

Reducing Polypharmacy in the Elderly

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Abstract

The purpose of this evidence-based project is to assess polypharmacy amongst the elderly and create an effective protocol that can be used by healthcare providers to reduce polypharmacy amongst the elderly. The project seeks to create an approach to increasing healthcare provider's awareness of polypharmacy to help improve medication management. Polypharmacy amongst the elderly people is a major problem because of high susceptibility to concurrent diseases. The project uses an experimental approach with 15 primary clinician participants; 30 pre-implementation and 30 post-implementation chart review before the implementation of the ARMOR assessment tool. The project found out that the use of the ARMOR tool is effective in reducing polypharmacy by increasing physician's awareness of polypharmacy as well as creating an effective medication management approach to manage prescription amongst the elderly patients. After the introduction of ARMOR assessment tool, there was a significant reduction in polypharmacy cases from 15.81 to 10.50 (mean =5.31, SEM=0.63), $p<.00$. Clinicians knowledge increased with an average score from 2.81 to 4.17 post-intervention (mean pre-post difference =-1.37, SEM=0.19), $p<.001$. There is the need to create more awareness amongst the healthcare providers on management of the elderly patient's medication.

Keywords: polypharmacy, polymedicine, deprescribing, elderly, geriatric, and ARMOR tool.

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Preventing Polypharmacy in the Elderly

Introduction

Physiological and pathological changes associated with aging places individuals at a higher risk of polypharmacy. Polypharmacy literally means “many pharmacies”. Polypharmacy is defined as “high numbers of medications (e.g., more than 5-10), use of more drugs than clinically indicated or use of appropriate medication (Farrell, Shamji, Monahan, & Merkley, 2013). Different scientific research studies that have been conducted on polypharmacy have shown inconclusive results regarding the risk factors and prevention of polypharmacy. According to Cantlay, Glyn & Barton (2016), 85% of the elderly are on seven medications while 58% are on five different medications. The practice of polypharmacy is common among elderly people because they are highly susceptible to concurrent diseases with each requiring a specific medical administration. From a report published by Gómez et al., (2015), the findings indicated there was an associated increased risk of mortality in elderly people with 50.5% death rate over a median of 6.5 years. The impact of polypharmacy on the elderly is significant. Ensuring safe medication management becomes a challenge when the individual is prescribed multiple medications. However, taking the time to review medications with the elderly patient can reduce the risk of this phenomenon. Kim et al., (2014), reported that more than half of the world’s population will be over the age of 65 years by the year 2030. This means that the proportion of elderly people is increasing yearly due to the increased longevity and decreased birth rate. In the United States, for instance, there are over 27% of older people receiving annual hospital admissions due to polypharmacy related infections (Takane, Balignasay, & Nigg, 2013).

Background

Elderly people are often associated with multiple health care problems which include many diagnoses such as hypertension, heart failure, diabetes; in which duplication of medication is often discovered. Golchin, Frank, Vince, Isham, & Meropol (2015), reported

polypharmacy to be associated with duplicated therapy and inappropriate drug combination. While the greatest concern is to ensure appropriate health care among older people; managing multiple health care problems among older people have created challenges for providers when prescribing medications. The provider must consider the need of the of the medication for the condition while avoiding the risks associated with polypharmacy. In addition, polypharmacy creates an undue financial burden on older adults who are often retired and on fixed incomes. A report from the National Institute for Clinical Excellence (NICE) observed that polypharmacy has contributed to unnecessary expenses among older adults as most of the healthcare plans do not cater for their cost of medications (Chobanian et al., 2003). Polypharmacy remains a recipe for increased depression, decreased mental status and decreased social activity (Scondotto, et al., 2017). The prevention of unnecessary polypharmacy may be addressed through a diverse range of interventions which may be categorized as professional, for instance, education programs involving consumers or prescribers; financial, for example, developing regulatory interventions and incentive structures or organizational where specific audits on drug use are conducted. Nonetheless, interventions that diminish the risks associated with adverse effects of using medication are given prominence (Cooper et al., 2015). This may be attributed to the fact that the implementation of such an intervention presents a multifaceted platform, which incorporates the contribution from various stakeholders such as healthcare service providers, policymakers, educators, and professionals. Equally important is that there is widespread perception that polypharmacy is harmful especially to the elderly and this notion has served as the cornerstone for inspiring efforts geared towards curtailing inappropriate medication. Researchers posit that through the identification of the risk factors associated with polypharmacy, there are prospects that its related costs, mortality, and morbidity may be reduced (Davies & O'mahony, 2015). Consequently, the ideal intervention for preventing polypharmacy would be through obtaining data of patients who are older than 65 years and

formulating the appropriate feedback mechanisms. This approach is projected to reduce the prevalence of drug-drug interactions; support patient education to heighten appropriate polypharmacy; visual identification of the drugs administered and uninterrupted medication review of an individual patient.

Problem Statement

Polypharmacy is a main issue of patient safety in all healthcare settings (i.e. increased adverse drug reactions and the incidence of drug-drug interactions) (Arnoldo, Cattani, Cojutti, Pea, & Brusaferrro 2016). Understanding polypharmacy will help providers to obtain effective strategies for gaining insight into patients' medication, prescription and the prevention of adverse effects of polypharmacy. Kim, et al., 2014, states that polypharmacy is a public health concern since the older populations have a higher prevalence of multiple drug use. A few additional studies have shown that elderly patients are subjected into using multiple prescriptions from different physicians, an issue that contributes to adverse health reactions. According to Mortazavi, Shati, Keshtkar, Malakouti, Bazargan, & Assari (2016), many polypharmacy related problems have emerged including hazards of prescribing that in turn leads to secondary morbidity.

Purpose Statement

The purpose of this DNP project was to develop a protocol designed to help the provider recognize risks common to polypharmacy in the elderly persons. The DNP project helped staff members and providers to familiarized with polypharmacy in the elder population.

Project Objective

The following objectives of this DNP project were:

- To identify and apply evidence-based information in the development of a protocol of polypharmacy and the elder adults

- To present the evidence-based protocol to key stake holders for review and approval
- To implement polypharmacy protocol for elderly adults in the primary care with continuous monitoring
- To develop a protocol that addresses evaluation of the implementation

Project Question

The PICOTs tool will be used to formulate the project question: Will a procedural protocol (I) improve polypharmacy in the elderly (O) in a community clinic (P)?

Search Terms

Original studies published between January 2012 and August 2017 were selected through literature searches in MEDLINE, Google Scholar, Medscape, PSYINFO, NIH, and PUBMED data bases. Moreover, the references for the retrieved articles were searched having in mind the relevance of the studies to polypharmacy in the elderly. Data was extracted based on study level constructs such as polypharmacy in the elderly, polymedicine, elderly, geriatric, aged, Beer's criteria, inappropriate prescribing, drug interactions, long-term care of the elderly and administration of drugs from the same class category for the elderly. Additionally, the studies chosen comprised of diverse methodologies such as randomized control trials, descriptive follow-up designs, and purposive cohort designs owing to the complexity of the relationship between treatment and polypharmacy in the elderly. The review of literature also encompassed interventions applied in different healthcare environments that targeted individuals older than 65 years and possessed a prolonged medical condition and received more than four regular medications.

Review of Literature

Contributory Factors of Polypharmacy in the Elderly

Understanding the mechanism of preventing polypharmacy demands the knowledge of its genesis. A common etiological approach involves paying attention to pharmacological roles played by diverse prescribers (Welker & Mycyk, 2016). According to Hammond and Wilson (2013), different specialists treat patients by the disease progression. This trend is based on factors such as access to health facilities, convenience, and augmentation in health costs. Best et al. (2013) concurred that tendencies of polypharmacy in the elderly always culminated in incomplete medical histories and unknowingly, physicians end up prescribing more medication than necessary thereby compounding the problem of polypharmacy. Oyarzun-Gonzalez, Taylor, Myers, Muldoon, & Baumgartner (2015) reported in a study that polypharmacy was associated with a 0.11 ± 0.09 decrease in Mini-Mental State Examination (MMSE) scores ($P=0.23$) and an increased risk of Mild Cognitive Impairment (MCI) (odds ratio=1.95, 95% CI 0.40–9.43). According to a study by Charlesworth, Smit, Lee, Alramadhan & Odden (2015), it was reported there were a median number of prescription medications used among adults in which this had doubled from 2 to 4 with 95% confidence interval. Also, a study by Fried et al. (2014) added that the pharmacist may be unaware of other types of medication, having contra indicative effect and consequently may impede the efficacy of the new prescription. Drug-drug interactions may be minimized through healthcare standardization of patient's interactions with pharmacies and providers. Inadequacies in treated disease state management have also emerged as a contributor to polypharmacy including other issues such as sub-therapeutic dosages, non-treatment, nonadherence, and misdiagnoses. For example, a sub-therapeutic dosage of donepezil, which is used to treat dementia and requires risperidone as an additional dosage, presented inadequate initial treatment (Welker & Mycyk, 2016).

In addition, the tendency of administering medications from the same class has proven to be problematic. Witticke et al. (2013) cited patients as the propagators of polypharmacy due to the perception that the patient needed only to report the type of medication that were being taken, based on the current acute condition or on the recommendation of the specialist. The over-the-counter (OTC) drugs such as ibuprofen, aspirin, and herbal supplements are often omitted in patient's reports. As a result, professionals may not be aware of the possible interactions that may occur due to maintenance medications. According to Mannucci, Nobili and REPOSI Investigators (2014), another contributing factor that propagates to the prevalence of polypharmacy is the tendency of patients to demand prescription drugs when using pay consultation visits. The standard expectation of most patients is that because certain ailments are being experienced or perceived then an entitlement to receive a prescription for drugs exist because of payment

Impact of the Problem of Polypharmacy in the Elderly

Polypharmacy is prevalent among individuals aged 65 years and older since this population is at a higher risk of experiencing problems because of taking medication. According to Nawaz et al. (2015), polypharmacy likelihood leads to drug reactions in senior citizens as pharmacodynamics also come into play. Due to kinetic alterations that is common in the elderly, gastric pH levels tend to rise while the bowel surface area diminishes, which alters an adjustment in the digestive processes. Dagli and Sharma (2014) proposed that the lipid and water distribution naturally increases with medications, which are either lipophilic or hydrophilic shifts to such areas where the medication-remained seated for an extended period. These drug interactions cause hepatic metabolism to diminish. According to Patterson et al. (2014), the marked decrease in renal function, the state of hydration of the patient, which is including analysis for the presence of intrinsic renal disease, should be considered. This phenomenon may be evidenced by the application of equations such as Modification of Diet in Renal Disease and Cockcroft-Gault in most medication packages when presenting

suggestions on renal dosing. Drenth-van Maanen et al., (2013), concluded that the Cockcroft-Gault was the widely accepted method for assessing renal function in the elderly due to accuracy in the findings obtained.

Polypharmacy and Current Evidence

Prevention of Polypharmacy Outside Healthcare Settings

The paramount protocol of averting polypharmacy involves scrutinizing patient's complete medication list and identifying the diagnosis for each drug. A provider may watch out for factors such as duplication in drug therapy, medications from the same class, drug to drug interactions, and the possibilities of non-drug interventions. According to Witticke et al., (2013), unnecessary medication has been found to occur commonly at the point of determination for efficacy, duplication, and level of indication. The Assess, Review, Minimize, Optimize, Reassess (ARMOR) instrument was developed to evaluate the instances of polypharmacy in the elderly correctly. The ARMOR framework presented a systematic and structured approach for the thorough scrutiny of medication while accounting for most of the prescription's aspects (Dagli & Sharma, 2014). Some of these components included adjusting dosages, minimizing non-essential medicines, reviewing for possible interaction and reassess for cognitive, functional and clinical status including medication adherence.

In addition, the considerations of a patient's functional ability and clinical status ensured that efforts are made in balancing the best prescription practices while the physical profile and quality of life are improved continuously. The findings from Mannucci, Nobili and REPOSI Investigators (2014), proposed an evidence-based instrument which is the Beers criteria. This instrument provided a selected drug medication, which should be avoided in treating the elderly. The identified categorizations of the drugs to be avoided have been known to instigate allergies across the elderly population including side effects that even impede the activities of daily living (Dagli & Sharma, 2014).

Prevention of Polypharmacy within Health Care Settings

According to Kwan (2013), long-term care settings are also afflicted by the unique problem resulting from over prescriptions. The phenomenon occurs when the side effect of one drug is treated by prescribing another medication. For instance, a patient may report having experienced constipation due to the use of calcium supplements. Rather than recommending the use of laxative in such a case, the prescriber should investigate on the type of calcium product that is being taken by the patient and decide on whether the benefits outweigh the risks. Patterson et al. (2014) suggested that it is paramount that a provider is on the lookout for anticholinergic properties while treating the elderly. Studies indicated that the prescription of two or more sets of drugs with anticholinergic element could have adverse effects such as blurred vision, increased heart rate, central nervous system complications, and cognitive impairment. According to Cadogan, Ryan, & Hughes, (2016), the issue of polypharmacy may be resolved through a proper organization as it has emerged that complicated medication regimen may take a toll even in the most dedicated patients. It is recommended for providers to caution patients to confine to taking medication that has only been prescribed by a provider, as this will limit chances of drug-drug interactions (Nawaz et al., 2015). Patients also need to be equipped with knowledge on the proper storage methodologies for the prescribed medications. Proper protocol or procedure could improve adherence to medication regimen, namely; use of color-coded chart.

Current Recommendations

According to Fried et al. (2014), the Comprehensive Geriatric Assessment has been used in contemporary, global healthcare settings in cooperating multilevel approaches that are concerned with the psychosocial, medical and functional limitations in the elderly population. The multilevel structure in medication management is aimed at enhancing the quality of administering prescriptions and at the same time it acknowledges and prevents the likelihood of adverse drug effects (ADE). Providers should prescribe essential medicines and should

learn how to deprescribe thereby making prescription as simple as possible. Varied studies recommend the following current practice in reducing polypharmacy in the elderly:

- Perform non-pharmacological measures when feasible.
- Always suppose the possibility that adverse drug events are related to the symptoms of the patients before adding a new drug in a prescription.
- Providers must counsel the patients about drugs in detail before initiating a new medication
- Providers need to review all medications on each visit including herbal products, supplements and over-the-counter products.
- Providers must coordinate with the elderly patients to avoid duplication in prescriptions.
- Providers must identify indication for each medication
- The drug for which there is no clear indication must be discontinued.
- If the therapeutic goal of a drug is not achieved, that medication must be discontinued.
- Providers must avoid drugs which have serious adverse effects in the elderly patients' outcomes.
- If appropriate, single drug is combined with the indications.
- Patient compliance with the prescribed medication should be assessed on each visit by the provider
- Providers should use software programs to check the drug interactions

Issues not yet Addressed in Polypharmacy

Polypharmacy definition needs to be addressed in concrete terms for better clarification in future studies as to the number of medications that constitute polypharmacy.

Also, polypharmacy and its clinical outcomes are indicated by only the number of

medications and not the proper diagnosis, dose & type of medication the elderly patient is taking (Dagli & Sharma, 2014).

Controversies

There is still a controversy and conflicting views on the polypharmacy inclusion criteria. Some studies exclude OTC meds, Multivitamins, and all complementary or functional medicine while others included every medication on the patient's list.

Theoretical Framework

Historical Development of the Normalization Process Theory (NPT)

The NPT is a contemporary philosophy that was conceptualized and initiated by Professor Carl May in conjunction with Dr. Tracy Finch including the integration of other international stakeholders and colleagues (May et al., 2007). The theory was developed to serve as a gold standard that offers an in-depth comprehension of the processes involved in the implementation of complex interventions in health care delivery.

Applicability of the Theory

The NPT may be used in addressing the issue of polypharmacy in the elderly through the employment of constructs such as depicted in a typical polypharmacy prevention model. Such a model involves the formulation of a healthcare pathway where health professionals corroborate their efforts to identify all the medications being consumed by the elderly patient; checking for potentially duplication of medications; checking for drug-drug interactions and the considerations for deprescribing.

Major Tenets of NPT

The NPT encompasses the scrutiny of how material practices naturally morph into routines depending on the context in which they are applied. This may be achieved through the considerations of four generative mechanisms which include coherence, cognitive participation, collective action and reflexive monitoring (May & Finch, 2009). The major

tenets of NPT include the *objects*, *agents*, and the *contexts*. May and Finch (2009) described each of the tenets as follows:

- *Objects*. The first iteration of the theory focused attention on the relationship between the properties of a complex healthcare intervention and the collective action of its users
- *Agents*. The second iteration of the theory built on the analysis of collective action and showed how this was linked to the mechanisms through which people make their activities meaningful and build commitments to them.
- *Contexts*. The third iteration of the theory developed the analysis of agentic contributions by offering an account of centrally important structural and cognitive resources on which agents draw as they act

The NPT is a flexible model which is instrumental in sensitizing the researcher on the fundamental features where focus should be placed during the implementation process. For example, if the said intervention makes little sense to healthcare providers, then challenges are bound to arise due to underlying ambiguity (Maher, Hanlon, & Hajjar, 2014).

NPT Application to Polypharmacy

The NPT is essential in the methodologies to be undertaken in preventing polypharmacy in the elderly as it will provide a platform for understanding the implementation of the healthcare pathway model. In addition, the NPT expounds on the roles to be undertaken by the various stakeholders that are associated with the processes of undertaking the preventive measures.

The conceptual theory that underpins this proposal is the polypharmacy prevention model. The polypharmacy prevention model is a framework that is aimed at helping deter the simultaneous consumption of multiple oral medications. According to Maher, Hanlon, and Hajjar (2014), polypharmacy is a prevalent issue among the elderly since their age predisposes them to some adverse health conditions that may occur at the same time. (See Appendix A)

Project Design

Polypharmacy is a complex issue. This DNP project is a quality improvement (QI) design, and all 15 clinicians at the primary care clinic participated. The project design method used for this DNP project included:

1. Electronic records to be gathered and analyzed to assess the number of medications that the patient was prescribed;
2. At least, 30 pre-implementation patient records and 30 post implementation charts were reviewed using the Drug Review Process adopted from gold standards framework by NHS Highland/NHS Scotland (Appendix H).
3. 5-point Likert scale questionnaire for 15 clinicians with pre and post educational intervention evaluation. All clinicians were kept anonymous using self-generated codes. Pre -interventional self-generated codes for the questionnaire was the first letter of father's first name (A-Z), first letter of mother's first name (A-Z), plus participant's birthday (01 – 31). The post -interventional self-generated codes for the questionnaire was the first letter of father's first name (A-Z), first letter of mother's first name (A-Z), plus participant's birth month (01 – 12). A copy of the instructions can be seen in Appendix M.
4. The ARMOR tool was implemented in the clinic to all elderly patients aged 65 years and over that has more than five or medications including vitamins and supplements.

The primary aim of this project was to reduce polypharmacy among the elderly in the primary care setting. A total of 60-charts was reviewed of patients over 65 years, which included 30 pre-implementation patient charts and 30 post implementation patient charts. For this project, polypharmacy was considered five or more medications including supplements and vitamins taken by the patient that is 65 years or above with an existing comorbidity. There are no standardized protocols in the literatures for addressing polypharmacy in the

primary care setting; however, evidenced-based practice has different assessment tools used in auditing polypharmacy in the elderly. The ARMOR tool of implementation was used in this project and the project lead obtained consent (Appendix C) to use this tool in the project. Project design and evidenced-based practice implementation included a quality improvement approach of each patient's chart review with monthly recommendations provided to clinicians on appropriate dosing, potential ADRs, and drug-to-drug interactions. Data used in this project were collected from 15 clinicians at the primary care clinic that prescribed medications to the elderly patients. The variables considered in selecting the charts included: age, type of medication (beta blockers, pain medications, antidepressants, antipsychotics, other psychotropics, vitamins, and supplements), drug-to-drug interaction, and comorbidities of the patient. The ARMOR assessment tool was used for patient over 65 years and older to determine the risk for polypharmacy. The population of interest was trained on how to use ARMOR tool and a completion of questionnaire on polypharmacy during a staff meeting. Once the patient charts were identified, a follow-up reassessment was done by the project leader and the prescribing clinician was contacted to address the issue of polypharmacy by either discontinuing or adjusting the medication(s). The findings were presented to State Quota. (See Appendix B)

Population of Interest and Stakeholders

The population of interest for this DNP project included 15 clinicians that prescribed medications for the elderly within the primary care clinic. The primary care clinic is in Northern Los Angeles County in California. The population of interest which is clinicians included physicians, nurse practitioners, and physician assistants. The stakeholders were pharmacy consultants, office managers, medical directors, and quality control personnel. All stakeholders participating in this project were aware and open to the need for reducing polypharmacy in the elderly. The project leader coordinated the timelines for all

implementation associated with this QI project. The involved roles with managing and implementing the project are described below:

Project Leader

- i. The project leader discerned best evidenced-based practices available and developed education and tools for translation into practice
- ii. The project leader tracked outcome metrics by developing process for consistent measurement of agreed outcome metrics. The project leader discerned baseline data and conducted analysis of clinical outcomes.
- iii. The project leader served as a facilitator in making sure specific training for reducing polypharmacy was used in the evaluation

Stakeholders

- i. The stakeholders helped recruit participants by garnering support from executive site, leadership, and staff
- ii. The stakeholder identified the key participants and assessed their knowledge, interests, positions, alliances, and importance related to polypharmacy. This allowed policymakers and managers to interact more effectively with key stakeholders and increased support for the ARMOR implementation program
- iii. The stakeholders (office manager) collaborated with the staff members in planning the process

Population

- i. The clinicians implemented interventions based upon best evidence review and corresponding ARMOR tool development

Exclusion Criteria

All elderly patients with recent admission (within the last three months) in the intensive care or emergency units were excluded from the project even if all requirements

were met. Any clinician without a complete patient case sheet was excluded from the project. A patient case sheet is important in establishing the prescription history of a patient, and without the document, the number of prescriptions prescribed to a patient by the provider cannot be determined.

Recruitment Procedures

To address polypharmacy in the elderly, a QI project supported by an evidenced-based approach of practice was proposed to evaluate the effectiveness of the ARMOR tool in reducing polypharmacy in the elderly. A chart review was conducted to measure effectiveness of the DNP project, but patients were not direct population of interest. The participants were notified at the staff meetings of the implementation and education of the ARMOR tool that was used at the clinic. Other recruitment methods that were used are 1) interview with each clinician regarding the ARMOR tool and 2) communication through staff emails with the authorization and coordination of the clinic manager. Since this was a QI project, all clinicians were expected to participate in this project. Individual patients were not involved in this project and were not recruited due to the DNP project design and ability to collect data anonymously,

Setting

The primary care clinic is in the center of northern Los Angeles County in the state of California. A family practitioner who is affiliated to two major hospitals in the area is the owner of the clinic. The clinic serves the newborn to geriatrics. The clinic is open from 8 am to 9pm PST Monday through Friday and the urgent care is open on Saturdays from 9 am to 3 pm PST. The clinic sees approximately 3000 patients in a month. The patient visits consist of 35% geriatrics with multiple comorbidities.

Tools/ Instrumentation

According to Haque (2009), the ARMOR tool (Appendix B) considers the patient's clinical profile and functional status and rises to balance evidence-based practice with altered physiological reserves. Permission from the author of the ARMOR tool has been given to the project leader to use the ARMOR tool in this project. The Insightly and Trello apps were used by the project leader to keep the activities of the project organized. The electronic educational material such as written data, graphical, audio and video on how to use the ARMOR tool were made available for clinicians since they all have iPads. The materials were provided to the clinicians before pre -implementation. This gave clinicians time to review the information before meeting with the project team. The subscription for access to the ARMOR video was negotiated by the project leader for the implementation of the ARMOR video decision tool. The first step was to assess where specific groups of drugs and the total number of drugs were scrutinized. Clinicians were expected to analyzed medication with prospective adverse outcomes such as antidepressants, beta-blockers, antipsychotics, supplements, and vitamins. The second step was to review for possible drug-body interactions, drug-disease interactions and drug-drug interactions. The third step involved minimizing of non-essential medication such as those whose risks outweigh the benefits and lack justification for their use. The issue of optimization was addressed through redundancy, duplication and considering the gradual dose reduction to ensure maximum positive gains in health outcomes of patients. The final step involved reassessment where conditions such as blood pressure, oxygen status, and cognitive status were considered by attending physicians as a holistic approach to preventing polypharmacy.

The ARMOR tool attempted to associate the components as mentioned above into interactive or functional instruments. This process was achieved by considering the functional status and the clinical profile of a patient including the endeavor to strike a balance between

altered physiological reserves and evidence-based practice. In addition is the fact that the preservation of the quality of life is taken into consideration during the decision-making process of whether to discontinue or alter medication regimens. This implied the use of a drug that was measured against its effects on the fundamental biological functions such as bowel, appetite, and bladder. The expected outcome was the effectiveness of the ARMOR tool in optimizing and monitoring prescription patterns in both outpatient settings and comprehensive geriatric assessments. Following the implementation of the project at the clinic, the team adopted the ARMOR tool assessment in reducing polypharmacy in the elderly.

Data Collection Procedures

The project leader and the QI committee developed a quality improvement plan that incorporated sampling strategies, and data collection plans such as patient chart audits using, questionnaire, and interviews with clinicians to capture each into an Action-Effect Diagram, a type of cause-effect chart derived from Driver. The interview with the clinicians were used for screening purposes only for the inclusion criteria. Following this, a system of measures was developed to track the translation of actions into concrete changes in delivery of patient care. The Polypharmacy Improvement Data Model (IDM) was used in collecting data with the WISH software. WISH is a collaborative framework for local improvement teams to specify the quality metrics for their improvement projects, and rapidly deploy the data collection web interfaces for the required data (Curcin, Woodcock, Poots, et. al., 2014). The basic steps for using WISH were: 1) defining the metrics that was used to measure the effect of an improvement initiative 2) specifying the data items needed to calculate those metrics and formally express the metrics using those items 3) encoding the data specification and metrics into the IDM model, together with question labels, data types, and reporting parameters. 4) loaded the IDM model into the WISH tool. At this point, data collection and reporting were available to users. (See Appendix E). Data were collected by reviewing and

analyzing the answered questionnaires, interviews, and patient records. All information regarding participants were treated with utmost confidentiality. Data were gathered from the electronic charting. The Statistical Package for the Social Sciences (SPSS) program was used for statistical analysis of the independent t-test for the number of medications prescribed to each patient. To determine if the ARMOR tool has been implemented, post implementation chart reviews were conducted. An audit tool was developed to measure the results of the implementation of the ARMOR tool and to collect data. An approval from the clinic manager was obtained before the implementation of the DNP project.

Project Timeline

A 90-day timeline including a step by step implementation plan (Table 1 -Project Management Timeline) was developed to ensure continued forward momentum and to guide activities. The target date of implementation was March 2018. This allowed for clean data collection in the EHR and comparison between quarters. Such information was used in tracking the list of medication that were assigned to a patient including tailoring the right response to curtail the adverse effects that emanate from polypharmacy. The timeframe allowed sufficient time to bring all the stakeholders on board to assess the various components of the intervention before the implementation phase began. The selected charts for pre-implementation and post implementation audit were patients who were 65 years and above and have been diagnosed with more than one prolonged medical condition, which necessitates the prescription of more than four drugs (Salvi et al., 2012). The project lead in the intervention utilized purposive sampling method, which is a non-sampling methodology that was essential in selecting the patient charts for audit and were based on characteristics.

Table 1: Project Management Timeline

January 2018	Person Responsible	Status/Goal Date
Clarify Project and Outcome	Medical Director	Completed
Identify Stakeholders	Project Leader	Completed
Build relationship with Stakeholders	Project Leader	Initiated and ongoing
Identify target clinicians	Project Leader	Completed
Analyze clinicians' knowledge on polypharmacy	Project Leader	Ongoing
February 2018	Person Responsible	Status/Goal Date
Provide timeline and project proposal to preceptor	Project Leader	Feb 2018
Meeting with clinicians to discuss the DNP project	Project Leader	Feb 2018
Verify access to polypharmacy materials on NP's iPad	Project Leader /designee	Feb 2018
Verify link connectivity to polypharmacy video in the clinic	Project Leader /NPs	Feb 2018
March 2018	Person Responsible	Status/Goal Date
Kickoff meeting with key clinicians	Project Leader	March 2018
Initiate and monitor activities and process	Project Leader /Office manager/Designee	March 2018

Implement communication plan for status and milestone reports	Project Leader	March 2018
Collect and manage data	Project Leader w/designee	March 2018
Initiate project completion plan	Project Leader	March 2018
Data analysis and interpretation	Project Leader	March 2018
Disseminate result – analyze data and compare before and after intervention on % polypharmacy reduction	Project Leader & designee	March 2018
April 2018	Person Responsible	Status/Goal Date
Provide data analysis to stakeholders for change management	Project Leader	April 2018

Ethics Issues

This is a DNP quality improvement project and does not directly involve any patient participants and did not need a full review from the Institutional Review Board (IRB). This project involved pre-implementation and post implementation chart reviews of patient records at the project practice setting. The patients' identities remained anonymous and it will not be possible to link any specific patient data to any specific patient. The project was reviewed and received approval by the DNP program of Touro University of Nevada as a quality improvement project. The project proposal was discussed with the medical director of

the clinic and an approval was received (see Appendix D). The participants of the projects were clinicians. The identity of the clinicians in the facility were masked. Standard clinical procedures were incorporated into this project that were consistent with established clinical guidelines. All the clinicians were informed of the project plan and the goals of the project. There were no identity conflict of interest and ethical issues within the team at the primary care clinic. The project lead was motivated to bring a change into the practice site.

Plan for Analysis/Evaluation

The quality improvement project was implemented at a private primary and urgent care center owned by the medical director in the Los Angeles County, California. There are 15 clinicians in the clinic with other ancillary staff members that assisted the clinicians in the day-to-day activities. The medical director was excited in bringing change to the clinic in reducing polypharmacy in the elderly. The project was implemented using the ARMOR tool with permission from the author (Dr. Raza Haque). The selected patient charts for pre-implementation and post implementation audit were assigned specific numbers for chart review. All data collected were kept in a password encrypted computer. Although a full IRB review was not required by the primary clinic, all tools, executional materials, and other project related items including the complete proposal were reviewed and approved by the medical director at the primary care clinic. Implementation of the intervention involved collecting responses from clinicians. The analysis of the response took two weeks, and the compilation of data took another two weeks. Additionally, the Assess, Review, Minimize, Optimize, Reassess (ARMOR) instrument was incorporated to provide a systematic and structured approach for the thorough scrutiny of medication while accounting for most of the prescription's aspects (Haque, 2009). The guidelines for prescribing in frail adults was used for retrospective data collection and all clinicians were trained. The guidelines aimed to provide guidance on how to make a safe and sensible decision in situations where extra thought and considerations are needed (Jones, 2016) (See Appendix H).

The Statistical Package for the Social Sciences (SPSS) program was used for statistical analysis using paired design with independent and dependent variables. The independent variables were time relative to intervention (before/after) and the dependent variables were number of medications a patient was taking. The number of medications before the intervention and after were collected from each patient's chart. These count data were entered on the same row of a spreadsheet. A sign test was used to establish if there was a significant change and a box plot was utilized for the 'after intervention – before intervention' of the number of medications to support the finding. (See Appendix E)

Significance/Implication for Nursing

The paramount procedure of averting polypharmacy was the scrutiny of a patients' complete medication list and identifying the diagnosis for each drug. According to Stawicki & Gerlach (2009), unnecessary medication has been found to occur commonly at the point of determination for efficacy, duplication, and level of indication. The ARMOR instrument was implemented to evaluate and reduce the polypharmacy in the elderly. The ARMOR framework presented a systematic and structured approach to the thorough scrutiny of medication while accounting for most of the prescription's aspects (Haque, 2009). Some of these components included adjusting dosages, minimizing non-essential medicines, reviewing for possible interaction and reassess for cognitive, functional and clinical status including medication adherence. The considerations of a patient's functional ability and clinical status ensured that efforts were made in balancing the best prescription practices while the physical profile and quality of life were improved continuously. In addition, the Beers criteria provides a selected drug medication, which should be avoided in treating the elderly (Le Couteur et al., 2004). The assessment of benefit-to-risk ratio in prescription medicine was a fundamental step in minimizing polypharmacy. Clinicians should endeavor to analyze the medical histories of patients critically before administering any form of medication.

The interventions that was implemented for the reduction of polypharmacy provided a realization of the integral role clinicians play in reducing the risk of polypharmacy. The clinicians used patient-centered skills which included educating the patients to keep on record the complete list of medications including the need to maintain proper communication between the specialists and primary care providers.

Project Analysis

Both quantitative and qualitative methods were used to draw inferences from the data. A comparison of the mean was the primary method used to analyze project data. Comparison of the means for the chart review and clinicians' questionnaire were each calculated and analyzed separately. The objective of the analysis was to establish a tendency in positive alterations to knowledge. To reduce polypharmacy using the ARMOR tool and to determine participants' attitude which infers a clinician's confidence and their obstructions and behavior which demonstrates the intent to change the practice and serves as a signal of project intervention success. As to realize its goals, the project calculated and compared the average tallies of related test questions for both pre and post assessment. For example, paralleling the mean score of reducing polypharmacy knowledge using the ARMOR tool before and after the educational intervention and then indicating whether the post-intervention mean score surpassed the pre-intervention knowledge total. By utilizing the Likert-form questions, the targeted goal should attain a mean score that is greater than 3. A 3 (undecided) on a 5-point Likert scale signifies an impartial score, and anything higher than 4=agree or likely, 5=strongly agree or most likely, exhibits better agreement with the notion at hand. As such, a score higher than a 3 shows confidence levels, an optimistic interventional outcome like improved knowledge, and the motive to change the practice. Average scores below a 3, 2=disagree or somewhat likely; 1=strongly disagree or not likely, show a negative inclination which fails to meet goal achievement measures. The qualitative technique utilized to assess

the intervention should examine and classify clinician's reactions to the open-ended test question, and a reflection on elderly care as proof in the post chart review.

SWOT Analysis

Strengths: The DNP project exhibits extraordinary forte for a QI project. The dedicated facility has significant prescribing experience in the elderly ethics. Even so, the clinic lacks a modest and consistent means to focus on polypharmacy among the elderly. Evident effort to improve polypharmacy to adopt an organized and systemic style is the use of an ARMOR assessment tool (Haque, 2009). Data gathered during the literature review offered useful insight and guidelines, which resulted in the best practice recommendation about the significance of using an assessment device for decreasing polypharmacy among the aged. The formation and the application of the ARMOR assessment method display positive prospects in discouraging elderly polypharmacy in the primary care centers. Notably, one can easily download the ARMOR tool online, a feature which enables clinicians to download and to utilize it efficiently. Similarly, the facility has an extra advantage as the clinic director is a medical professor with sufficient experience in the method and who had an encounter with the DNP student in their previous work. Additionally, the director depicts full support and trust in the DNP learner to manage the project. Also, due to the natural access to such resources, it was easier for the clinicians to integrate the ARMOR assessment instrument in their medical profession.

Weaknesses: A vital flaw in the project is its lack of a national polypharmacy standard that is recognized by the United States. As such, data collection and staff education processes in the project utilized the regulation formulated by NHS Highland/NHS Scotland. Further, some clinicians were reluctant to recognize the ARMOR tool as an effective means to diminish the practice of polypharmacy among senior citizens. Time constraint is another factor which poses a challenge for the project as several practitioners took time off, as such, they were unable to participate in the entire process. Likewise, other clinicians stated the lack of ample

time for every patient per visit to complete the reconciliation of medication. Moreover, some of the elderly patients proved difficult by refusing to have physicians titrate or discontinue their prescription which was a daily challenge.

Threats: A risk to the scheme is the unfamiliarity and the dependence on technology by the IT team while implementing the ARMOR assessment methods. Similarly, a new tool was uploaded for the practitioners to utilize during the ARMOR assessment device training. Consequently, the IT manager was emailed and occasionally informed to rationalize access to the novel tool. Subsequently, after downloading the appropriate tool, clinicians encountered some technical glitch alerts while trying to access the device for patient assessment. Leading to a delay in care, which frustrated clinicians involved in the process. Also, some patients threatened to shift to other providers presenting a challenge for many of the clinicians as they wanted to ensure they did not get any complaints from the patients. Appendix I about the SWOT analysis table depicts the scenario.

Responsibility and Communication Matrix

The DNP student was mainly accountable in the implementation and representation of this DNP project. As such, the student included manufacturing proof, designed the project matrix, developed educational content, formulated the questionnaire and utilized other data collection techniques such as training, analyzing and adjusting project metrics. Further, the DNP board through its chair provided relevant advice and backing during the project.

Project Budget

The polypharmacy QI project incurred an insignificant cost. Mainly, the DNP project incurred expenses during the design, implementation, and evaluation procedures which were related to human resource expenditures. Among the spending is the time utilized in educating staff and for them to understand the ARMOR assessment means and to implement strategies governing prescription among the elderly, amounting to about \$1500, \$100/hour x 15 participants. The cost incurred on the project manager is about \$128, \$32 x 4 hours.

Information technology fee was estimated to be \$200, \$28 x 8 hours. The time spent by the DNP student to analyze, design, and implement the project were their volunteer hours, as such, did to incur any outlays. Even so, there was an unclear clinician's cost incurred during each hour of in-services by seven physicians, five nurse practitioners, and three physician assistants. See Appendix K for budget and expense details.

Study of the Intervention

The evaluation of the project utilized quality metrics that were measurements allied to process, outcomes and participant or provider understanding. To assess the knowledge base of the clinician's participant's the project utilized outcomes metrics before and after the ARMOR tool training session and to measure performance enhancements after implementing the plan in curbing polypharmacy. Another measurement of consequences involved determining the prospect of every clinician's purpose to reduce polypharmacy in the diagnosis of senior patients aged 65 years and above by utilizing the drug review procedure assumed from the rules for prescription among elderly patients and the ARMOR assessment technique. An analysis of the participant's familiarity in using the ARMOR tool in the application stage determined the precision and efficiency of the assessment device. As to learn the process outcome, the project evaluates participant response concerning the exercise of reading and applying the ARMOR instrument and identifying hurdles that limit the operation of the tool in the educational seminar.

Measures

A 21--item questionnaire titled ARMOR/Polypharmacy Knowledge Evaluation (APKE) instrument utilized a 5-point Likert scale to determine probable outcomes of the project. Appendix J depicts the structure of the questionnaire, which compares before and after interventional tests totals. As such, the latter is a consistent technique of evaluating the acquired knowledge and the resultant intervention outcomes. Additionally, the intervention evaluation utilized the questionnaire for the post. Similarly, an assessment of the initial and

resulting chart review outcomes helped to analyze a decrease in the polypharmacy for the 30 surveying charts. All the 15 clinicians who contributed to the project preliminary and post-training on techniques to reduce polypharmacy among the elderly, and to measure the early and resulting intervention outcomes finished the APKE surveys. Colosi (2006) highlights that questionnaires are a useful means to capture relevant data when assessing educational plans, as they often gather material related to the behavior, attitudes, and knowledge. Consequently, the latter are defined as knowledge, which infers the understanding of the participants about the program content. An attitude refers to the participant's judgments, outlooks, and feelings about the topic. Behavior denotes people's current, future and previous actions related to the center of focus. Further, questionnaires are convenient means to gather qualitative data. They are reasonable as one can use to acquire relevant information regarding a specific group of the sample. Equally, questionnaires are flexible as they can provide a variety of data that is easy to analyze. Mainly, questionnaires give the participant the benefit of anonymity, as the contributor's information is irrelevant. The DNP student composed the APKE questionnaire as an instrument to measure the latter concepts. Notably, the project does not rate the first five questions since they are meant for identification and screening purposes. Also, the project utilized four of the nine created test questions to evaluate clinician's acquaintance with the polypharmacy reduction in treating old patients and the ARMOR assessment tool. The questions inquired data regarding a clinician's discipline, experience in their current department, previous encounters with the polypharmacy assessment tool, the age range of a practitioner's patients, and their elder patients use more than five medications including supplements and multivitamins

The subsequent five statements inquire about a clinician's acquaintance and experience with the necessary tools and resources to reduce prescribed medications among elderly patients, who are 65 and above.

- Before today's presentation, I was conscious of the ARMOR technique to examine all senior patients, 65 years and above, during every appointment to diminish potential polypharmacy practices.
- Before the presentation, I was aware of ARMOR tool and prescription strategies among the old.
- After today's presentation, I learned how to access and utilize the ARMOR assessment method to reduce polypharmacy in the elderly
- I feel assertive in applying the ARMOR assessment tool in my practice.
- The following obstructions may inhibit my ability to deprescribe among the elderly: time restraints, opposing healthcare demands and problems, and the facts about how to evaluate and screen for falls or risk influences.

Further, questionnaires determine behaviors associated with a participant's motivation to modify their practice to allow the reduction of polypharmacy in mature patients by utilizing means provided by the ARMOR tool. Queries resulting in the latter outcome enquire the prospect of a participant to complete the reconciliation medication for patients during each visit, their frequency of screening among aged patients, 65 years and over, for potential polypharmacy, the possibility of you having ample time for every senior patient in every session to evaluate the perils for polypharmacy, and the probability of a clinician to ask the elderly patient if they are using any multivitamins or supplements during each visit.

The next four questions inquire about medication safety knowledge among the elderly.

- I check for correct dosage of patients by their age
- I check the drug to drug interactions during every patient's visit
- I reduce prescriptions without withdrawals to less than five medicines
- I reduced patient medications based on their assessment and the reconciliation of the medication during each visit

The last three queries analyze communication among providers to reduce polypharmacy

- I converse with fellow clinicians regarding risk reduction and the prevention of polypharmacy among the elderly
- I inform the other prescribing clinicians after identifying polypharmacy in a senior patient
- I am likely to suspend a treatment I did not recommend and communicate the changes to the prescribing clinician after establishing polypharmacy or if there are probable drug-to-drug interactions.
- A concluding open-ended response question was necessary for contributors to deliver overall response regarding the exercise.

DNP Project Questionnaires

The questionnaire for both the initial and resulting examination coincided while using a 5-point Likert scale. Further, the contributors rated their level of agreement with every response using the following measures: disagree, undecided, agree, strongly agree or strongly disagree with questions #1 and 2 used for identification purposes. Question 3 - 5 determines screening resolutions with no, no uncertain, and yes alternatives. Questions 6 – 10 rate outcomes as strongly disagree, strongly agree, neutral, disagree, or agree. Question 11 – 14 rates result in order of very unlikely, very likely, neutral, unlikely, and likely. The final queries # 15 – 21 assess frequency as either every time, never, almost never, occasionally, or almost every time. Nemoto and Beglar (2014) indicate that the Likert scale is a psychometric gauge with multiple categories for the respondents to select and to show their feelings, attitudes, and opinions regarding an issue. The Likert scale is popular as it is reliable and easy to utilize indicated by the fact that most researchers have utilized it in the past. Similarly, it is a quick and easy way to assess outcomes as participants are familiar with the procedure of filling out Likert-style scales. The method is impartial as it offers the participant a single

option, as such, encouraging the integrity of the procedure. Successively, the structure of the scale, by magnitude, makes the presented information easy to analyze and conclude. The scale's ordinal nature allows for easy interpretation of the interludes between values. Utilizing the Likert scale offered a quantitative attitude for assessing the results. Lastly, the detail that age maybe gathered as ordinal data makes the 5-point Likert scale appropriate for the project. The reason for utilizing the distinct open-ended question was to produce qualitative replies about the participant views about the QI project using ARMOR assessment device as a method of decreasing polypharmacy among the elder patients.

Discussion of the Findings

The DNP project included the use of the ARMOR tool as part of the project intervention. The tool was used as a part of the pre and post implementation intervention of the project and the statistical data collected from 30 pre-implementation patient electronic records (N=30) which assessed the number of medications prescribed to patients using the Drug Review Process adopted from gold standards framework by NHS Highland/NHS Scotland. The second part of the intervention analyzed the participant's knowledge on polypharmacy with a group of fifteen (N=15) using the APKE questionnaire. A brief introduction of the ARMOR tool was provided to the participants by the project leader. The results provided information on how to improve the PowerPoint and APKE questionnaire of the didactic polypharmacy reduction in the clinic. A pre-implementation chart review showed that there was a reduction in the full didactic polypharmacy which utilized the use of the ARMOR tool. This also included providing the PowerPoint presentation to fifteen participants (N=15).

The result of the post-implementation chart review showed that the majority of 26 patients (four patients dropped out) were female (57.7%), 42.3% were 65-70 years of age, and 38.5% were Hispanic. The percentage of patients which had a high school degree or higher education (77.0%) and half were married at the time of survey (Appendix M, Table 1).

The change in number of medications (pre-post) appeared normally distributed with an average reduction of 5.31 medication (SD=3.20) (Appendix N, Figure 1). The average number of medications showed a significant reduction from were 15.81 to 10.50 (mean =5.31, SEM=0.63), $p<.001$. The reductions were observed across demographic characteristics, but notably higher in males (mean=6.36, SEM=1.25), Hispanic patients (mean=6.70, SEM=0.97), and those with some college education or degree (mean=6.38, SEM=1.34). (Appendix O, Table 2).

The results of the APKE questionnaire revealed that the 15 participants included physician (33.3%), nurse practitioners (40.0%), and physician assistants (26.7%). In addition, the results showed that approximately one third of the participants had held the current position less than one year while 20% reported 10 or more years of experience. The results showed that of the participants that there were 13 participants that had not previously utilized the polypharmacy tool and two that answered no, uncertain. (Appendix P, Table 3). Change in average score across items Q6-Q21 (pre-post) followed a normal distribution with an average differential of -1.37 points on the 5-point Likert scale (SD=0.74). This was interpreted as an average score in the pre-implementation phase and was -1.37 points lower on the 5-point scale than reported post intervention (Appendix Q, Figure 2). The results indicated that the average scores across items improved from 2.81 to 4.17 post intervention (mean pre-post difference =-1.37, SEM=0.19), $p<.001$. Lastly, the results revealed that the largest improvement in average scores was 1.93 points for the following questions (mean and SEM reported for each question in table): Q8, Q9, Q12, Q13, and Q21. Only two items had no change in average scores (Q6 and Q7). (Appendix R, Table 4).

Significance of Findings for Nursing

Findings from this project demonstrated success in reducing polypharmacy using the ARMOR tool and meeting the objectives of this project. This project attests to the poor physiological reserves in most elderly. It supports the dictum of optimizing and re-evaluating

the risk-benefit profile of any pharmacological agent and potential drug-body and drug-drug interaction. Elderly people pose unique questions. As nursing leaders, a systematic approach with the use of the ARMOR tool should be instituted in all organizations to be able to effectively improve patient care and outcomes. The use of the ARMOR tool would provide a way to evaluate the adverse drug reactions from commonly used pharmacological agents routinely (Davies & O'mahony, 2015). Using this tool, nurses would be able to provide a continuous medication reconciliation that would help with the number of drug-drug reactions, decreased medication non-compliance, and would improve the quality of life. In addition, an understanding of polypharmacy would help decrease the unnecessary drug expense posed on the elderly patients (Davies & O'mahony, 2015). The average number of medications showed a significant reduction from 15.81 to 10.50 (mean =5.31, SEM=0.63), $p < .001$.

This DNP project showed the importance of updating and reconciling medications on a regular basis to provide quality patient outcomes. As prescribers, there is the need to sufficiently investigate clinical situations with evidence-based practice that supports that the medication prescribed is the “best” medication for a problem.

Limitations of the Project

There were several limitations of this project. One of the limitations included the short time frame to implement the project. A longer period would allow for a more in-depth pre-intervention analysis which would provide more data when compared to the results of the post-intervention data. The project used a single mechanism during the pre and post implementation phases which helped reduce these challenges so that the results could be measured. Another limitation included that a few participants in the project did not complete the post intervention questionnaire. This could lead to inaccurate reporting of data.

It is a presumption that participants could have been faced with time constraints to fill the evaluation tool and had it done hurriedly or failed to do so due to circumstances. However, the ARMOR tool which was used in this project was made accessible to the participants prior

to implementation. Also, the tool had a user-friendly interface with a guiding statement “Continue to Next Page.” The project used an approach through which the tool was made easy to complete, through making brief and direct assessment questions and applying Likert-like scale for each question.

Lastly, a limitation of the project was that the implementation phase of the project was done only at one practice site. Future opportunities to incorporate this project at additional sites would enhance the data collection and results. Monitoring is essential in a continuous process of a project to enhance and correct its content. Evaluations and regular surveys keep a project on the right course due to the insightful feedback update training process. A benefit of the adaption of the ARMOR tool by many healthcare settings and in training programs, would provide more pertinent literature and case studies as resources, lessons and training materials.

Dissemination/Project Sustainability

The DNP project met its intended goal on decreasing polypharmacy in the elderly as well as increasing clinicians’ knowledge on the ARMOR assessment tool in reducing polypharmacy. The result of this project will be disseminated with a written manuscript for publication in the geriatric journal. There will be publication restrictions. Authorship eligibility guidelines will be followed. The results of the project may be implemented in other clinic practice settings.

Conclusion

Polypharmacy occurs among the elderly due to some reasons propelled by aging and cell deterioration. Contributory factors may include duplication: prescription of the same specific drug for different health reasons, which usually occurs due to lack of knowledge about other complications on the part of the part of the physician. Another factor contributing to the advancement of polypharmacy is poor drug combination, caused by either self-medication or the lack of knowledge on health practices. These factors, considered together

with the natural complications that come with age, hasten the advancement of polypharmacy among the elderly.

Polypharmacy leads to a higher rate of mortality among the elderly. Since the affected elderly persons essentially overdose on various drugs, their immune systems are weakened. This is made worse by the health complications typically associated with old age. As a result, elderly people tend to face a higher risk of mortality than should exist. Polypharmacy also causes major financial burdens because the health plans most of these elderly people have do not cover the cost of multiple medications. This makes it difficult for them to cope, increases the risk of diseases such as heart attack and worsens the instance of polypharmacy. Although methods of reducing the occurrence exist, there is the need for a comprehensive yet simple method of risk assessment that allows for quick, organized action.

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Appendix A

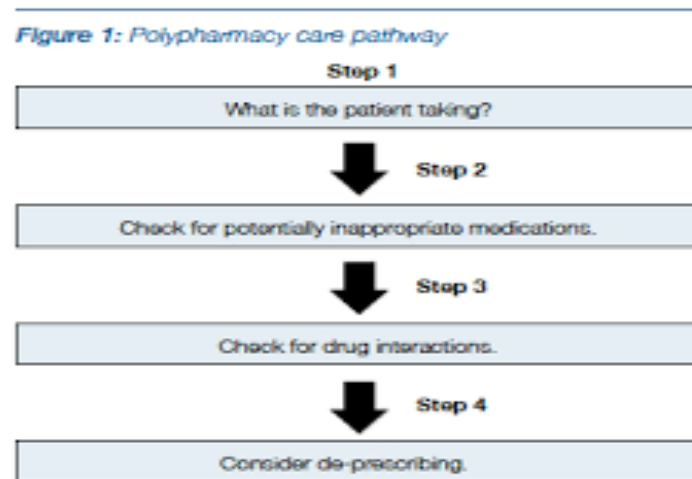


Figure 1: Polypharmacy Care Pathway (Cancer Forum, n.d)

Appendix B

Table 4 The ARMOR tool		
A	Assess	<ul style="list-style-type: none"> • Beers criteria • β-blockers • Pain medications • Antidepressants • Antipsychotics • Other psychotropics • Vitamins and supplements
R	Review	<ul style="list-style-type: none"> • Drug–disease interactions • Drug–drug interactions • Adverse drug reactions
M	Minimize	<ul style="list-style-type: none"> • Number of medications according to functional status rather than evidence-based medicine
O	Optimize	<ul style="list-style-type: none"> • For renal/hepatic clearance, PT/PTT, β-blockers, pacemaker function, anticonvulsants, pain medications, and hypoglycemics; gradual dose reduction for antidepressants
R	Reassess	<ul style="list-style-type: none"> • Functional/cognitive status in 1 week and as needed • Clinical status and medication compliance

From Haque R. ARMOR: a tool to evaluate polypharmacy in elderly persons. *Annals of Long-Term Care* 2009;17(6):26–30; with permission. Available at: <http://www.annalsoflongtermcare.com/>

Figure 2: ARMOR tool (Annals of Long-Term Care)

Appendix C – Approval from Dr. Haque

To: Dr. Raza Haque
December 1, 2017

Dear Sir,
My name is Emelia Jeffrey. I am a DNP student at Touro University and preparing my DNP project on reducing polypharmacy in the elderly.

Author: Emelia Jeffrey

I request your permission to include the ARMOR assessment tool in this and all subsequent editions of the above-referenced project, in all media of expression now known or later developed and in all foreign language translations and other derivative works published or prepared by Emelia Jeffrey or its licensees, for distribution throughout the world, and in versions made by nonprofit organizations for use by blind or physically handicapped persons. Appropriate credit will be given as provided below.

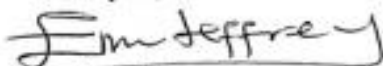
Author(s) and/or editor(s): Dr. Raza Haque

Title of selection: ARMOR: A Tool to Evaluate Polypharmacy in Elderly Persons

Copyright date: 2009; page 3 Table #1

Please indicate agreement by signing and returning the enclosed copy of this letter to me. In signing, you warrant that you are the sole owner of the rights granted and that your material does not infringe upon the copyright or other rights of anyone. If you do not control these rights, I would appreciate your letter letting me know to whom I should apply.

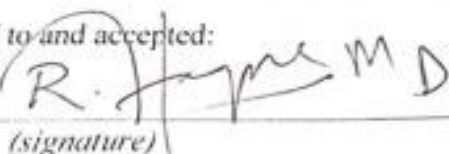
Thank you,



Emelia Jeffrey

Agreed to and accepted:

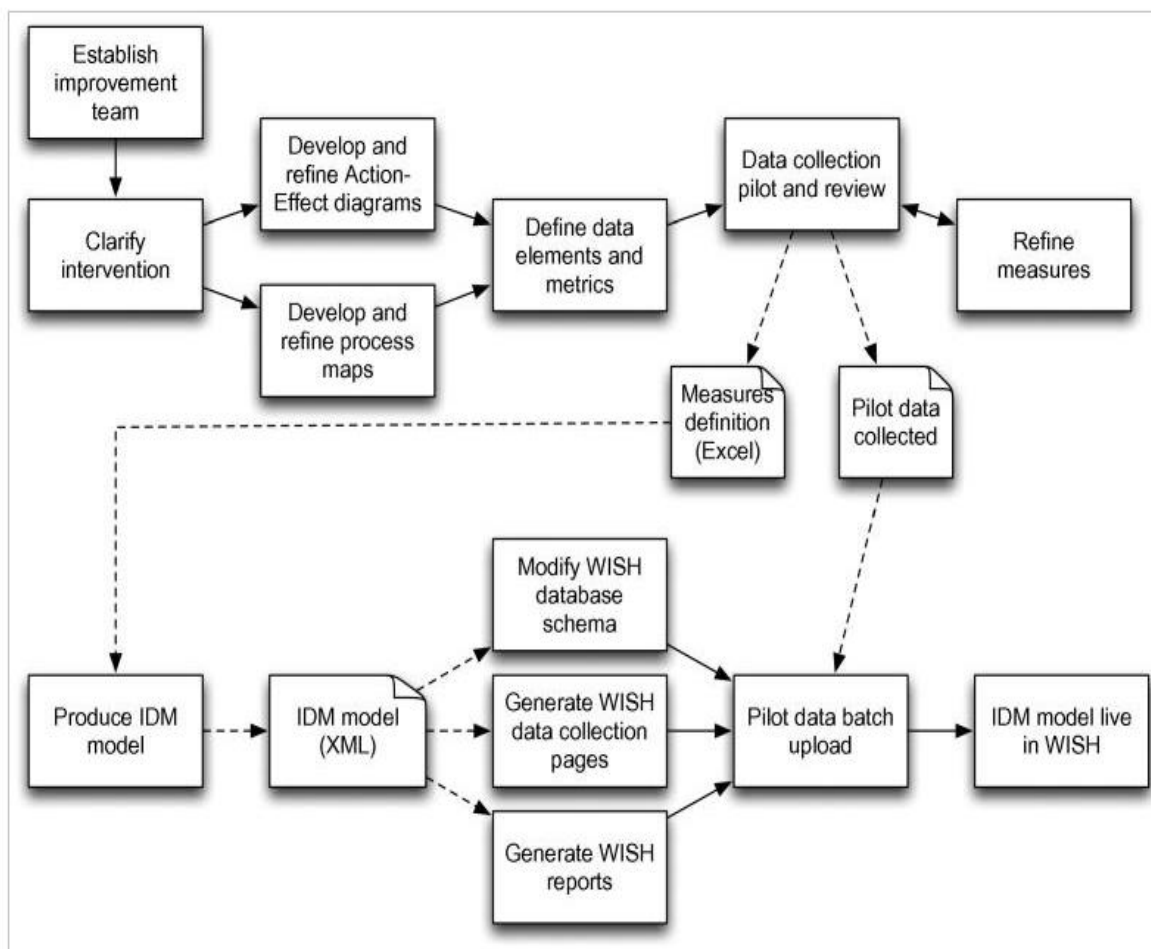
by:


(signature)

RAZA HAQUE
(title)

Credit and/or copyright notice:

Appendix D



From Curcin, Woodcock, Poots et. al., Model-driven approach to data collection and reporting for quality improvement *Journal of biomedical informatics* 2014;52, 151-162. with permission available at: <https://www.ncbi.nlm.nih.gov/pmc>

Figure 3: IDM/WISH process mapping stages (Journal of biomedical informatics)

Appendix E

Table 3 Medication appropriateness index	
Item	Weight
Is there an indication for the drug?	3
Is the medication effective for the condition?	3
Is the dosage correct?	2
Are the directions correct?	2
Are the directions practical?	1
Are there clinically significant drug-drug interactions?	2
Are there clinically significant drug-disease/condition interactions?	2
Is there unnecessary duplication with other drug(s)?	1
Is the duration of therapy acceptable?	1
Is this drug the least expensive alternative compared to others of equal utility?	1

Data from Hanlon JT, Schmader KE, Samsa GP, et al. A method for assessing drug therapy appropriateness. *J Clin Epidemiol* 1992;45(10):1045–51 and Samsa GP, Hanlon JT, Schmader KE, et al. A summated score for the medication appropriateness index: development and assessment of clinimetric properties including content validity. *J Clin Epidemiol* 1994;47(8):891–96.

Appendix F



DNP PROJECT: STATISTICAL PLAN WORKSHEET

Name: Emelia O. Jeffrey

Date: December 20, 2017

Section	Description
Project Title	Reducing polypharmacy in the elderly
Project Purpose	The purpose of this DNP project is to develop a protocol, which will be designed to help the provider recognize risks common to polypharmacy in the elderly persons
Project Question	The PICOTs tool will be used to formulate the project question: Will a procedural protocol (I) improve polypharmacy in the elderly (O) in a community clinic (P)?
Project Outcomes	By implementing ARMOR tool in the clinic, a likely outcome is reducing the many medications in the elderly
Project Design (general description how treatments are assigned/observational/repeated measures of X # of people, etc.)	<ol style="list-style-type: none"> 1. Electronic records to be gathered and analyzed to assess the number of medications that the patient was prescribed; 2. At least, 30 pre-implementation patient records and 30 post implementation

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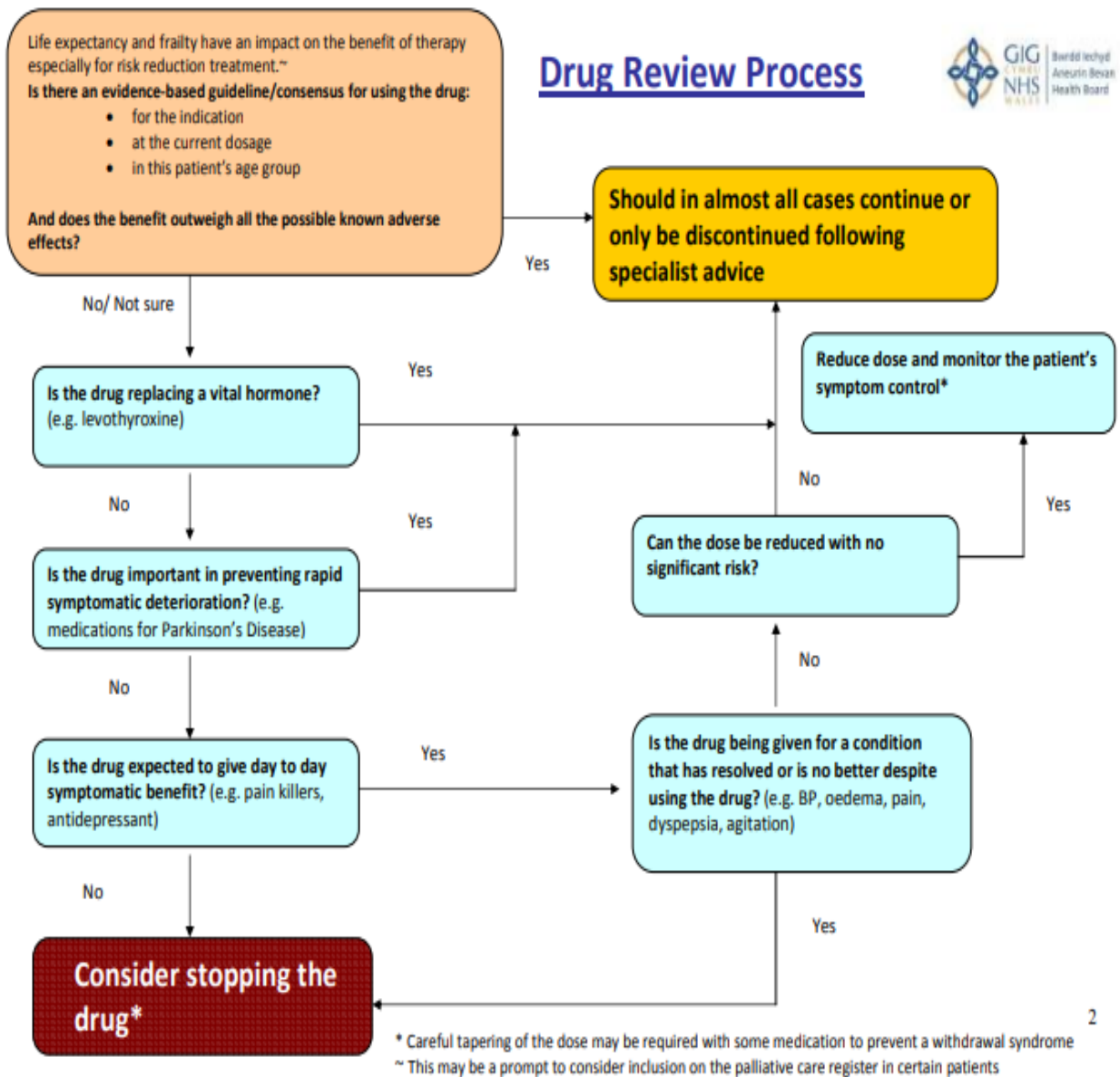
	<p>charts will be reviewed using the Drug Review Process adopted from gold standards framework by NHS Highland/NHS Scotland (Appendix H).</p> <p>3. 5-point Likert scale questionnaire for 15 clinicians with pre and post educational intervention evaluation. All clinicians will be kept anonymous using self-generated codes. Pre -interventional self-generated codes for the questionnaire will be the first letter of father's first name (A-Z), first letter of mother's first name (A-Z), plus participant's birthday (01 – 31). The post -interventional self-generated codes for the questionnaire will be the first letter of father's first name (A-Z), first letter of mother's first name (A-Z), plus participant's birth month (01 – 12). A copy of the instructions can be seen in Appendix M.</p> <p>4. The ARMOR tool will be implemented in the clinic to all elderly patients aged 65</p>
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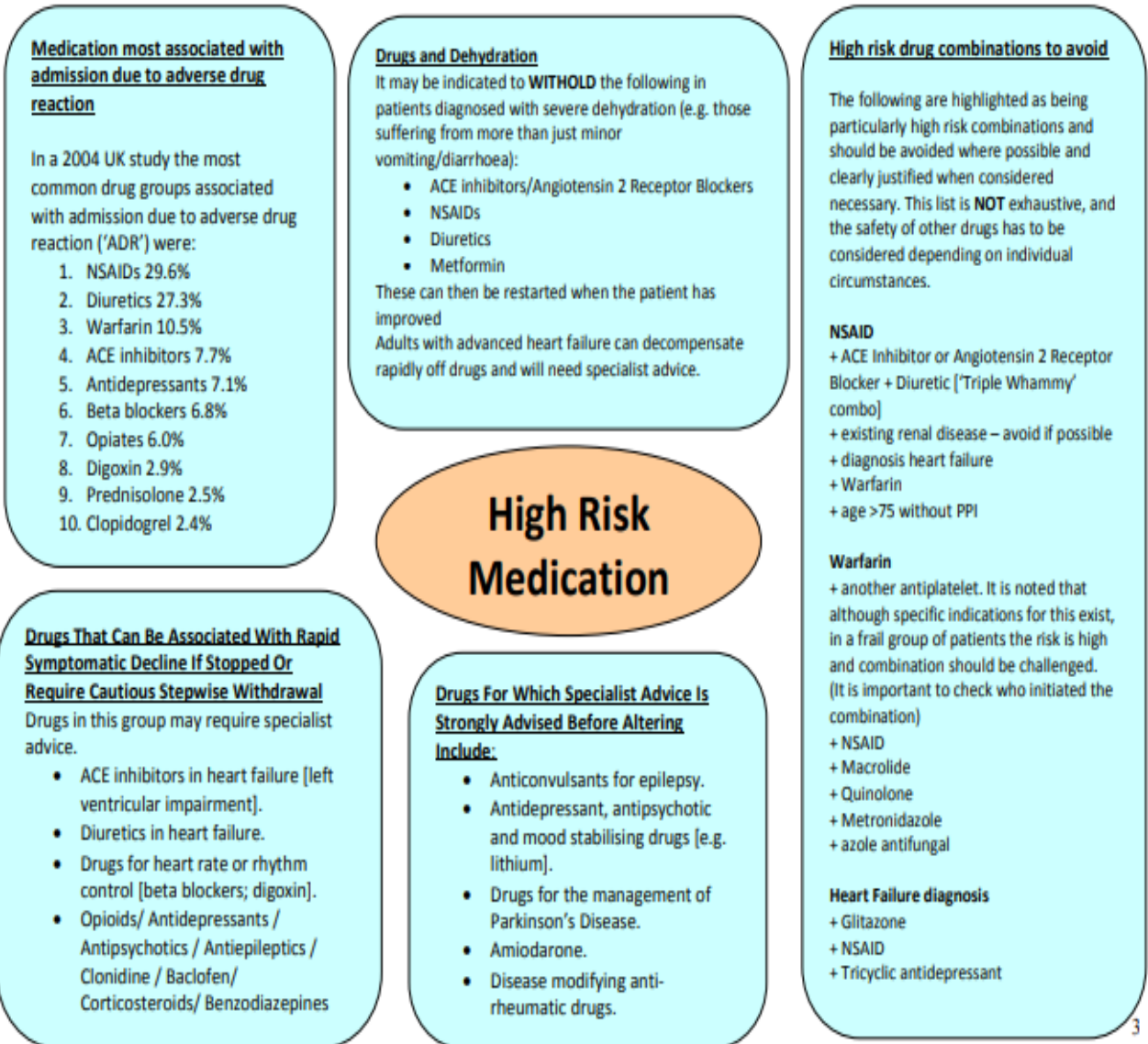
	years and over that has more than five or medications including vitamins and supplements.
Population of Interest	Clinicians (MDs, DOs, NPs, PAs)
Variables	<ol style="list-style-type: none"> 1) Independent variable(s): Time relative to intervention (before/after) 2) Dependent variable(s): Number of medications a person is taking
Sample Size	30
Recruitment Methods	Questionnaire, chart review, interview
Instruments/Tools (Validity/Reliability)	ARMOR tool
Proposed Statistical Tests	Paired design

Appendix G



Jones, E. (2016). Polypharmacy: guidance for prescribing in frail adults. Retrieved April 6, 2018, from <http://www.goldstandardsframework.org.uk/pig>

Next page →



Jones, E. (2016). Polypharmacy: guidance for prescribing in frail adults. Retrieved April 6, 2018,

from <http://www.goldstandardsframework.org.uk/pig>

Next page →

Cardiovascular system in general

- **Anticoagulants** - do patients have an active indication for anticoagulant therapy? Is monitoring robust? Is the INR within the recommended therapeutic range? Are there frequent falls (>1 per week)?
- **Antiplatelets**- does the patient have a history of coronary, cerebral or peripheral symptoms/ events?- If not – consider stopping. Ensure aspirin/clopidogrel combination reviewed as per cardiology advice. Reduce aspirin to evidence-based doses.
- **Statins** – Re-evaluate risk profile for primary/secondary prevention
- **Diuretics** for dependent ankle oedema - consider alternative ways of managing oedema, consider medication causes e.g. CCB
- **Digoxin** in the presence of CKD - consider reducing the dose, or stopping
- **Peripheral vasodilators**- e.g. **Cilostazol, pentoxifylline** , clinical effectiveness not often established
- **Quinine**- Review long-term use- see MHRA advice
- **Anti-anginal medication** - Consider reducing particularly if mobility has decreased with less need for medication

Central nervous system and psychotropic medication

- **Hypnotics and anxiolytics** - discuss reducing long-term therapy with the aim of stopping
- **Antidepressants** - Review combinations e.g. tricyclic antidepressants for analgesia used in combination with other antidepressants for depression
- **SSRIs** are in general better tolerated in people with dementia who also have depression
- **Metoclopramide** - review long-term use
- **Vertigo** - review long-term use of drugs such as **prochlorperazine and cinnarizine**
- Consider cumulative GI effects when co-prescribing **SSRI's+NSAID's/ aspirin**

Endocrine system

- **Metformin** – use with caution in renal impairment due to risk of lactic acidosis
- **Oral corticosteroids** for long term use – maintenance dose should be kept as low as possible with withdrawal considered where feasible. When possible local treatments e.g. inhalations, creams etc should be used in preference
- **Bisphosphonates**-has treatment been taken for > 5 years?

Other Factors To Consider When Conducting A Review

Analgesic medication

- **Strong opioids** - Long term use of for mild-moderate pain – review diagnosis (is pain neuropathic or otherwise not responsive to opiates) and effectiveness - discuss stepping down therapy
- Consider **non-pharmacological treatment** such as gentle exercise, relaxation or TENS
- Check compliance with long-term analgesia
- Check effectiveness- step up or step down analgesia using the WHO analgesic ladder available
- Check safety - reduce use of NSAIDs and opioids and amitriptyline if possible. Prescribe laxatives with opioids.

Gastrointestinal system

- **PPIs and H2 antagonists** - consider reducing the dose or stopping, especially if antibiotics are required (remember increase in risk of *C. difficile*).
- **Laxatives** -reduce overuse if possible. Opioids stopped?

Urogenital system

- **α-blockers / 5α reductase inhibitors** for BPH in men with long term urinary catheters - consider stopping
- **Antimuscarinics**. e.g. **solifenacin**. Is there still a valid indication?

Jones, E. (2016). Polypharmacy: guidance for prescribing in frail adults. Retrieved April 6, 2018,

from <http://www.goldstandardsframework.org.uk/pig>

Appendix H

SWOT ANALYSIS

<p style="text-align: center;">STRENGTHS</p> <ul style="list-style-type: none"> ▪ Strong deprescribing in the elderly ethics at the clinic ▪ Data collection provided the importance of using an assessment tool in polypharmacy of the elderly. ▪ ARMOR tool as a missing link in polypharmacy in the primary care settings. ▪ Online access for ARMOR tool ▪ Easy access to ARMOR tool ▪ Personal expertise in geriatrics and polypharmacy ▪ Personal knowledge of clinic structure and organizational policies 	<p style="text-align: center;">WEAKNESS</p> <ul style="list-style-type: none"> ▪ Lack of nationally accepted polypharmacy guideline in the United States ▪ Unwillingness of some clinicians to accept the ARMOR tool ▪ Unfamiliarity with ARMOR tool by clinicians ▪ Time and resource constraints
<p style="text-align: center;">OPPORTUNITIES</p> <ul style="list-style-type: none"> ▪ Governmental initiatives created to increase the safety and health education of patients, ▪ Standardize protocol quality tool in screening, management, and reducing polypharmacy in the primary care setting. ▪ Rise in the elderly population ▪ Decrease polypharmacy in the elderly ▪ Learn and Fun time with other clinicians 	<p style="text-align: center;">THREATS</p> <ul style="list-style-type: none"> ▪ IT errors in the ARMOR tool implementation ▪ Patients threatening to clinicians during titration of medications ▪ Availability of clinicians and charts ▪ Time delays due to personal vacations/holidays by clinicians.

Appendix I

Instructions on Generating Survey Self Codes

Please follow the following instructions to generate a four-letter survey code for the pre – and post -interventional questionnaires. Write this code for the participant number slot on the survey form. To Keep anonymity, please shred this paper after use.

Pre -interventional self-generated codes — — — —

- First letter of father's first name (A-Z)
- First letter of mother's first name (A-Z)
- Participant's birthday (01 – 31).

Post -interventional self-generated codes — — — —

- First letter of father's first name (A-Z)
- First letter of mother's first name (A-Z)
- Participant's birth month (01 – 12).

Appendix J

**ARMOR/POLYPHARMACY KNOWLEDGE EVALUATION (APKE)
QUESTIONNAIRE**

Please circle the most appropriate response to each question

Participant number

1. Identify your discipline
 - a. Physician
 - b. Nurse Practitioner
 - c. Physician Assistant

2. About how many years have you been in your current position?
 - a. Less than 1 year
 - b. At least 1 year but not less than 3 years
 - c. At least 3 years but less than 5 years
 - d. At least 5 years but less than 10 years
 - e. 10 years or more

3. Have you worked in a previous clinic that utilized polypharmacy assessment tool?

No, not at all No, uncertain Yes

4. Do you see patients 65 years and older?

No, not at all No, uncertain Yes

5. Do your elderly patients have more than five medications including multivitamins and supplements?

No, not at all No, uncertain Yes

6. Before today's presentation, I was aware of ARMOR tool to screen all elderly who are =>65 years on each visit to reduce possible polypharmacy

Strongly disagree Disagree Neutral Agree Strongly agree

Next page →

**ARMOR/POLYPHARMACY KNOWLEDGE EVALUATION (APKE)
QUESTIONNAIRE**

7. Before today's presentation, I had knowledge of ARMOR tool and guidelines for prescribing in the elderly.

Strongly disagree Disagree Neutral Agree Strongly agree

8. After today's presentation, I know how to access and use ARMOR's assessment tool in reducing polypharmacy in the elderly

Strongly disagree Disagree Neutral Agree Strongly agree

9. I feel confident in using the ARMOR assessment tool

Strongly disagree Disagree Neutral Agree Strongly agree

10. The following barriers may prevent me from deprescribing in the elderly: time constraints, competing healthcare demands/problems, and knowledge of how to assess/screen for falls and/or risk factors.

Strongly disagree Disagree Neutral Agree Strongly agree

11. How likely are you to complete medication reconciliation for my patients on each visit?

Extremely unlikely Unlikely Neutral Likely Extremely likely

12. How likely are you to screen the elderly who are 65 years and over for possible polypharmacy?

Extremely unlikely Unlikely Neutral Likely Extremely likely

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**ARMOR/POLYPHARMACY KNOWLEDGE EVALUATION (APKE)
QUESTIONNAIRE**

13. How likely are you to have sufficient time for each elderly patient who are 65+ on each visit to assess the risks for polypharmacy?

Extremely unlikely Unlikely Neutral Likely Extremely likely

14. How likely are you to ask the elderly patient 65+ if they are taking any supplements and multivitamins on each visit?

Extremely unlikely Unlikely Neutral Likely Extremely likely

15. I check for appropriate dosage for patients based on age

Never Almost never Occasionally Almost every time Every time

16. I check for drug to drug interactions on each patient's visit

Never Almost never Occasionally Almost every time Every time

17. I titrate medications without withdrawals to less than five medications

Never Almost never Occasionally Almost every time Every time

18. I deprescribed medications based on patient's assessment and medication reconciliation on each visit

Never Almost never Occasionally Almost every time Every time

19. I communicate with other clinicians about risk reduction/prevention of polypharmacy in the elderly

Next page →

ARMOR/POLYPHARMACY KNOWLEDGE EVALUATION (APKE)
QUESTIONNAIRE

Never Almost never Occasionally Almost every time Every time

20. I communicate with other prescribing clinicians immediately if polypharmacy is identified in a patient

Never Almost never Occasionally Almost every time Every time

21. I am likely to discontinue a medication I did not prescribe and communicate that to the prescribing clinician if polypharmacy is identified or possible drug-to-drug interaction is imminent.

Never Almost never Occasionally Almost every time Every time

Comments/Suggestions:

Thank you!

Appendix K

Budget and Expenses for DNP Project

Direct Expenses	Projected (\$)	Actual (\$)
Clinicians' Fees (\$100/hour x 15 participants)	\$1500	\$1500
Project Manager Fees (\$32/hour x 4 hours)	\$128	\$128
Information Technology Fees ((\$25 x 8 hours)	\$200	\$200
Printing and Coping Pre and Post Evaluation Tools/Tests	\$68	\$68
Travel Fees: Hotel and Transportation	\$0	\$0
Visual Aids	\$0	\$0
Subtotal Direct Expenses	\$1896	\$1896
Indirect Expenses		
DNP Student's Time to Plan, Develop, and Implement project	\$0	\$0
Lunches and snacks for Teaching Sessions	\$0	\$0
Subtotal Indirect Expenses	\$0	\$0
Total Project Expenses	\$1896	\$1896

NOTE: Hourly wages for clinicians, project manager, and information technician were approximated.

Appendix L**Table 1.** Characteristics of Patient Population.

Overall	
N=26	
Age in years, %:	
65-70	42.3% (n=11)
71-80	19.2% (n=5)
81-90	26.9% (n=7)
91-100	11.5% (n=3)
Gender, %:	
Female	57.7% (n=15)
Male	42.3% (n=11)
Ethnicity, %:	
Hispanic	38.5% (n=10)
Non-Hispanic ^a	61.5% (n=26)
Educational Background, %:	
Less than high school degree or	23.1% (n=6)
High school degree/GED	46.2% (n=12)
Some college or associate/bachelor's degree	30.8% (n=8)
Marital Status, %:	
Married	50.0% (n=13)
Single ^b	50.0% (n=13)

^a (n=2 American Indian or Alaskan Native, n=5 Asian/Pacific Islander, n=6 African-American, and n=3 Caucasian).

^b (n=2 Never married, n=4 Separated, n=4 Divorced, n=3 Widowed)

Appendix M

Table 2: Change in Pre-Post Medications

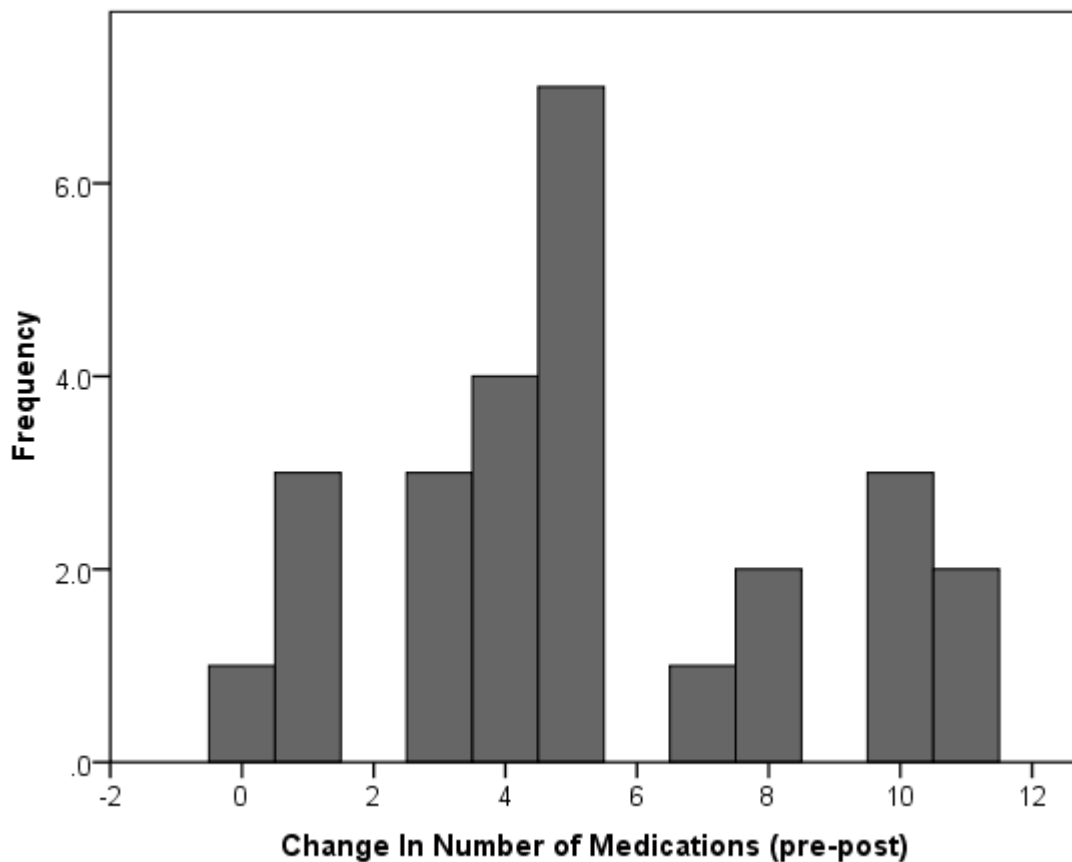


Figure 1. Histogram displays distribution of change in average number of medications was significantly reduced from 15.81 to 10.50 (mean =5.31, SEM=0.63), $p < .001$. Reductions were observed across demographic characteristics, but notably higher in males (mean=6.36, SEM=1.25), Hispanic patients (mean=6.70, SEM=0.97), and those with some college education or degree (mean=6.38, SEM=1.34).

Appendix N

Table 2. Average number of medications pre vs. post examined overall and by patient characteristics (n=26).

Average number of medications	PRE Mean (SD)	POST Mean (SD)	Mean Reduction in # Medications (SEM), [95% CI]	Paired T Test, P-val
Overall	15.81 (4.87)	10.50 (4.61)	5.31 (0.63), [4.02, 6.60]	t _(df=25) =8.47, P<.001
Age, years:				
65-70	16.36 (5.68)	11.64 (5.89)	4.73 (1.02), [2.46, 7.00]	t _(df=10) =4.64, P=.001
>70	15.40 (4.34)	9.67 (3.37)	5.73 (0.80), [4.01, 7.45]	t _(df=14) =7.15, P<.001
Gender:				
Female	15.67 (4.55)	11.13 (5.60)	4.53 (0.54), [3.37, 5.70]	t _(df=14) =8.36, P<.001
Male	16.00 (5.50)	9.64 (2.77)	6.36 (1.25), [3.57, 9.15]	t _(df=10) =5.08, P<.001
Ethnicity:				
Hispanic	17.50 (3.38)	10.80 (2.82)	6.70 (0.97), [4.51, 8.89]	t _(df=9) =6.93, P<.001

Non-Hispanic	14.75 (5.43)	10.31 (5.52)	4.44 (0.76), [2.81, 6.07]	$t_{(df=15)} = 5.81, P < .001$
Educational Background:				
High school degree/GED or some HS	15.61 (4.95)	10.78 (5.01)	4.83 (0.68), [3.39, 6.27]	$t_{(df=17)} = 7.08, P < .001$
Some college or associate/bachelor's degree	16.25 (4.98)	9.88 (3.76)	6.38 (1.34), [3.22, 9.53]	$t_{(df=7)} = 4.77, P = .002$
Marital Status:				
Married	16.31 (5.66)	10.77 (5.90)	5.54 (0.78), [3.84, 7.24]	$t_{(df=12)} = 7.09, P < .001$
Single ^b	15.31 (4.09)	10.23 (3.03)	5.08 (1.01), [2.88, 7.28]	$t_{(df=12)} = 5.03, P < .001$

SEM=Standard error of the mean difference

Appendix O**Table 1.** Characteristics of clinicians (n=15).

Overall	
N=15	
Discipline, %:	
Physician	33.3% (n=5)
Nurse Practitioner	40.0% (n=6)
Physician Assistant	26.7% (n=4)
Years in current position, %:	
<1 year	33.3% (n=5)
1-2 years	0.0% (n=0)
3-4 years	20.0% (n=3)
5-9 years	26.7% (n=4)
>=10 years	20.0% (n=3)
Previously utilized polypharmacy tool, %:	
No	86.7% (n=13)
No, uncertain	13.3% (n=2)

Figure 1. Histogram displays distribution of change in average score (pre-post) in 15 clinicians, mean change score= -1.37 (SD=0.74). Shapiro Wilk's test of normality non-significant (p=0.77) and distribution appears normal in histogram; therefore, parametric procedures assumed appropriate to test significance of reduced number of average medications (i.e. paired t-test).

Appendix P

Figure 2: Average Pre-Post APKE Scores

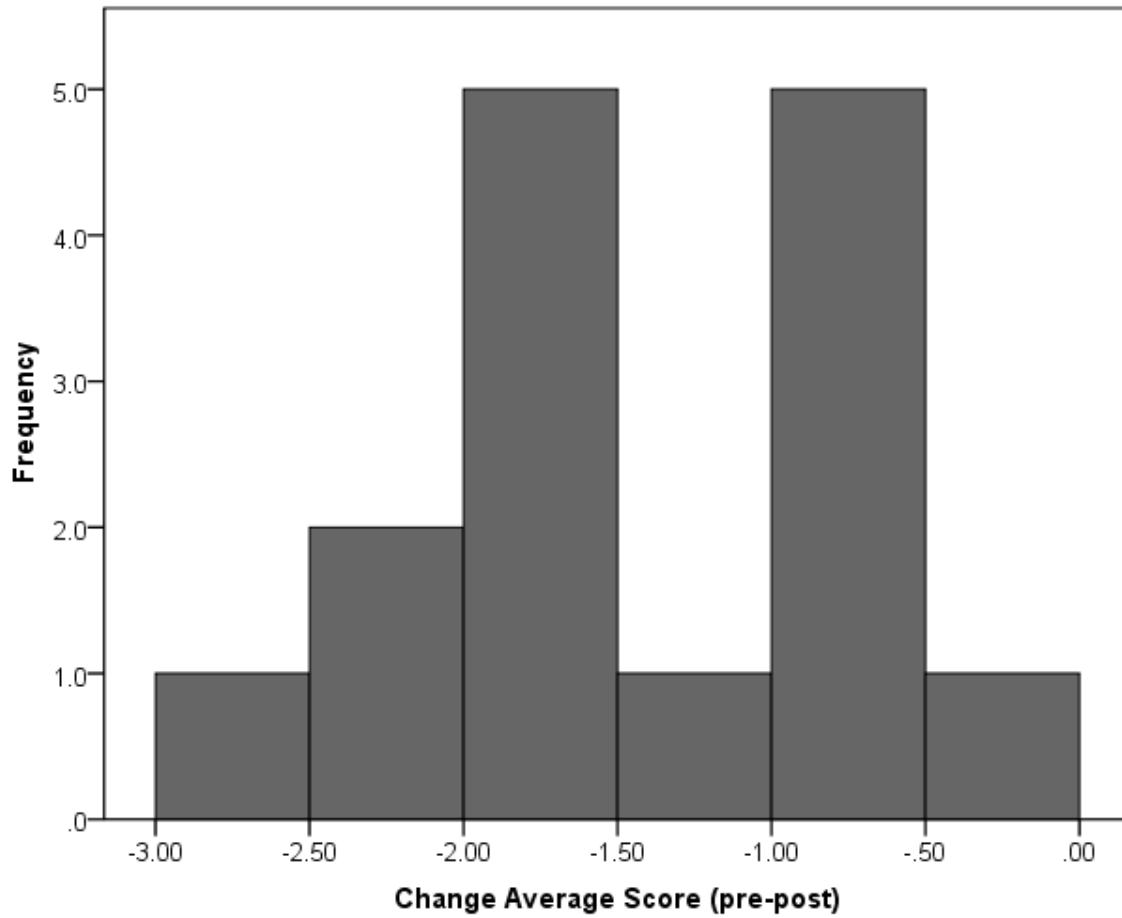


Figure 1. Histogram displays distribution of change in average score (pre-post) in 15 clinicians, mean change score= -1.37 (SD=0.74). Shapiro Wilk's test of normality non-significant ($p=0.77$) and distribution appears normal in histogram; therefore, parametric procedures assumed appropriate to test significance of reduced number of average medications (i.e. paired t-test).

Appendix Q

Table 2. Average score pre vs. post (n=15)

Average score on items 6-21 (higher scores are better)	PRE Mean (SD)	POST Mean (SD)	Mean Difference in Scores (SEM), [95% CI]	Paired T Test, P- val
Average score across items	2.81 (0.69)	4.17 (0.56)	-1.37 (0.19), [-1.78, -0.95]	t_(df=14) = -7.12, P<.001
Average score on individual items:				
Q6	3.21 (1.58)	3.21 (1.58)	0.00 (0.30), [-0.64, 0.64]	t _(df=13) = 0.00, P=1.00
Q7	3.14 (1.51)	3.14 (1.51)	0.00 (0.00) ---	
Q8	2.07 (1.34)	4.00 (1.07)	-1.93 (0.40), [-2.78, -1.08]	t _(df=14) = -4.88, P<.001
Q9	2.64 (1.39)	4.57 (0.51)	-1.93 (0.37), [-2.73, -1.13]	t _(df=13) = -5.21, P<.001
Q10	2.79 (0.98)	4.57 (0.85)	-1.79 (0.35), [-2.54, -1.03]	t _(df=13) = -5.10, P<.001
Q11	2.64 (1.39)	4.07 (1.14)	-1.43 (0.51), [-2.53, -0.33]	t _(df=13) = -2.80, P=.015
Q12	2.64 (1.01)	4.57 (0.65)	-1.93 (0.27), [-2.50, -1.35]	t _(df=13) = -7.24, P<.001

Q13	2.71 (0.99)	4.64 (0.50)	-1.93 (0.34), [-2.66, -1.20]	$t_{(df=13)} = -5.69$, P<.001
Q14	2.86 (0.95)	4.43 (0.94)	-1.57 (0.23), [-2.06, -1.08]	$t_{(df=13)} = -6.90$, P<.001
Q15	3.14 (0.77)	4.07 (1.21)	-0.93 (0.32), [-1.63, -0.23]	$t_{(df=13)} = -2.88$, P=.013
Q16	3.29 (0.99)	4.43 (0.85)	-1.14 (0.33), [-1.85, -0.43]	$t_{(df=13)} = -3.47$, P=.004
Q17	3.21 (1.19)	4.14 (1.17)	-0.93 (0.43), [-1.85, -0.01]	$t_{(df=13)} = -2.18$, P=.048
Q18	3.40 (1.35)	4.13 (1.13)	-0.73 (0.30), [-1.38, -0.09]	$t_{(df=14)} = -2.44$, P=.028
Q19	2.60 (1.24)	4.07 (1.03)	-1.47 (0.38), [-2.27, -0.66]	$t_{(df=14)} = -3.90$, P=.002
Q20	2.93 (1.03)	4.20 (1.15)	-1.27 (0.36), [-2.04, -0.50]	$t_{(df=14)} = -3.54$, P=.003
Q21	2.27 (1.10)	4.20 (1.08)	-1.93 (0.30), [-2.58, -1.29]	$t_{(df=14)} = -6.44$, P<.001

SEM=Standard error of the mean difference