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## Addressing Polypharmacy: Implementing the Medication Appropriateness Index Clinical Tool to Increase Deprescribing by Healthcare Providers

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**Addressing Polypharmacy: Implementing the Medication Appropriateness Index Clinical  
Tool to Increase Deprescribing by Healthcare Providers**

A DNP Project Submitted to the  
Graduate Faculty  
of Jacksonville State University  
in Partial Fulfillment of the  
Requirements for the Degree of  
Doctor of Nursing Practice

By

Lori K. Floyd

Jacksonville, AL

August 5, 2022

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Lori K. Floyd

August 5, 2022

## **Abstract**

**Background:** Polypharmacy is a national and local issue of concern within healthcare.

Deprescribing medications has been identified as a plausible solution for patients experiencing polypharmacy. However, many healthcare providers are unaware of the practice of deprescribing and, if aware, may not be implementing clinical tools for deprescribing effectively. The family medicine clinical site supplies an opportunity for healthcare providers to utilize an evidence-based clinical tool to review medications, identify if inappropriate, and deprescribe if indicated.

**Purpose:** The purposes of the Doctor of Nursing Practice (DNP) project were to increase deprescribing activity among prescribing healthcare providers and to increase prescribing healthcare providers' awareness and adherence to incorporating evidence-based clinical guidelines for adults aged 62 years and older experiencing polypharmacy.

**Methods:** This quality assurance project involved educational sessions provided to prescribing healthcare providers educating them how, when, and why to use the Medication Appropriateness Index (MAI) clinical tool supplemented with handouts and clinical scenarios.

**Results:** Key results included statistically significant implications of deprescribing activity with utilization of the MAI clinical tool ( $p=0.0003$ ). Numerical increases were observed as deprescribing activity increased. Notably, the average number of medications deprescribed was 1.85 medications.

**Conclusion:** This project underscored the importance of utilizing an evidence-based clinical tool like the MAI clinical tool to increase the awareness of healthcare providers regarding polypharmacy and increase the occurrence of deprescribing activity.

**Keywords:** polypharmacy, deprescribing, older adults

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## Table of Contents

Background .....	2
Health Risks .....	2
Health Benefits of Deprescribing .....	4
Current Plans to Increase Deprescribing Activity .....	4
Healthcare Providers' Use of Clinical Tools for Medication Review .....	5
Needs Analysis.....	6
The Family Medicine Clinic .....	6
SWOT Analysis .....	7
Problem Statement .....	8
Aims and Objectives .....	8
Review of Literature .....	9
Theoretical Model.....	12
Methodology .....	13
Setting .....	13
Population .....	14
Inclusion/Exclusion Criteria for Healthcare Providers .....	14
Recruitment.....	14
Consent .....	15
Design .....	15

Chart Review .....	16
Risks and Benefits .....	17
Compensation .....	17
Timeline .....	17
Budgets and Resources .....	18
Evaluation Plan .....	18
Statistical Considerations.....	18
Data Maintenance and Security .....	19
Results.....	19
Results of Chart Review .....	20
Results of Survey Responses .....	21
Discussion.....	22
Implications for Clinical Practice .....	24
Implications for Healthcare Policy .....	24
Implications for Quality/Safety .....	25
Implications for Education.....	25
Limitations .....	26
Dissemination .....	26
Sustainability.....	27
Plans for Future Scholarship.....	28



Conclusion .....	28
References .....	30
Tables.....	36
Table 1 .....	36
Table 2 .....	37
Appendix .....	38
Appendix A: SWOT Analysis: Family Medicine Clinic.....	38
Appendix B: Table of Evidence: Polypharmacy among adults aged 62 years and older..	39
Appendix C: Participant Recruitment Flyer .....	45
Appendix D: Participant Consent Form .....	46
Appendix E: Educational Session Outline: "Polypharmacy and Deprescribing" .....	49
Appendix F: Medication Appropriateness Index clinical tool and Permission to Use.....	50
Appendix G: DNP Project Timeline.....	52
Appendix H: DNP Project Budget.....	54
Appendix I: Deprescribing Review Log.....	55
Appendix J: Pre-intervention Questionnaire .....	56
Appendix K: Post-intervention Questionnaire .....	58
Appendix L: CITI Training Certificate .....	61
Appendix M: University IRB Approval .....	62

## **Addressing Polypharmacy: Implementing the Medication Appropriateness Index Clinical Tool to Increase Deprescribing by Healthcare Providers**

Polypharmacy is a concerning issue in healthcare, affecting patients nationally and locally alike. Polypharmacy is defined as the use of five or more medications on a regular basis (Varghese et al., 2021). The potential for health complications and intra-drug interactions increases as the number of medications taken increases (Tarn & Schwartz, 2020). The concurrency of consumption of several medications in older adult patients is a serious problem in pharmacotherapy (Hosseini et al., 2018).

Approximately 44% of men and 57% of women older than 65 years take five or more nonprescription and/or prescription medications per week, and 12% of persons in this age group take 10 or more nonprescription and/or prescription medications per week (Saljoughian, 2019). Research has shown individuals older than 65 years of age constitute the largest group of consumers of medications, and approximately 50% of this population utilizes at least one over-the-counter medication, and in addition, also consume at least one nutritional supplement (Valenza et al., 2017).

Deprescribing medications has been identified as an intervention to combat polypharmacy (Kurczewska-Michałek et al., 2021). Deprescribing is defined as the complex and sensitive process of supervised withdrawal of excessive and inappropriate medications (Duncan et al., 2017). Furthermore, deprescribing can be described as discontinuing, tapering, reducing dose, or reducing frequency of a medication (Duncan et al., 2017). Professionals responsible for the care of patients should be motivated to implement targeted polypharmacy interventions to benefit those individuals who fall in these criteria (Kurczewska-Michałek et al., 2021).

## **Background**

Polypharmacy is a healthcare issue on the rise, as the older adult population continues to age (Halli-Tierney et al., 2019). Polypharmacy poses a risk to patient health and safety, as well as financial and cost related problems (Komiya et al., 2018). Taking multiple medications is often burdensome on patients and can lead to drug interactions or adverse drug events (Komiya et al., 2018). Rising healthcare costs and the price of pharmaceuticals is increasing the burden of prices for patients and insurance companies (Khezrian et al., 2020).

At the present, an excess of 20,000 drugs are approved for use by the FDA to be used in the United States (Tarn & Schwartz, 2020). Polypharmacy is on the rise in most of the industrialized countries of the world and is a threat to overburden their already strained healthcare systems (Tagny et al., 2020). Polypharmacy is a cause of significant concern in relation to adverse health outcomes, higher use of medical care, and the increasing costs associated with the excessive use of medications (Kardas et al., 2021).

Multi-drug use is increasingly prevalent in the older population (Badawy et al., 2020). The occurrence of chronic diseases is increasing with age and the complication from these diseases result in an increased use of medications among the older population (Hosseini et al., 2018). Polypharmacy has been found to be the main risk for inappropriate prescribing of medications, which has harmful effects on healthcare costs (Khezrian et al., 2020).

## **Health Risks**

Polypharmacy carries health risks of liver and kidney damage, as most medications are metabolized by the liver and then mostly excreted by the kidneys (Villén et al., 2020). This issue increases the risk of drug-drug interactions and increases the likelihood of adverse drug events (Villén et al., 2020).

The implications on health risks of polypharmacy for the older population are significant (Komiya et al., 2018). Several studies have been completed which examined the correlation between polypharmacy and adverse outcomes (Chang et al., 2020). Aging places the older adults at an increased risk for multi-morbidity and therefore in peril of the over-prescribing of potentially harmful and inappropriate medications (Varghese et al., 2021). It has been found over 60% of Medicare beneficiaries have at least five chronic medical conditions (Unlu et al., 2020). Polypharmacy in older adults has been associated with an increased occurrence of many undesirable consequences, including a higher incidence of fall, frequency and length of in-patient hospital stays, and mortality rate (Hosseini et al., 2018). Polypharmacy also has been found to contribute to adverse drug events and geriatric syndromes (Gabauer, 2020). Additionally, the presence of multiple, chronic conditions results in increased complexity of management of those conditions, both for the patient and the provider (Mansoon et al., 2017).

This issue has been reported to result in adherence issues among older adults, especially those not residing in nursing home facilities where medication administration is more closely monitored (Saljoughian, 2019). The complexity of combinations of medications can cause the beneficial aspects of individual medications to become detrimental when used in conjunction with multiple other medications (Wastesson et al., 2018). Deprescribing therefore should be considered as a potentially powerful intervention (Mach et al., 2021).

Concerns which correlated with adverse health risks for older adults included the use of multiple medications resulting in mistakes in storage and self-administration, the diminished effects of medications used in conjunction with other medications, and the serious possibility of the negative effects of some medications on other comorbidities (Onder & Marengoni 2017).

Studies of general surgery patients suggest polypharmacy is associated with a three to fourfold increase in the likelihood of serious complications after surgery (McIsaac et al., 2018).

### **Health Benefits of Deprescribing**

Many health benefits are related to deprescribing non-essential medications.

Deprescribing is a process of planned and monitored tapering of medications which are potentially harmful or are no longer determined to be useful and appropriate as current therapy (Salahudeen, 2018). Deprescribing has the potential to lessen some of the undesired outcomes associated with polypharmacy (Duncan et al., 2017). When unnecessary or inappropriate medications are discontinued, the medication load on the patient is reduced (Halli-Tierney et al., 2019). Deprescribing one or more medications has the possible benefit of decreasing damage to kidneys or liver (Villén et al., 2020).

Direct benefits of deprescribing include drug reactions, drug interactions, and pharmaceutical costs may be reduced; moreover, quality of life may improve, and medication adherence may be enhanced (Reeve et al., 2017). Deprescribing has also been discussed as a promising intervention in events of organ morbidities, such as hepatic encephalopathy (Williams et al., 2021).

### **Current Plans to Increase Deprescribing Activity**

National plans to increase deprescribing activity include incorporating clinical tools into everyday healthcare practice settings (Halli-Tierney et al., 2019). Many of these clinical tools are being utilized, such as the Beers Criteria, the Medication Appropriateness Index, and the Screening Tool for Older Peoples Prescriptions (Halli-Tierney et al., 2019). The MAI clinical tool discussed in this project is presently being incorporated into healthcare practice and appears

to be effective at identifying inappropriate medications to deprescribe (Halli-Tierney et al., 2019).

The literature identifies several tools both historically and currently employed to assist healthcare providers in efforts to deprescribe medications which are not beneficial or may cause other harmful effects. The Beers Criteria, developed in 1991, is one of the more established tools existing to help in the identification of potentially inappropriate medications in older adults (Khamis et al., 2019). The STOPP (screening tool of older people's prescriptions) and START (screening tool to alert to right treatment) are also tools developed to assist in identifying inappropriate medications (Halli-Tierney et al., 2019).

The MAI clinical tool is another tool to evaluate medication appropriateness, but is not as solely geared toward older adults (Wastesson et al., 2018). The FORTA (Fit for the Aged) tool is also an instrument designed to assist providers and classify medications into categories addressing safety, efficacy, and age-appropriateness (Pazan & Wehling, 2020).

### **Healthcare Providers' Use of Clinical Tools for Medication Review**

Currently, healthcare providers overall are either underusing clinical tools for medication review or are unaware of the significance of using clinical tools for medication review (Halli-Tierney et al., 2019). The issue of polypharmacy exists due to the practice of healthcare providers not thoroughly reviewing and discontinuing medications when appropriate (Halli-Tierney et al., 2019). While pharmacists and nurses may play a role in polypharmacy, the most important group of focus for intervention is the healthcare provider with prescriptive capabilities (Halli-Tierney et al., 2019). Prescribing healthcare providers are in a unique position, as the catalyst for prescribing and deprescribing medications (Halli-Tierney et al., 2019).

Providers express difficulty exists with their ability to deprescribe (Farrell et al., 2017). Reasons for underutilization of deprescribing include patient expectation, the time-consumption of deprescribing, the medical culture, and organizational constraints surrounding the issue of deprescribing (Wallis et al., 2017). Providers also cited patient resistance and unwillingness to stop taking medications they are currently taking as one of the main barriers in deprescribing (Reeve et al., 2017).

Physicians, pharmacists, and patients all share some responsibility for review and evaluation of medications with the express concern of identifying any medications which can be decreased or eliminated (Badawy et al., 2020). Providers should evaluate patient medications and discuss with the patient those medications to be deprescribed (Halli-Tierney et al., 2019). Family physicians are in a unique position to examine the issue of excessive or redundant medications or those which no longer have a place in the patient's schedule of treatment (Schwartz, 2020).

### **Needs Analysis**

The family medicine clinic is a clinic in a rural area. The area has a population of about 900 people; however, the clinic serves a population of about 4,000 patients. The clinical preceptor is a physician at the family medicine clinic and will be overseeing this project. The clinical preceptor likewise views polypharmacy as an issue in the current clinical practice and voices a need for intervention. The clinical preceptor reported at least 50% of current patients at the clinic have or are currently experiencing polypharmacy.

### **The Family Medicine Clinic**

Current measures to address polypharmacy by utilizing the MAI clinical tool do not exist. The family medicine clinic has no clinical tool for medication review at present. As previously

stated, many patients at the clinic are experiencing polypharmacy and could benefit from medications being deprescribed.

### **SWOT Analysis**

A SWOT analysis (see Appendix A) was performed to determine existing internal strengths and weaknesses and external opportunities and threats. Internal strengths were present and included the family medicine clinic has a very dedicated and competent provider who has experience in prescribing in older adult patients. While the provider is cognizant of the implications of polypharmacy, the clinic lacks a procedure and monitoring tool to assist in determining the extent of polypharmacy in patients and assist and direct in deprescribing of identified medications. The provider would very willingly accept and utilize assistance and direction to deprescribe when appropriate. Another strength of the MAI clinical tool is availability and utility. Finally, the provider in the family medicine clinic was very supportive of the DNP student and was eager to assist and learn how better to address polypharmacy in the clinic patients.

The weaknesses included the general reluctance of patients to accept some medications they have been prescribed and have taken for perhaps many years are no longer needed. This perception was evident in the review of the literature and is cited in this manuscript. An associated weakness is the time the provider at the family medicine clinic will need to devote to the analysis of those medication lists. Consult with pharmacies will likely be needed to ensure a complete, correct, and current list of medications is available. Then, extra time will be necessary with patients to discuss the potential for the deprescribing of some of their medications. Also, the provider will need to monitor those patients on a regular basis to talk with the patients about how things are going with the lessened medication load.



Opportunities existed regarding support for this project. With the successful implementation of a deprescribing program, the patients at the family medicine clinic stand to benefit from the removal of unneeded or redundant medications. This will result in a reduced medicine load to adhere to at home. Additionally, the potential for the sharing of information regarding polypharmacy and deprescribing is a considerable opportunity.

Threats to this project included the potential for the reluctance of patients to deprescribing due to the belief the medications they have been taking for conceivably many years are still needed. Another threat is the time commitments needed on the part of the provider may prove to be excessive.

### **Problem Statement**

The question addressed during this project is: “Among prescribing healthcare providers (P), does implementing the Medication Appropriateness Index tool (I), compared to utilizing no clinical tool (C), result in an increase in deprescribing activity (O)?”

### **Aims and Objectives**

The overarching aims of this project were to:

- Increase deprescribing activity among prescribing healthcare providers.
  - Improve utilization of the Medication Appropriateness Index clinical tool when reviewing patient medication lists and deprescribing.
- Increase prescribing healthcare providers’ awareness and adherence to incorporating evidence-based clinical guidelines for adults aged 62 years and older experiencing polypharmacy.

- Improve prescribing healthcare providers' awareness and adherence regarding the utilization and effectiveness of the Medication Appropriateness Index clinical tool.
- To improve deprescribing activity related to polypharmacy as healthcare providers review, prescribe, and deprescribe medications for patients.

### **Review of Literature**

A review of literature was performed with priority placed on searches including the topics of polypharmacy, deprescribing, and older adults. Search engines such as Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PubMed were utilized (see Appendix B). Deprescribing, polypharmacy, and older adults were the key terms incorporated in CINAHL searches. Likewise, deprescribing, polypharmacy, and older adults were utilized in PubMed searches, as well. Reliable sources were gleaned by identifying peer-reviewed academic journals within the last five years of publication.

Polypharmacy is an issue requiring much consideration among healthcare providers due to its prevalence among the older adult patient population and the potential for benefits of reducing medications and the potential serious consequences of not addressing medication load among those patients. Polypharmacy increases the chance for a patient to receive a potentially inappropriate medication (Niehoff, 2019). The current process for reviewing and identifying potentially inappropriate medications contributing to polypharmacy is variable and widely unstructured (Kurczewska-Michalak et al., 2021). By implementing a clinical tool to review medications, a systematic approach can be created (Kurczewska-Michalak et al., 2021).

The average number of diseases in older adults is 7.7 per individual (Hosseini et al., 2018). Having co-existing medical conditions often results in visiting several physicians and

specialists which may lead to various providers writing multiple prescriptions (Halli-Tierney et al., 2019). The literature is clear regarding multimorbidity and the associated prescribing of numerous medications is common in older adults (Mansoon et al., 2017).

When managing several chronic conditions in patients, multiple medications are often necessary. Polypharmacy is most often observed in older patients with multiple comorbidities (Zhang et al., 2021). The use of multiple medications increases the risk for drug-drug interactions which may not exist when medications are taken alone (Varghese et al., 2021). Malone (2021) found at times, polypharmacy issues are the result of incorrect medications being prescribed.

Primary care physicians express several factors as hindrances to the deprescription of medications among their patients (Halli-Tierney et al., 2019). Some of those hindrances to be a lack of time, poor awareness of the harmful aspects of medications, fear of withdrawal reactions, and patient resistance to ending some of their medications (Martin et al., 2018)

Intervention tools to assist providers in reduction or elimination of nonessential medications do exist and have been employed and results reported in several publications. Among these tools are several clearly established and validated methods for evaluation of patients' medical regimen and identification of inappropriate medications (Niehoff, 2019).

Campins et al. (2017) utilized the STOPP Tool with over 503 providers and over 2700 drugs were evaluated. Approximately 26.5% of prescriptions were found to be potentially inappropriate and 21.5% of those were changed, and the researchers reported significant discontinuations, dose adjustments, and substitutions of medications in the intervention group utilizing the STOPP tool (Campins et al., 2017).

Martin et al. (2018) utilized the Beers Criteria in a study designed to determine if implementation of the Beers would result in an increase in deprescribing between a control group and intervention group of patients over 65 years of age. The conclusion was a significant reduction in the intervention group, with approximately 42% of the intervention group seeing a reduction in potentially inappropriate medications compared with approximately 12% in the control group (Martin et al., 2018).

The MAI clinical tool is considered the most reliable and valid tool to measure medication appropriateness (Krisch et al., 2020). This tool utilizes a precise medication review using criteria set scrutinizing patient medications which have no benefit, have therapeutic redundancy, and result in drug-drug or drug-disease interactions (Krisch et al., 2020). The MAI clinical tool is evidence-based and has proven effectiveness to address the issue of polypharmacy (Halli-Tierney et al., 2019).

The incorporation of the MAI clinical tool by healthcare providers on a routine basis assists in the process of identifying inappropriate medications applicable for deprescribing (Lopez-Rodriguez et al., 2020). Aside from simply utilizing a clinical tool to increase deprescribing activity, clinical tools raise awareness for healthcare providers as reminders to review medication lists at each visit and determine if all medications prescribed are necessary and/or appropriate (Lopez-Rodriguez et al., 2020). Many healthcare providers are either unaware of the issue of polypharmacy or are unsure of how to handle the problem (Lopez-Rodriguez et al., 2020).

The consistent and ongoing monitoring of patients' current medication lists are necessary to reduce medications taken and therefore any undesired interaction consequences (Halli-Tierney et al., 2019). The literature revealed among older adults, intervention-centered techniques result

in greater deprescribing of inappropriate medications (Martin et al., 2018). The importance of deprescribing is found consistently in the literature, and a review of the literature reveals polypharmacy has significant negative consequences for both those individuals who take medications which are redundant, excessive, or harmful, as well as the entire health care system (Halli-Tierney et al., 2019).

To improve outcomes, clinical tools like the MAI need to be consistently implemented by healthcare providers while reviewing medication lists. In addition, healthcare providers need to have increased awareness of the issue of polypharmacy and increased adherence to medication review tools (Halli-Tierney et al., 2019). Patients also need to be included in the medication review process, as patient hesitancy may prove to be a barrier to procedure change (Kurczewska-Michalak et al., 2021). Procedure changes regarding polypharmacy demand a change in attitude and mind-set to improve outcomes and sustain success (Kurczewska-Michalak et al., 2021).

### **Theoretical Model**

The theory utilized to guide this project is Lewin's Theory of Planned Change. Kurt Lewin published a Three-Step Model of Change which has become the most influential approach to organizational change (Burnes, 2019). Lock (2018) explains Lewin's Model proposed three main stages to move from a current state through a change process to a desired future state; thereby, utilizing the three stages: unfreezing (assess why change is needed), change (movement toward the desired state), and refreezing (set the new behavior as the new normal).

This theory will assist the progress of this project by allowing certain behaviors to occur. First, in unfreezing, the provider will recognize the problem of polypharmacy and consider why deprescribing needs to occur. This will occur as the provider is given access to the literature on polypharmacy and understands the implications of deprescribing medications. Secondly, the

change component will be enacted by enabling the provider to change beliefs and procedures; furthermore, allowing implementation of a program of review of medication lists of patients and have a mechanism to allow deprescribing to occur. Thirdly, in the refreeze stage, the provider will move forward with the new behavior intact, encouraging deprescribing to proceed in a methodical manner (Lock, 2018).

### **Methodology**

This project anticipates improving deprescribing activity and awareness by healthcare providers. Specifically, this project will utilize the Lewin Model to allow the provider to proceed from a difficult task to a manageable task which can be successfully implemented.

The primary intervention of this project is to equip the provider with the ability to increase deprescribing among patients. In the first stage, the provider will be presented with the pertinent information and will be allowed to process and provide thoughts on their current beliefs and actions in relation to the status of if and how polypharmacy is approached at the present time. In the second phase of change, the MAI clinical tool will be introduced and employed. In the final phase of unfreezing, the provider will proceed to utilize the MAI clinical tool in an ongoing and consistent manner to review medication lists, identify potentially inappropriate medications, and deprescribe those medications.

After implementation of the project intervention, it will be possible to evaluate and analyze how effectively the provider utilized the MAI clinical tool to successfully deprescribe unnecessary medications for the twenty selected patients.

### **Setting**

The setting where this project was conducted involved a family medical clinic located in the rural, Southeastern region. The family medicine clinic was staffed with one medical doctor.

The average number of patients seen on a typical full workday is twenty-five patients. Of those patients, approximately fifteen per day would be above age 62, and typically those patients aged 62 and older had several medical conditions treated with multiple medications.

### **Population**

The population of interest was the healthcare provider with prescriptive capabilities at the family medicine clinic. Nurses and clinical staff also working at the family medicine clinic were excluded from this project

### **Inclusion/Exclusion Criteria for Healthcare Providers**

The inclusion criteria were as follows:

- healthcare providers with prescriptive capabilities
- working within clinical site facility
- employment status: full-time

The exclusion criteria are listed below:

- healthcare providers caring for vulnerable patient populations like cancer patients
- healthcare providers without prescriptive capabilities

### **Recruitment**

A flyer for recruitment purposes was prepared and sent to the healthcare provider at the family medical clinic (see Appendix C). The flyer allowed the participating provider time for review and consideration. The clinical preceptor was the sole participant in the project population. A meeting was arranged, and the provider was able to ask questions and give consent to participate.

**Consent**

Consent was collected from the project participant voluntarily prior to project intervention implementation (see Appendix D). Participants were informed this project would be led by the Principal Investigator (PI), but university faculty could be contacted at any time during the project implementation. The PI of this project did not have any impact over administrative decisions at the family medicine clinic. Any data collected by the PI would be non-identifiable and confidentiality of all participants would be maintained (see Appendix D) for plan of confidentiality).

**Design**

This quality assurance project utilized the MAI clinical tool to allow the healthcare provider at the family medicine clinic to assess medicine lists of patients and identify inappropriately prescribed medications. An educational session was provided for the healthcare provider at the family medicine clinic (see Appendix E). The identification of those medications would then allow the provider to deprescribe unnecessary medications during primary care visits. The provider at the family medicine clinic received the MAI clinical tool hard copy version (see Appendix F) and access to electronic version to be utilized during the primary care visits. The DNP PI contacted the MAI clinical tool's creator, Dr. Joseph Hanlon, via email and asked permission to use the tool in DNP project. The DNP PI was informed by Dr. Hanlon the MAI clinical tool is public domain and does not require permission to use (see Appendix F).

After identification of the twenty patients, a consultation was conducted with the provider and the DNP PI. At the meeting, the DNP PI reviewed the twenty patients and the medications currently being taken by each of the patients. The provider and the DNP PI identified those medications to most likely be deprescribed. The provider noted those medications on the chart to



be discussed with the patient at their next scheduled visit. At the next scheduled visit, the provider discussed with each of the patients any medications eligible for elimination, and the patients were allowed to agree or disagree with any changes to their medication regimen. Any medications deprescribed were noted on the chart, and the provider also kept a hand-written record of any eliminated medications.

After the twenty patients were seen during their scheduled office visit, medications were either deprescribed or not. Of course, the number of patients experiencing polypharmacy was the original twenty patients; however, only a certain number of those patients had potential medications to be deprescribed. The provider and the DNP PI evaluated components such as average number of medications deprescribed, average patient age, demographic information based on gender, and the average number of medications a patient was initially taking.

### **Chart Review**

A pre-intervention chart review with the provider and DNP PI was conducted after IRB approval was obtained. The chart review allowed the provider and the DNP PI to identify those patients aged 62 and older who were taking five or more medications. Medication lists for those identified patients were available and the number of medications for each of the identified patients was determined. The medications included all types of medications, including over-the-counter medications, vitamins and supplements, as well as those prescribed by providers. The provider, acting as preceptor, was the only individual able to access identifiable patient information, such as name, date of birth, or medical record numbers. This information was de-identified before reviewed by the DNP PI.

During the chart review, any medications deemed as candidates for deprescription were identified and noted by the provider in the chart for discussion at the next scheduled visit of each

patient. After the chart review was completed, twenty patients aged 62 and older who were taking at least five medications were identified. These twenty patients were all previously scheduled for an office visit in the coming weeks, so this provided certainty the designated patients could be evaluated in a short timeframe.

### **Risks and Benefits**

No physical harm will affect participants in this project. The only risk of harm would pertain to confidentiality of patients, and such risks were mitigated by ensuring no names or identifiable information were associated with any patients. When medications lists were presented to the DNP PI, patient names and demographic information were not viewed in any way, and the patients were only identified by alphabetical letters assigned by the family medicine clinic provider. At no time was the DNP project leader privy to any patient names or information other than their medication lists and age range (older than 62 years of age).

Benefits of this project included equipping providers at the family medicine clinic with a tool to assist them in the deprescribing of unnecessary medications for their patients. Benefits also extended to patients as the deprescribing of unnecessary medications will likely have various positive results.

### **Compensation**

No version of compensation was offered or provided during this DNP project to any participants, other than educational handouts and information.

### **Timeline**

The timeline is included in Appendix G. The timeline developed for the implementation and completion of this project was nine weeks. The projected dates were January 14, 2022, to March 18, 2022. Prior to the beginning of the implementation, the DNP project leader worked

with faculty to obtain proper guidance and permission to continue with the project. In December 2021, the Institutional Review Board of Jacksonville State University approved the project (see Appendix M). The DNP PI also completed CITI training in 2021 prior to project implementation (see Appendix L).

### **Budgets and Resources**

A budget was prepared prior to project implementation. The project actual cost was less than the anticipated cost. Finances for this project proved to be reasonable and low cost. Finances primarily involved copies of educational materials (see Appendix H).

### **Evaluation Plan**

#### **Statistical Considerations**

The data collection tool was developed by the DNP PI in a handwritten deprescribing log template (see Appendix I). The tool was used to collect medication information from each of the patients aged 62 and older who received primary care at the family medicine clinic. The statistical collection of data from the study involved review of charts of patients aged 62 and older and who in addition take five or more medications.

The general information for each patient was presented in table form and included gender, age, and number of medications taken. The provider was then educated regarding how to utilize the MAI clinical tool to perform deprescribing nonessential medications. The provider then proceeded to implement the tool with each of the twenty patients at their scheduled primary care visit.

Post-intervention data included the number of patients taking five or more medications. In addition, data was compiled to evaluate how many patients had medications deprescribed versus how many did not. Other post-intervention data included the average number of

medications per patient, the average number of medications deprescribed per patient, and the average age of patients participating in the patient population pool.

For statistical analysis, a paired t-test was used to compare the number of medications each patient was taking before the intervention with the number of medications after the intervention. The paired t-test enables the determination of a statistically significant difference between two groups' (the same patients being compared pre-intervention and post-intervention) medication amounts both before and after intervention. A significance level of  $\alpha < 0.05$  was established when performing the t-test. The p-value results from the t-test were compared to the  $\alpha = 0.05$  established significance level to find the degree of statistical significance.

Pearson correlation values from the paired t-tests were utilized to allow further analysis of the potential reduction in medication load for each of the sample patients. These statistical analyses allowed a determination to be made as to whether there existed a significant difference between pre-intervention and post-intervention.

### **Data Maintenance and Security**

The only information the DNP project leader was privy to in regard to patient demographics was gender, age, medical conditions, and medication lists. At no time was any patient confidential information provided to the DNP project leader. Also, the exact location of the confidential information at the family medicine clinic was not disclosed to any parties other than the clinical preceptor and the PI.

### **Results**

The project tracked the twenty patients at the family medicine clinic meeting the following criteria: aged 62 years and older and prescribed five or more medications. The provider at the clinic utilized the MAI clinical tool to evaluate the medication lists of each of the

twenty patients. At the next visit of each of the patients, the provider discussed medications deemed inappropriate and discussed the option of elimination by deprescribing. After each of the patients were seen, the number of starting medications before deprescribing were compared with the new total number of medications after any deprescribing of medications occurred.

Pre-intervention, all of the twenty patients were taking five or more medications (100%) and were candidates for deprescribing. The results of the project indicated out of the twenty patients, seventeen (85%) were found to have inappropriate medications indicating deprescribing or discontinuing. It was determined after employing the tool, the other three patients (15%) did not have any medications with the potential to be eliminated. In the case of the seventeen patients with inappropriate medications, all of the seventeen agreed to the elimination of at least one medication, if not more.

Pre-intervention, the average number of medications per patient was 12.25. Post-intervention, the average number of medications per patient was 10.4. The average number of medications deprescribed was 1.85 medications. The medication class most likely to be deprescribed appeared to be antihistamines. Significant to remark, the provider did not write any new prescriptions during any of the visits, so no medications were added to the medication load of each patient. Notably, with many patients, polypharmacy continued to be present, even despite positive deprescribing activity. For example, a patient was taking twelve medications and had two medications deprescribed, leaving the patient with a total of ten current medications; therefore, deprescribing activity occurred but the patient was still experiencing polypharmacy.

### **Results of Chart Review**

The chart review resulted in a total of twenty patients who were identified as being age 62 years or older and currently prescribed five or more medications. The chart review found the

average age of the patients was 74.95 years of age. The sex/gender of the patients was fairly equal, including eleven males and nine females. The average number of medications taken by the group was 12.25. Each of the twenty patients were scheduled to come for an office visit during the indicated weeks of implementation.

The analyzed p-value was 0.0003, which is less than 0.05. Since the p-value was less than 0.05, the results were statistically significant. From analysis utilizing the paired *t* test, the following data was ascertained. The mean of the two groups was 1.85. The standard deviation was 1.7965 and  $t = 4.4886$ . Utilizing the Pearson Correlation Coefficient determined *r* was equal to 0.8996.

### **Results of Survey Responses**

A tool was constructed by the DNP project leader to allow an evaluation of the attitudes of the healthcare provider regarding polypharmacy. A pre-intervention questionnaire (see Appendix J) was administered to the provider prior to any presentation of education regarding polypharmacy. The provider was then educated on the pertinent aspects of polypharmacy and was introduced to the MAI clinical tool.

Then, the intervention with the patients occurred over the next five weeks. After all the patients were seen at their regular scheduled visits, the DNP PI then returned to the clinic to meet with the provider. At that time, a post-intervention questionnaire (see Appendix K) was administered measuring the attitudes of the provider concerning polypharmacy. The comparison of the pre-intervention questionnaire with the post-intervention questionnaire allowed the DNP PI to draw conclusions regarding the attitudes of the provider pre-intervention and post-intervention.

The convenience sample was extremely limited for this project. The population of interest consisted of one healthcare provider with prescriptive capabilities. Therefore, no alternative participants exist to compare results across the population of interest. However, the individual healthcare provider's responses to the questionnaires can be formulated and analyzed in data collection.

Questions eight, nine, and ten of the pre-intervention questionnaire evaluated the healthcare provider's knowledge regarding the MAI. The healthcare provider did successfully answer all three questions correctly (100%), even despite knowing very little about the MAI clinical tool. To note, the pre-intervention questionnaire was administered prior to the educational session.

Questions five, six, seven, eight, and ten on the post-intervention questionnaire were graded with responses ranging from never to always, with question ten ranging from strongly unprepared to strongly prepared. The healthcare provider did not find the MAI clinical tool to be convenient to use, nor did the healthcare provider find the MAI clinical tool to be essential to the medication review process. The healthcare provider did respond "usually" to question six and seven regarding how often inappropriate medications were identified and how often did deprescribing occur. The healthcare provider answered question ten regarding personal preparedness to use the MAI when reviewing medications to deprescribe as "strongly prepared".

### **Discussion**

This project aimed to address the concerning issue of polypharmacy affecting many older adult patients in primary care settings. The results of the project provided promising findings and supported the assumption suggesting primary care providers can evaluate patient medication lists and identify medications to be deprescribed or discontinued. Further supporting evidence

indicated patients with unnecessary medications were willing to allow deprescribing of such medications. The results of the project confirmed the views expressed in the literature review suggesting polypharmacy can be addressed via education and access to an appropriate medication review tool.

The main aims of the project were to increase deprescribing activity among prescribing healthcare providers and increase prescribing healthcare providers' awareness and adherence to incorporating evidence-based clinical guidelines to address polypharmacy. Significant findings of this project included statistically significant results of deprescribing activity with utilization of the MAI clinical tool ( $p=0.0003$ ). Numerical increases were observed as deprescribing activity increased. Notably, the average number of medications deprescribed was 1.85 medications. The awareness of the healthcare provider increased as a result of project implementation. The healthcare provider was surprised by how many medications patients were being prescribed; even more so, concern existed regarding the number of medications considered to be inappropriate or unnecessary. The healthcare provider concluded the project's target population are the prime candidates to be leaders in the process of addressing polypharmacy by means of deprescribing medications.

While the healthcare provider supported the incorporation of the MAI clinical tool as a guide and reminder to review medications for appropriateness, the healthcare provider communicated the tool was cumbersome to use at times. The MAI clinical tool is considered an implicit tool and is proven to be more time consuming than other clinical tools (Halli-Tierney et al., 2019). The MAI clinical tool focuses more on physician judgment and being patient-centered (Halli-Tierney et al., 2019). Yet, since the tool is more patient-centered, patients are more likely to be agreeable with the deprescribing of medications (Halli-Tierney et al., 2019). This



component of patient compliance was observed by the healthcare provider, as each patient who was offered medication deprescribing was receptive.

### **Implications for Clinical Practice**

The project's aims regarding clinical practice were met evidenced by an increase in deprescribing activity and an increase in healthcare providers' awareness of the issue of polypharmacy. The project revealed useful findings for clinical practice. Among these is the clear conclusion regarding the excessive number of patients in a primary care clinic being prescribed multiple medications.

Furthermore, patients can successfully experience medication deprescribing of at least some of the unnecessary medications. Another implication is providers can manage the additional time commitment for evaluation of patient medication lists to identify potentially inappropriate medications. Also implied is the concept of the reliability and success of the MAI clinical tool to utilize to determine the necessity of medications.

### **Implications for Healthcare Policy**

The results of the project indicate healthcare clinical management or individual healthcare clinics can implement the evaluation of patient medications as a requirement for prescribing providers. Furthermore, healthcare policy leaders can determine evidence-based clinical tools are reliable to ascertain which medications can be removed regularly and consistently. In addition, healthcare policy leaders could include the requirement for prescribing healthcare providers to discuss medication lists with patients at least annually and initiate discussion regarding the necessity of each of the medication.

**Implications for Quality/Safety**

The project utilized the MAI clinical tool to allow providers to evaluate the medication load of patients and determine if any medications can be eliminated. When medications are determined to be inappropriate, those can be discussed with patients with the intention of eliminating those medications. When medications are eliminated, patients will benefit financially; additionally, drug-drug and drug-disease interactions will be reduced (Halli-Tierney et al., 2019).

Medication safety is a major topic in healthcare today, as patient age continues to increase and co-morbidities continue to accumulate (Halli-Tierney et al., 2019). Polypharmacy is a threat to medication safety, as negative consequences may materialize when patients are taking multiple medications (Halli-Tierney et al., 2019). Addressing polypharmacy focuses on quality and safety issues such as decreasing patient falls and increasing quality of life (Halli-Tierney et al., 2019).

**Implications for Education**

The result of this project indicates providers can be educated in relation to deprescribing medications for their patients. Patients can also be successfully educated in relation to the benefits of deprescribing. Education appears to be positively welcomed and accepted by healthcare providers and patients alike. Not only increasing education distribution, but increasing education frequency, can further reinforce the awareness of polypharmacy and the adherence to utilizing clinical tools to assist with medication review and identifying inappropriate medications.

Primary care clinic sites should consider at least annual educational sessions regarding polypharmacy and deprescribing medications. The education can be offered via clinical in-

service sessions and can also be administered to new employees during orientation. Educational sessions should be instructive and open for discussion and questions to facilitate the best learning environment.

### **Limitations**

Three main limitations of this project exist. The first limitation was the limited number of participating providers. One provider at the family medicine clinic participated. The participating healthcare provider was the lead provider at the clinic and thereby does hold considerable influence over the other providers at the clinic. However, the other healthcare providers did not participate in the project implementation.

The other limitation was the small sample size. Twenty patients were included in the population pool of patients. These patients' medication lists were evaluated, and the participating healthcare provider attempted, during the intervention, to deprescribe medications. Time constraints, namely the short implementation timeframe, also contributed as a limitation since less patients were able to be seen. In addition, time constraints existed for the healthcare provider attempting to use the MAI during patient office visits to review extensive medication lists, identify potentially inappropriate medications, and then initiate the process of deprescribing.

### **Dissemination**

The findings for this research will be shared at the Jacksonville State University Annual Virtual Dissemination Day on July 15, 2022. The findings will be disseminated via poster presentation or podium presentation, as well as within this manuscript. The results were shared with the clinical preceptor in person at the conclusion of project implementation.

### **Sustainability**

The family medicine clinical site will continue to have the option to utilize the MAI clinical tool in practice. This project can easily be implemented again in a clinical setting with patients or in a pharmaceutical setting with pharmacists. In addition, the project can be implemented by nursing staff during the triage process, new patient process, or medication reconciliation process.

Not to mention, various other tools exist for medication review and to assist with deprescribing medications. This DNP PI will carry on the practice after graduating. This DNP PI already considers using the MAI to assess medication necessity for patients. This DNP PI is eager to deprescribe medications when possible and include patients in the decision-making process.

This DNP PI's plan for sustainability involves leaving the participating healthcare providers with copies of the MAI clinical tool for future use to review medication lists. The MAI essentially provides a check-list for healthcare providers to use in determining medication necessity. Collaborating with patients will be a great future endeavor; furthermore, receiving feedback from patients regarding their feelings about polypharmacy and deprescribing will aide in sustainability.

This DNP project leader will carry on the practice in her employment as a family nurse practitioner. This DNP project leader is eager to evaluate medication lists for those in her care and is excited about being able to potentially help in the elimination of unnecessary medications in her patients. The process of including patients in the decision-making process is also very desirable to this DNP PI.

### **Plans for Future Scholarship**

This project proved to be helpful to further confirm existing data surrounding the topics of polypharmacy and deprescribing. However, further research will be needed in the future to continue support and progress towards the reduction of unnecessary medications. Further studies to utilize different clinical tools for medication review will be informative. Moreover, future studies regarding patient participation will address the barriers of patient hesitancy regarding discontinuing medications.

This project was led by one DNP PI and involved the participation of one prescribing healthcare provider. Future scholarship would benefit from including more prescribing healthcare providers in the study, as well as a mix of disciplines, such as nurse practitioners and physician assistants. In addition, such studies may benefit from including pharmacy staff in the intervention, since pharmacists hold the prime responsibility of dispensing prescribed medications. Consequently, this project involved a small group of twenty patients evaluated over an approximately five-week timeframe. Future studies would be more helpful if evaluating a larger group of patients over a longer timeframe. In addition, patient follow-up after deprescribing medications would be assistive to such project topics.

Throughout the formulation and implementation of this project, the DNP PI was optimistic this project would yield results to prove beneficial to the professional field. The DNP project leader has also been encouraged and has gained confidence future research can be conducted and may yield information to assist the professional community.

### **Conclusion**

Polypharmacy remains a concerning issue nationally and locally, and utilizing clinical tools, like the MAI clinical tool, remains a viable solution to the issue (Saljoughian, 2019). The

MAI assists prescribing healthcare providers to review, analyze, and identify if medications are inappropriate and can be discontinued (Halli-Tierney et al., 2019).

Despite evidence-based research and studies, a need still exists for more effective methods of reviewing medications and identifying inappropriate medications (Halli-Tierney et al., 2019). This DNP project was aimed towards increasing deprescribing activity and reducing polypharmacy, while raising awareness of the issue of polypharmacy in primary care practice settings. This DNP project aspired to increase awareness and adherence of prescribing healthcare providers to the incorporation of evidence-based clinical guidelines and clinical tool to address polypharmacy.

To continue to increase awareness and implementation of evidence-based clinical guideline tools, further research should focus on determine barriers impeding compliance over a lengthened timeframe. Determining barriers to deprescribing among healthcare providers and patients alike will be helpful to increase acceptance and adherence with deprescribing activity.

Utilizing the MAI has a strong correlation with the ability of healthcare providers to deprescribe medications, so more education and counseling should be directed toward prescribing healthcare providers. Projects, such as this one completed by the DNP PI, highlight the benefits of implementing clinical tools for the process of medication review to identify inappropriate medications and deprescribe when indicated.

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## Tables

**Table 1**

*Demographics and Medication Load*

Characteristics	Frequency	Percentage
Male	11/20	55%
Female	9/20	45%
Experiencing polypharmacy	20/20	100%
Aged 62-70	6/20	30%
Aged 71-80	9/20	45%
Aged over 81	5/20	25%
Taking 5-9 medications	5/20	25%
Taking 10-14 medications	11/20	55%
Taking 15 or more medications	4/20	20%

**Table 2***Chart Review Pre-intervention and Post-intervention*

Polypharmacy occurrence	Pre-intervention frequency	Post-intervention frequency	<i>p</i> -value
Medications prescribed	12.25	10.4	0.0003

## Appendix A

### SWOT Analysis: Family Medicine Clinic

Internal		External	
Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> <li>-The family medicine clinic has a very dedicated and competent provider who has experience in prescribing in elderly patients.</li> <li>-The provider would very willingly accept and utilize assistance and direction to deprescribe when appropriate.</li> <li>-The Medication Appropriateness Index (MAI) clinical tool is available and not difficult to utilize. -</li> <li>The provider in the family medicine clinic is very supportive of the DNP student and is very eager to assist.</li> </ul>	<ul style="list-style-type: none"> <li>-The general reluctance of patients to accept some medications they have been prescribed and have taken for perhaps many years are no longer needed.</li> <li>-The time the provider at the family medicine clinic will need to devote to the analysis of those medication lists.</li> <li>-Consult with pharmacies will likely be needed to ensure a complete, correct, and current list of medications is available.</li> <li>-Extra time will be necessary with patients to discuss the potential for the deprescribing of some of their medications.</li> </ul>	<ul style="list-style-type: none"> <li>-The patients at the family medicine clinic stand to benefit from the removal of unneeded or redundant medications.</li> <li>-Result in a reduced medicine load to adhere to at home.</li> <li>-The potential for the sharing of information regarding polypharmacy and deprescribing is a considerable opportunity.</li> </ul>	<ul style="list-style-type: none"> <li>-The potential for the reluctance of patients to deprescribing due to the belief the medications they have been taking for conceivably many years are still needed.</li> <li>-The time commitments needed on the part of the provider may prove to be excessive.</li> </ul>

## Appendix B

Table of Evidence: Polypharmacy among adults aged 62 years and older

*Clinical Question: Among prescribing healthcare providers (P), does implementing the Medication Appropriateness Index tool (I) compared to utilizing no clinical tool (C) result in an increase in deprescribing activity (O) over a nine-week timeframe (T)?*

Article	Author & Date	Evidence Type	Sample, sample size, setting	Study findings related to PICOt question	Limitations	Evidence Level and Quality
1	Niehoff, K., Mecca, M., & Fried, T. (2019).	Narrative review	Database: PubMed.  Keywords: medication appropriateness; multi-morbidity; polypharmacy.  13 articles of criteria to evaluate appropriateness.	-Polypharmacy can cause adverse outcome.  -Medication appropriateness should be evaluated.	-Concluded more data is required.  -Little data supporting criteria.	Level IV, Quality C.
2	Kurczewska-Michalak, M., Lewek, P., Jankowska-Polańska, B., Giardini, A., Granata, N., Maffoni, M., Costa, E., Midão, L., & Kardas, P. (2021).	Scoping review	Database: CINAHL, EMBASE, PubMed.  Keywords: adverse drug event; adverse drug reaction; elderly; explicit criteria; inappropriate prescribing; multimorbidity; older adults; polypharmacy.  Timeframe: January 2010-March 2018.	-Criteria-based drug reviews are recommended.  -Polypharmacy should be addressed more seriously.	-“Gold standard” criteria was not identified.  -Long lists of medications reviewed.  -49 papers identified.	Level III, Quality C.
3	Hosseini, S., Zabihi, A., Amiri, S., &	Descriptive/analytical cross-sectional study	1616 individuals, ages 60 years and older. 883 men, 733 women.	-Polypharmacy is more prevalent in older women.	-one location.	Level II, Quality A.



	Bijani, A. (2018).		Setting: city of Amirkola in northern part of Iran.	<p>-Polypharmacy is a serious issue requiring intervention.</p> <p>-Educational programs are a reasonable approach to inform physicians, pharmacy staff, and healthcare staff about medication safety and polypharmacy.</p>	-Small sample size.	
4	Halli-Tierney, A., Scarbrough, C., & Carroll, D. (2019).	Compilation. The search included RCT, clinical trials, reviews, meta-analyses, case reports, evidence-based guidelines.	<p>Databases: PubMed, Cochrane Database of Systematic Reviews, UpToDate, the Canadian Task Force on Preventive Health Care, the ABIM Foundation's Choosing Wisely website, the Centers for Disease Control and Prevention guideline on prescribing opioids for chronic pain, the U.S. Preventative Services Task Force recommendations.</p> <p>Keywords: polypharmacy, multiple medications, risks, potentially inappropriate medications, deprescribing.</p>	<p>-Patients and physicians may be cautious to the practice of deprescribing.</p> <p>-Validated tools exist to address polypharmacy.</p> <p>-The MAI clinical tool is a patient-centered tool to utilize to evaluate medication necessity.</p>	-Short timeframe.	Level I, Quality A.

			Timeframe: July and August 2018, February 2019.			
5	Masnoon, N., Shakib, S., Kalisch-Ellett, L., & Caughey, G. (2017).	Systematic review	Databases: Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) checklist, MEDLINE (Ovid), EMBASE, Cochrane.  Timeframe: January 2000-May 2016.	-Most commonly used definition for polypharmacy is five or more medications daily.  -Tools or criteria, like the MAI clinical tool, can be used to identify potentially inappropriate medications.  -Addressing polypharmacy and reviewing medications requires a holistic approach to medical care.	-Studies in English only were used.  -possible information bias.  -only articles from 2000 to present (2016) were used.	Level 1, Quality A.
6	Zhang, S., Swallow, N., Pomilla, W. (2021).	Opinion of recognized expert	Not applicable.	-Risk factors for polypharmacy include age, sex, chronic conditions.  -Deprescribing is a proposed intervention for polypharmacy and the MAI clinical tool is a recommended guideline.	-No setting or sample size included.  -Expert opinion only.	Level V, Quality D.

7	Varghese, D., Ishida, C., & Hayas, H. (2021).	Continuing education activity	Not applicable.	<p>-Older adults often require multiple medications to manage co-morbidities.</p> <p>-Adverse drug events are a risk of polypharmacy.</p> <p>-Strategies, like using clinical tools, can be implemented to prevent polypharmacy.</p>	<p>-No setting or sample size included.</p> <p>-Educational use only.</p>	Level V, Quality D.
8	Malone, L. (2021).	Opinion of recognized expert	Not applicable.	<p>-Identifying inappropriate medications and deprescribing can improve patient outcomes.</p> <p>-Annual wellness visits are a reasonable time to recognize and address polypharmacy.</p>	<p>-No setting or sample size included.</p> <p>-Expert opinion only. No references cited.</p>	Level V, Quality D.
9	Martin, P., Tamblyn, R., Benedetti, A., Ahmed, S., & Tannenbaum, C. (2018).	Randomized clinical trial	<p>Setting: community pharmacies in Quebec, Canada.</p> <p>Timeframe: February 2014-September 2017, with follow-up until February 2018.</p>	<p>-Inappropriate medications exist with older adults at an alarming rate.</p> <p>-Deprescribing or discontinuing</p>	<p>-Small sample size.</p> <p>-one location.</p>	Level I, Quality A.

			<p>Sample Size: 248 patients and 241 to control group.</p>	<p>medications is a reasonable intervention to address polypharmacy.</p> <p>-Sedative-hypnotics, first-generation antihistamines, glyburide, or non-steroidal anti-inflammatory drugs are over-prescribed and often inappropriate with older adults.</p>		
10	<p>Campins, L., Serra-Prat, M., Gozalo, Lopez, D., Palomera, E., Clara, A., &amp; Cabre, M. (2017).</p>	<p>Randomized controlled trial</p>	<p>Setting: Primary care centers.</p> <p>Sample: polymedicated elderly people (aged 70 years and older).</p> <p>Sample size: 503 patients. 2709 drugs evaluated.</p>	<p>-Medication evaluation programs are helpful to address polypharmacy and reduce potentially inappropriate medications.</p> <p>-Reducing potentially inappropriate medications is a safe, evidence-based intervention to address polypharmacy.</p> <p>-Continued re-evaluation and follow-up of medication lists is needful to</p>	<p>-no differences observed in reduction rates of hospitalizations or death among elderly patients.</p>	<p>Level 1, Quality A.</p>

				emphasize and sustain the effects of deprescribing.		
11	Krisch, L., Mahlknecht, A., Bauer, U., Nestler, N., Hempel, G., Osterbrink, J., & Flamm, M. (2020).	Content-based approach	Not applicable.	<p>-The MAI clinical tool is recommended as the most reliable, implicit tool to evaluate medication appropriateness.</p> <p>-The MAI clinical tool can be correlated to the mean reduction of medications.</p>	<p>-content-based.</p> <p>-No setting or sample size included.</p>	Evidence V, Quality D.
12	Lopez-Rodriguez, J.A., Rogerio-Blanco, E., Aza-Pascual-Salcedo, M., Lopez-Verde, F., Pico-Soler, V., & Leiva-Fernandez, F. (2020).	Cross-sectional study	<p>Sample: 593 community-dwelling elderly aged 65-74 years.</p> <p>Size: A total of 4,386 prescriptions were evaluated.</p> <p>Setting: Spanish regions (Andalucia, Aragon, Madrid).</p>	<p>-The MAI clinical tool scores increase when new medications are added.</p> <p>-Explicit and implicit criteria tools are indicated for use when addressing polypharmacy by identifying inappropriate medications.</p> <p>-The MAI clinical tool recognizes greater medication inappropriateness than other explicit criteria tools.</p>	<p>-Addressed an objective against initial design.</p> <p>-Possible inappropriate valuation.</p>	Level II, Quality B.

## Appendix C

### Participant Recruitment Flyer

#### DNP Nursing Project in Need of Participants!

PURPOSE: Educate healthcare providers to utilize the Medication Appropriateness Index clinical tool to increase deprescribing activity and reduce the prevalence of polypharmacy among patients aged 62 years and older.

---

WHO: Healthcare providers at clinical facility site with prescriptive capabilities \*Note: Participation is voluntary and can be withdrawn at any time.

---

WHAT: Attend 30-minute one-time educational session to learn about polypharmacy, deprescribing, and the Medication Appropriateness Index clinical tool.

---

WHERE: On site at clinical facility location.

---

WHEN: 30-minute educational session in January during the day when office is closed for lunch.

---

DATE: To be determined and announced at later time.

If interested in participation, please contact:

Lori K. Floyd, MSN, CRNP, FNP-C at

[lgorham@stu.jsu.edu](mailto:lgorham@stu.jsu.edu) or phone number can be provided.

## **Appendix D**

### **Participant Consent Form**

**TITLE OF STUDY:** Addressing Polypharmacy: Implementing the Medication Appropriateness Index clinical tool to Increase Deprescribing by Healthcare Providers.

**Principal Investigator:** Lori K. Floyd, MSN, CRNP, FNP-C

This consent form relates to an informed consent process for a Doctor of Nursing Practice (DNP) student project, and it will supply you with information to assist you in deciding whether or not you are interested in participating in this project. This consent form is designed to inform you what the project is about and what will occur during the project.

If at any point during the decision-making process you should have questions, please feel comfortable asking them with high expectations of prompt answers you will understand clearly.

Once your questions have been answered and you are ready to decide to participate in the DNP project, please complete the attached survey and be involved in the educational session. You are not surrendering any legal rights by participating in this DNP project.

#### **Why is this project being performed?**

The project will aim to develop a clinical plan to implement the use of the Medication Appropriateness Index by prescribing healthcare providers to evaluate an increase in deprescribing activity and a decrease the prevalence of polypharmacy in adults aged 62 and older. This project is designed to educate healthcare providers to utilize a clinical tool, like the Medication Appropriateness Index, when reviewing medications to determine if any medications are unnecessary and can be deprescribed. This project is beneficial for healthcare providers and patients, as polypharmacy is taxing on the healthcare system and on patients' wellbeing. The duration of this project will be 9 weeks.

#### **What will you be expected to do if you choose to participate in this project?**

First, participants will be asked to participate in one educational session lasting about 30 minutes. At the educational session, the participants will be provided with information, clinical scenarios, and handouts. The participants will be asked to complete a pre-intervention survey at

the educational session, and then complete a post-intervention survey at the completion of the educational session. The participants will be encouraged to provide feedback.

**What are the potential risks or disadvantages you may experience if you choose to participate in this project?**

No harm is anticipated for any participants involved in this project. The project has no input or involvement from any individual in an administration position, and participation is completely voluntary. No individuals from administration, human resources, or clinical supervision will be permitted to view any information regarding a participant's involvement in this project, feedback given, or survey responses. Furthermore, participants are under no obligation to change practices after learning in the educational session. No financial contributions are expected from participants in this project.

**Are there any potential benefits from participating in this project?**

Participating in this project is a great way to learn more about the Medication Appropriateness Index clinical tool and the process of deprescribing medications.

**How will personal information be kept private and confidential?**

While total confidentiality can never be guaranteed, absolute effort will be taken to keep personal information private during this project. Personal names will not be placed on documents, rather a randomized ID code will be used on surveys or any other documents. Surveys will be kept in the clinical facility setting and will not be removed until any and all identifiable information has been removed. All collected information and data will be completely discarded upon project completion.

**What will happen if you decide to not participate in this project or later decide to end your participation in this project?**

Please remember any participation in this project is completely voluntary. If at any point, you decide you do not want to begin the project or if you wish to leave the project, you may do so. Feel free to change your mind about participation at any time. Please understand there is no point of time before, during, or after the project that you may not choose to stop participating. If you decide to leave the project, you will not meet any consequences or penalties.

You may retract your consent for data use collected about you prior to your decision to leave the project, but please do this in writing by sending an email to [lgorham@stu.jsu.edu](mailto:lgorham@stu.jsu.edu).

**Who can you call if you have any questions?**

Lori K. Floyd, MSN, CRNP, FNP-C

(256) 657-7037.



## AGREEMENT TO PARTICIPATE

### 1. Subject Consent:

I have read the entire consent form, or it has been read to me, and I believe I comprehend what has been discussed. All my questions regarding this form or this project have been answered or addressed. I agree to participate in this DNP project.

Subject name: .....

Subject signature: ..... Date: .....

### 2. Signature of Investigator/Individual Obtaining Consent:

To the best of my ability, I have explained, elaborated, and discussed this DNP project's complete purpose and content, including all the information addressed in this consent form. All questions of the DNP project participants or those of their parent or legally authorized representative have been concisely and accurately answered.

Investigator/Person Obtaining Consent name: .....

Signature: ..... Date: .....

## Appendix E

### Educational Session Outline: “Polypharmacy and Deprescribing”

#### Learning Objectives:

1. Discuss the issue of polypharmacy and the important role of deprescribing.
2. Review how, when, and why to use the Medication Appropriateness Index (MAI) index clinical tool to assist with medication deprescribing.
3. Provide educational resources to participants: copies of MAI clinical tool.

Time in Minutes:	Activity:
2 minutes	Welcome
10 minutes	Pre-intervention Questionnaire and Background
10 minutes	Present and review MAI. Perform clinical scenarios
8 minutes	Discussion and Questions

#### Supplies/equipment needed:

- Conference room
- Printed materials:
- Pencils/Pens

## Appendix F

### Medication Appropriateness Index clinical tool and Permission to Use

#### Medication Appropriateness Index.

To assess the appropriateness of the drug, please answer the following questions and circle the applicable rating:

- |   |   |
|---|---|
| 1. Is there an indication for the drug?   | A_____ B_____ C_____                                |
|   | Indicated                      Not Indicated        |
| 2. Is the medication effective for the condition?                                     | A_____ B_____ C_____                                |
|   | Effective                      Ineffective          |
| 3. Is the dosage correct?   | A_____ B_____ C + or C -                            |
|   | Correct                      Incorrect              |
| 4. Are the directions correct?  | A_____ B_____ C_____                                |
|   | Correct                      Incorrect              |
| 5. Are the directions practical?  | A_____ B_____ C_____ Z                              |
|   | Practical                      Impractical          |
| 6. Are there clinically significant drug-drug interactions?                           | A_____ B_____ C_____                                |
|   | Insignificant                      Significant      |
| 7. Are there clinically significant drug-disease/condition interactions?              | A_____ B_____ C_____                                |
|   | Insignificant                      Significant      |
| 8. Is there unnecessary duplication with other drug(s)?                               | A_____ B_____ C_____                                |
|   | Necessary                      Unnecessary          |
| 9. Is the duration of therapy acceptable?   | A_____ B_____ C_____                                |
|   | Acceptable                      Not acceptable      |
| 10. Is this drug the least expensive alternative compared to others of equal utility? | A_____ B_____ C_____                                |
|   | Least expensive                      Most expensive |

## Doctor of Nursing Practice Student: Question regarding the MAI



Hanlon, Joseph T <jth14@pitt.edu>

To: Lori Kristen Gorham Floyd



Tue 10/19/2021 12:31 PM

The Mai is in the public domain and no permission is needed- regards joe hanlon

Sent from my iPhone

On Oct 19, 2021, at 1:17 PM, Lori Kristen Gorham Floyd <lgorham@stu.jsu.edu> wrote:

Hello,

My name is Lori Floyd, and I am a Doctor of Nursing Practice student at Jacksonville State University in Jacksonville, AL.

I am doing a DNP project regarding polypharmacy and deprescribing. I am requesting to use your created tool (the Medication Appropriateness Index) in this project as a means of medication review and identification of inappropriate medications.

If you are agreeable with this DNP student utilizing the Medication Appropriateness Index tool for clinical and educational purposes for this project, will you please send a letter of approval to use your tool to this email?

Thank you for your time!  
Lori Floyd

## Appendix G

### DNP Project Timeline

Finalized:	Pre-Design	Design	Implementation	Evaluation
Summer 2021	<p>Identity gap in care/clinical topic.</p> <p>Create PICOt question.</p> <p>Initial Review of the Literature.</p> <p>Project planning/proposal development.</p> <p>First communication with University staff regarding project.</p> <p>Begin search for clinical preceptor.</p>			
Fall 2021	<p>Revise and complete final PICOt question.</p> <p>Creating Title for DNP Project.</p> <p>Discuss with University staff about project goals and objectives.</p> <p>Assembling DNP team.</p>	<p>Draft project proposal.</p> <p>Finalize consent forms, educational materials, data collection tables.</p> <p>PERC meeting and approval.</p> <p>Application for IRB approval.</p>		

	<p>Obtain final approval for clinical preceptor and receive letter of support.</p> <p>Draft and create consent forms, data collection tables, participant educational materials.</p> <p>Choose theoretical methodology and nursing theorist.</p> <p>Complete CITI training.</p>			
Spring 2022			<p>DNP Project Implementation.</p> <p>Collaboration with clinical preceptor and University chair members.</p>	<p>Collect data and analyze data.</p> <p>Begin process for compilation of final DNP manuscript.</p>
Summer 2022				<p>Complete DNP manuscript for submission.</p> <p>Poster presentation.</p> <p>E-Portfolio submission.</p> <p>Participate in Project Dissemination Day.</p>

## Appendix H

### DNP Project Budget

<b>PROGRAM EXPENSE</b>	<b>PROJECTED COST</b>	<b>ACTUAL COST (<i>Add Later</i>)</b>
Salaries, wages ( <i>Admin support, practitioners, statistics, or writing consultation</i> )	\$300.00	\$0.00
Start-up costs ( <i>copies, charts, displays</i> )	\$150.00	\$100.00
Capital costs ( <i>hardware, equipment</i> )	\$100.00	\$0.00
Operational costs ( <i>heat/electricity</i> )	\$50.00	\$0.00
Completed copy of Project Manuscript	\$200.00	Pending
<b>Total Project Expenses</b>	<b>\$800.00</b>	<b>\$100.00</b>

## Appendix I

## Deprescribing Review Log

[illegible]



## Appendix J

### Pre-intervention Questionnaire

#### **Pre-Intervention Test for Participating Healthcare Providers**

Unique ID:

Practice Setting:

*Please choose the best and most accurate answer for questions 1-10.*

1. Do you find yourself concerned at the number of patients you care for aged 62 years and older who are experiencing polypharmacy (taking 5 or more medications)?
  - a. Yes.
  - b. No.
  
2. Do you currently use a clinical tool when reviewing a patient's medication list for potentially inappropriate or unnecessary medications?
  - a. Yes.
  - b. No.
  
3. Would you be willing to utilize a clinical tool each time you are reviewing a patient's medication list to prescribe, deprescribe, or routinely refill medications?
  - a. Yes.
  - b. No.
  
4. Do you feel any solutions or options exist to address the issue of polypharmacy in older adults?
  - a. Yes.
  - b. No.

5. Do you have personal biases or negative feelings toward the practice of deprescribing medications for patients experiencing polypharmacy?
  - a. Yes.
  - b. No.
6. Have you ever heard of the Medication Appropriateness Index (MAI) clinical tool?
  - a. Yes.
  - b. No.
7. Do you know what the primary purpose of the Medication Appropriateness Index (MAI) clinical tool is?
  - a. Yes.
  - b. No.
8. How many questions are included in the Medication Appropriateness Index (MAI) clinical tool questionnaire?
  - a. 3 questions.
  - b. 5 questions.
  - c. 8 questions.
  - d. 10 questions.
9. What information is needed to accurately utilize the Medication Appropriateness Index (MAI) clinical tool?
  - a. List of medical problems.
  - b. List of medications.
  - c. Both A and B.
  - d. Neither A or B.
10. After utilizing the Medication Appropriateness Index (MAI) clinical tool, what score suggests a medication may be unnecessary or inappropriate?
  - a. 3 or greater.
  - b. 5 or greater.
  - c. 7 or greater.
  - d. 8 or greater.

## Appendix K

### Post-intervention Questionnaire

#### **Post-Intervention Test for Participating Healthcare Providers**

Unique ID:

Practice Setting:

*Please choose the best and most accurate answer for questions 1-10.*

1. Were you surprised by how many medications your patients were taking that could be considered unnecessary or inappropriate?
  - a. Yes.
  - b. No.
  - c. Somewhat.
  - d. Unsure.
  
2. Did you find it convenient to use a clinical tool like the Medication Appropriateness Index (MAI) to review patient medication lists at each office visit?
  - a. Yes.
  - b. No.
  - c. Somewhat.
  - d. Unsure.
  
3. Do you feel utilizing the Medication Appropriateness Index (MAI) clinical tool helps you review medication lists and deprescribe medications if indicated?
  - a. Yes.
  - b. No.
  - c. Somewhat.
  - d. Unsure.
  
4. Did you find the educational sessions and training helpful to understand and implement the Medication Appropriateness Index (MAI) clinical tool?
  - a. Yes.

- b. No.
  - c. Somewhat.
  - d. Unsure.
5. After the educational session and training, how often did you use the Medication Appropriateness Index (MAI) clinical tool when reviewing patient medication lists?
- a. Always.
  - b. Usually.
  - c. Sometimes.
  - d. Seldom.
  - e. Never.
6. After the educational session and training, how often did you identify an unnecessary or inappropriate medication a patient was taking?
- a. Always.
  - b. Usually.
  - c. Sometimes.
  - d. Seldom.
  - e. Never.
7. After the educational session and training, how often did you deprescribe medications for your patients?
- a. Always.
  - b. Usually.
  - c. Sometimes.
  - d. Seldom.
  - e. Never.
8. After the educational session and training, how often did you agree with the recommendation to deprescribe a medication based upon the results of the Medication Appropriateness Index (MAI) clinical tool?
- a. Always.
  - b. Usually.
  - c. Sometimes.
  - d. Seldom.
  - e. Never.

9. Do you think prescribing healthcare providers are the prime candidates to lead the way towards deprescribing medications and addressing polypharmacy? Please explain.
  - a. Yes.
  - b. No.
10. How prepared do you feel to utilize the Medication Appropriateness Index (MAI) clinical tool when reviewing patient medication lists to deprescribe unnecessary or inappropriate medications?
  - a. Strongly prepared.
  - b. Somewhat prepared.
  - c. Neutral.
  - d. Somewhat unprepared.
  - e. Strongly unprepared.

## Appendix L

### CITI Training Certificate

The screenshot shows a web browser window with two tabs: 'CITI - Collaborative Institutional' and 'CITI Training - Revised Instruction'. The address bar shows the URL: [https://www.citiprogram.org/members/index.cfm?pagelD=900&cr=44896811&cr\\_verify=E98F961D8CB726E410DBB0001BC561C...](https://www.citiprogram.org/members/index.cfm?pagelD=900&cr=44896811&cr_verify=E98F961D8CB726E410DBB0001BC561C...)

The page content includes:

- Jacksonville State University** (ID 4028)
- Social and Behavioral Responsible Conduct of Research**
- A table with the following data:
 

Name	Stage	Completion Date	Expiration Date	Record ID
Lori Floyd	1 - RCR	10-Sep-2021	09-Sep-2024	44896811
- Two sections: **Completion Report** and **Completion Certificate**, each with a description and a 'View / Print' button.

The Windows taskbar at the bottom shows the search bar, task view button, and several application icons. The system tray shows the date and time as 8:12 PM on 9/10/2021.

The screenshot shows the 'My Records' page of the CITI Program. The browser tabs are the same as in the previous screenshot. The address bar shows the URL: <https://www.citiprogram.org/members/index.cfm?pagelD=181>

The page content includes:

- CITI PROGRAM** logo and navigation links: [My Courses](#), [My Records](#) (active), [My CE/CMEs](#), [Support](#).
- A search bar with the text 'Lori Floyd ID 10465311'.
- A large blue banner with the text **Records** and *All Institutions*.
- A dropdown menu labeled 'Show Records for:' with 'All Institutions' selected.
- Jacksonville State University Records (ID 4028)**
- Social and Behavioral Responsible Conduct of Research (ID 184050)**
- A table with the following data:
 

Stage	Record ID	Passing Score	Your Score	Start Date	Completion Date	Expiration Date	Gradebook	Completion Record
RCR	44896811	80%	100%	08-Sep-2021	10-Sep-2021	09-Sep-2024	<a href="#">View</a>	<a href="#">View-Print-Share</a>

The Windows taskbar at the bottom shows the search bar, task view button, and several application icons. The system tray shows the date and time as 8:13 PM on 9/10/2021.

## Appendix M

### University IRB Approval



**Institutional Review Board for the Protection of Human Subjects in Research**  
203 Angle Hall  
700 Pelham Road North  
Jacksonville, AL 36265-1602

**December 8, 2021**

Lori Floyd  
Jacksonville State University  
Jacksonville, AL 36265

Dear Lori:

Your protocol for the project titled "Addressing Polypharmacy: Implementing the Medication Appropriateness Index Clinical Tool to Increase Deprescribing by Healthcare Providers" 12082021-08 has been granted exemption by the JSU Institutional Review Board for the Protection of Human Subjects in Research (IRB). If your research deviates from that listed in the protocol, please notify me immediately. One year from the date of this approval letter, please send me a progress report of your research project.

Best wishes for a successful research project.

Sincerely,

A handwritten signature in black ink, appearing to read "Lynn Garner".

Lynn Garner  
Associate Human Protections Administrator, Institutional Review Board