is equally rapidly aging, with an estimated proportion of older adults reaching 35% by 2050[2]. Incidence of chronic non-communicable diseases also increases with ageing, creating a challenge for health and social systems to maintain and improve the well-being and quality of life of older adults[3]. The need for optimal continuous social and medical care, such as that provided in long-term care facilities (e.g., nursing homes), increases as well, as many elderly adults will require help with the majority of activities of daily living and will find such help in nursing homes[3]. In Croatia, the precise count of nursing homes remains elusive, though estimates suggest around 700 facilities, predominantly private but including three state-run and 45 county-run homes. Approximately 17,000 of the over 869,000 citizens aged 65 and older are believed to reside in these facilities, according to the 2021 Census[4].

Nursing home residents are often exposed to unnecessary and inappropriate polypharmacy[5], thus requiring special attention and additional medication management services[6]. Nursing staff, including registered nurses and non-nursing-educate care staff are responsible for the majority of day-to-day health care to nursing home residents, with physicians available based on on-call duties (not being on site, rather called for a visit when necessary). Research recognizes the importance of the nurse's role in maintaining and improving medication safety in health care[6-8] with very little involvement from the pharmacist. The heavy workload of nurses might lead to the delegation of specific tasks to care workers regardless of their skills, which may not always be carried out appropriately[9-12]. Nevertheless, while nursing homes and social care fall under the Social Service Act, medication administration is regulated by the Health and Medical Service Act. Once delegated, the basic medication management is performed by care workers, while registered nurses and physicians are called in when necessary. As care workers in social services, they lack formal medical competence but are deemed competent through work experience and practical knowledge[13].

Hence, polypharmacy among institutionalized older adults, which may lead to potentially life-threatening harm[14], suggests the need to incorporate new pharmacist-led comprehensive medication management (CMM) services within the existing care facilities so as to improve the care provided to nursing home residents[15]. CMM is recognized as the standard of care

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that ensures each patient's medications, regardless of type, are individually assessed to determine that their appropriateness, effectiveness for the medical condition, safety considering the comorbidities and other medications being taken, and whether the patient can take them as intended[16-17]. Several studies have shown that a medication management specialist (i.e., pharmacist) can play an important role in clinical practice by working towards the prevention, identification, and resolution of DTPs[18-21]. Pharmacists are considered experts in pharmacotherapy, and their skills and expertise could be leveraged in nursing homes to improve patient outcomes. For instance, in the United States, medication review by a consultant pharmacist is a mandatory service in all nursing homes receiving funding from major federal health programs[22]. Australian cluster randomized controlled trial SIMPLER proved that residential medication management reviews could simplify the medication regimen and reduce medication administration times without affecting residents' quality of life, health outcomes, or satisfaction[23,24]. Pharmacotherapy optimization recommendations can be proposed to the prescriber to improve patient outcomes related to DTPs recommendation. In Croatia, pharmacists are typically not involved in CMM within nursing homes. Therefore, understanding the acceptance of pharmacists' suggestions could help optimize pharmacists' services, especially those aimed at reducing drug-related problems and improving medication management.

Few studies have reported on DTP profiles of elderly nursing homes residents[25-27] created using a theoretical framework for providing pharmaceutical care suggested by Cipolle[18]. In our study, Cipolle's Pharmacotherapy Workup method was selected over other available systems due to its comprehensive, structured, and patient-centered approach, which is crucial for effectively managing the complex medication needs of nursing home residents. This choice was further supported by existing literature documenting the framework's success in various healthcare settings, underscoring its relevance and applicability to our study objectives[18,20-21]. Data on prescribing patterns and DTP profiles among the elderly in Croatian nursing homes are lacking. This study aims to identify and classify DTPs in a nursing home setting, focusing on the role of pharmacists-led recommendations in managing these issues. A key component of our research is assessing the acceptance rate of these pharmacist recommendation by physicians. While the identification of DTPs is key aspect of pharmacists' roles, the success of these recommendations largely depends on GP acceptance and implementation. This acceptance reflects the collaborative dynamics between pharmacists and physicians, reflecting on both the trust in pharmacists' clinical judgments and the integration of CMM in routine care[25-27].

MATERIALS AND METHODS

Study Design and Setting

Based on previous experience of providing CMM in a nursing home aimed at exploring the prevalence of DTP in nursing home residents[28], this quality-of-care improvement project was suggested to the management in order to confirm prior finding and explore the extent of physician's acceptance of pharmacist's recommendations regarding pharmacotherapy optimization. The quality-of-care improvement project was conducted as a cross-sectional study from February 2018 to January 2019 at the "Sv Kamilo de Lellis" nursing home in Vrbovec, Zagreb County, Croatia. "Sv. Kamilo de Lellis" nursing home, ran/supported by Croatian Caritas organization, is located in the Bjelovarsko - Krizevacka Diocese and accommodates older adults who need help and support due to changes in their health status. This study was conducted in a single nursing home. The nursing home accommodates mobile and immobile patients with Alzheimer's dementia or other forms of dementia as well, in separate residential units with access to professional care at all times, which are not included in study. A multidisciplinary team of a general practitioner (GP), 20 registered nurses, five social workers, and a psychiatrist ensure the well-being of 148 residents accommodated in 79 rooms.

The study was registered at the U.S. National Library of Medicine under the identifier NCT04506801 and conducted according to the guidelines of the Declaration of Helsinki and Tokyo. The Ethics Committee of the "Sv. Kamilo de Lellis" nursing home and the Ethics Committee of the Faculty of Pharmacy and Biochemistry, University of Zagreb, approved the conduct of this study.

Study Participants

The initial participant pool included 105 residents who met the inclusion criteria out of a total of 148 residents housed in the nursing home. The final sample size was reduced to 60 participants after accounting for those who opted not to participate and those who deceased during the study period.

Nursing home residents were invited to participate in the study if they met the following inclusion criteria: a) age 65 or older, b) use of two or more medications, c) at least one chronic condition recorded in the patient's nursing home record, and d) signed written informed consent to participate in the study. Exclusion included end-stage disease and diagnosed dementia that precluded informed consent, as assessed by the community pharmacist responsible for medication management.

Data Collection

The research team identified residents who met the inclusion criteria. The research team consisted of an academic pharmacist, a community pharmacist, a clinical pharmacy resident, and a general practitioner (GP). The community pharmacist works in the pharmacy which supplies the nursing home with medications for all residents, and has an established relationship with the GP who is the primary care provider for nursing home residents. The academic pharmacist and the clinical pharmacy resident provided guidance and support during CMM to ensure medication management was provided according to best practice. Data were obtained through a careful review of nursing home admission records, available patient's medical records (i.e. hospital records, emergency department records…), and interviews with the resident and the nursing staff. When necessary, additional information

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regarding residents' medical history was obtained from the GP. In Croatia, digitalization of the healthcare system is in progress. The majority of data in nursing homes is still in paper form or computerized to the facility's database but it is still not a part of the national centralized healthcare information system (CEZIH). Hospitals' medical records can be uploaded and saved to CEZIH but are only available to the patient and their GP. Neither hospitals nor nursing homes have access to other patients' medical information. General physicians maintain patients' medical records in CEZIH and prescribe medications on electronic prescriptions (e-prescriptions), which are then uploaded to the CEZIH. Community pharmacists access the CEZIH to retrieve the e-prescription when dispensing medications but do not have access to other medical information.

Community pharmacist collected data including sociodemographic characteristics (age, sex, education, marital status), current and past diagnoses, detailed list of all used prescription and over-the-counter medications, recorded medication allergies and potential adverse drug reactions (ADRs), available blood serum biochemistry, renal function, and blood pressure. Anatomical Therapeutic Chemical (ATC) classification codes were used to analyze the prescribed therapy. The principal diagnoses and comorbidities were coded according to the International Classification of Diseases (ICD-10 Version: 2016). Medication containing two or more active ingredients was considered a separate drug.

Pharmacists' Recommendations

The proposed Comprehensive Medication Management (CMM) aimed to identify and address drug therapy problems (DTPs) among nursing home residents. Cipolle's Pharmacotherapy Workup framework is focused on ensuring that each patient takes medication satisfies the criteria of appropriateness, effectiveness, safety and is taken correctly. The chosen comprehensive medication management type can be defined as a comprehensive medication review (CMR), which involves a detailed evaluation of a patient's entire medication regimen. This CMM aligns with existing frameworks by taking a holistic approach while involving close collaboration between pharmacists and general practitioners to optimize patient care and ensure effective implementation of tailored recommendations[18]. Identification of DTPs was based on patients' medication lists and information gathered from the interviews conducted by a community pharmacist. To identify a DTP, the pharmacist needed to establish a link between the patient's health status and pharmacotherapy to determine whether the patient's drug-related needs were met.

A multi-component pharmacist-led intervention was performed as follows. Firstly, the community pharmacist performed medication reconciliation to identify discrepancies between the nursing home admission records and pharmacist-patient interview records. Secondly, included participants were provided with a comprehensive medication management service by trained pharmacists (clinical pharmacy resident and community pharmacist), which included reviewing each resident's medical and medication histories alongside their current health status. Feedback from the multidisciplinary team and insights gained from patient interviews were meticulously incorporated into the final decision-making process. This iterative approach ensured that each clinical decision was not only based on comprehensive data but also aligned with best practice guidelines and patient-centered care principles. The CMM service aimed to identify and address drug therapy problems. Cipolle's Pharmacotherapy Workup framework, the basis for this CMM service, ensures that each medication the patient takes, satisfies the criteria of appropriateness, effectiveness, safety and correct usage. This holistic approach aligns with existing frameworks by involving close collaboration between pharmacists and general practitioners to optimize patient care and ensure effective implementation of tailored recommendations[29]. Identified DTPs were systematically classified into categories such as unnecessary drug therapy, need for additional drug therapy, dosage too low, adverse drug reactions, and noncompliance, following the framework established by Cipolle et al[18]. Academic pharmacist (experienced in providing CMM) supervised and monitored the community pharmacist and the clinical pharmacy resident in providing CMM, and during identification of drug therapy problems, ensuring optimal medication management. After identification of DTPs, pharmacists providing CMM discussed each potential recommendation amongst themselves before creating and representing the care plan to the GP. Suggested recommendations were categorized as drug discontinuation, drug initiation, dose adjustment, drug modification, drug regimen modification, and patient education. Recommendations were documented using a standardized form that included detailed rationale for each suggestion, based on the identified DTPs, and resulting care plans were appropriately structured to ensure all information is clearly represented. Finaly, community pharmacist presented the care plan to the physician in a face-to-face meeting held at the GP's office. Collaborative meetings were scheduled in advance to ensure both healthcare providers' full attention to the topic and patient in question, and in order to facilitate discussion, exchange of opinions, and decision-making. The acceptance of pharmacist recommendations by the GP was determined through a follow-up review process. Each recommendation's status was categorized as 'accepted' or 'rejected', for clarity and ease of statistical analysis. Acceptance was recorded when the GP implemented the recommendation as proposed without modifications. Rejections were noted along with reasons provided by the GP, if any. However, it is important to note that some recommendations may require further discussion with the patient. This categorization process is aligning with models used in prior research, demonstrating the value of clear and measurable outcomes in interprofessional collaboration studies[30]. Figure 1 brings a step-wise representation of the CMM approach performed.

Outcomes

The primary outcome was the proportion of accepted recommendations. The acceptance of recommendations involving drug choice, dose adjustments, or optimization of administration was determined by reviewing the computerized

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Figure 1. Steps of multidisciplinary CMM approach

physician-ordering system in national centralized healthcare information system (CEZIH). Acceptance was defined as the actual recommendation of the proposed change in pharmacotherapy within 24 hours from receiving the suggestion. This time window was chosen to allow physicians enough time to make the necessary changes due to workload, as well as to allow junior doctors to consult supervisors if necessary.

Statistical Analysis

Descriptive analysis of study population characteristics included frequency distribution for the qualitative variables and measures of central tendency and dispersion for the quantitative variables. Statistical data analysis was performed using the statistical software IBM SPSS (IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.). The statistical approach was designed to accommodate the potential biases and heterogeneity inherent in single-site studies.

RESULTS

Participants Characteristics

A total of 60 residents participated. Most were female (42/60, 70%), and the median age was 79.9 (IQR 66.1 – 96.7). Participants used a median of 7 medicines (IQR 2–16), and the most commonly used medicines included electrolytes, proton pump inhibitors, analgesics, and antihypertensives. 260 diagnoses were tallied, and residents had a median of 5 comorbidities (IQR 1–12). Sixteen residents had six diagnoses, eleven had four, nine had five, and five had three diagnoses. One resident had nine unique diagnoses, and seven had no diagnoses on record but they have medication. The most commonly identified diagnoses were those of the circulatory system (78.33% of residents), mental and behavioral disorders (71.67% of residents), diseases of the musculoskeletal system and connective tissue (43.33% of residents), and endocrine, nutritional and metabolic disease (40% of residents). Twenty participants experienced falls, and all 60 participants complained of/or had symptoms of constipation.

Regarding drug therapy problems, 141 problems were identified, with a mean of 4.3 ± SD of 2.35 DTPs per resident. The most prevalent drug therapy problems were" additional drug therapy needed" (n = 55; 39%), falling into the effectiveness category. The need for vitamin D due to the in-creased risk of fractures or the need for secondary prevention with acetylsalicylic acid were the two most commonly identified drug-related needs within the indication category. In the safety category, inappropriately long-use of benzodiazepines and/or zolpidem were identified as the most commonly occurring problem

Pharmcists Recommendations

The pharmacist made 133 recommendations, and more than 80% of them were accepted and implemented (Table 1). The two most common recommendations were regarding indication and patient safety.

The pharmacist suggested starting new medication 52 times, tapering or stopping medications 40 times, and changing or switching medication 16 times. Additionally, changing or adapting medication dosing was suggested 12 times, patient education was provided 10 times, and dose adjustment was suggested 6 times. Regarding changing or switching medications, most suggestions aimed to optimize of hypertension control (e.g. change of ACE inhibitor due to cough to alleviate this common side effect). For additional drug therapy, the pharmacist most often suggested starting vitamin D supplementation for the prevention and/or treatment of osteoporosis (based on serum concentration levels), and starting probiotic for constipation (Table 1). Most recommendations were suggested for medications within the blood and blood forming organs (B)group (n= 37, 27.82%), followed by medications for the treatment of cardiovascular system (C) (n= 28, 21.05%) and the nervous system (N) (n= 18, 13.53%). Over one third of suggestions (n= 50, 37.59%) were made for medications for the treatment of respiratory system (R), musculo-skeletal system (M), genitourinary system and sex

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Table1. Pharmacists' recommendations and acceptance rate of drug therapy problem.

DTP category	N (%)	DTP cause, N (% of 141 DTPs)	Pharmacists' recommendation	N of the proposed recommendations n (% of 133 recommendations)	N of accepted recommendations n (% of the number in left column)	Example
INDICATION						
1. Unnecessary drug therapy	11 (7.7)	No medical indication, 7 (63.6)	Drug discontinuation	9 (6.8)	7/9 (77.8)	PPIs use for stomach problems caused by other long-term medications
			Drugs that should be avoided in the older adults			
		Duplicate therapy, 3 (27.3)				Two benzodiazepines
		Treating avoidable adverse reaction, 1 (9.1)				Metoclopramide use for drug-induced nausea
2. Needs additional drug therapy	55 (39.0)	Untreated condition, 45 (81.8)	Dug initiation	52 (39.1)	43/52 (82.7)	Probiotic for constipation
		Synergistic therapy, 5 (9.1)				Beta blockers after MI
		Preventive therapy, 5 (9.1)				Statin therapy for hyperlipaemia
						Vitamin D for osteoporosis
EFFECTIVENESS						
3. Ineffective drug	10 (7.1)	More effective drug available, 7 (70.0)	Drug discontinuation	7 (5.3)	6/7 (85.7)	ACE inhibitors or calcium channel blockers in secondary prevention of CVI instead of beta blockers
			Drug modification			
		Contraindication present, 1 (10.0)	Drug regimen modification			NSAIDs in haemodialysis patient
						aspirin for stroke prevention in AF
		Drug not indicated for condition, 2 (20.0)				
4. Dosage too low	9 (6.38)	Ineffective dose, 1 (11.1)	Dose adjustment	9 (6.8)	7/9 (77.8)	Dose of atorvastatin (20mg) in a patient with a high cardiovascular risk
			Drug modification			
		Frequency inappropriate: the dosage interval, 7 (77.8)	Drug regimen modification			Prolonged interval between two daily ISMN doses (12 hours instead of 6 hours)
		Incorrect administration, 1 (11.1)				Potassium
SAFETY						
5. Adverse drug reaction	14 (9.9)	Undesirable effect that is not dose-related, 5 (35.7)	Drug discontinuation	14 (10.5)	13/14 (92.9)	Tramadol (constipation)
			Patient education			
		Unsafe drug for the patient, 2 (14.3)				Olanzapine in patients with diabetes
		Drug interaction - not dose related, 5 (35.7)				Olanzapine with diazepam and fluphenazine caused multiple falls

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						Taking mirtazapine in the afternoon instead of the evening
		Incorrect administration, 2 (14.3)				
6. Dosage too high	35 (24.8)	Duration too long, 25 (71.4)	Dose adjustment	35 (26.3)	29/35 (82.9)	Zolpidem 10mg in elderly patients
			Drug modification			
		Dose too high, 6 (17.1)	Drug regimen modification			Pantoprazole 40mg in the prevention of NSAID-induced gastroduodenal ulcers
			Drug discontinuation			
		Frequency too short, 4 (11.4)				Twice daily sertraline use (increased side effects: nausea and hypertonia)
ADHERENCE						
7. Nonadherence	7 (4.9)	Does not understand instructions, 7 (100.0)	Patient education	7 (5.3)	7/7 (100.0)	Patient education (asthma medication)
Total	141 (100.0)			133 (100.0)	112/133 (84.2)	

ACE- angiotensin –converting enzyme; AF- atrial fibrilation; CVI- cerebrovascular insult; HF-heart failure; ISMN- isosorbide mononitrate; MI- myocardial infarction; NSAIDs- nonsteroidal anti-inflammatory drugs; PPIs- proton pump inhibitors.

hormones (G), alimentary tract and metabolism (A) according to Anatomical Therapeutic Chemical (ATC) classification system.

DISCUSSION

Providing medication review and comprehensive medication management to older adults residing in a nursing home in Croatia reveals not only high prevalence of polypharmacy but also high prevalence of drug therapy problems. Participants had an average 4.3±SD of 2.35 DTP per resident, similar to elderly in nursing homes in Norway, slightly more than elderly in the Netherlands, and somewhat lower than nursing home residents in Spain or Germany[31-34]. Differences in the average number of DTP could be due to variations in the classification, sample size, or resident demographic and health conditions. Differences in healthcare settings, such as the availability of multidisciplinary teams or pharmacist involvement, also affect DTP identification and management. Furthermore, detection frameworks and methodologies, and regional prescribing patterns also can contribute to these discrepancies[35]. These factors collectively influence the reported prevalence and types of DTPs across different studies, indicating a significant burden of potentially inadequate care for nursing home residents across Europe. In 2021, the European Commission initiated its Horizon 2020 project, Individualized CARE for Older Persons with Complex Chronic Conditions at Home and in Nursing Homes (I-CARE4OLD), to develop and test decision support to help healthcare professionals care for older adults[36]. With the ageing population, it is crucial to ensure standardized care for older adults in all settings.

A pharmacist-led medication review in nursing home residents has been proven to be effective in detecting and resolving drug therapy problems[37]. Comprehensive medication management services can similarly have a positive impact, especially for complex patients, by considering clinical outcomes and personal therapy goals. CMM is also aims to integrate pharmacist into the care team[38]. A pharmacist's timely recognition of drug therapy problems, effective collaboration with the nursing home team and the patient-centered approach, followed by acceptance and implementation of the recommendations can achieve the quadruple aim: better outcomes, lower costs of care, improved patient experience, and improved clinician experience[39]. While implementation and sustainability of a service can be challenging, pilot projects such as this study, highlight the need for pharmacists' integration into nursing home care. This study's findings confirm that a pharmacist-led CMM services effectively detects DTPs. A prior study by lead author[28] highlighted the most common DTPs found in nursing home residents, and emphasized the need for additional therapy and addressing adverse drug reactions. Results from this study corroborate these findings and underscore the importance of pharmacist-led medication review and management for nursing home residents. In this study, most recommendations were related to the need for additional drug therapy. Other studies often reported recommendations regarding safety, such as adverse drug reactions or drug-drug interactions leading to adverse drug reactions, and recommendations regarding indications, such as unnecessary drug therapy[33,34,40]. Differences in patient characteristics, including gender distribution, could explain these variations. In our study, females comprised 70% of the participants, which could influence the observed DTPs and necessary medication management interventions. Gender-specific differences in drug metabolism and response,

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influenced by variations in body composition, hormonal levels, and genetic factors, may affect the efficacy and side effect profiles of medications[41]. These differences can necessitate tailored therapeutic approaches or adjustments in medication management. Furthermore, the prevalence of certain chronic conditions may differ by gender, potentially leading to variations in the types and frequencies of DTPs encountered[42]. Acknowledging and discussing these gender-related factors are crucial for understanding their impact on DTPs and enhancing the personalization of medication management in geriatric care settings[43].

Approximately 30% of the recommendations involved reducing, tapering, or stopping medications. Deprescribing in nursing home residents can positively affect patient outcomes, such as a reduction in the number of inappropriate and potentially harmful medications or a number of falls[44]. Medication review-directed deprescribing can reduce all-cause mortality[45]. Research shows that nursing home residents are generally open to deprescribing, but a tailored approach is necessary[46-48]. In CMM, which focuses on patient-centred care, healthcare providers can make deprescribing recommendations while ensuring all aspects of shared decision-making are met.

As CMM is tailored around the patient and patient's important outcomes, it is an ideal opportunity for healthcare providers to make recommendations such as deprescribing, ensuring all aspects of shared decision-making are met. Our analysis highlighted a range of pharmacist interventions, including drug discontinuation, initiation, dose adjustments, and patient education, each addressing specific aspects of pharmaceutical care critical for managing complex medication regimens in elderly nursing home residents. The variety and specificity of these recommendations underscore the pharmacist's role in tailoring medication plans to meet individual patient needs effectively.Moreover, medication therapy management services improve clinical outcomes, such as reduced healthcare utilization (fewer emergency department visits) or improved medication adherence[49]. Pharmacist-led interventions aimed at reducing adverse drug events in older adults in aged care facilities have also proven beneficial[50]. These outcomes are significant in frail elderly populations.

Micro-level interventions in nursing homes, such as those ensuring pharmacists are available to provide patient-centered services, are effective[51]. This study confirms that pharmacists' recommendations can help resolve drug therapy problems. Physicians accepted most suggestions, particularly those involving new medication initiation and stopping unnecessary and inappropriate medication. This acceptance suggests potential for fruitful collaboration between the pharmacists and GP. However, it also brings to light the areas where discrepancies occur, such as instances of outright rejection of recommendations. Understanding these dynamics is essential for enhancing interprofessional communication and ensuring shared decision-making aligns with patient-care goals. Research shows a varying GP's acceptance of pharmacists' recommendations, ranging from 52% to 100%[25-27]. For example, our study's acceptance rate is higher than the 62% found in a multicentre study in France[52]. However, direct comparisons should be cautious due to significant differences in scale and healthcare settings. Variation in acceptance rates can be explained by differences in the prescribing process (computerized or handwritten), method of identification of potential drug-related problems (using CMM or medication review), setting (medical, surgical or intensive care unit), and the method of recommendation communication (over the tele-phone, during ward rounds and/or electronically). Most previous studies addressed physicians' acceptance rates of recommendations suggested during ward rounds by clinical pharmacists who were a part of a multidisciplinary care team[28-30]. The acceptance rate in our study is comparable with reported acceptance rates of around 60-80% in settings where pharmacists have been integrated into the medical team on the ward[52,53]. This could indicate that a pharmacist could be easily and readily integrated into the nursing home care team and that other healthcare providers find collaboration with a pharmacist productive and feasible. Differences in the prescribing process, whether computerized or handwritten, can influence acceptance rates. Conversely, handwritten prescriptions may be more prone to errors. Regarding the method used for identifying potential drug-related problems, comprehensive medication management typically involves a more thorough and systematic review of a patient's medication regimen, considering factors such as appropriateness, effectiveness, safety, and adherence. The higher acceptance rate, found in this study, could be explained by pharmacists' accurate assessment of identified drug-related problems using the CMM cognitive process. Traditional medication review process may be less comprehensive, potentially resulting in fewer identified issues and lower acceptance rates of suggested recommendations. The setting in which recommendations take place can also impact acceptance rates and influence the receptiveness of clinicians to suggested recommendations, with factors such as time constraints, patient stability, and competing priorities. Furthermore, the method of communication for recommendation delivery—whether over the telephone, during ward rounds, or electronically—can significantly influence acceptance rates. Communication barriers such as interruptions during ward rounds or lack of direct interaction may hinder the acceptance of suggestions. Acceptance rate in this study could have been influenced by the fact that pharmacists established a continuous and sound communication with the physician which enabled a productive multidisciplinary team to deliver patient care.

Strengths and Limitations

There are several significant limitations to this research. Only one nursing home and a relatively small number of participants were involved, presents significant limitations regarding generalizability and objectivity of the findings. Currently, in Croatia, there is no established pharmacy practice within nursing homes, nor do pharmacists directly participate in providing pharmaceutical care for nursing home residents. This was the first study in Croatia to explore pharmacists' recommendations to GP regarding changes needed in nursing home residents' pharmacotherapy and to report physicians'

acceptance of such recommendations. Such collaboration remains uncommon in everyday practice. Most nursing homes do not have a resident in-house physician, and the nursing staff is responsible for providing medicine and ensuring its safe use. Physicians are community-based and provide services and visits on an as-needed basis. Medication dispensing is managed through community pharmacies, and pharmacists are rarely involved in collaborative or direct pharmaceutical care. Furthermore, a short time frame of 24 hours was used to follow up on the recommendation of pharmacists' suggestions, which could be viewed as a limitation. This time frame was chosen for technical reasons. Only one community pharmacist-researcher was involved in communicating suggested recommendations. In order to keep track of all the patients and recommendations for 24 hours and ensure the involved GP could do the same, one working day was chosen as the recommendation frame period. Recognizing the critical role of long-term monitoring in Comprehensive Medication Management (CMM), we acknowledge the limitation in our study due to the absence of continuous follow-up measures and validation. Future studies should incorporate a structured follow-up protocol to track clinical and patient related outcomes, including medication effectiveness, safety and patient adherence over time. Such follow-up would not only validate the immediate outcomes of pharmacist interventions but also assess their sustainability and the long-term impact on patient health. In our study, it is imperative to note the gender distribution of the participant cohort, with females comprising 70% of the study population, which could be viewed as a limitation and could affect the results. This predominance of women could have profound implications on the observed DTPs and the requisite medication management interventions. Results of this study accentuate the need and potential for pharmacists' involvement in the care of nursing home residents, and the high rate of physicians' acceptance suggests that a collaborative model of pharmaceutical care is feasible in this setting. Residential pharmacists' services have proven useful in many countries[55-58].

While the study provides valuable insights, we acknowledge its limitations due to the single-site design and the specific demographic and health profile of the participants. The results serve as a preliminary exploration into the complexities of medication management in elder care facilities. Future studies should expand to include a larger number of participants, participants with more diverse characteristics, nursing homes in different geographical areas, and a longer time frame for physicians to implement the proposed recommendations in order to measure, not only the impact of pharmacists' involvement in the care of nursing home residents and clinical outcomes, but also to gather important information for future policy making. To improve transferability of results, future research should consider multicenter studies, diverse healthcare teams and standardization of recommendations.

We recommend that subsequent research efforts include collaboration among various institutions to facilitate a multicentric study design. This collaborative approach would enable the collection of a wide range of data, ensuring that the findings are reflective of the diverse healthcare environments within Croatia.

CONCLUSION

The high prevalence of DTPs identified among institutionalized older adults strongly suggests the need to incorporate CMM services within institutional care facilities to improve provided care. This study identifies critical gaps in care for older adults at a single facility, reflecting broader systemic challenges observed across Europe. Despite methodological limitations, such as sample size and site specificity, the robust, multidisciplinary approach employed provides valuable initial insights. Physician's high acceptance of pharmacists' suggestions accentuates the importance of pharmacists' active involvement in nursing home patient care. A collaborative care practice involving pharmacists, physicians and the nursing staff is necessary. Future research should include multicentric studies to enhance generalizability and deepen understanding of regional differences. Ultimately, this work lays the groundwork for improving elderly care standards across diverse healthcare environments.

AUTHOR CONTRIBUTIONS

Conceptualization, KFS; Methodology, KFS; software and formal analysis, PH; investigation, KFS; resources, IB; data curation, KFS, PH; writing—original draft preparation, KFS; writing—review and editing, IB, LJFP; supervision, KFS. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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