Title
Addressing Appropriateness of Medications in the 65 Years and Older Patients in the Outpatient Setting

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Addressing Appropriateness of Medications in Patients 65 Years and Older in the Outpatient Setting

A dissertation submitted in partial satisfaction of the

requirement for the degree

Doctor of Nursing Practice

by

Velma D. Yep

2021

ABSTRACT OF THE DISSERTATION

Addressing Appropriateness of Medications in Patients 65 Years and Older in the Outpatient Setting

by

Velma D. Yep

Doctor of Nursing Practice

University of California, Los Angeles

Professor Mary Cadogan, Co-Chair

Professor Janet Mentes, Co-Chair

Background: The use of many medications is common among those over 65 and older living in the United States. However, the increased number of medications used, especially prescription medications, results in harmful consequences: prescription of potentially inappropriate medications (PIMs) and medications without clinical indications. The World Health Organization reported that four out of ten patients are harmed in outpatient settings because of unsafe healthcare-related to wrong prescriptions. There are works of literature suggesting that healthcare providers (HCP) often do not follow clinical practice guidelines. **Objectives:** This

quality improvement project implemented an NP-led educational intervention to decrease the frequency of potentially inappropriate medications in older patients in the outpatient setting. The intervention provided the healthcare providers a mechanism to address PIMs.

Methods: This pre-post quality improvement project used a nurse practitioner-led educational intervention and applied an evidence-based screening tool to manage PIMs. This study was conducted between November 2020 and March 2021. Quantitative measurements were used to evaluate the intervention's effects in addressing PIMs in the outpatient setting in eight weeks. Descriptive statistics were used to characterize variable distributions. The t-tests estimated group comparisons between pre-educational intervention and post-educational intervention number of inappropriate medications, the proportion of patients with inappropriate medications, patients with duplicated medications, and medications that had matching diagnoses.

Results: There were a total of 166 patients' medical records reviewed. The mean age for all the patients was 73.2, 49.4%, and the majority were female and predominantly Hispanic (50.6%). Throughout the entire period, reviewed medical records showed that the three most prevalent diagnoses were hypertension (63.9%), hyperlipidemia (49.4%), and type 2 diabetes mellitus (43.4%). There was no observed statistically significant difference in the number of inappropriate medications between pre-and post-intervention. However, there was a trend of improvement in the number of patients receiving duplicated medications from pre-intervention to post-intervention. **Conclusion:** Although there was no significant decrease in the frequency of inappropriate medications in the eight weeks, issues associated with PIMs in the multimorbid older patients require further quality improvement projects. A longer process evaluation period is necessary to provide HCPs the time to adapt and use evidence-based screening tools and increase patient-provider consistency in decreasing PIMs.

Keywords: inappropriate medications, older patients, outpatient setting, nurse practitioner-led intervention.

The dissertation of Velma D. Yep is approved.

Sarah Choi

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2021

This dissertation is dedicated to the patients we care for. As healthcare providers, their quality of life, safety, well-being, and health maintenance are of utmost importance.

TABLE OF CONTENTS

List of Tables

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VITA

Velma Yep is a board-certified geriatric nurse practitioner and a practicing NP since 2002. Velma had finished her master's degree in nursing from UCLA and is expected to complete her doctorate in nursing practice degree from UCLA. Before being an NP, Velma had been a registered nurse for 20 years and had worked in different hospital settings, including critical care, emergency room department, and case management. Velma had also experienced working as an RN both on the east and west coasts.

As a nurse practitioner, Velma had worked in an Oncology/ Internal Medicine medical group for over six years, and in 2009 started her corporation. Since then, she has worked in ambulatory medicine, urgent care, hospice, and palliative medicine practices. She was instrumental in helping create the Weight and Nutrition Management Center at Pomona Valley Medical Center. She had precepted geriatric NP students from UCLA, Western University, and is a clinical preceptor of family nurse practitioner students from California Baptist University.

Velma is the current president for the California Association for Nurse Practitioners Inland Empire chapter, a member of the CANP Health Justice committee, a legislative representative for the Philippine Nurses Association of Southern California and is active with the Philippine Nurses Association America. She is involved in committees for health care equity and addressing discrimination. She continues to lobby and advocate for improving patient care access in California.

She was also accepted in the national honors society-Sigma Theta Tau. In 2003, she received the Philippine Heritage Awards for 'top 20 Filipino-American nurses' in Southern California. Velma participated in the "Stay Well and Healthy" pilot study program in coordination with UCLA and Casa Colina Centers for Rehab as lead NP. The actual study,

authored by her former nursing professor, was titled "Using Nursing Intervention Classification in an Advanced Practice Registered Nurse-Led Preventative Model for Adults Aging with Developmental Disabilities," published in the Journal of Nursing Scholarship in 2014.

CHAPTER ONE: INTRODUCTION

The World Health Organization (WHO) describes polypharmacy as multiple medications (WHO, 2019). Polypharmacy is defined as the simultaneous use of five or more medications, including prescription and over-the-counter drugs. (Farrell et al., 2018; Franco et al., 2017; Masnoon et al., 2017). About 30% of the 65 and older take an average of 18 medications per year (Sherman et al., 2017). According to Scott et al. (2017), using five or more medications may be medically necessary to treat multimorbid patients' health-related problems. Still, the increased number of medications used results in high-risk consequences. Consequences as drug- to- drug interactions, adverse drug effects, hospitalizations, and even death (Novaes et al., 2017; Scott et al., 2017). The scope of polypharmacy includes potentially inappropriate medications (PIMs) and medications without a clinical indication. PIMs must be avoided, especially if there are better, less risky alternatives (Novaes et al., 2017; Tommelein et al., 2015). And according to Mortazavi et al. (2018), PIMs may cause overprescribing or underprescribing.

PIM use is an urgent issue among multimorbid older patients in outpatient settings that requires interprofessional effort by healthcare systems worldwide (Mangin et al., 2018). The demands and expectations set by society from physicians' practices in primary outpatient care increase because they want to achieve a better quality of life (Detsky, 2011). According to (Bodenheimer & Sinsky, 2014), the Institute for Healthcare Improvement (IHI) Triple Aim—enhancing patient experience, improving population health, and reducing costs—is the guide to optimize health system performance. Inappropriate medication management involves physicians, pharmacists, and nurses (Mangin et al., 2018). Nurse practitioners (NP) can position themselves at the table, collaborate with interdisciplinary healthcare professionals, and influence healthcare improvements in their institutions and workplaces (Zaccagnini & White, 2017).

Problem Statement

The WHO in 2019 reported that some patients are harmed each year because of unsafe health care. The WHO (2019) also added that four out of ten patients are harmed in outpatient settings because of unsafe healthcare-related PIMs. In the United States, inappropriate medications alone cost an average of $42 billion annually, and approximately 4% of the world's avoidable costs are related to PIMs (WHO, 2019). PIMs are a high indicator for increase healthcare spending. It is estimated that $7.2 billion of the healthcare expenditure accounts for PIMs' use of the older people living in the community in the United States (Fu et al., 2007).

Another problem with prescriptions is duplication of medications related to multimorbid patients seeing multiple physicians (Halli -Tierney et al., 2019). Duplication of medications or the use of medications in the same classification can lead to cumulative effects in the body (Sherman et al., 2017). The lack of communication between patients and their healthcare providers and lack of communication amongst healthcare providers can cause PIMs (Stevenson et al., 2004). Despite evidence of safe deprescribing, written pieces of the literature suggest that healthcare providers (HCP) often do not follow clinical practice guidelines (Rash et al., 2018; Wallis et al., 2017). Changes in the HCPs' behaviors, knowledge, motivation, and adherence to guidelines need to be addressed to improve polypharmacy and PIMs issues in older patients (Rash et al., 2018). Therefore, creating and implementing ways to prevent medication-related problems is vital because of polypharmacy's and PIMs' economic and medical burden consequences.

The Clinical PICOT Question

Can an NP-led educational intervention addressing inappropriate medications in the 65 and older patients, compared to no educational intervention, decrease the frequency of potentially inappropriate medications eight weeks post-intervention?

Purpose of the Project

The purpose of this quality improvement study was to determine if a nurse practitioner-led educational intervention to healthcare providers decreases the frequency of polypharmacy and potentially inappropriate medications in an outpatient setting. The nurse practitioner-led educational intervention will provide the HCPs a mechanism to address inappropriate medications in older patients. According to Cadogan et al. (2016), educational intervention and guidance in the process of deprescribing may influence behavior change to address polypharmacy. Incorporating evidence-based theories in interventions improve behavior change in HCPs (Cadogan et al., 2016). This project aims to a) decrease the frequency of potentially inappropriate medications, c) discontinue duplicated medications, and d) ensure that the medications the patients are taking have matching diagnoses.

Background

The increased population of baby boomers living longer is becoming a problem for the healthcare system (Cadogan et al., 2016). According to the WHO (2019), long-term health issues are related to getting older, and the world's population of people over 65 years old will increase from 11% in 2010 to 22% in 2050 (WHO, 2019). According to The International Conference on Harmonization (1993), older people are considered a unique population because they are vulnerable (ICH, 1993). This 'unique population' is vulnerable to adverse drug reactions because

of co-morbidities and has degenerative changes in pharmacokinetics and pharmacodynamics compared to the younger population (Davies & O' Mahony, 2015).

In this study, older patients are defined as patients aged 65 years old and above. The increased prescribing in older patients is related to the increase in this population's multimorbidity (Kucukdagli et al., 2020). The decreased drug clearance results from metabolic changes that come with the aging process, leading to increased drug-drug interactions, increased non-therapeutic serum drug levels, and possible adverse reactions. Additionally, according to Kuckdagli et al., 2020), PIMs were associated with common geriatric syndromes, including loss of bladder control, falls, depression, dementia, and functional dependency (Kucukdagli et al., 2020).

Some of the classifications of PIMs for older patients are benzodiazepines in combination with opioids, sulfonylurea, and proton pump inhibitors. Also, antidepressants alone or in combination, barbiturates, and fast-acting sulfonylurea are considered PIMs for older patients (Beers et al., 1991; Greenburg, 2019; Williams et al., 2017). According to Sherman et al. (2017), about 119,000 deaths per year are due to prescription medication problems. Moreover, according to the Medical Expenditure Panel Survey in 2007, the estimated health care expenditures were $7.2 billion related to PIMs (AL Rasheed et al., 2018; Fu et al., 2007). Adverse drug reactions and drug-to-drug interactions are considered a public health problem in older patients and cause disability, increased hospitalizations, and mortality (Davies &O' Mahony, 2015). Therefore, healthcare prescribers should consider using safer alternatives in prescribing medications for the elderly. Adherence to prescribing guidelines can reduce inappropriate medication use in the older population (Davies &O' Mahony, 2015).

CHAPTER TWO: THEORETICAL FRAMEWORK

The Theory of Planned Behavior (TPB) is a behavior change model applied to HCPs and all patient populations. Studies have shown that behavior-change education has been beneficial to guide interventions to improve older people's PIMs use (Rich 2020). The application of TPB can help target the construct of behavior changes, the HCPs' subjective views and attitudes to address polypharmacy, and PIMs in older patients. According to Ajzen (1991), a person's intention to engage in a planned behavior may motivate to perform the behavior. Also, a person has total control of intentions when there are no constraints to perform a given behavior (Ajzen, 1991). The NP integrates theoretical concepts to the target audience's readiness to change (Zaccagnini& White, 2017). Rich et al. (2020) examined the TPB use for guiding the physicians' professional behaviors on patients' safety, reflective practice, and using clinical guidelines on confidentiality. The study results showed that the TPB constructs significantly predict intention to engage in reflective behavior. Therefore, the TPB provided the NP a foundation for implementing the educational intervention for the HCPs in the clinical setting.

The Donabedian structure, process, and outcomes model paved the way to recognizing a practice change. The Donabedian conceptual model suggests that health care quality be evaluated by the structure (the health care setting), process (clinical processes in the health care setting), and outcome (ultimate status of the patient following a given set of interventions) (Butts & Rich, 2018). With Donabedian's quality-of-care conceptual framework, this study addressed PIMs issues in the outpatient setting (structure). The framework's application helped implement the intervention (process) to decrease polypharmacy and discontinue inappropriate medications in 65 and older patients (outcomes).

CHAPTER THREE: REVIEW OF LITERATURE

Literature Search

Although there are robust publications on polypharmacy, there are not many PIMs in outpatient setting-related publications within the last five years. Therefore, the literature search strategy supporting the PICOT question was narrowed to works of literature from 2017-2020 in the English language. However, three seminal studies were done in 2006, 2009, and 2014 included in this review that reflected PIMs in the outpatient setting: screening tools detect PIMs and the NP's educational role. Databases searched in this comprehensive literature review included CINAHL, PubMed, Google Scholar, UC Library links. The searches revealed over 75 pieces of works of literature on the phenomenon of interest. Fourteen publications were selected and reviewed, based upon settings, applying evidence-based screening tools for older patients, NP-led interventions, physicians' views on polypharmacy and PIMs, and nurse practitioners' roles. The studies chosen comprised various quality improvement studies and methodologies such as pre- and post-intervention, randomized control trials and cross-sectional studies, descriptive qualitative and quantitative designs.

Synthesis of Literature Review

Polypharmacy and PIMs are common in older people with multiple chronic conditions and are found in outpatient settings (Franco et al., 2017; Maio et al., 2006). The prevalence of polypharmacy in chronic cardiovascular patients in an Ethiopian hospital in 2020 was 24.8% (Tefera et al., 2020). Moreover, the study found that patients 65 years and above were twice more likely to have PIMs associated with polypharmacy than patients 18–64 years old ($p = 0.027$) (Tefera et al., 2020). Tefera et al.'s (2020) study were limited because it did not utilize standard tools to measure health status objectively. On the contrary, in seminal research examined by Maio et al. (2006), the prevalence of PIMs among the older patients in two

outpatient settings suggested that with the use of the Beers criteria tool (Beers et al., 1991), out of 100 patients studied, one-fourth had at least one PIM.

There are structured guides that provide HCPs the steps in deciding which medications are considered inappropriate for older patients and should be avoided or discontinued (Mortazavi et al., 2018; Scott et al., 2017). While Maio et al. (2006) utilized the 2003 Beers screening tool criteria to address polypharmacy in the outpatient setting, Franco et al. (2017) described the different medication discrepancies discovered with the use of the Screening Tool of Older Persons' Potentially Inappropriate Prescriptions (STOPP) (Gallagher et al., 2008). The use of the STOPP criteria detected 77% PIM in 186 sample patients and 1242 medication discrepancies with the electronic medical record (Franco et al., 2017). Comparatively, the prevalence of PIMs was 72.75% found in prescriptions prescribed to 2231 patients aged 65 years old or older, based on the Beers criteria in an outpatient setting study in Santa Fe, Argentina (Chiapella et al. (2019). Moreover, Chiapella et al. (2019) mentioned in their research that prescribing and monitoring errors are common in outpatient settings and can be determined by screening tools like the Beers criteria. Inappropriate medications in older patients were discovered using the Beers criteria list (Bergman-Evans, 2020; Chiapella et al., 2019; Scott et al., 2017).

The most used PIMs in the outpatient settings found were antidepressant medications, anxiolytics, and non-steroidal anti-inflammatory medications (Chiapella et al., 2019; Maio et al., 2006; Scott et al., 2017). Unfortunately, the patients' health insurance groups restricted the physicians' safer medication choices (Maio et al., 2006). According to Kesselheim et al. (2015), managed care plans have created formularies or preferred medication choices for their beneficiaries. In addition, tight restrictions were implemented on specific prescription medication coverage for patients (Kesselheim et al., 2015). Altogether NPs use multiple evidence-based

measurement tools for medication reviews (Ryder et al., 2020). Therefore, valid screening tools such as the Beers and the STOPP criteria aid in addressing PIMs in older patients (Franco et al., 2017; Maio et al., 2006). Scott et al. (2017) reported that all these screening tools have limitations when used. Screening tools do not include the severity of illness and physical, mental, and emotional capacity (Scott et al., 2017). Although there is no specific best screening tool, deprescribing or discontinuing any unnecessary medications and medication monitoring are recommended to reduce the number of medications and PIMs burden (Halli-Tierney et al., 2019).

Chen et al. (2009) conducted a seminal study in an inpatient unit that showed that an NP-led multidisciplinary intervention that monitored and reviewed medications daily had significantly reduced unnecessary drug use. In a skilled nursing facility setting (SNF), an NP-led medication management team created an evidence-based medication management guideline that discontinued medications if the condition no longer exists or has PIMs in the older patients (Bergman-Evans, 2020). Anderson & Ferguson (2020) conducted an NP-led implementation project using a pre- and post-implementation design in a similar setting. The study used a medication reconciliation system to decrease hospital re-admission rates from SNF. Although it did not yield a statistically significant result, the intervention reduced hospital re-admission by 29% (Anderson & Ferguson, 2020). In Bergman-Evan's study, polypharmacy and PIMs were not reduced because the NPs assumed consultants' roles instead of primary provider roles (Bergman-Evans, 2020). According to the American Association of Nurse Practitioners (AANP), limitations on NPs' full practice authority as primary care providers in certain states prevent NPs from practicing to the full extent of their knowledge, education, and preparation (AANP, 2019). Although medical residents and students are aware of the value NPs specialized knowledge and skill, medical residents and medical students were unclear of NPs role and NPs professional

identity (Walsh et al., 2014). NPs functions are controlled by professional regulatory frameworks (AANP, 2019; Ryder et al., 2020). Therefore, to close the gap in the knowledge and information on NPs identity among health care providers, an increase in the education on the role of NPs in healthcare requires needed attention. Clarity of NP professional roles, competencies, and responsibilities may reduce barriers to improving/reducing PIMs (Farrell et al., 2018).

HCPs working collaboratively can perform better when they know each profession's expertise (Farrell et al., 2018). Interdisciplinary collaboration in addressing polypharmacy and PIMs work amongst physicians, health practitioners, and patients on medication review results in discovering medication discrepancies and reducing PIMs (Franco et al., 2017; Jager et al., 2017). Physicians reported that polypharmacy and inappropriate medication use resulted from the lack of or limited knowledge on de-prescribing, lack of communication amongst health providers, and lack of a monitoring process for many prescription medications (Al Rasheed et al., 2018; Mortazavi et al., 2018; Wallis et al., 2018). On the contrary, physicians expressed that they had the duty, responsibility, and accountability to do what was best for their patients (Wallis et al., 2017). HCPs recognize and respond to PIMs within their clinical practice (Farrell et al., 2018), although HCPs had suggested institutional and organizational changes for safer prescribing (Farrell et al., 2018; Wallis et al., 2017).

Improved patient and healthcare provider communication can help address PIMs (AL Rasheed et al., 2018; Bergman-Evans, 2020; Mortazavi et al., 2019). This draws attention to the need to integrate PIMs awareness education, de-prescribing education, and communication between patients and HCPs. Bergman-Evan's (2020) study is relevant to the clinical question of how an NP-led intervention and interdisciplinary role can improve the de-prescribing of inappropriate medications by improving patient-provider communication. Nurse practitioners

understood the importance of their role as health educators, and they believed they were well trained for this role (Ryder, 2020; Walsh et al., 2014).

Summary of the Literature

The WHO Global Patient Safety Challenge: Medication Without Harm had recommended ways to address safe medication practices and lessen harm related to PIMs use (WHO, 2019). Inappropriate medications are usually detected through a process, and the use of screening tools has been beneficial. Medication management is an interdisciplinary huddle, and NPs are an integral part of the interdisciplinary team in healthcare (Bergman-Evans, 2020; Chen et al., 2009; Ryder, 2020). Therefore, collaborative efforts amongst the interdisciplinary team may reduce PIMs in a patient-centered care approach.

The works of literature reviewed have shown an NP-led intervention's effectiveness in addressing polypharmacy and PIMs in two different settings (SNF and in-patient). Further studies on NP-led interventions in the outpatient settings are needed to close the gap between NP interventions' effectiveness in inpatient and outpatient settings. Nurse practitioners are at the forefront of healthcare. Therefore, NPs are well-positioned to provide education and interventions in reducing inappropriate medications and are valued by other health professionals for their knowledge. Part of the solution in closing the gaps in the confusion of NPs roles is by increasing education of what nurse practitioners can do in their work settings. According to Zaccagnini & White (2017), as part of the Institute of Medicine's 2010 report, The Future of Nursing: Leading Change, Advancing Health (IOM, 2010), "advanced practice registered nurses must practice to the full extent of their education, knowledge, and skills"(p. 42).

CHAPTER FOUR: METHODS

Study Design

This pre-and post-design quality improvement project used an NP-led educational intervention and applied an evidence-based screening tool to address inappropriate medications. This study was conducted between November 2020 and March 2021. This study aimed at reducing PIMs in 65 and older patients in the outpatient setting. The categories examined to compare the prevalence of PIMs for older patients before and after the NP-led education intervention were a) the frequency of potentially inappropriate medications, b) the proportion of patients with inappropriate medications, c) duplicated medications, and d) medications that did not have a matching diagnosis. A pre-and post-educational intervention questionnaire was given to each HCP participant to provide the nurse practitioner HCPs' knowledge and motivation to address polypharmacy. The Theory of Planned Behavior framed the foundation to guide HCPs' behavior change in reducing polypharmacy and PIMs in older patients. The Donabedian model was adopted throughout the project's implementation, monitoring, and evaluating the effects of the intervention.

Ethical Considerations

Ethical approval to carry out the project was obtained from the outpatient clinic practice's medical director and office manager. All information collected as part of this project process completion was aggregated data from the project participants and did not include any potential patient identifiers. This quality improvement project does not directly involve patient participation; therefore, this quality improvement project is exempt from the UCLA Institutional Review Board.

Sample and Setting

Two Family Practice board-certified physicians and one physician assistant in the focus clinic received the NP-led education intervention on PIMs. All providers were men over the age of 30, had graduated from medical schools in the United States, and had over twelve years of medical experience. All HCPs are employees of the clinic setting and have local hospital affiliations.

This quality improvement study addressing PIMs was conducted in an outpatient ambulatory clinic in San Bernardino County's suburban area. The clinic serves patients of all ages, from the pediatric to the geriatric population residing in the Inland Empire and parts of Los Angeles. The clinic provides services to patients with acute, urgent, and chronic conditions. The clinic accepts patients with private insurance, managed care, and cash payments. The clinic sees an average of 800 patients per month.

Stakeholder support and sustainability

The primary stakeholders involved in the project were the medical doctors, the NP, the physician assistant, the office manager, and the office staff. The stakeholders' support allowed for a successful one-hour education session administered by the NP. The project's evaluation is aligned with the process, outcomes, and HCPs' application of the intervention in the clinical practice. This quality improvement project's sustainability relies on how the stakeholders value addressing polypharmacy and PIMs among older patients.

Intervention

The NP scheduled a one-hour individual face-to-face educational presentation with each HCP. The NP-led education intervention was provided to the HCPs using the 2019 American Geriatrics Society's (AGS) Beer's screening tool. The HCPs were provided a mechanism to

obtain the project aims and improve patient health outcomes in the older patients in the clinical practice. The presentation was followed by a discussion on implementing the AGS Beers criteria tool in the practice when performing medication reviews during patient visits. The presentation was conducted on three separate occasions from January 8- January 29, 2021: two educational intervention presentations were given in the study's outpatient clinic setting, each for the physician and the physician assistant. Because of the Covid-19 pandemic situation, the NP provided the other physician's educational intervention in his satellite office in Los Angeles while giving Covid testing services. Pre-printed copies of the AGS 2019 Beers criteria were shared and discussed with each of the HCPs, and visual reminders of the screening tool were placed on their workstations.

An interdisciplinary collaboration approach was integrated with the intervention, including patient education, patient involvement, and shared decision-making with their medication review process.

Instrument

According to Greenburg. (2019) the Beers Criteria was developed in 2012 using a peer-reviewed evidence-based approach that substantially followed the Institute of Medicine standards for evidence and transparency. The review methods were based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) guidelines for clinical practice guideline development and consistent with recommendations from the National Academy of Medicine (Greenburg, 2019). Because of the Beers criteria's evidence-based standards, this screening tool was used in this quality improvement project to increase awareness of inappropriate medication use in older adults. Additionally, the screening tool supports the

clinical decision-making for HCPs as they work to prevent PIMs and subsequently improve patient outcomes (Greenburg, 2019, Steinman et al., 2015).

The AGS Beers Criteria tool named after the developer Mark H. Beer, MD, in 1991, a widely used valid, and reliable screening tool used in any clinical setting that includes categories of PIMs to be used with caution and avoid in older adults (Fixen, 2019; Steinman et al., 2015). The 2019 updated version of the AGS Beers Criteria has clinical practice guidelines recommended by the National Academy of Medicine with ratings of quality of evidence (QE) and strength of recommendation (SR) for each criterion for a specific class of medications (Fixen, 2019; Greenburg, 2019, Steinman et al., 2015). The type of medications having a strong QE and SR that are potentially inappropriate for older patients fall under antidepressants alone or in combination, sulfonylurea and proton pump inhibitors used over eight weeks without benefits, systemic hormone replacement, and benzodiazepines combined with opioids. The class of medications considered by the AGS Beers criteria as having moderate QE and strong SR are benzodiazepines, alpha one blocker, non-benzodiazepines, insulin, and NSAIDs. However, the screening tool is not used to supersede clinical judgment or patient's needs. Individualized prescribing and de-prescribing require shared decision-making.

Data Collection

Data were collected using a convenience sample of medical records of patients 65 and older. The medical record review (a combination of hard copies and electronic medical records) was conducted from November 2020 to March 2021. Inclusion criteria for chart review selection included patients who (1) are at least 65 years old and (2) take five or more prescription medications, including over-the-counter medicines. Patients were excluded from the chart review if they were patients under hospice care or receiving chemotherapy. For this quality

improvement project, the pre and post samples were reviewed independently. Baseline information was collected in the last week of November 2020. Post-intervention data collection was performed from February 2021 to March 21, 2021.

Primary Outcomes

The primary outcome for this project was to compare the proportion of patients receiving inappropriate medications, medications without a corresponding diagnosis, and duplicate medications at baseline and after the intervention.

Timeline of the Project

The project spanned 16 weeks from November 30, 2020, to March 26, 2021. Pre-intervention data collection occurred from the last week of November to the second week of December 2020. The education intervention was implemented between January 4, 2021, to January 29, 2021. Data collection was completed on March 21, 2021, eight weeks after the educational intervention.

Budget

The time which the DNP student used in analyzing and implementing the project was voluntary. Each project participant received a $25.00 gift card for Subway.

Data Analysis

Descriptive statistics (frequencies, percentages, and proportions) were used to summarize the distribution of patients' demographic variables and the project-aims variables by each phase of the project. A variety of unpaired hypothesis tests (t-, Proportional z-, and Chi Squared-type, as applicable) were used to compare the differences between the pre-intervention (baseline) and post-intervention (outcome) periods. Hypothesis tests were performed at the single-tailed 95% confidence level.

CHAPTER FIVE: RESULTS

Patient Demographics

There was a total of 166 patients' medical records reviewed. There were 82 pre-education and 84 post-education intervention records examined. The mean age for the patient pre-intervention review was 73.2 and post-intervention was 74.4; more male patients from pre-intervention (52.4 %); however, more female patients (57.1%) post-intervention. The most prevalent percentage of patients' pre-intervention was White at 41.5%, whereas post-intervention showed a higher percentage of Hispanic patients (40.5%) (Table 1).

Table 1: *Demographic Profile of Participants by Project Phase with p-values of the Pre-and Post-intervention Comparison by Demographics*

		Pre -intervention		Post -intervention		
Variable	Category	n	%	n	%	p-value
Age						
	65 to 69 years	23	28.0	33	39.3	0.12602
	70 to 74 years	31	37.8	21	25	0.07508
	75 to 79 years	8	9.8	11	13.1	0.4956
	80 to 84 years	7	8.5	12	14.3	0.24604
	85 to 96 years	13	15.9	7	8.3	0.13622
	Mean age=	73.2		74.4		
Gender						
	Male	43	52.4	36	42.9	0.21498
	Female	39	47.6	48	57.1	0.21498
Ethnicity	Asian/ Pacific Islander	6	7.3	11	13.1	0.2187
	Black	7	8.5	7	8.3	0.96012
	Hispanic	33	40.2	34	40.5	0.97606
	Middle Eastern	2	2.4	0	-	0.14986
	White	34	41.5	32	38.1	0.65994
	n	82		84		

A t-test was used to compare pooled sample proportion of pre-and post-intervention by age, gender, and ethnicity; there was no statistical difference seen comparing the pre-and post-intervention by demographics.

Most Prevalent Diagnoses

Multiple co-morbidities were observed in the patients' medical records review. Table 2 shows the ten medical diagnoses used for older patients in the outpatient setting throughout the project implementation. For pre-intervention, hypertension (70.7%), hyperlipidemia (59.8%), and type 2 diabetes (35.4%) were the top three. Post-intervention, the same diagnoses remained to be the top three: hypertension (59.9%), hyperlipidemia (50.0%), and type 2 diabetes (47.6%). Additional diagnoses were chronic kidney disease, gastro-esophageal reflux disease, low back pain, anxiety, hypothyroidism, coronary artery disease, and benign prostatic hypertrophy (Table 2).

Table 2: *Percentages of Top Ten Diagnoses in the Clinic Practice*

	Pre-Implementation		Post-Implementation	
Diagnosis	n	%	n	%
Hypertension	58	70.7	50	59.5
Hyperlipidemia	49	59.8	42	50.0
Diabetes Mellitus Type 2	29	35.4	40	47.6
Chronic Kidney Disease	17	20.7	23	27.4
Gastroesophageal Reflux Disease	13	15.9	27	32.1
Low Back Pain	15	18.3	12	14.3
Anxiety	12	14.6	15	17.9
Hypothyroidism	11	13.4	16	19.0
Coronary Artery Disease	13	15.9	13	15.5
Benign Prostatic Hypertrophy	3	3.7	17	20.2
n =	82		84	

Potentially Inappropriate Medications

Based on the AGS Beers criteria tool, both the strong and moderate QE and SR inappropriateness of medications were reviewed in the project. The project study revealed that prescribed or over-the-counter proton pump inhibitors (PPI) use was common during the pre-education intervention phase. However, post-intervention showed a reduction in the frequency of PPI use by 18.41%. With diabetes type 2 being one of the top three diagnoses in the clinic, the use of sulfonylurea did not decrease post-intervention implementation. Also, both the frequency of benzodiazepines combined with opioids use did not improve post-intervention, along with the frequency of alpha-blockers, antidepressants, and systemic hormone replacement therapy (HRT). It may be insightful to note that both the combination of benzodiazepine and opioid frequency and antidepressant had a slight increase in the frequency post-intervention.

It is important to note that there was a reduction in the number of benzodiazepines alone by more than half post-intervention (4.97%). It was also found that patients who were diagnosed with hypertension were on over-the-counter (OTC) use of non-steroidal anti-inflammatory pain (NSAID) medication as needed for musculoskeletal pain, whether recommended by their HCPs or not. Despite this, there was a substantial decrease in NSAID use post-intervention (14.72%) (Table 3).

Table 3: *Potentially Inappropriate Medications for Older People*

AGS Beers Criteria Potentially Inappropriate Medications for Older People

Quality of Evidence (QE) Strength of Evidence (SR)

	Pre-Intervention		Post-Intervention	
Strong QE and SR by Class of Medication	n	%	n	%
Alpha 1 blocker (Doxazosin, prazosin, terazosin)	1	1.22%	2	2.38%
Antidepressants alone or in Combination (amitriptyline, paroxetine)	2	2.44%	3	3.57%
Benzodiazepines in Combination with Opioids (alprazolam with hydrocodone) (lorazepam with hydrocodone) (temazepam with hydrocodone)	5	6.1%	7	8.33%
Proton Pump Inhibitors (esomeprazole, omeprazole, pantoprazole)	19	23.17%	4	4.76%
Sulfonylureas (glimepiride, glipizide)	9	10.98%	12	14.29%
Systemic hormone replacement therapy	1	1.22%	2	2.38%
Moderate QE and Strong SR				
Antihistamines (hydroxyzine, meclizine)	1	1.22%	2	2.38%
Benzodiazepines Alone (alprazolam, diazepam, lorazepam, temazepam)	7	8.54%	3	3.57%
Nonbenzodiazepines (zolpidem)	2	2.44%	3	3.57%
Nonsteroidal anti-inflammatory (diclofenac, ibuprofen, meloxicam, naproxen)	15	18.29%	6	7.4%
Rapid -acting Insulin (Humalog, lispro)	2	2.44%	3	3.57%

Statistical Results for Inappropriate Medications

A comparison of all medications pre-and post-intervention project showed that although there was no statistically significant difference between the two phases, the mean number of medications per patient for both pre-intervention post-intervention was 7. The mean number of inappropriate medications per patient pre-intervention was 0.57 compared to 0.68 post-intervention. Concerning the proportion of patients receiving inappropriate medications, a non-significant increase from 48.8% pre-intervention to 53.6 % post-intervention was calculated.

Results for Duplicated Medications and Medications without Matching Diagnoses

The number of duplicated medications improved with a slight decrease at post-intervention (from n=4 out of 82 at baseline to n= 4 out of 84 at post-intervention). The proportion of patients receiving duplicated medications was similarly small (< =5), particularly in the baseline period. A comparison of the proportion of patients taking any medications without a matching diagnosis between the pre-and post-intervention implementation was conducted. The proportion of patients receiving medications without a corresponding diagnosis increased from 43.9% at pre-intervention (to 45.2% at post-intervention, although it did not reach a statistical significance (p-value 0.5687).

Only the number of patients with duplicate medications showed any improvement, but the progress was not enough to be statistically significant. None of the tests resulted in a p-value less than the 0.05 threshold necessary to show significance at the 95% confidence level. Because none of the null hypotheses have been rejected, there was not enough evidence to conclude that statistically, significant improvement has occurred eight weeks post-education intervention (Table 4).

Table 4: *Statistical Results of Pre- and Post-intervention Comparison of Primary Outcomes from a Total of N=166 Patients*

	Pre-intervention n or % n = 82	Post-intervention n or % n= 84	p-value
Patients receiving inappropriate medications	48.8	53.6	0.537
Number of patients with duplicated medications	4/ 82	4/ 84	0.5
Patients receiving medications without a matching diagnosis	43.9	45.2	0.56

Questionnaire

All three HCPs in the clinic were provided a pre- and post-education intervention questionnaire. This questionnaire guided the NP on approaching each HCPs' education use of the screening tool to decrease the frequency of polypharmacy and inappropriate medication use.

Table 5: *Healthcare Providers' Questionnaire Responses*

HCPs responses to Questionnaire	Pre-education Intervention number of HCPs			Post -education Intervention number of HCPs		
	Yes	Neutral	No	Yes	Neutral	No
Do you frequently see 65 and older patients in the clnic	3			3		
Do your older patients use five or more medications	3			3		
Have you used the AGS Beers Criterea screening tool/ will you use the AGS Beers Criteria			3	2	1	
I am able to find time each patient's visit to screen for polypharamcy		1	2	3		
I am able to deprescribe inappropriate medications based on their age	3			3		
I am able to communicate with other HCPs about polypharmacy use in older patients	2	1		2	1	
I am able to discuss inappropriate medications with my older patients	3			3		
I am able to check the appropriate medications for oder patients	3			3		
I am able to review my patients medications with them	1	2		3		
I am able to involve my patients in decision -making regarding their medication use	3			3		

CHAPTER SIX: DISCUSSION

The NP successfully conducted and implemented the education intervention to the HCPs in the clinic despite conflicting schedules and dealing with the global pandemic issues in practice. Despite the well-received educational intervention, the number of PIMs did not decrease eight weeks post-intervention. The medication review process and management is a challenge to tackle, particularly with older multimorbid patients. It is always ideal to perform medication reviews with the patients and with either a family member or a caretaker. Multimorbid patients receive prescription medications from other HCPs outside the clinic practice as well. The lack of patients' sharing information with their medications may have led to underestimating the frequency of PIMs use (Franco et al., 2017; Jager et al., 2017).

Moreover, this project reviewed patients' medical records ranging from 65 to 96 years old and coming from different ethnicities. The HCPs are primarily English-speaking only and require translators. However, according to Maio et al. (2006), demographic variables are not significantly associated with PIMs. The medication review process takes time, and all three HCPs from the pre-intervention survey reported that they do not have time to perform medication reviews on each patient's visit. Whether all three HCPs completed medication reviews with translators or with patients alone, or with caregivers was not evaluated in this study.

The study also found that some patients took over-the-counter medications such as aspirin, antacids, non-steroidal inflammatory, and antihistamines, whether recommended or not by their HCPs. Therefore, whether patient education was performed regarding the use of over-the- counter medications or not, this study did not evaluate HCPs' patient education performance.

This study found a slight improvement in the number of patients receiving duplicated medication classes at post-intervention, compared to pre-intervention, yet the difference was not significant. However, this result needs to be interpreted with caution because the patients whose medical records were reviewed at pre-intervention were not followed up at post-intervention. The total number of medical records reviewed was different between pre- and post-intervention.

There was a higher percentage of medications without a corresponding diagnosis post-intervention. Reviewed medical records showed many patients were using online purchasable sleep aids, dietary supplements, iron supplements, and herbal tablets found in nutrition stores.

Iatrogenic Effects of Medications

The project study discovered that hypertension, hyperlipidemia, and type 2 diabetes were the three prevalent diagnoses in the clinic. Patients with hypertension were also on OTC NSAIDs such as ibuprofen, which adversely raises blood pressure. Also, antidepressants may potentially cause elevated blood glucose levels (Novaes et al., 2017). Iatrogenic effects of medication are adverse effects caused by medication pathogenesis to treat a condition or disease process (Novaes et al., 2017).

The AGS Beers criteria had recommended avoiding the use of benzodiazepine in combination with opioids in older people. Combining these two medications increases central nervous system effects such as confusion, drowsiness, delirium, and the potential for falls and injuries. The study found that 6.1% pre-intervention and 8.3% post-intervention of older patients were on this combination of medications. This is an essential finding in the outpatient setting, requiring diligent monitoring amongst all HCPs across the board. Increasing HCP communication within the clinic practice and with outside HCPs is vital. Pharmacists and healthcare plans should coordinate and employ a communication delivery system to HCPs in

private practices of patients' PIMs. Multimorbid patients go to different specialty physicians, contributing to one of the root cause analyses of PIMs and polypharmacy. Shared decision-making between the HCPs and their patients should be an integral part of the medication review process.

The lack of significant results overall suggests that medication management in older adults is multifaceted, therefore requires HCPs time, dedication, and perseverance over time. Despite not producing statistically significant results, important findings were observed in this QI project. For example, benzodiazepines alone were reduced by half despite the diagnosis of anxiety which had increased post-intervention. Many patients presented anxiety and depression symptoms during the pandemic. Also, the use of NSAIDs and PPIs was reduced post-intervention by half. A longer post-intervention process could have made significant findings by giving sufficient time for HCPs to reduce the frequency of inappropriate medications.

Effects of the Global Pandemic on the QI Project

The overall clinic practice protocols were altered to adjust to the state-mandated guidelines of social distancing and stay-home orders. During the post-implementation process of the project, the only patients allowed to come to the clinic were only those who required urgent care or those with acute conditions, which may have limited the time that HCPs had to review patients' medication lists. Additionally, the post-intervention data collection number of patients observed could have been more if older patients in the clinic were consistent with their follow-up visits.

Limitations

This study has many limitations. We could not follow up the same patients' medical records post-intervention because the post-intervention medical records review was only for

eight weeks. Not every 82 pre-intervention patients returned for follow-up visits within the eight weeks of post-intervention review. This project's duration may have been too short and interrupted by pandemic issues to demonstrate significant results. Also, surveillance of the effect of the NP-led education intervention was only eight weeks. The HCPs were not given adequate time to use the screening tool to its full capability effectively. The overall limitation of this study is the relatively small sample size of healthcare providers involved and the lack of long-term follow-up outside of the pandemic scenario. Additionally, the cost-effectiveness of the NP-education intervention impact in the clinical practice was not evaluated.

Recommendations

Understanding the reasons why and how patients view the use of many medications may be essential to include in addressing the inappropriateness of medications in an outpatient clinic. It is worth discussing alternative treatments to alleviate conditions before adding new medications, such as integrating lifestyle changes, increasing physical activity, and dietary management as part of the treatment plan. Discussing drug-to-drug interaction, medication side, and adverse effects is a process that needs to be part of medication review. Involving allied healthcare professionals in the interdisciplinary team in caring for multimorbid older patients is vital. Improving patient-provider communication and utilizing language interpreters may cut the miscommunication barriers. Clinicians should provide a follow-up on their patients to evaluate the effect of implementing EBP in their clinics. A team effort approach is needed by involving patient caregivers, pharmacists, and other specialists to address inappropriate medications is an important aspect to perform. Possible improvements to this study include a longer duration of implementation process evaluation, utilizing larger sample sizes, and obtaining paired data if available.

CONCLUSION

Implications for Future Research, Education, and Nursing Practice

It is necessary to implement rapid action to decrease the negative impacts in both the clinical and the economic consequences of PIMs use, especially in the older population. This action involves an increase in safe practice guidelines, research, and education to be instituted. Scott et al. (2017) suggested incorporating tailored curricula in appropriate prescribing in all undergraduate, graduate, and postgraduate courses in medicine, nursing, pharmacy, and allied health programs. However, this action requires funding and ethics approval for research projects to move forward (Scott et al., 2017). Therefore, further studies are necessary to investigate how an improved education on addressing inappropriate medications and inappropriate polypharmacy in all healthcare disciplines may reduce adverse effects in the older population.

This QI project is helpful in another setting for another population group, and the NP-led education intervention is replicable in any clinical setting. In addition, replicating this QI project is possible by using the valid and reliable AGS Beers screening tool. According to Melnyk and Fineout -Overholt (2019), the passage of time alone can impact the study's outcomes (p. 635). Further nurse-practitioner-led interventions in the outpatient setting may provide concrete evidence that the NP's role significantly reduces polypharmacy.

Role of the DNP- prepared nurse

DNP-trained nurse practitioners are increasingly seen in healthcare settings. Nurse practitioners, with their advanced education and knowledge, play significant roles in improving patient care. Today's complicated health care delivery, which includes the puzzle of polypharmacy and PIMs use, requires the knowledge and skills of healthcare professionals to work collaboratively and effectively. NPs partnering with physicians, pharmacists, and other

members of the interdisciplinary teams will aid in resolving the complexities of providing evidence-based practice for the patients and the community. NPs are engaged in evidence-based leadership and multidisciplinary collaboration (AACN, 2006; Zaccagnini & White, 2017).

Summary of Conclusion

This QI project addressed the question, "can an NP-led educational intervention addressing PIMS in the 65 and older patients, compared to no educational intervention, decrease the frequency of potentially inappropriate medications in eight weeks post-intervention?

Older adults receive health treatments for a health condition, diagnosed disease, and are treated solely from a medical perspective, often through prescription medications (WHO, 2019). As people get older, physiologic, and cognitive decline accompanied by multiple co-morbidities increases their vulnerability to PIMs (Mangin et al., 2018). Inappropriate medications are common in all clinical settings, and nurse practitioners in any environment are equipped to provide leadership for evidence-based interventions in the interdisciplinary practice (Zaccagnini & White, 2017). Therefore, whether primary outcomes are achieved or not, evidence-based practice projects need an ongoing evaluation to attain practice improvements. The studies on NP-led interventions conform to the American Association of Colleges of Nursing (AACN) DNP essential II (Organizational and Systems Leadership for Quality Improvement) and the DNP essential III (Clinical Scholarship Analytical Methods for Evidence-Based Practice) roles of the doctoral-prepared nurse practitioners. Despite not having a statistically significant outcome, the DNP-prepared nurse applied evidence base in this quality improvement project and translated evidence-based into practice.

APPENDICES

Appendix A Theory of Planned Behavior

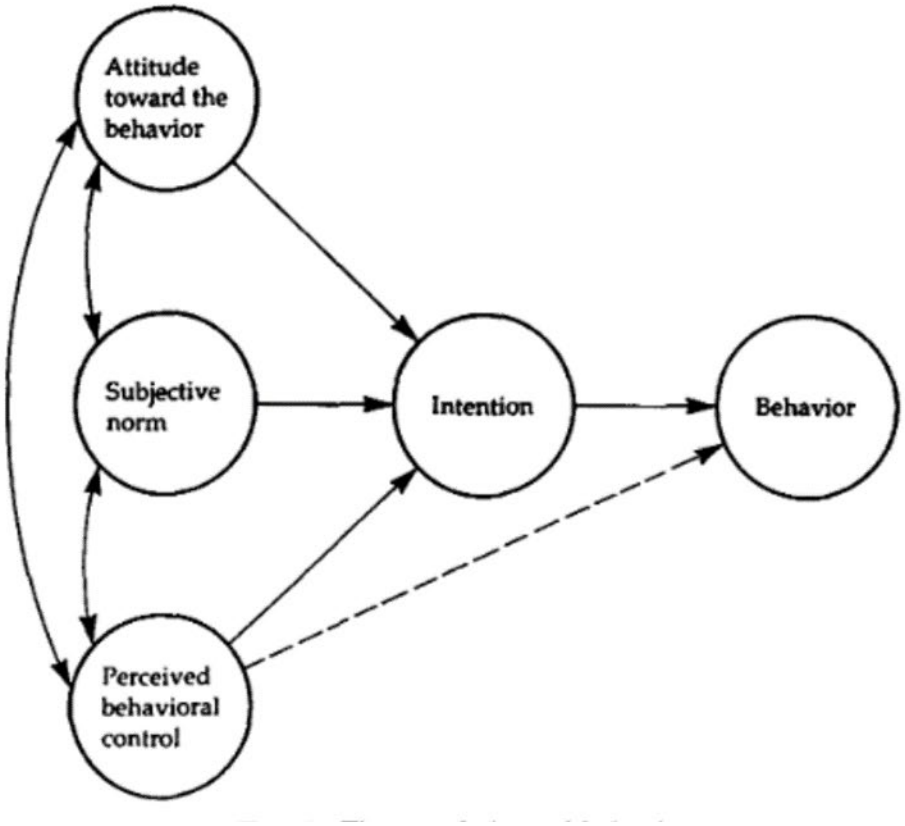
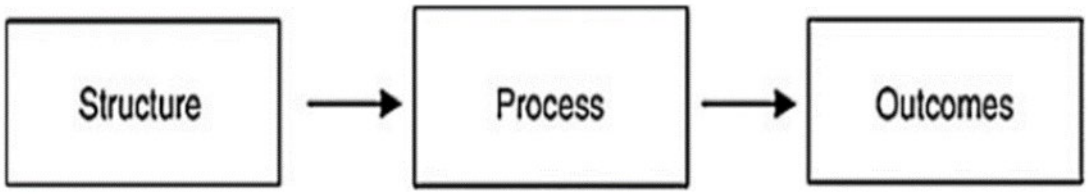


Figure 1: Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179–211.

Retrieved from: https://www.sciencedirect.com/science/article/pii/074959789190020TEnter

Appendix B The Donabedian Concept



Donabedian, A., Wheeler, J., & Wyszewianski, L. (1982). Quality, cost, and health: An integrative model. Medical Care, 20(10), 975–992.

Retrieved from: https://doi.org/jstor.org/stable/3764709

Appendix C Request for Permission to Use the 2019 AGS Beers Criteria

March 22, 2021

American Geriatrics Society
40 Fulton Street, 18th Floor
New York, NY 10038

To Whom It May Concern:

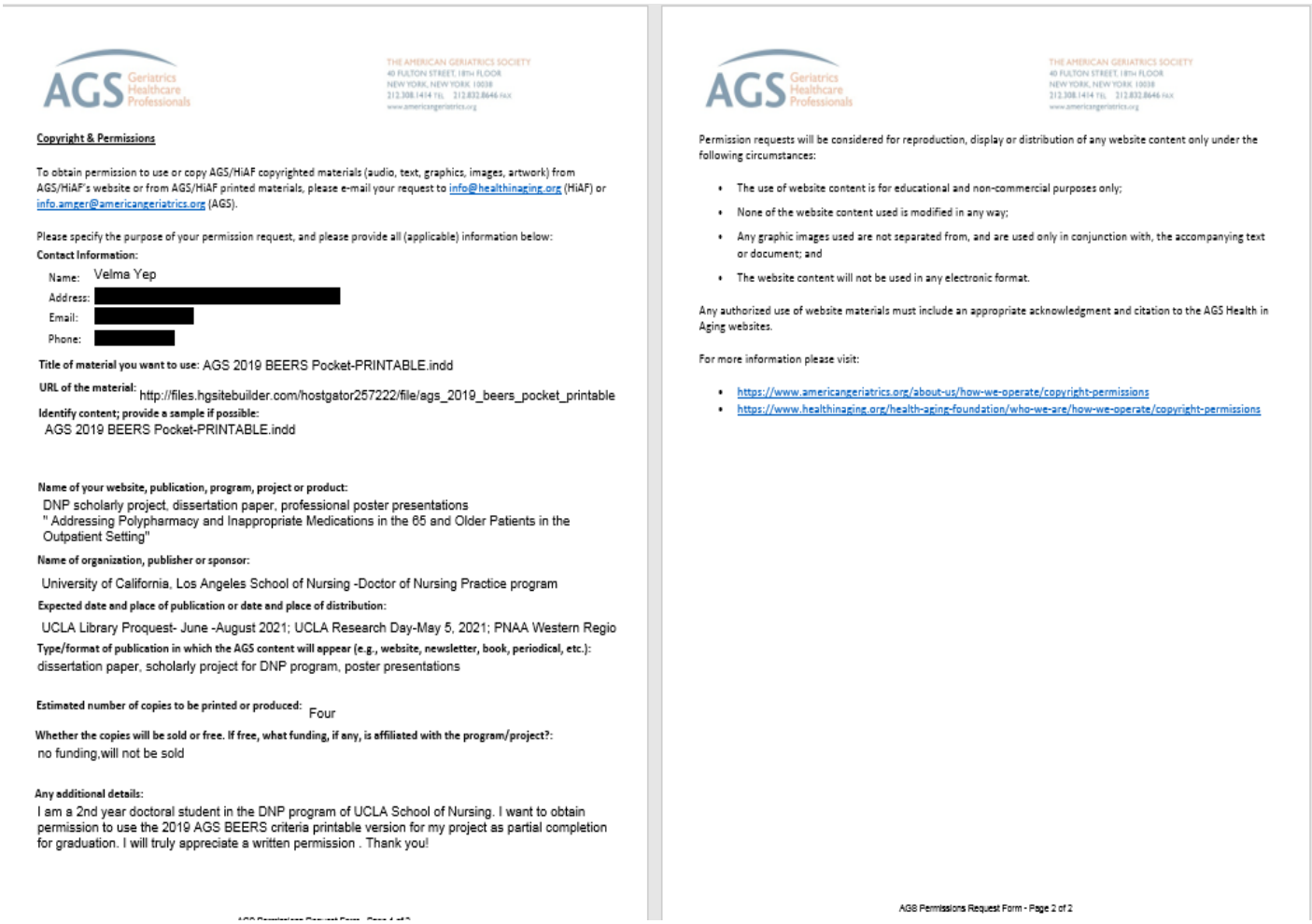
I am Velma Yep. I am a nurse practitioner, and I am currently in the Doctor of Nursing Practice program at the University of California in Los Angeles School of Nursing. I am in the process of writing my dissertation entitled "Addressing Polypharmacy and Inappropriate Medications in the 65 and Older Patients in an Outpatient Setting". I am using the AGS BEERS 2019 Criteria as a screening tool in my paper. I want to obtain permission to use the 2019 AGS BEERS Criteria printable version for my dissertation paper and professional poster presentations.

If you could please provide written permission for me to use the 2019 BEERS Criteria printable version from this site: AGS 2019 BEERS Pocket-PRINTABLE.indd

Sincerely,

Velma Yep, APRN, GNP-C, DNPc
Geriatric Nurse Practitioner

Appendix D Permission Letter from AGS to Use the 2019 Beers Criteria



AGS Geriatrics Healthcare Professionals

THE AMERICAN GERIATRICS SOCIETY
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Please specify the purpose of your permission request, and please provide all (applicable) information below:

Contact Information:

Name: Velma Yep
Address: [redacted]
Email: [redacted]
Phone: [redacted]

Title of material you want to use: AGS 2019 BEERS Pocket-PRINTABLE.indd

URL of the material: http://files.hgsitebuilder.com/hostgator257222/file/ags_2019_beers_pocket_printable

Identify content; provide a sample if possible:
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Name of your website, publication, program, project or product:
DNP scholarly project, dissertation paper, professional poster presentations
" Addressing Polypharmacy and Inappropriate Medications in the 65 and Older Patients in the Outpatient Setting"

Name of organization, publisher or sponsor:
University of California, Los Angeles School of Nursing -Doctor of Nursing Practice program

Expected date and place of publication or date and place of distribution:
UCLA Library Proquest- June -August 2021; UCLA Research Day-May 5, 2021; PNAA Western Regio

Type/format of publication in which the AGS content will appear (e.g., website, newsletter, book, periodical, etc.):
dissertation paper, scholarly project for DNP program, poster presentations

Estimated number of copies to be printed or produced: Four

Whether the copies will be sold or free. If free, what funding, if any, is affiliated with the program/project?:
no funding,will not be sold

Any additional details:
I am a 2nd year doctoral student in the DNP program of UCLA School of Nursing. I want to obtain permission to use the 2019 AGS BEERS criteria printable version for my project as partial completion for graduation. I will truly appreciate a written permission . Thank you!

AGS Permissions Request Form - Page 1 of 2

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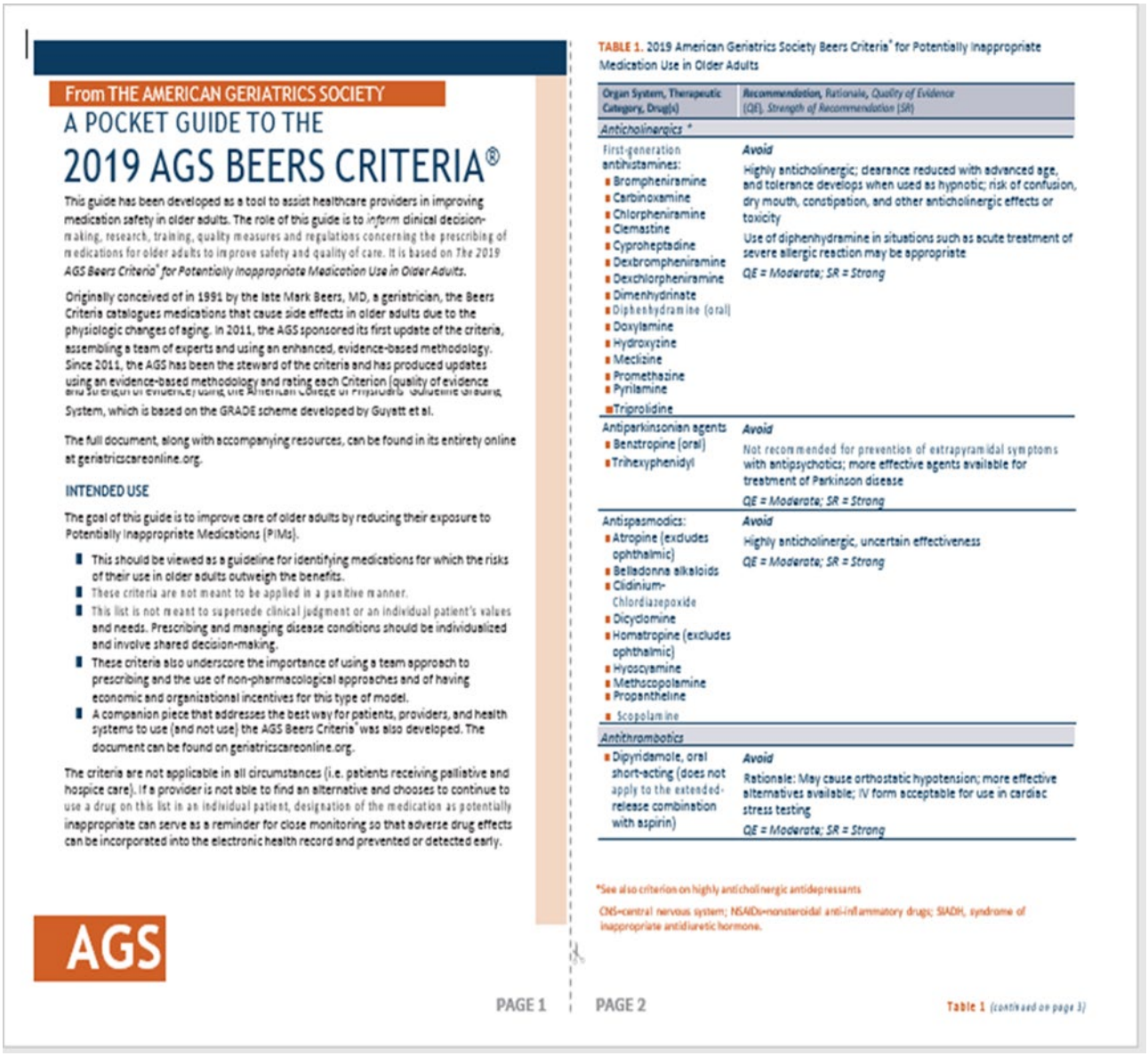
Appendix E The 2019 AGS Beers Criteria Pocket Guide Version



From THE AMERICAN GERIATRICS SOCIETY

A POCKET GUIDE TO THE

2019 AGS BEERS CRITERIA®

This guide has been developed as a tool to assist healthcare providers in improving medication safety in older adults. The role of this guide is to *inform* clinical decision-making, research, training, quality measures and regulations concerning the prescribing of medications for older adults to improve safety and quality of care. It is based on *The 2019 AGS Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults.*

Originally conceived of in 1991 by the late Mark Beers, MD, a geriatrician, the Beers Criteria catalogues medications that cause side effects in older adults due to the physiologic changes of aging. In 2011, the AGS sponsored its first update of the criteria, assembling a team of experts and using an enhanced, evidence-based methodology. Since 2011, the AGS has been the steward of the criteria and has produced updates using an evidence-based methodology and rating each Criterion (quality of evidence and strength of evidence) using the American College of Physicians' Guideline Grading System, which is based on the GRADE scheme developed by Guyatt et al.

The full document, along with accompanying resources, can be found in its entirety online at geriatricscareonline.org.

INTENDED USE

The goal of this guide is to improve care of older adults by reducing their exposure to Potentially Inappropriate Medications (PIMs).

- This should be viewed as a guideline for identifying medications for which the risks of their use in older adults outweigh the benefits.
- These criteria are not meant to be applied in a punitive manner.
- This list is not meant to supersede clinical judgment or an individual patient's values and needs. Prescribing and managing disease conditions should be individualized and involve shared decision-making.
- These criteria also underscore the importance of using a team approach to prescribing and the use of non-pharmacological approaches and of having economic and organizational incentives for this type of model.
- A companion piece that addresses the best way for patients, providers, and health systems to use (and not use) the AGS Beers Criteria® was also developed. The document can be found on geriatricscareonline.org.

The criteria are not applicable in all circumstances (i.e. patients receiving palliative and hospice care). If a provider is not able to find an alternative and chooses to continue to use a drug on this list in an individual patient, designation of the medication as potentially inappropriate can serve as a reminder for close monitoring so that adverse drug effects can be incorporated into the electronic health record and prevented or detected early.

AGS

PAGE 1

TABLE 1. 2019 American Geriatrics Society Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults

Organ System, Therapeutic Category, Drug(s)	*Recommendation, Rationale, Quality of Evidence (QE), Strength of Recommendation (SR)*
Anticholinergics*	
First-generation antihistamines: ▪ Brompheniramine ▪ Carbinoxamine ▪ Chlorpheniramine ▪ Clemastine ▪ Cyproheptadine ▪ Dexbrompheniramine ▪ Dexchlorpheniramine ▪ Dimenhydrinate ▪ Diphenhydramine (oral) ▪ Doxylamine ▪ Hydroxyzine ▪ Meclizine ▪ Promethazine ▪ Pyrilamine ▪ Triprolidine	***Avoid*** Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; risk of confusion, dry mouth, constipation, and other anticholinergic effects or toxicity Use of diphenhydramine in situations such as acute treatment of severe allergic reaction may be appropriate *QE = Moderate; SR = Strong*
Antiparkinsonian agents ▪ Benztropine (oral) ▪ Trihexyphenidyl	***Avoid*** Not recommended for prevention of extrapyramidal symptoms with antipsychotics; more effective agents available for treatment of Parkinson disease *QE = Moderate; SR = Strong*
Antispasmodics: ▪ Atropine (excludes ophthalmic) ▪ Belladonna alkaloids ▪ Clidinium-Chlordiazepoxide ▪ Dicyclomine ▪ Homatropine (excludes ophthalmic) ▪ Hyoscyamine ▪ Methscopolamine ▪ Propantheline ▪ Scopolamine	***Avoid*** Highly anticholinergic, uncertain effectiveness *QE = Moderate; SR = Strong*
Antithrombotics	
▪ Dipyridamole, oral short-acting (does not apply to the extended-release combination with aspirin)	***Avoid*** Rationale: May cause orthostatic hypotension; more effective alternatives available; IV form acceptable for use in cardiac stress testing *QE = Moderate; SR = Strong*

*See also criterion on highly anticholinergic antidepressants

CNS=central nervous system; NSAIDs=nonsteroidal anti-inflammatory drugs; SIADH, syndrome of inappropriate antidiuretic hormone.

PAGE 2

Table 1 (continued on page 3)

Table 1 Continued

Organ System, Therapeutic Category, Drug(s)	Recommendation, Rationale, QE, SR
Anti-infective	
■Nitrofurantoin	***Avoid in individuals with creatinine clearance <30 mL/min or for long-term suppression*** Potential for pulmonary toxicity, hepatotoxicity, and peripheral neuropathy, especially with long-term use; safer alternatives available *QE = Low; SR = Strong*
Cardiovascular	
Peripheral alpha-1 blockers for treatment of hypertension ■Doxazosin ■Prazosin ■Terazosin	***Avoid use as an antihypertensive*** High risk of orthostatic hypotension and associated harms, especially in older adults; not recommended as routine treatment for hypertension; alternative agents have superior risk/benefit profile *QE = Moderate; SR = Strong*
Central-alpha agonists Clonidine for first-line treatment of hypertension Other CNS alpha-agonists ■Guanabenz ■Guanfacine ■Methyldopa ■Reserpine (>0.1 mg/d)	***Avoid clonidine as first-line antihypertensive. Avoid other CNS alpha-agonists as listed*** High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension *QE = Low; SR = Strong*
Disopyramide	***Avoid*** May induce heart failure in older adults because of potent negative inotropic action; strongly anticholinergic; other antiarrhythmic drugs preferred *QE = Low; SR = Strong*
Dronedarone	***Avoid in individuals with permanent atrial fibrillation or severe or recently decompensated heart failure*** Worse outcomes have been reported in patients taking dronedarone who have permanent atrial fibrillation or severe or recently decompensated heart failure *QE = High; SR = Strong*

Table 1 (continued on page 4)

Table 1 Continued

Organ System, Therapeutic Category, Drug(s)	Recommendation, Rationale, QE, SR
Digoxin for first-line treatment of atrial fibrillation or of heart failure	***Avoid this rate control agent as first-line therapy for atrial fibrillation. Avoid as first-line therapy for heart failure. If used for atrial fibrillation or heart failure, avoid dosages >0.125 mg/d*** Use in atrial fibrillation: should not be used as a first-line agent in atrial fibrillation, because there are safer and more effective alternatives for rate control supported by high-quality evidence. Use in heart failure: evidence for benefits and harms of digoxin is conflicting and of lower quality; most but not all of the evidence concerns use in heart failure with reduced ejection fraction (HFrEF). There is strong evidence for other agents as first-line therapy to reduce hospitalizations and mortality in adults wiht HFrEF. In heart failure, higher dosages are not associated with additional benefit and may increase toxicity. Decreased renal clearance of digoxin may lead to increased risk of toxic effects; further dose reduction may be necessary in those with Stage 4 or 5 chronic kidney disease. *QE = Atrial fibrillation: Low. Heart failure: Low. Dosage >0.125 mg/d: Moderate; SR = Atrial fibrillation: Strong. Heart failure: Strong. Dosage >0.125 mg/d: Strong*
Nifedipine, immediate release	***Avoid*** Potential for hypotension; risk of precipitating myocardial ischemia *QE = High; SR = Strong*
Amiodarone	***Avoid as first-line therapy for atrial fibrillation unless the patient has heart failure or substantial left ventricular hypertrophy*** Effective for maintaining sinus rhythm but has greater toxicities than other antiarrhythmics used in atrial fibrillation; may be reasonable first-line therapy in patients with concomitant heart failure or substantial left ventricular hypertrophy if rhythm control is preferred over rate control *QE = High; SR = Strong*
Central nervous system	
Antidepressants, alone or in combination: ■Amitriptyline ■Amoxapine ■Clomipramine ■Desipramine ■Doxepin >6 mg/d ■Imipramine ■Nortriptyline ■Paroxetine ■Protriptyline ■Trimipramine	***Avoid*** Highly anticholinergic, sedating, and cause orthostatic hypotension; safety profile of low-dose doxepin (≤6 mg/d) comparable to that of placebo *QE = High; SR = Strong*

Table 1 (continued on page 5)

Table 1 Continued

Organ System, Therapeutic Category, Drug(s)	*Recommendation, Rationale, QE, SR*
Antipsychotics, first- (conventional) and second- (atypical) generation	***Avoid, except in schizophrenia, bipolar disorder, or for short-term use as antiemetic during chemotherapy*** Increased risk of cerebrovascular accident (stroke) and greater rate of cognitive decline and mortality in persons with dementia Avoid antipsychotics for behavioral problems of dementia or delirium unless nonpharmacological options (e.g., behavioral interventions) have failed or are not possible ***and*** the older adult is threatening substantial harm to self or others *QE = Moderate; SR = Strong*
Barbiturates ■ Amobarbital ■ Butabarbital ■ Butalbital ■ Mephobarbital ■ Pentobarbital ■ Phenobarbital ■ Secobarbital	***Avoid*** High rate of physical dependence, tolerance to sleep benefits, greater risk of overdose at low dosages *QE = High; SR = Strong*
Benzodiazepines *Short- and intermediate-acting:* ■ Alprazolam ■ Estazolam ■ Lorazepam ■ Oxazepam ■ Temazepam ■ Triazolam *Long-acting:* ■ Chlordiazepoxide (alone or in combination with amitriptyline or clidinium) ■ Clonazepam ■ Clorazepate ■ Diazepam ■ Flurazepam ■ Quazepam	***Avoid*** Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; in general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes in older adults May be appropriate for seizure disorders, rapid eye movement sleep behavior disorder, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, and periprocedural anesthesia *QE = Moderate; SR = Strong*
Meprobamate	***Avoid*** High rate of physical dependence; sedating *QE = Moderate; SR = Strong*
Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics (ie, "Z-drugs") ■ Eszopiclone ■ Zaleplon ■ Zolpidem	***Avoid*** Nonbenzodiazepine benzodiazepine-receptor agonist hypnotics (ie, "Z drugs") have adverse events similar to those of benzodiazepines in older adults (e.g., delirium, falls, fractures); increased emergency room visits/hospitalizations; motor vehicle crashes; minimal improvement in sleep latency and duration *QE = Moderate; SR = Strong*

Table 1 (continued on page 6)

Table 1 Continued

Organ System, Therapeutic Category, Drug(s)	*Recommendation, Rationale, QE, SR*
Ergoloid mesylates (dehydrogenated ergot alkaloids) Isoxsuprine	***Avoid*** Lack of efficacy *QE = High; SR = Strong*
Endocrine	
Androgens ■ Methyltestosterone ■ Testosterone	***Avoid unless indicated for confirmed hypogonadism with clinical symptoms*** Potential for cardiac problems; contraindicated in men with prostate cancer *QE = Moderate; SR = Weak*
Desiccated thyroid	***Avoid*** Concerns about cardiac effects; safer alternatives available *QE = Low; SR = Strong*
Estrogens with or without progestins	***Avoid systemic estrogen (eg, oral and topical patch). Vaginal cream or vaginal tablets: acceptable to use low-dose intravaginal estrogen for management of dyspareunia, recurrent lower urinary tract infections, and other vaginal symptoms*** Evidence of carcinogenic potential (breast and endometrium); lack of cardioprotective effect and cognitive protection in older women. Evidence indicates that vaginal estrogens for the treatment of vaginal dryness are safe and effective; women with a history of breast cancer who do not respond to nonhormonal therapies are advised to discuss the risk and benefits of low-dose vaginal estrogen (dosages of estradiol <25 mcg twice weekly) with their healthcare provider *QE = Oral and patch: High. Vaginal cream or tablets: Moderate.; SR = Oral and patch: Strong. Topical vaginal cream or tablets: Weak*
Growth hormone	***Avoid, except for patients rigorously diagnosed by evidence-based criteria with growth hormone deficiency due to an established etiology*** Impact on body composition is small and associated with edema, arthralgia, carpal tunnel syndrome, gynecomastia, impaired fasting glucose *QE = High; SR = Strong*
Insulin, sliding scale (insulin regimens containing only short- or rapid-acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin)	***Avoid*** Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting; Avoid insulin regimens that include only short- or rapid-acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin. This recommendation does not apply to regimens that contain basal insulin or long-acting insulin. *QE = Moderate; SR = Strong*
Megestrol	***Avoid*** Minimal effect on weight; increases risk of thrombotic events and possibly death in older adults *QE = Moderate; SR = Strong*

Table 1 (continued on page 7)

Table 1 Continued

Organ System, Therapeutic Category, Drug(s)	*Recommendation, Rationale, QE, SR*
Sulfonylureas, long-acting ■ Chlorpropamide ■ Glimeperide ■ Glyburide (also known as glibenclamide)	***Avoid*** Chlorpropamide: prolonged half-life in older adults; can cause prolonged hypoglycemia; causes SIADH Glimepiride and Glyburide: higher risk of severe prolonged hypoglycemia in older adults *QE = High; SR = Strong*
Gastrointestinal	
Metoclopramide	***Avoid, unless for gastroparesis with duration of use not to exceed 12 weeks except in rare cases*** Can cause extrapyramidal effects, including tardive dyskinesia; risk may be greater in frail older adults and with prolonged exposure *QE = Moderate; SR = Strong*
Mineral oil, given orally	***Avoid*** Potential for aspiration and adverse effects; safer alternatives available *QE = Moderate; SR = Strong*
Proton-pump inhibitors	***Avoid scheduled use for >8 weeks unless for high-risk patients (e.g., oral corticosteroids or chronic NSAID use), erosive esophagitis, Barrett's esophagitis, pathological hypersecretory condition, or demonstrated need for maintenance treatment (e.g., because of failure of drug discontinuation trial or H2-receptor antagonists*** Risk of *C difficile* infection and bone loss and fractures *QE = High; SR = Strong*
Pain medications	
Meperidine	***Avoid*** Oral analgesic not effective in dosages commonly used; may have higher risk of neurotoxicity, including delirium, than other opioids; safer alternatives available *QE = Moderate; SR = Strong*
Non-cyclooxygenase-selective NSAIDs, oral: ■ Aspirin >325 mg/d ■ Diclofenac ■ Diflunisal ■ Etodolac ■ Fenoprofen ■ Ibuprofen ■ Ketoprofen ■ Meclofenamate ■ Mefenamic acid ■ Meloxicam ■ Nabumetone ■ Naproxen ■ Oxaprozin ■ Piroxicam ■ Sulindac ■ Tolmetin	***Avoid chronic use, unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol)*** Increased risk of gastrointestinal bleeding or peptic ulcer disease in high-risk groups, including those aged >75 or taking oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents; use of proton-pump inhibitor or misoprostol reduces but does not eliminate risk. Upper gastrointestinal ulcers, gross bleeding, or perforation caused by NSAIDs occur in ~1% of patients treated for 3–6 months and in ~2–4% of patients treated for 1 year; these trends continue with longer duration of use. Also can increase blood pressure and induce kidney injury. Risks are dose-related. *QE = Moderate; SR = Strong*

Table 1 (continued on page 8)

Table 1 Continued

Organ System, Therapeutic Category, Drug(s)	*Recommendation, Rationale, QE, SR*
■ Indomethacin ■ Ketorolac, includes parenteral	***Avoid*** Increased risk of gastrointestinal bleeding/peptic ulcer disease, and acute kidney injury in older adults Indomethacin is more likely than other NSAIDs to have adverse CNS effects. Of all the NSAIDs, indomethacin has the most adverse effects. *QE = Moderate; SR = Strong*
Skeletal muscle relaxants ■ Carisoprodol ■ Chlorzoxazone ■ Cyclobenzaprine ■ Metaxalone ■ Methocarbamol ■ Orphenadrine	***Avoid*** Most muscle relaxants poorly tolerated by older adults because some have anticholinergic adverse effects, sedation, increased risk of fractures; effectiveness at dosages tolerated by older adults questionable *QE = Moderate; SR = Strong*
Genitourinary	
Desmopressin	***Avoid for treatment of nocturia or nocturnal polyuria*** High risk of hyponatremia; safer alternative treatments *QE = Moderate; SR = Strong*

TABLE 2. 2019 American Geriatrics Society Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults Due to Drug–Disease or Drug–Syndrome Interactions That May Exacerbate the Disease or Syndrome

Disease or Syndrome	Drug(s)	*Recommendation, Rationale, Quality of Evidence (QE), Strength of Recommendation (SR)*
Cardiovascular		
Heart failure	Avoid: Cilostazol Avoid in heart failure with reduced ejection fraction: Non-dihydropyridine CCBs (diltiazem, verapamil) Use with caution in patients with heart failure who are asymptomatic; avoid in patients with symptomatic heart failure: NSAIDs and COX-2 inhibitors Thiazolidinediones (pioglitazone, rosiglitazone) Dronedarone	***As noted, avoid or use with caution*** Potential to promote fluid retention and/or exacerbate heart failure (NSAIDs and COX-2 inhibitors, non-dihydropyridine CCBs, thiazoildinediones); potential to increase mortality in older adults with heart failure (cilostazol and dronedarone) *QE = Cilostazol: Low Non-dihydropyridine CCBs: Moderate NSAIDs: Moderate COX-2 inhibitors: Low. Thiazolidinediones: High. Dronedarone: High; SR = Strong*

*See Table 7 in full criteria available on www.geriatricscareonline.org.

†May be required to treat concurrent schizophrenia, bipolar disorder, and other selected mental health conditions but should be prescribed in the lowest effective dose and shortest possible duration.

‡Excludes inhaled and topical forms. Oral and parenteral corticosteroids may be required for conditions such as exacerbation of COPD but should be prescribed in the lowest effective dose and for the shortest possible duration.

CCB=calcium channel blocker; AChEI=acetylcholinesterase inhibitor; CNS=central nervous system; COX=cyclooxygenase; NSAIDs=nonsteroidal antiinflammatory drug; SNRI=serotoninnorepinephrine reuptake inhibitor; SSRI=selective serotonin reuptake inhibitor; TCAs=tricyclic antidepressant.

Table 2 (continued on page 9)

TABLE OF EVIDENCE

CITATION	PURPOSE	SAMPLE/SETTING	METHODS (Design, Interventions, Measures)	RESULTS	DISCUSSION, INTERPRETATION, LIMITATIONS
Anderson, R.; Ferguson. (2020). A nurse practitioner-led medication reconciliation process to reduce hospital readmissions from a skilled nursing facility. Journal of the American Association of Nurse Practitioners, 32(2), 160-167 doi: 10.1097/JXX.0000000000000264	►To determine whether an NP-led medication reconciliation on admission would reduce hospital readmissions from SNF	►A seasoned NP with experience in the emergency room, intensive care, and skilled nursing facilities. Along with her medical director of the SNF in Tennessee	A pre- and post-implementation design was used to compare 30-day hospital readmission rates over a 30-day project period. ►An evidence-based workflow process for systematic medication reconciliation was designed. ►The NP used the workflow process to complete stabilization visits with medication	►Results revealed a hospital readmission rate of 19.2% pre-implementation and 13.5% post-implementation, reflecting a 29.7% decrease in the rate of hospital readmissions within 30 days.	►There was no statistical significance; but the positive benefits of NP intervention reduced hospitalizations improved quality measures and preparation for the Centers for Medicare and Medicaid Services mandates. ►Nurse practitioners have the necessary education and skills to provide quality care in skilled nursing facilities.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS (Design, Interventions, Measures)	RESULTS	DISCUSSION, INTERPRETATION, LIMITATIONS
AL Rasheed, M., Alhawassi, T., Alanazi, A., Aloudah, N., Khurshid, F., &Alsutan, M. (2018). Knowledge and willingness of physicians about deprescribing among older patients: a qualitative study. Clinical Interventions in Aging, 13, 1401–1408. https://doi.org/10.2147/CIA.S165588	► To explore physician's knowledge & identify barriers that prevent family medicine physicians from engaging in deprescribing among older patients	► Three focused groups of physicians, total =15, experienced & knowledgeable in the topic of interest, Mean age 38 years, majority female. All working at the Department of Medicine as a family medicine specialist, resident, or general practitioner. ► A study was conducted at the Department of Medicine at the King Saud University Medical Center, Riyadh, Saudi Arabia , between 10/ 2016 &12/ 2016.	► Qualitative study using interpretive behavioral & theoretical approach. Thematic content analysis. ►Conducted in English, for 40–60 minutes, audio-taped, transcribed verbatim, conducted until saturation confirmed. ►Questions developed by health psychologists, health researchers, & clinicians from 14 domains help understand health care provider behavior & how to change it.	►Barriers expressed: lack of de-prescribing, knowledge, patients' reluctance or acceptance, lack of documentation or communication from other prescribers, limited time of patients' visits in busy practices. ►Facilitators of de-prescribing: cost-effectiveness, systems technology, clear & transparent communication, screening of patients.	► Implementation of de-prescribing education to increase de-prescribing knowledge recommended, providing patient education to minimize de-prescribing, open patient & provider communication to reduce adverse reactions & undue medical costs. ►The use of theoretical concepts provided factors that can be implemented for an intervention ►Limitations: cultural beliefs and expectations, lack of generality in Western countries

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSION
Bergman-Evans, B. (2020). A nurse practitioner-led protocol to address polypharmacy in long-term care. Geriatric Nursing,000, 1-6 https://doi.org/10.1016 /j.gerinurse.2020.07.002	►To determine a medication management protocol completed at four-month intervals by NPs would decrease polypharmacy & administration times for long term care residents	►15 participating long-term care facilities were recruited to participate in a 4-year study. ►2442 individuals seen for at least one visit Inclusion criteria: dual-eligible Medi-Medi resident, living in the participating facility for>101 days, not expected to return home, not expected to transition to a facility providing less support	►Descriptive quantitative study Protocol: 5 NPs provided routine & emergent care to participants. Routine care: completion of Medication Outcome Monitor (MOM) evidence-based medication. Protocol. ►The schedule started with admission to the program & repeated at 4-month intervals Data collection: 2/3013-9/2016	►Generated no. 2442 of NP reviews. ► ANOVA between groups =mean square of 1.153, an F value of 3.587, a significance of 0.006. ► Polypharmacy present throughout study administration schedules= decrease no. by almost a half (0.47) is significant ► NPs recommendations to PCP=5476. No Change: 64.2% Decrease dose: 16.9%; Increase dose: 8.0%; Decrease med/dose and increase different me: 7.9% Update Labs: 3.0%	►Interdisciplinary coordination had positive results. ►Patient-centered de-prescribing improves health outcomes by potentially harmful medications. Shared goals for medication management for older adults in long-term care. NPs working in long-term care have leadership skills. ►Lack of significant impact in discontinuing polypharmacy. ► NPs' consultation role instead of PCP contributed to the inability to decrease polypharmacy in this study.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSIONS
Chen, C., McNeese-Smith, D., Cowan, M., Upenieks V., Afifi, A. (2009). Evaluation of a nurse practitioner-led care management model in reducing inpatient drug utilization and cost. Nursing Economics, 27(3) pp. 160-168	►To determine the prevalence & patterns of drug utilization, with a focus on antibiotics ►To evaluate the effect of NP-led care intervention in reducing drug utilization & cost as compared to usual care among general medicine inpatients.	►1,207 enrolled in Multidisciplinary, Physician, & Nurse Practitioner (MD/NP) Study during 2000 to 2004 ►Experimental = 581 control=626 patients ►Acutely ill patients in general medical unit in a tertiary academic medical center	►MD/NP Study initially quasi-experimental pre & post-test study ►Descriptive statistics, control & intervention group, t-test compared with chi-square test assess the difference between groups. Multi-linear regression, multivariate analysis ► NPs did daily rounds to facilitate multidisciplinary interventions, & minimize the turnaround time for lab tests & Med-Surg interventions. ►NPs maintained medication list, reviewed treatment/ monitor drug therapy & minimize unnecessary drug utilization. ►The Control group received usual care from PCP weekly, did not receive the NPs' interventions	►Experimental: M>F (49% vs. 43%, p=0.04) Control group: More Asian ethnicity (7% vs. 4%, p=0.0038) ►Mean drug cost/ hospital- stay: $743.98 per patient between $0.48 & $35,760.48. ►Experimental: significantly less on drugs ($636 vs. $844, p=0.002), Data did not have a normal distribution. ►Experimental group less ($88.5) than control ($95.8), experimental: lower no. of drug days/ patient t-test (p=0.03) (statistically significant p<0.05) ►Length of stay intervention group a significant decrease	►NPs role & impact on prescribing practice, cost savings, and clinical outcomes need further research. ►Future studies on antibiotic management & antibiotic resistance are needed. ►Relationships of NPs & use of pharmaceuticals are limited.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSION
Chiapella, L., Montemarani Menna, J., Marzi, M., & Mamprin, M. (2019). Prevalence of potentially inappropriate medications in older adults in Argentina using Beer's criteria and the IFAsPIAM List. International Journal of Clinical Pharmacology, 41(4), 913–919. https://doi.org/10.1007/s11096-019-00858-8	►To identify potentially inappropriate medications (PIM) in the older outpatient population ►to assess the prevalence of PIMs in the outpatient setting ►To evaluate relationships of polypharmacy, gender, and age of patients. ►to compare results gathered with the use of Beers criteria and the IFAsPIAM List (Latin -American screening tool for inappropriate medications)	►2231 patients in an outpatient setting. (Instituto Nacional de Seguridad Social para Jubilados y ensionados in Santa Fe, Argentina) inappropriate medications	►A cross-sectional observational study was conducted between February and September 2015. ►56,952 prescriptions prescribed to 2231 patients aged 65 years old or older from 10 pharmacies specializing in 65 and older	►monthly average medications dispensed/ patient= 4.35 ± 2.18 42.27% patients with polypharmacy. ►Prevalence of PIMs= 72.75% by Beer's criteria 71.13% by IFAsPIAM List (Kappa coefficient $k = 0.72$), ►Significantly higher in patients with polypharmacy in 75 years and older. Mostly females. on anxiolytics, analgesics, and antipsychotics were most frequently prescribed	► High prevalence of PIMs with the use of IFAsPIAM List related to polypharmacy. ► Limitations: a) studies registered only prescribed drug, pattern of delivery and that patients adhered to treatments; b) lack of reported self-medications information may have resulted in missed polypharmacy count/ use; c) there was no information on patients' clinical conditions related to PIMs. ►IFAsPIAM List criteria are comparable to BEERS criteria

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSION
Farrell, B., Thompson, W., & Black, C. (2018). Health care providers' roles and responsibilities in the management of polypharmacy. Canadian Pharmacists Journal, 151(6). https://doi.org/10.1177/17151635188042 76	►to identify consensus on roles, obligations, and competencies of health care professionals (HCP) managing polypharmacy in older patients. ►to reach a consensus on HCPs competencies in the management of older patients' polypharmacy issues	►geriatric healthcare professionals (HCP) – physicians, social workers, psychologist, pharmacists, dietitians, recreation therapists, nurses) ►Canadian Healthcare System	►a sequential, exploratory, mixed-methods survey study of focus groups participants and survey participants followed by a 2-round Delphi process	►35 team members (focus group) ►98 survey participants Round 1 was completed by 98 survey respondents and round 2 by 72. ►consensus on the importance of competencies among physicians, nurses, and pharmacists was high though pharmacists rated themselves with less importance of competencies ► less consensus was observed or indicated among other HCPs on the nonimportance of competencies despite focus group discussion to the contrary. .	► The strong consensus of polypharmacy management competencies across HCPs continues with different understandings of competencies medication. ►Pharmacists do not recognize their roles in interprofessional polypharmacy management. ►Limitations: small sample size of other HCPs (social workers, recreation therapists, psychologists, dietitians) . ►Results raise questions about the role of certain HCPs in polypharmacy management.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSIONS
Franco, J., Terrasa, S., & Kopitowski, K. (2017). Medication discrepancies and potentially inadequate prescriptions in elderly adults with polypharmacy in ambulatory care. Journal of Family Medicine, 6(1), 78–82. https://doi.org/10.4103/2249-4863.214962	►to describe the frequency and type of medication discrepancies (MD) through medication reconciliation ► to describe the frequency of potentially inadequate prescription (PIP) medications using screening tool of older persons' prescriptions criteria	►65-year-old or older) with 10 or ↑ more active prescriptions in their EMR. ► An exclusion criterion was hospital admission or domiciliary care within the last 12 months ►a population of elderly adults with polypharmacy in a Private Academic Community Hospital of Buenos Aires, Argentina	►Cross-sectional study, random sequence from hospital database (5/ 31/ 2014) ► A physician conducted a telephone interview using a protocolized oral consent. ►Collected demographics (age, education, marital status) & complete list of current meds (P-LIST) Each patient was called 3X ►PIP was detected using STOPP criteria ►The P-LIST was then compared with the list present in the EMR (EMR LIST)	► 1252 total MD 99% had at least 1 discrepancy. ►Majority not consuming an RX in the EMR (93%, 95% CI = 88%–97%) ► minority (5%, 95% CI = 2%–9%) consumed a duplicated RX (e.g., 2 types of benzodiazepines simultaneously). ► The mean number of discrepancies per patient was 8.34 (95% CI = 7.65–9.04).	► According to MDs "patient no longer taking medication" (54.1%) ►Limitations: telephone interviews could have selected a population of elderly adults ► The recall could be a source of bias, especially in patients trying to remember a long list of prescription medications.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSION
Maio, V., Hartmann, C., & Poston, S. (2006). Potentially inappropriate prescribing for elderly patients in 2 outpatient settings. American Journal of Medical Quality, 21, (3), 162-168. https://doi.org/10.1177/1062860605285475	► To examine the prevalence of potentially inappropriate prescribing (PIP) as defined by 2003 Beers criteria, among elderly patients in two outpatient settings ►To assess whether prevalence rates vary between the 2 outpatient settings and (3) to determine the factors associated with PIP.	►Sample of 50 established patients ► Random retrospective chart review ► The 2003 Beers criteria were used to identify PIP ►to examine factors related to the likelihood of PIP aged 65 years or older from each practice. ►One located in a senior citizen center (SC)and one in general family medicine (FM)clinic	►Descriptive statistics for variables: no. of drugs used, no. of ambulatory visits, no. of diagnoses, & income level. ►Tests for continuous variables & 2 tests for categorical regression analysis	► 82% F, mean age 77, predominantly African American. Less than $25,000/ year income ►Statistically significant differences ($p < .05$) between FM &SC r/t to no. of visits, no. of diagnoses, and no. of meds. PIP not statistically different. male (20%) vs female (12%) received PIP. ►1/4 found to have at least 1 PIP with Beers. Most common PIP drug prescribed: psychotropic agents & NSAID	►Demographic variables are not significantly associated with PIP. ► PIP may be prevalent across physician groups. ►Familiarity with the use of Beers criteria needed, as well as adherence to guidelines, awareness & education. ►Restrictions: insurance coverage impedes physicians from prescribing some safer medication choices.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSIONS
Mortazavi SS, ShatiM, Malakouti SK, et al. (2019) Physicians 'role in the development of inappropriate polypharmacy among older adults in Iran: a qualitative study. BMJ Open 2019;9: e024128. doi:10.1136/ bmjopen-2018-024128	► To provide in-depth descriptions of the physician's role in the development of inappropriate polypharmacy among older adults in Iran	► A total of 7 physicians, 10 older adults' caregivers, and 3 pharmacists with a median age of 54 (IQR 23) years were recruited through convenience sampling Three purposively selected referral hospitals in Tehran, Iran	► Qualitative content analysis of interviews, field notes, and other relevant documents available (e.g., medical records). Data collection and studies were done concurrently to guide the sampling process	► Emerged categories included misdiagnosis, inappropriate prescribing, insufficient patient education, poor communication, unprofessional behavior, and limited perspectives highlight the role of physicians in developing inappropriate polypharmacy among older adults in Iran under the main concept of poor medical. practice	► Misdiagnosis and prescription by physicians can lead to taking unneeded and excessive medications by older patients. ►Influential factors include physicians' lack of information about geriatric medicine and PIMs. ►Limitations: study conducted in the Iranian culture and health system

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSIONS
Ryder, M., Jacob, E., & Hendricks, J. (2020). An integrative review to identify evidence of nurse practitioner-led changes to healthcare delivery and the outcomes of such changes. International Journal of Nurse Practitioners, 26(6), 1–16. https://doi.org/10.1111/ijn.12901	►To identify evidence of nurse practitioner-led changes to healthcare delivery and the outcomes of such changes	►Total of 3,039 patients Control= 1,039 ,12 research projects conducted in a community care ►6 research projects conducted in acute care organizations ►1 examined NP interventions in community & acute care settings ►13 conducted in a single healthcare setting	►Pre-intervention and post-intervention studies, evaluation of quality improvement projects, randomized controlled trial, and descriptive studies. ►Mixed Methods Appraisal Tool was applied to appraise the literature critically	►Two major themes were identified a) evidence-based practice champions b) improved patient outcomes ►Leadership was mentioned as part of an inter-disciplinary team or a project leader	►NPs are skillful clinical leaders in their specialist areas. ►NPs achieve optimal management as either independent practitioners or collaborators in health care interdisciplinary teams. ►However, NPs are not research related leaders. ►Literature on using nursing role titles other than NP was excluded.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSIONS
Scott, I., Anderson, K., & Freeman, C. (2017). Review of structured guides for de-prescribing. European Journal of Hospital Pharmacy: Science and Practice, 24(1), 51–57. https://doi.org/10.1136/ejhpharm-2015-000864	►To obtain an overview of more direct evidence of the efficacy and safety of de-prescribing by retrieving articles from Medline, the Cumulative Index to Nursing and Allied Health Literature, and the Cochrane Library	►65 years and older with appropriate patient selection and education coupled with careful withdrawal and close monitoring. ►Samples from different settings (outpatient, post-hospital discharge, SNF) from 2011-2013	►A systematic review of 31 withdrawal trials of specific classes of drugs education with careful withdrawal and close monitoring, use of agents, anti-psychotropic drugs, and benzodiazepines► 2013 Cochrane analysis of 5 randomized trials of inpatient medication reviews, involving 1186 participants ►2011 review of 20 randomized trials in nursing homes involving 14 416 residents	►22 of 36 studies ↓ drugs deemed unnecessary ► 20% to 100% drugs w/o no harm in between. withdrawal of benzo& antipsychotic 77% 6 months no falls ↑ cognitive & psychomotor, 37% normotensive 1 year, ↓CV events & deaths 5-yrs. Follow-up period. ►36% ↓ER visits from. 30 days to one year following discharge but no effect on readmissions	►Prescribers and pharmacists collaborate in collecting information. ►Was an alternative, equally effective nonpharmacological therapy available? ► There was limited consultation time, problematic care among many prescribers, incomplete sharing of information, uncertainty about the benefits and harms of continuing or discontinuing prescriptions.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSIONS
Tefera, Y.G., Alemayehu, M., Mekonnen, G.B. (2020). Correction: Prevalence and determinants of polypharmacy in cardiovascular patients attending an outpatient clinic in Ethiopia University. Hospital. PLOS ONE 15(7). e0236328. https://doi.org/10.1371/journal.pone.0236328	► To assess the prevalence and predictors of polypharmacy in cardiovascular outpatients attending the University of Gondar Comprehensive specialized hospital, northwest Ethiopia	►Cardiovascular patients who visited the ambulatory clinic of the University of Gondar Comprehensive Specialized Hospital in Ethiopia (UoGCSH) from March 30 –May 30, 2019. (n=424) ► University of Gondar Comprehensive Specialized Hospital (UoGCSH) outpatient clinic ► Ambulatory care with hypertensive, heart failure, diabetic, asthmatic, epileptic, psychiatric &other chronic disease patients	►Exploratory qualitative study semi-structured interview format ►All 3 researchers conducted 20 to 90 min (average 30 min) face-to-face or phone interviews Questions: physicians' views on polypharmacy and de-prescribing in older people. ►Socio-cultural factors & personal, relational factors, organizational factors ► Participants compared to minimize bias, interviews conducted till saturation met ►All transcripts were independently read and coded	►The mean age of the respondents was 56.83 ± 15.27 years. Mean number of meds per patient 3.3±1.6. ►Prevalence of polypharmacy= 24.8% in cardiovascular ►Outpatients/ cardiovascular specific polypharmacy = 9.2%. ►Elderly 65 & above 2x more polypharmacy was p = 0.027 ($p<0.05$ cut off)	► Need preventative and pharmaceutical management care with medication review and optimization of the prescribed medications. Reduction of polypharmacy and improve medication experiences critical. ►Factors related to increasing polypharmacy: age, morbidity, abnormal body weight. ►Limitations: health status and physical activity patient's perception was not measured objectively by standard tools.

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSION
Wallis, K., Andrews, A., & Henderson, M. (2017). Swimming against the tide: primary care physicians' views on deprescribing in everyday practice. Annals of Family Medicine, 15(4), 341–346. https://doi.org/10.1370/afm.2094	►To explore the views of primary care physicians on the barriers and facilitators to deprescribing in everyday practice ►To inform the development of an intervention to support safer prescribing	► 24 primary care physicians (PCP) practicing in New Zealand	►The exploratory study used qualitative methodology with a semi-structured interview format ►All 3 researchers conducted the interviews, 20 to 90 mins ►Questions: physicians' views on polypharmacy and deprescribing in older people. Sociocultural factors & personal, relational factors, organizational factors ►To minimize biases, participants compared. ►All transcripts were read and coded	F= 10; M=14 Years in practice More than 10=6 More than 20=12 Less than 10=6 ; Employment status: Partner=11. Practice size: Small=Medium=7. Large=10 Prescribing ↓time than deprescribing 2.↓ info-sharing among prescribers. 3.↓ evidence & knowledge on best-prescribing practice in older pts. w/ ↑diseases. 4. Repercussions 5. Duty to do right	►Attention needed for cultural, attitude and behavior. changes of patients. and physicians deprescribing. ►Improved information, increase research & education ►Professional& ethical values Limitation: risk of bias because of snowball sampling ►Strengths: of deprescribing in everyday practice. Education important in preventing adverse results ►Institutional improvements on guidelines and tools recommended by physicians

CITATION	PURPOSE	SAMPLE/SETTING	METHODS	RESULTS	DISCUSSION
Walsh, A., Moore, A., Barber, A., &Opsteen, J. (2014). The educational role of nurse practitioners in a family practice center: perspectives of learners and nurses. Canadian Family Physician, 60(6), e316–e321	►To examine the role of nurse practitioners as educators of family medicine residents to understand better the interprofessional educational dynamics in a clinical teaching setting	►A purposeful sampling of the first year (8 of 9) and second-year (9 of 10) family medicine residents whose training program was based at the family practice center associated with an academic department of family medicine based in an urban area in southern Ontario, Canada. ►All NPs (4 of 4) who worked at the center.	►Qualitative descriptive ►Semi-structured audio-taped & transcribed interviews were conducted ►An iterative approach was used for coding and analysis. ►Data management software guided the analysis of data. ►Coding analysis guided by a model framework that incorporates knowledge, roles, and willingness to collaborate, semi-structured interview questions	►Resident's value NPs' specialized knowledge & function in the team depending on their level of training ►Most were unclear about NPs' scope of practice & responded differently to NPs teachings. ►Junior residents valued the step-by-step instructional approach used by NPs & less sense of vulnerability when being taught by NPs.	► NPs identified nursing expertise in geriatrics, smoking cessation and counseling. ►Challenges in interprofessional education related to lack of orientation on the role and scope of practice of NPs. ►Limited to views held by residents and NPs in one single academic center. ►Need to increase positive inter-professional education and decrease resistance to NPs as educators

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