

Implementation of Medication Reconciliation to Improve Medication Safety in a Geriatric

Psychiatric Population

by

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Abstract

Problem: There was a 90% prevalence rate of polypharmacy (5 or more prescribed daily medications) identified between January 2022, and May 2022, among geriatric adults aged sixty-five and older, on the inpatient geriatric unit a mental health hospital. Eleven percent of the geriatric inpatients experienced adverse drug reactions resulting in hyperglycemia with increased risk for type 2 diabetes. Twenty-two percent of the geriatric inpatients were sent to hospital emergency rooms secondary to adverse drug effects. The purpose of this Doctor of Nurse Practice (DNP) project was to implement the evidence-based Screening Tool for Older Persons/Screening Tool to Alert to Right Treatment (STOPP/START) for medication reconciliation to reduce polypharmacy and potential adverse drug reactions.

Methods: The tool was applied to a sample size of eleven patients. Data collection was completed using two tools the STOPP/START Data Collection Tool and the STOPP/START Data Sheet. Weekly review of patient's electronic medical administration record (EMAR) identified medications to be stopped or started. Data collection was completed over a 15-week period beginning August 2022.

Results: There was an 11% decrease in the total number of prescribed medications post implementation. The total number of medications stopped was seventeen and the total number of medications started was five resulting in a net decrease of twelve medications among all patients over the 15-week implementation. The majority decreases were associated with antipsychotics, gastrointestinal and renal drug classes.

Conclusion: STOPP/START tool is effective for identifying medications with potential adverse effects on the geriatric inpatient mental health setting.

Keywords: polypharmacy, geriatric, stopp/start

Implementation of Medication Reconciliation to Reduce Polypharmacy in a Geriatric Psychiatric Population

Aging is associated with an accumulation of comorbidities for which multiple medications are prescribed (Hoel, R. W. et al., 2021). As a result, polypharmacy has become an increasing concern among medical providers. Halli-Tierney, A. et al. (2019) defines polypharmacy as five or more prescription medications daily with the possibility that they may not be clinically necessary. Maher (2014) reports that polypharmacy increases the risk for increased drug interactions, adverse drug events, injurious falls, increased acute hospitalizations, and cognitive impairment with older adults aged 65 years and older.

Problem

Polypharmacy has been observed in the medical management of geriatric patients at a long-term inpatient mental health hospital. Data collected retrospectively from the electronic health record (EHR) over a period of twenty months (May 2020 – December 2021) found a 90% prevalence rate of polypharmacy among adult geriatric inpatients. The average number of medications prescribed during the same period was 9.5 (including vitamin supplements). Twenty-two percent of the geriatric adult patients were sent to hospital emergency rooms secondary to adverse drug effects, (i.e., hyponatremia, seizure) and 11% experienced adverse drug reactions resulting in hyperglycemia with increased risk for type 2 diabetes. A root cause analysis identified lack of a medication reconciliation tool, poor communication among prescribers and lack of awareness of polypharmacy and its effect on the geriatric adult population.

Available Knowledge

A literature review was completed to support the prevalence of polypharmacy and identify evidence-based interventions for polypharmacy in older adults. The search was

conducted through PubMed, Medline and CINAL databases. This search produced a combination of Level I-III studies (JHNEBP, 2022) that define polypharmacy, associated risks, and support for evidence-based medication reconciliation tools to reduce polypharmacy. Young, E.H. et al., (2021), Romskaug, R (2020), Halli-Tierney, A. et al. (2019), Khezrian, M., et. al., (2020), and Maher, R.L. et al., (2014) are studies that defined polypharmacy, risk factors associated with polypharmacy (adverse drug reactions, acute hospitalization, injurious falls, cognitive impairment, and death), and supported the need for reducing polypharmacy among older adults. Earl, T. R et. al, (2020) Rankin, A (2018) Hill-Taylor, B (2016), Boland, B., (2016) O'Connor, M (2016) Haque, R.U. (2009) are studies that are studies that supported the use of medication reconciliation tools (STOPP/START, Beers criteria, ARMOR) to reduce polypharmacy (see Table 1: Evidence Review Table and Synthesis). The Screening Tool for Older Persons/Screening Tool to Alert to Right Treatment (STOPP/START) tool (Appendix A) was validated through 6 studies obtained through the literature review. A DNP Project Management tool was created to guide project planning, implementation, and evaluation (Appendix B). The DNP Project Management tool included a root cause diagram (Appendix C), current process map (Appendix D) and desired process map (Appendix E). Overall, the evidence was compelling.

Rationale

The Quality Initiative (QI) framework used for this project proposal was the Knowledge to Action Model (KTA) (Graham et al., 2006) (see Appendix F). The KTA framework is a conceptual framework intended to help those concerned with knowledge translation deliver sustainable, evidence-based interventions. The framework consists of two related components: Knowledge Creation (represented by the funnel) and Action Cycle (application). The framework

begins with identification of the problem of polypharmacy with geriatric inpatients in the mental health setting as part of the action cycle. There is a symbiotic relationship between problem identification and knowledge creation. Therefore, a knowledge inquiry into polypharmacy and ways to reduce through a literature review were completed. The literature review identified an evidence-based medication reconciliation tool, STOPP/START, that could reduce adverse drug reactions associated with polypharmacy. The action cycle began by presenting the STOPP/START tool to our director of pharmacy to obtain buy-in for the expected implementation. The knowledge and data were presented to the Internal Review Board (IRB) of the hospital for review, feedback, and approval. IRB approval was received, and the tool was reviewed with providers for feedback on possible barriers to use of the tool. Evaluation for compliance occurred through weekly chart reviews for the number of medications, appropriateness of medications (a specific medication is supported by a specific diagnosis), adverse drug reactions and acute hospitalizations. An excel spreadsheet will be created by the DNP project leader to track the data and outcomes to be shared with the implementation team and stakeholders.

The purpose of this DNP quality initiative (QI) project was to implement the evidence-based STOPP/START medication reconciliation tool for prescribing and reviewing medications to reduce polypharmacy with associated adverse drug reactions (ADRs).

Methods

Context

Observation and data collection established that polypharmacy was a problem among patients in the geriatric inpatient unit of this long-term inpatient mental health hospital. A literature review produced an evidence-based medication reconciliation tool that had been shown

to reduce polypharmacy. Contextual elements considered at the outset of introducing the intervention included the culture for change as well as establishing a team that was willing to assist with implementation. An evidence-based tool (Content Assessment Index, or CAI) was identified to assess the context in which care is provided and the readiness of this context to implement evidence into practice (McCormack et al., 2009). The CAI provided clinicians with the means to assess and understand the context (setting or environment) in which they work and the effect this had on using evidence in practice (McCormick et al. 2009). The CAI focused on three elements within the practice setting as measures for change: culture, leadership, and evaluation with scores ranging from “strongly agree” to “strongly disagree” on a 1- 4 ordinal scale. The element of culture scored 89%. This was a strong indicator for clearly defined personal and professional boundaries between health care professionals (HCPs) and understanding of HCPs and support workers roles at the inpatient behavioral health hospital (IBHH). The element of leadership scored 71%. This score could be higher except there was disagreement regarding leadership as democratic and inclusive. The IBHH leadership structure was hierarchical with a chief executive officer as the head followed by a defined chain of command. This structure could have slowed down innovation and important changes due to increased bureaucracy (Schultz et al., 2013). The element of evaluation scored 70%. Medical decision making for treatment at the IBHH was based on evidence of best practice. HCPs and nursing were encouraged to use best practice in all areas of patient management.

Intervention

The STOPP/START evidence-based reconciliation tool was the intervention for this DNP QI project to reduce polypharmacy on the geriatric unit in an inpatient mental health hospital. The unit consisted of adult inpatients 65 years and older who were prescribed 5 or more daily

medications. The prescribers on the unit were the attending psychiatrist and the nurse practitioner. All the geriatric inpatients on the unit who were 65 years and older and prescribed 5 or more daily medications were included in the study.

The STOPP/START criteria are composed of a total of 114 criteria, 80 STOPP and 34 START. The 80 STOPP and 34 START criteria are grouped by a physiological system (e.g., the cardiovascular system, central nervous system) and accompanied by a short explanation of the interaction. The DNP QI project was led by the DNP student project lead (DNP-SPL) and followed a 15-week timeline. Prior to the plan implementation period, both University of Maryland Baltimore Human Research Protections Office (HRPO) and the site IRB approval were granted. All current patients on the geriatric unit who met the inclusion criteria of age 65 years and older, taking 5 or more medications daily received the intervention. Each participant was assigned an identification number with no other patient identifiers. The DNPS-PL created a Microsoft Excel spreadsheet for the STOPP/START tool with the following categories: code number, gender, age, current number of daily medications prescribed, and number of daily medications prescribed after each weekly intervention. Strategies to achieve this goal are outlined in the Implementation Action Table (Appendix G). A project implementation team was created consisting of the DNP-SPL, Supervisory Pharmacist (Champion), RN team lead on the geriatric inpatient unit, Clinical Site Representative (CSR) and a Nurse Educator. The STOPP/START was to be implemented over a 15-week period from September 2022 to November 2022.

Measures

The structure process focused on staff education and STOPP/START tool availability. The STOPP/START tool was available for every eligible geriatric inpatient. All prescribers

received education and training on use of the STOPP/START medication reconciliation tool. An education handout was developed to describe the project, its purpose and expected goals and presented to other prescribers as the project expands from the pilot study.

The process measure was 100 % compliance with use of the STOPP/START tool by prescribers for eligible geriatric inpatients. The process was measured both pre- and post-implementation and documented on a Microsoft Excel spreadsheet by the DNP-SL. The process measure was compliance with the tool by providers and the number of medication changes with the tool compared to the number of patients evaluated.

The outcome measure was 100% of geriatric patients would have no adverse drug reactions, drug interactions or acute hospitalization after STOPP/START tool implementation. A change in the prevalence rate of polypharmacy was evaluated over the 15-week implementation and disseminated through a run chart showing trends and patterns over the implementation period.

The tool was found to have reliability and validity based on the consistent use of the STOPP/START tool and data collection results. Reliability of the STOPP/START tool was established when the tool was applied at 15 weekly intervals to the same sample size yielding the same results which was identifying medications that could be stopped based on the tool criteria. The STOPP/START tool (Appendix A) was validated through 6 studies obtained through the literature review during which the tool was applied across different settings identifying inappropriate medications resulting in a reduction of medications and reducing polypharmacy (internal validity). The results were linked to reducing the number of medications that were contraindicated and should be stopped; therefore, reducing polypharmacy and improving safety (internal validity). The studies were assessed to have low risk of bias which decreases the threat

to internal validity. The tool accurately measured the number of medications that could be stopped weekly based on the tool criteria contributing to polypharmacy on the geriatric unit. The population and setting are like other units; and therefore, the results can be generalized to other units (external validity). However, the small sample size of 11 from this QI limits external validity.

The attending psychiatrist and an alternate advanced practice nurse were trained on use and application of the STOPP/START tool. The setting was an inpatient mental health hospital. The target population was geriatric inpatients age 65 or older prescribed five or more daily medications. The sample size was eleven inpatients. The implementation occurred over a 15-week period from September 2022 – November 2022. Data was recorded on the STOPP/START Screening Tool (Appendix H) and the STOPP/START Data Sheet (Appendix I) created in REDCap; a HIPAA protected server. A STOPP/START Tool Survey was created based on the evidence-based System Usability Scale (SUS) questionnaire distributed via link to all users trained for the STOPP/START tool to measure satisfaction with use of the tool (Appendix J).

Data collection occurred weekly through cross-referencing the weekly medication order printout provided by the hospital Supervisory Pharmacist with the STOPP/START Data Collection tool for the sample of eleven patients. The data extracted for analysis was coded to protect confidentiality and only the DNP-SPL had access to the identifiable raw data. To protect human subjects, no protected health information was collected during this project. The DNP-SPL reviewed data weekly and analyzed results to determine the number of recommended changes or adjustments in medications identified. To ensure that data collection procedures and methods were complete and accurate, weekly audits were completed by the DNP-SPL and reviewed with

prescribers and the CSR. This also identified medications with potential adverse drug reactions that can produce poor outcomes.

Sustainability can be achieved by integrating STOPP/START criteria into the electronic health record (EHR) and expanding the tool to other inpatient units. One idea is to condense the STOPP/START tool to focus on the most prevalent drug classifications where there was the greatest benefit, i.e., psychotropic, gastrointestinal, and renal. This will make the tool more efficient. A cost analysis can be done with assistance from the pharmacy department who is responsible for the purchase of medications to determine the savings from the reduction in medications identified by the STOPP/START tool. These cost savings could be used to develop or purchase an automated version of the STOPP/START criteria, increasing the sustainability of the project by including the screening in the routine documentation systems rather than requiring an additional process.

Ethics

All data was collected and stored without patient identifiers in REDCap, a HIPAA protected server, with access only by the DNPQI-SL. The data extracted for analysis was coded to protect confidentiality. Data collection occurred in a private area using HIPAA privacy guidelines. Training was conducted in-person, in a private area free of distractions. The project was intended for QI purposes on the geriatric unit of an inpatient mental health hospital. This project is not intended to be generalizable to other settings/populations outside this unit because it is specifically designed for an inpatient geriatric mental health population. There was a determination by the University of Maryland IRB that this DNP proposed project was approved as nonhuman subject research. In addition, organization IRB approval was given for the DNP project implementation.

Results

The post-implementation results of the STOPP/START tool showed an appreciable decrease in the total number of active medications prescribed. This is reflected in the polypharmacy run chart (Figure 1). The structure process was achieved because the STOPP/START tool was available and applied to 100% of eligible geriatric inpatients. to each patient who met the inclusion criteria for this DNP quality improvement project. The process outcome for compliance with use of the STOPP/START tool by prescribers was approximately 25% due to unforeseen circumstances resulting in prescribers not being available for most of the implementation period. The outcome process was 100% of geriatric patients had no adverse drug reactions, drug interactions or acute hospitalization after the 15-week implementation of STOP/START.

The DNP quality improvement project has been implemented over an 8-week period to date. The most frequently observed category of “gender” was female (n = 8, 72.73%). Frequencies and percentages are presented in Table 2. The average age of eligible patients is 73. The sample size is 11 throughout the 15-week implementation period. The total number of prescribed medications during the pre-implementation phase was 109. The total number of prescribed medications after the 15-week implementation period was 97. There was an 11% decrease in the total number of medications post-implementation. A total of 17 medications were stopped and 5 medications started during the 15-week implementation resulting in an overall decrease of 12 medications. Among individual inpatients, there was either a decrease or no change in the total number of medications during the 15-week implementation (Figure 2). Two participants had 3 meds stopped, three participants had one med stopped and 5 participants had zero meds stopped. There were no adverse drug reactions (ADEs), adverse drug interactions

or acute hospitalizations observed during this implementation phase. Among the STOPP/START criteria, the greatest effect in medication decreases were seen with antipsychotics, gastrointestinal and renal drug classes.

Discussion

The results show a positive benefit with use of the STOPP/START to reduce inappropriate medication prescribing and polypharmacy on an individual level. The project impact on the geriatric inpatient population and system was positive. The goal to introduce an evidence-based medication reconciliation tool to reduce inappropriate drug prescribing and polypharmacy was achieved with little to no cost to the organization. A financial analysis was not completed as part of this implementation, but there were no costs associated with obtaining the STOPP/START tool, developing data collection, and analyzing data. The benefit was a reduction in medications with no adverse drug reactions, drug interactions or acute hospitalizations which would result in decreased costs for total medications and cost savings related no Hospitalizations related to medication adverse events.

The findings from the literature review supported the prevalence of polypharmacy and the STOPP/START tool as an evidence-based intervention for reducing polypharmacy in older adults. The comparison of results between the studies from the literature review and the 15-week implementation of STOPP/START was the same with regards to a reduction in inappropriate medication prescribing and polypharmacy (Earl, T. R et. al, (2020), Rankin, A (2018), Hill-Taylor, B (2016), Boland, B., (2016).

The project design was straightforward and required no adjustments. The STOPP/START data collection tool and data collection sheet were not changed or revised during the 15-week implementation and was assessed weekly to the sample size producing consistent results when

applied at different intervals; therefore, supporting the reliability of the tool. The goal of 100% compliance among prescribers was not met in terms of all prescribers but 100% percent of geriatric patients did receive the intervention weekly without interruption. Limitations included the lack of availability of one of the prescribers to utilize the tool, the small sample size, and low patient turnover decreasing the need to stop or start medications. The greatest decrease in the total number of medications occurred during the first 1-3 weeks of the implementation. Due to the low patient turnover and chronic comorbidities, once the initial medications were decreased, there were no changes in the medical comorbidities that required further changes in medication prescribing.

Conclusion

Medication reconciliation can reduce inappropriate prescribing and polypharmacy in the geriatric inpatient mental health setting. STOPP/START tool is effective for identifying medications with potential adverse effects on the geriatric inpatient mental health setting. The strengths of this project were improving medication safety and reducing health care costs with little to no expenditures to implement. Other strengths of this project were stakeholder buy-in and support for the project, early identification of champions and facilitators and immediately identifying and resolving barriers to completion. There was an increased awareness and sensitivity among prescribers, nurses, and clinical staff to address polypharmacy in the clinical setting and that the clinical staff is essential to prevent polypharmacy through medication reconciliation.

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Table 1

Evidence Review Table

Boland, B., Guignard, B., Dalleur, O., & Lang, P.-O. (2016). Application of stopp/start and beers criteria: Compared analysis on identification and relevance of potentially inappropriate prescriptions. <i>European Geriatric Medicine</i> , 7(5), 416–423. https://doi.org/10.1016/j.eurger.2016.03.010					<p>Level and Quality</p> <p>Level III-A</p> <p>(JHNEBP, 2022)</p>
Purpose/ Hypothesis	Type of Evidence Research Design	Sample – Population, Size, Setting	Intervention/Procedures	Primary Outcome/Measures	Results/Conclusions
To compare Beers (2003, 2012) and STOPP/START version1 (v1) and v2 in terms of impact on the incidence of <u>potentially inappropriate prescribing</u> (PIP) medication (including prescribing omission), <u>polypharmacy</u> , and clinical relevance of medication changes.	Retrospective cohort study	Twenty patients were randomly selected from a list of patients admitted to acute geriatric medicine. N =20 (10%) patients over age 65 (76.7 + 5.4 years, 55% female) from an acute geriatric medicine floor selected randomly from 200 consecutive admissions.	Four experts (2 <u>geriatricians</u> and 2 pharmacists) independently reviewed the medication regimen using the four tools. They reported the detected potentially inappropriate medications (PIM) and prescribing omissions (PPO), and level of clinical relevance of each modification (major, moderate, minor, or unfavorable).	The twenty patients (76.7 ± 5.4 years, 55% women) were prescribed 173 chronic daily medications (median 9.5). As compared to Beers 2003 and 2012, STOPP.v1 and v2 led to more decisions to withdraw PIM (18 and 26 vs. 38 and 70). START.v1 and v2 also recommended PPO-related prescriptions (21 and 29). The use of each of the four lists significantly decreased the mean number of medications (8.7 ± 2.8) as follows: Beers 2003 (7.7 ± 2.8), STOPP/START.v1 (8.1 ± 2.3), Beers 2012 (7.2 ± 2.8), and STOPP/START.v2 (6.4 ± 1.9). Medication modifications of major relevance were more frequent according to STOPP/START.v1 and v2 (25 and 41) as compared to	The number of medications was most reduced by STOPP/START.v2 even after considering PPO-related prescribing. In addition, STOPP/START.v2 identified more instances of potential major clinical relevance.

				Beers 2003 and 2012 (6 and 14).	
Earl, T. R., Katapodis, N. D., Schneiderman, S. R., & Shoemaker-Hunt, S. J. (2020). Using deprescribing practices and the screening tool of older persons' potentially inappropriate prescriptions criteria to reduce harm and preventable adverse drug events in older adults. <i>Journal of Patient Safety</i> , 16(3). https://pubmed.ncbi.nlm.nih.gov/32809998/					<p>Level and Quality</p> <p>Level II-A</p> <p>(JHNEBP, 2022)</p>
Purpose/ Hypothesis	Type of Evidence Research Design	Sample – Population, Size, Setting	Intervention/Procedures	Primary Outcome/Measures	Results/Conclusions
To examine the deprescribing interventions to reduce polypharmacy with use of the Screening Tool of Older Persons' Potentially Inappropriate Prescriptions (STOPP)	Systematic review	<p>Sampling Technique: 26 studies including randomized control trials (RCTs), feasibility studies, intervention studies, a cost study, a pilot study and 1 systemic review met inclusion criteria and evaluated interventions related to deprescribing or use of the STOPP criteria. See Figure 1 PRISMA</p> <p>Population: Adults 65 years and older</p> <p>Setting: Inpatient long-term care facilities and outpatient primary care across various countries and the United States</p> <p>Size: Deprescribing studies: ranged from 40 to 490 participants.</p>	<p>Control: Control groups varied. 5 of the deprescribing literature were randomized control trials (RCTs) and 3 of the STOPP literature were RCTs.</p> <p>Intervention: Intervention groups varied based on the 8 RCTs identified. Studies evaluated a range of interventions, from protocols and clinical decision support tools to patient education and medication reviews.</p> <p><u>Intervention fidelity</u> Most of the deprescribing interventions were delivered by pharmacists in consult or collaboration with providers or conducted by providers themselves. 3 studies focused on the use of protocols, algorithms, and clinical decision support systems to promote deprescribing. Two</p>	<p>DV: Reducing polypharmacy and preventable ADEs in older adults were the dependent variables throughout the RCTs.</p> <p>Various instruments used include Shed-MEDS for deprescribing, the Medication Appropriateness Index, the Assessment of Underutilization index to measure the STOPP intervention, clinical decision support tools, educational interventions and medication reviews by pharmacists and providers.</p>	<p>Statistical Results Deprescribing studies showed the number of adverse drug reactions decreased by 4.24 (P<0/05) after 6 months. Pharmacist-led medication review interventions using the Beers Criteria resulted in a decrease in drug-related problems from 1.73 to 1.31 (P<0.05). There was a larger reduction in the number of medications prescribed in the intervention group (P<0.046). Clinician led reviews led to an average reduction of total medications from 16.64 to 15.53 (P<0.001), average number of scheduled medications from 111.3 to 10.99 (P<0.001), average number of PRN medications from 5.33 to 4.56 (P<0.001) and average number of high-risk medications from 5.33 to 4.56 (P<0.001). Combined pharmacist and clinician led studies lead to a mean decrease in chronic</p>

		<p>STOPP studies: range 52 to 1579 participants</p> <p>Setting: Varied, but most of the deprescribing interventions were in long-term care facilities, community pharmacies, inpatient hospital geriatric units, hospital outpatient departments and hospital discharges.</p> <p># Eligible: 114 (Deprescribing to Reduce Polypharmacy)</p> <p>80 (Using STOPP Criteria to Reduce Polypharmacy)</p> <p># Accepted: 14 (Deprescribing to Reduce Polypharmacy)</p> <p>12(Using STOPP Criteria to Reduce Polypharmacy))</p> <p># In control: Varied based on several different RCTs (8 total)</p> <p># In intervention: Studies evaluated a range of interventions, from protocols and clinical decision support tools to patient education and medication reviews.</p>	<p>pharmacist-led medication review interventions across several settings involved deprescribing. There was one clinician-led medication review study using an updated Beers criterion. Two studies combined both pharmacist and clinician medication review.</p> <p>STOPP interventions integrated STOPP criteria into medication reviews as part of the usual checkups and geriatric assessments. The STOPP interventions were completed by pharmacists or providers during medication reviews.</p>		<p>medications from 9.0 to 8.6(P<0.05)</p> <p>STOPP interventions overall resulted in a reduction of potentially inappropriate medications based on acceptance rates from pharmacist recommendations. In one study, the STOPP tool used by pharmacists found 27% of the IG prescriptions potentially inappropriate resulting in 43% being discontinued, 33% receiving dose adjustment, 14% receiving a substitution and 10% receiving a new prescription. However, the data is not conclusive.</p> <p><u>Clinical Significance</u> Deprescribing interventions were often found to significantly reduce polypharmacy in this systematic review. Medication reviews involving both pharmacists and clinicians effectively decreased medication use, but not in all studies. The strength of the evidence for STOPP was limited by the study design.</p> <p>Conclusions Deprescribing interventions and STOPP interventions can be useful in reducing</p>
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		<p>Power analysis: Not applicable for SR but specific for each individual RCT included.</p> <p>Group Homogeneity: Adults 65 years or older, no other demographic information is provided.</p>			polypharmacy, but more controlled studies need to be done to determine clinical significance and implementation.
<p>Hill-Taylor, B., Walsh, K. A., Stewart, S., Hayden, J., Byrne, S., & Sketris, I. S. (2016). Effectiveness of the stopp/start (screening tool of older persons' potentially inappropriate prescriptions/screening tool to alert doctors to the right treatment) criteria: Systematic review and meta-analysis of randomized controlled studies. <i>Journal of Clinical Pharmacy and Therapeutics</i>, 41(2), 158–169. https://doi.org/10.1111/jcpt.12372</p>					<p>Level and Quality</p> <p>Level II-B</p> <p>(JHNEBP, 2022)</p>
Purpose/ Hypothesis	Type of Evidence Research Design	Sample – Population, Size, Setting	Intervention/Procedures	Primary Outcome/Measures	Results/Conclusions
<p>To update a 2013 systematic review that showed limited evidence of impact using STOPP/START tool to identify potentially inappropriate prescribing (PIP) in older adults using new evidence from randomized controlled trials (RCTs).</p>	<p>Systematic review based on previous review from 2013 which included studies from 2007 - 2012</p>	<p>N= 4 RCTs (n= 1925 adults) from four countries, reporting both acute (n=2) and long-term care (n=2) patients.</p>	<p>Search of PubMed, EMBASE, CINAHL, Web of Science and grey literature for RCTs published in English since the previous review through June 2014. The Cochrane Risk of Bias Tool was used. A meta-analysis on the effect of STOPP on potentially inappropriate medication (PIM) rates and a narrative synthesis on other outcomes.</p>	<p>Studies differed in implementation. Two studies were judged to have low risk, and two to have moderate-to-high risk of bias. Meta-analysis found that the STOPP criteria reduced PIM rates in all four studies, but study heterogeneity (I (2) = 86.7%) prevented the calculation of a meaningful statistical summary. Evidence that uses of the criteria reduce falls, delirium episodes, hospital length-of-stay, care visits (primary and emergency) and medication costs, but no evidence of improvements in quality of life or mortality.</p>	<p>STOPP/START may be effective in improving prescribing quality, clinical, humanistic, and economic outcomes. Additional research investigating these tools is needed, especially in frail elderly and community-living patients receiving primary care.</p>

<p>Khezrian, M., McNeil, C. J., Murray, A. D., & Myint, P. K. (2020). An overview of prevalence, determinants, and health outcomes of polypharmacy. <i>Therapeutic Advances in Drug Safety</i>, 11, 204209862093374. https://doi.org/10.1177/2042098620933741</p>					<p>Level and Quality</p> <p>Level IV-C</p> <p>(JHNEBP, 2022)</p>
Purpose/ Hypothesis	Type of Evidence Research Design	Sample – Population, Size, Setting	Intervention/Procedures	Primary Outcome/Measures	Results/Conclusions
<p>To appraise and summarize studies published about polypharmacy to define, identify determinants and prevalence of polypharmacy and effect on health outcomes in older adults.</p>	<p>Narrative literature review of systematic reviews and original studies between 2003 and 2018 with original studies in English</p>	<p>The exact number of studies reviewed between 2003 and 2018 is not stated. Settings included the United States, UK, Scotland, Switzerland, Sweden, Italy, Belgium, Korea, Germany, and Taiwan</p>	<p>Search of MEDLINE using search terms “polypharmacy” (and its variations, i.e., multiple prescriptions, inappropriate drug use) in titles. Studies selected aimed to address definition of polypharmacy prevalence, determinants, and outcomes. For health outcomes, articles that reported on the association of polypharmacy and frailty, hospitalization and mortality were selected.</p>	<p>The prevalence of polypharmacy varied between 10% and 90% in different populations. Chronic conditions, demographics, socioeconomics, and self-assessed health factors were independent predictors of polypharmacy. In a Taiwan study, a dose-response relation was found between polypharmacy and hospital admissions. A Scottish study reported that 11% of unplanned hospital admissions were related to harm from medicines with 50% of these preventable. 47 studies demonstrated a significant association between mortality and polypharmacy</p>	<p>Polypharmacy was associated with various adverse outcomes after adjusting for health conditions. Optimizing care for polypharmacy with valid reliable measures will improve the health outcomes of older adults. The association of polypharmacy and poor outcomes could represent that polypharmacy is a marker for increased risk of poor outcomes.</p>
<p>O'Connor, M. N., O'Sullivan, D., Gallagher, P. F., Eustace, J., Byrne, S., & O'Mahony, D. (2016). Prevention of hospital-acquired adverse drug reactions in older people using screening tool of older persons' prescriptions and screening tool to alert to right treatment criteria: A cluster randomized controlled trial. <i>Journal of the American Geriatrics Society</i>, 64(8), 1558–1566. https://doi.org/10.1111/jgs.14312</p>					<p>Level and Quality</p> <p>Level I-A</p> <p>(JHNEBP, 2022)</p>
Purpose/ Hypothesis	Type of Evidence Research Design	Sample – Population, Size, Setting	Intervention/Procedures	Primary Outcome/Measures	Results/Conclusions
<p>To determine whether use of the Screening Tool of</p>	<p>Single-blind cluster randomized controlled trial (RCT) of unselected</p>	<p>Tertiary referral hospital in southern Ireland.</p>	<p>Single time point presentation to attending physicians of potentially inappropriate</p>	<p>The primary outcome was the proportion of participants experiencing</p>	<p>One or more ADRs occurred in 78 of the 372 control participants (21.0%; median</p>

<p>Older Persons' Prescriptions (STOPP) and Screening Tool to Alert to Right Treatment (START) criteria reduces incident hospital-acquired adverse drug reactions (ADRs), 28-day medication costs, and median length of hospital stay in older adults admitted with acute illness.</p>	<p>older adults hospitalized over a 13-month period.</p>	<p>Consecutively admitted individuals aged 65 and older (N = 732)</p>	<p>medications according to the STOPP/START criteria.</p>	<p>one or more ADRs during the index hospitalization. Secondary outcomes were median length of stay (LOS) and 28-day total medication cost.</p>	<p>age 78, interquartile range (IQR) 72-84) and in 42 of the 360 intervention participants (11.7%; median age 80, IQR 73-85) (absolute risk reduction = 9.3%, number needed to treat = 11). The median LOS in the hospital was 8 days (IQR 4-14 days) in both groups. At discharge, median medication cost was significantly lower in the intervention group (€73.16, IQR €38.68-121.72) than in the control group (€90.62, IQR €49.38-162.53) (Wilcoxon rank test Z statistic = -3.274, P < .001). Application of STOPP/START criteria resulted in significant reductions in ADR incidence and medication costs in acutely ill older adults but did not affect median LOS.</p>
<p>Rankin, A., Cadogan, C., Patterson, S., Kerse, N., Cardwell, C., Bradley, M., Ryan, C., & Hughes, C. (2018). Interventions to improve the appropriate use of polypharmacy for older people. <i>Cochrane Database of Systematic Reviews</i>, 2018(9). https://pubmed.ncbi.nlm.nih.gov/30175841/</p>					<p>Level and Quality Level II-B (JHNEBP, 2022)</p>
<p>Purpose/ Hypothesis</p>	<p>Type of Evidence Research Design</p>	<p>Sample – Population, Size, Setting</p>	<p>Intervention/Procedures</p>	<p>Primary Outcome/Measures</p>	<p>Results/Conclusions</p>
<p>The purpose of this review was to determine which interventions are effective in improving the appropriate use of</p>	<p>Systematic review. Three reviewers independently screened titles and abstracts identified in searches to assess which studies met</p>	<p>Sampling Technique: 32 studies consisting of 18 randomized trials, 10 cluster randomized trials, two non-randomized trials and two controlled before-after</p>	<p>Control: Varied based on type of study. 18 RCTs and 10 cluster RCTs. Intervention: All types of interventions aimed at improving</p>	<p>DV: Reduction in polypharmacy Reduction in Validated measures of inappropriate prescribing (such as criteria, Medication</p>	<p>Statistical Results: It is uncertain whether pharmaceutical care improves medication appropriateness (as measured by an implicit tool), mean difference (MD) -4.76, 95% CI -9.20 to -0.33; 5</p>

<p>polypharmacy and reducing medication-related problems in older people.</p>	<p>the inclusion criteria of the review.</p>	<p>studies. See Figure 1 PRISMA</p> <p>Setting: The included studies were carried out in 12 high-income countries: Australia, Belgium, Canada, Finland, Germany, Hong Kong, Ireland, Israel Italy, Spain, Sweden, and the United States. The location included hospital inpatient, hospital outpatient clinics, primary care settings, and nursing homes.</p> <p>Population: Adults aged 65 years and older, who had more than one long-term medical condition and were receiving polypharmacy (classified as four or more medicines. This included a prescribed medication (one that is scheduled or part of a repeat prescription and does not include over the counter and herbal products) and included studies targeting patient groups in which polypharmacy was common practice, such as patients with Parkinson’s disease or diabetes.</p> <p>Size: 28,672 participants were included in this review.</p>	<p>appropriate polypharmacy in any setting (such as pharmaceutical care) compared with usual care (as defined by the study). Uni-faceted interventions, for example, those targeted solely at drug prescriptions, and multi-faceted interventions, for example, specialist clinics involving comprehensive geriatric assessment were reviewed. Studies of interventions for which the target was polypharmacy provided results for those aged 65 years and older. were available separately. We examined all types of interventions as set out by the most recent.</p> <p><u>Intervention fidelity</u> Thirty-one studies examined complex, multi-faceted interventions of pharmaceutical care in a variety of settings. One uni-faceted study examined computerized decision support (CDS) provided to GPs in their own practices. Pharmaceutical care was commonly provided by pharmacists working closely with other healthcare professionals in a variety of settings. In hospital settings,</p>	<p>Appropriateness Index (MAI), STOPP/START criteria or Assessing Care of Vulnerable Elderly (ACOVE) were the main outcome measures considered in the review. Studies in which medication appropriateness was determined solely by expert opinion (i.e., no measures/tools were used) were excluded.</p>	<p>studies, N = 517; very low-certainty evidence). It is uncertain whether pharmaceutical care reduces the number of potentially inappropriate medications (PIMs), (standardized mean difference (SMD) -0.22, 95% CI -0.38 to -0.05; 7 studies; N = 1832; very low-certainty evidence). It is uncertain whether pharmaceutical care reduces the proportion of patients with one or more PIMs, (risk ratio (RR) 0.79, 95% CI 0.61 to 1.02; 11 studies; N = 3079; very low-certainty evidence). Pharmaceutical care may slightly reduce the number of potential prescribing omissions (PPOs) (SMD -0.81, 95% CI -0.98 to -0.64; 2 studies; N = 569; low-certainty evidence), however it must be noted that this effect estimate is based on only two studies, which had serious limitations in terms of risk bias. Likewise, it is uncertain whether pharmaceutical care reduces the proportion of patients with one or more PPOs (RR 0.40, 95% CI 0.18 to 0.85; 5 studies; N = 1310; very low-certainty evidence). Pharmaceutical care may make little or no difference in hospital admissions (data not pooled; 12 studies; N = 4052;</p>
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		<p># Eligible: 32 eligible studies</p> <p># Accepted: 32 studies (18 RCTs, 10 cluster RCTs, 2 non-randomized trials and 2 controlled before-after studies)</p> <p># In control: Varied based on several different RCTs (8 total)</p> <p># In intervention: Studies evaluated a range of interventions, from protocols and clinical decision support tools to patient education and medication reviews.</p> <p>Power analysis: Not applicable for systematic review but specific for each individual RCT included.</p> <p>Group Homogeneity: Majority of participants were female (64.4%) and had a mean age of 72.8 years. In those studies where ethnicity was reported (five studies, N = 8710), most participants were white. All study participants had more than one long-term medical condition, which included asthma, diabetes, dyslipidemia, hypertension,</p>	<p>pharmacists worked as part of a multi- disciplinary team in outpatient. in inpatient services on hospital wards as a clinical pharmacy service or as part of the hospital discharge process in community settings, pharmaceutical care services, including medication reviews, patient interviews, and counselling, were provided by different healthcare professionals. These included pharmacists working in community-based family medicine clinics or within primary care centers and nurses/healthcare assistants. In nursing homes, interventions involved multi-disciplinary case conferences combined with staff education provided by pharmacists, medication reviews by the study pharmacists and discussed with the chief physician (training sessions for staff, and a drug therapy management service</p>		<p>low-certainty evidence). Pharmaceutical care may make little or no difference in quality of life (data not pooled; 12 studies; N = 3211; low-certainty evidence). Medication-related problems were reported in eight studies (N = 10,087) using different terms (i.e., adverse drug reactions, drug-drug interactions). No consistent intervention effect on medication-related problems was noted across studies.</p> <p><u>Clinical Significance</u> The evidence obtained when results of these studies were combined is weak, and it is uncertain whether interventions provided to improve appropriate polypharmacy, such as pharmaceutical care, resulted in clinically significant.</p> <p>Conclusions: Overall, the quality of the studies in this review was poor, and further research should focus on study design. More research is needed to test whether existing tools for comprehensive medication review can improve appropriate polypharmacy.</p>
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		cardiovascular disease (including congestive heart failure) and dementia.			
<p>Romskaug, R., Skovlund, E., Straand, J., Molden, E., Kersten, H., Pitkala, K. H., Lundqvist, C., & Wyller, T. B. (2020). Effect of clinical geriatric assessments and collaborative medication reviews by geriatrician and family physician for improving health-related quality of life in home-dwelling older patients receiving polypharmacy. <i>JAMA Internal Medicine</i>, 180(2), 181. https://pubmed.ncbi.nlm.nih.gov/31617562/</p>					<p>Level and Quality</p> <p>Level 1-A</p> <p>(JHNEBP, 2022)</p>
Purpose/ Hypothesis	Type of Evidence Research Design	Sample – Population, Size, Setting	Intervention/Procedures	Primary Outcome/Measures	Results/Conclusions
<p>The purpose of this study was to investigate the effect of geriatric assessments and medication reviews by a geriatrician and family physician (FP) on quality of life and patient-relevant outcomes in home-dwelling older patients receiving polypharmacy.</p>	<p>Research: Single blind cluster randomized clinical trial (RCT)</p>	<p>Sampling Technique: Non-probability, convenient sampling for FP recruitment. Probability cluster sampling for patients at the FP level</p> <p>Population: Home-dwelling patients 70 years or older take ≥ 7 medications regularly administered by a home nursing service.</p> <p>Size: 84 FPs 355 patients</p> <p>Setting: Akershus and Oslo, Norway</p> <p># Eligible: 70 FPs, 192 patients # Accepted: 70 FPs, 174 patients # In control: 34 FPs, 87 patients # In intervention:</p>	<p>Control: Participants in the control group (CG) received usual care.</p> <p>Intervention The intervention consisted of 3 parts: (1) geriatric assessment combined with review of medications; (2) meeting between geriatrician and the FP; and (3) clinical follow-up.</p> <p><u>Intervention fidelity</u> Assessments were completed by a physician trained in geriatric medicine, supervised by a senior consultant. One hour was allotted for each consultation. A meeting between the geriatrician and FP with discussion of each medication followed establishing a collaborative plan for adjustments and follow-up. Approximately 15</p>	<p>DV: HRQoL, number of medications</p> <p>A 15D instrument was used to assess mobility, vision, hearing, breathing, sleeping, eating, speech, elimination, mental function, discomfort/symptoms, depression, distress, vitality, and sexual activity. Each dimension was rated on an ordinal scale with 5 levels with higher scores indicating better HRQoL. A change of ±0.015 or more was considered clinically important. Scores were calculated at 16 weeks and 24 weeks performed by a statistician blinded to group allocation. A secondary outcome was the appropriateness of drug regimens assessed by the Medication Appropriateness</p>	<p>Statistical Results: The mean 15D instrument score at baseline was 0.708 (0.121) in the IG and 0.714 (0.113) in the CG. At week 16, the mean (SD) 15D instrument score was 0.698 (0.164) in the IG and 0.655 (0.184) in the CG with an estimated between group difference of 0.045 (95% CI, 0.004-0.086; p=.03). The mean score decreased in both groups. At week 24, the mean (SD) 15D instrument score was 0.675(0.186) in the IG group and 0.620 (0.216) in the CG with an estimated between-group difference of 0.052(95%CI, -0.002 to 0.105; p=.06). The mean score decreased again in both groups.</p> <p>Medication appropriateness improved in the IG compared with the CG at 16 weeks and 24 weeks (Table 2) as</p>

		<p>36 FPs, 87 patients</p> <p>Power analysis: 0.80 for a two-sided test; Effect size 0.5</p> <p>Group Homogeneity: Mean age 83.3, 67.8% female. See Table 1.</p>	<p>minutes was allotted for each patient discussion. A clinical follow-up by the geriatrician or FP. The primary outcome was health related quality of life (HRQoL)</p>	<p>Index and the Assessment of Underutilization, physical functioning assessed by the Short Physical Performance Battery, gait speed and grip strength, cognitive functioning as assessed by the Digit Span Forward and Digit Span Backward, Trail Making Test A and Trail Making Test B and Five Digits Test; and physical and cognitive disability assessed by the Functional Independence Measure. Orthostatic blood pressures, falls, weight, hospital admissions, the number of days the patient spent in his/her own home during follow-up, use of home nursing service, admission to permanent institutional care and mortality were also assessed. Statistical analyses were performed with software programs including SPSS and Stata.</p>	<p>measured by the Medication Appropriateness Index and the Assessment of Underutilization instrument. There were more reduced dosages, drug withdrawals and new drug regimens started in the IG group from baseline to week 16, but no differences between groups from week 16 to week 34.</p> <p><u>Clinical Significance</u> Medication appropriateness improved in the IG group compared to the CG. The intervention group experienced more reduced dosages and drug withdrawals.</p> <p>Conclusions: In older, home-dwelling patients exposed to polypharmacy, clinical geriatric assessments and comprehensive drug reviews (medication reconciliation) may be beneficial in reducing polypharmacy and improving quality of life.</p>
<p>Young, E. H., Pan, S., Yap, A. G., Reveles, K. R., & Bhakta, K. (2021). Polypharmacy prevalence in older adults seen in United States physician offices from 2009 to 2016. <i>PLOS ONE</i>, 16(8). https://doi.org/10.1371/journal.pone.0255642</p>					<p>Level and Quality</p> <p>Level III-A</p> <p>(JHNEBP, 2022)</p>
<p>Purpose/ Hypothesis</p>	<p>Type of Evidence Research Design</p>	<p>Sample – Population, Size, Setting</p>	<p>Intervention/Procedures</p>	<p>Primary Outcome/Measures</p>	<p>Results/Conclusions</p>

<p>To describe the prevalence of polypharmacy and high-risk medication prescribing in U.S. physician offices.</p>	<p>This was a cross-sectional study of the Centers for Disease Control and Prevention’s National Ambulatory Medical Care Survey (NAMCS) from 2009 to 2016.</p>	<p>All patients over 65 years old during their visit in the NAMCS from 2009 to 2016 were included in this study. The NAMCS utilizes a sample of visits within non-federal employed office-based outpatient physicians (e.g., private practice and free-standing clinics) in the U.S. Providers in this survey are assigned to a one-week reporting period, where information is collected on patient demographics, diagnoses, medications ordered or provided, any diagnostic procedures performed, and future treatment plans. From 2009 to 2013, the database contains a total of three diagnoses and 8 to 10 medications collected for each patient visit. From 2014 to 2016, these were expanded to five diagnoses and 30 medications. Over 2 billion patient visits were included.</p>	<p>Polypharmacy was categorized as no polypharmacy (< 2 medications), minor polypharmacy (2–3 medications), moderate polypharmacy (4–5 medications), and major polypharmacy (>5 medications). Medications were further categorized into high-risk medication categories (anticholinergics, cardiovascular agents, central nervous system (CNS) medications, pain medications, and others). Comparisons between the degrees of polypharmacy were performed utilizing chi-square or Wilcoxon rank-sum tests with JMP Pro 14® (SAS Institute, Cary, NC).</p>	<p>Patients who exhibited a higher degree of polypharmacy (i.e., major polypharmacy) had a documented high-risk medication prescribed compared to those exhibiting fewer polypharmacy (i.e., minor, and moderate polypharmacy). Overall, 703.0 per 1,000 patient rate visits with major polypharmacy had a documented high-risk medication prescribed. This rate declined with less severe forms of polypharmacy (moderate polypharmacy, 456.9 per 1,000, minor polypharmacy, 267.6 per 1,000, and no polypharmacy, 42.1 per 1,000). Additionally, pain medications were the most frequently ordered medication class overall, as well as in patients who exhibited major polypharmacy (477.3 per 1,000 patient visits), followed by CNS medications (185.8 per 1,000), and cardiovascular agents (182.4 per 1,000). In patients exhibiting moderate polypharmacy, CNS medications were the most frequently prescribed (97.6 per 1,000), followed by</p>	<p>Polypharmacy was common (65.1%): minor polypharmacy (16.2%), moderate polypharmacy (12.1%), and major polypharmacy (36.8%). Patients with major polypharmacy were older compared to those with moderate or minor polypharmacy (75 vs. 73 years, respectively) and were most frequently prescribed pain medications (477.3 per 1,000 total visits). NSAIDs were the most frequently prescribed, with 232.4 per 1,000 total visits resulting in one high-risk NSAID prescription, while 21.9 per 1,000 total visits resulted in two or more high-risk NSAIDs.</p> <p>Most patients over 65 years experienced some degree of polypharmacy, with many experiencing major polypharmacy. This indicates an increased need for expanded pharmacist roles through medication therapy management and safety monitoring in this patient population.</p>
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				<p>cardiovascular agents (85.7 per 1,000) and other high-risk medications (44.7 per 1,000). Like major polypharmacy, pain medications were the most frequently prescribed medication class in patients exhibiting minor polypharmacy (130.2 per 1,000), followed by CNS medications (64.8 per 1,000) and cardiovascular agents (29.9 per 1,000). Lastly, pain medications (16.8 per 1,000), CNS medications (9.1 per 1,000), and other medications (4.5 per 1,000) were the most frequently prescribed in patients with no polypharmacy.</p>	
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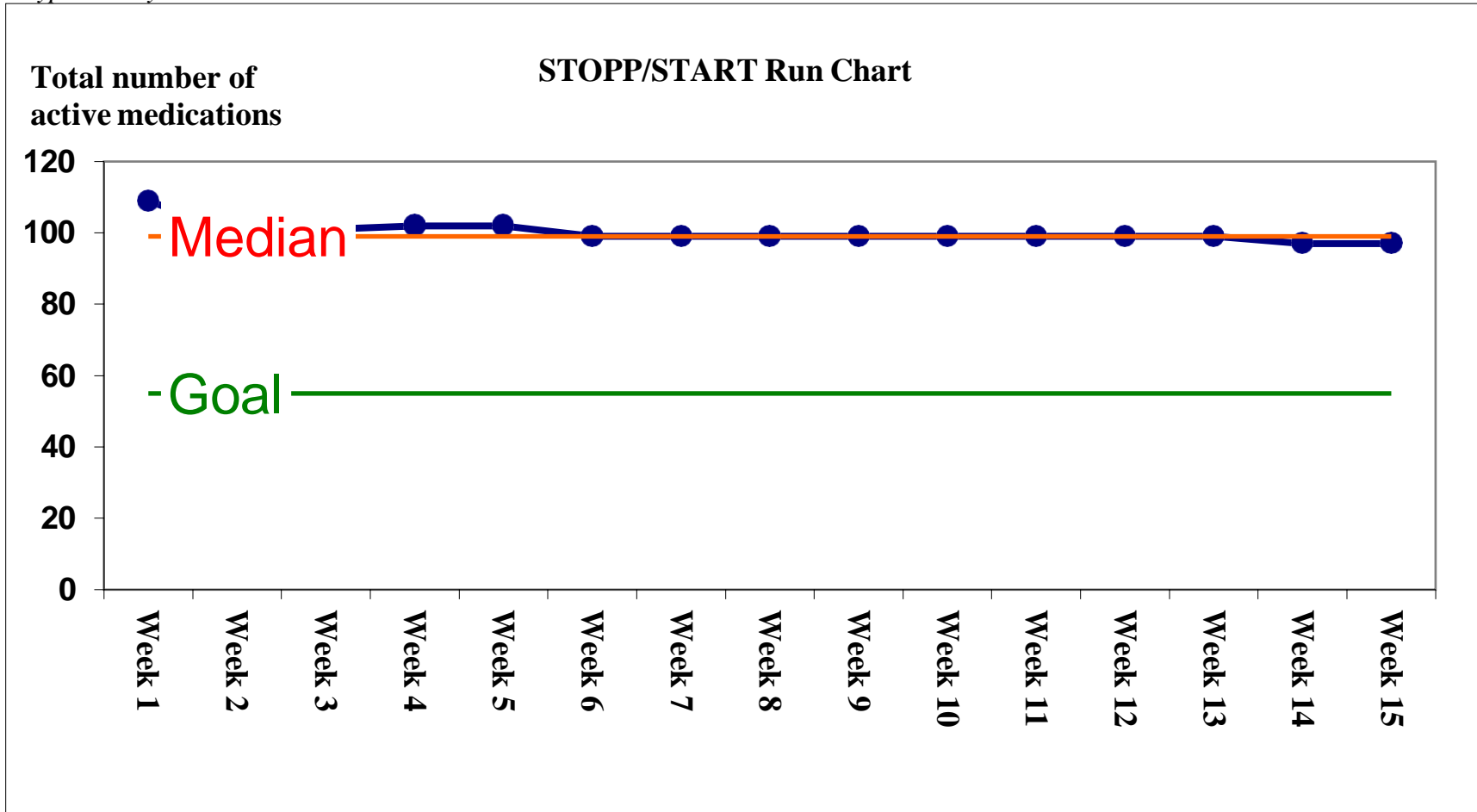
Table 2*Frequency Table for Nominal Variables*

Variable	<i>n</i>	%	Cumulative %
GENDER			
FEMALE	8	72.73	72.73
MALE	3	27.27	100.00

Note. N=11. The average age of eligible participants is 73.36

Figure 1

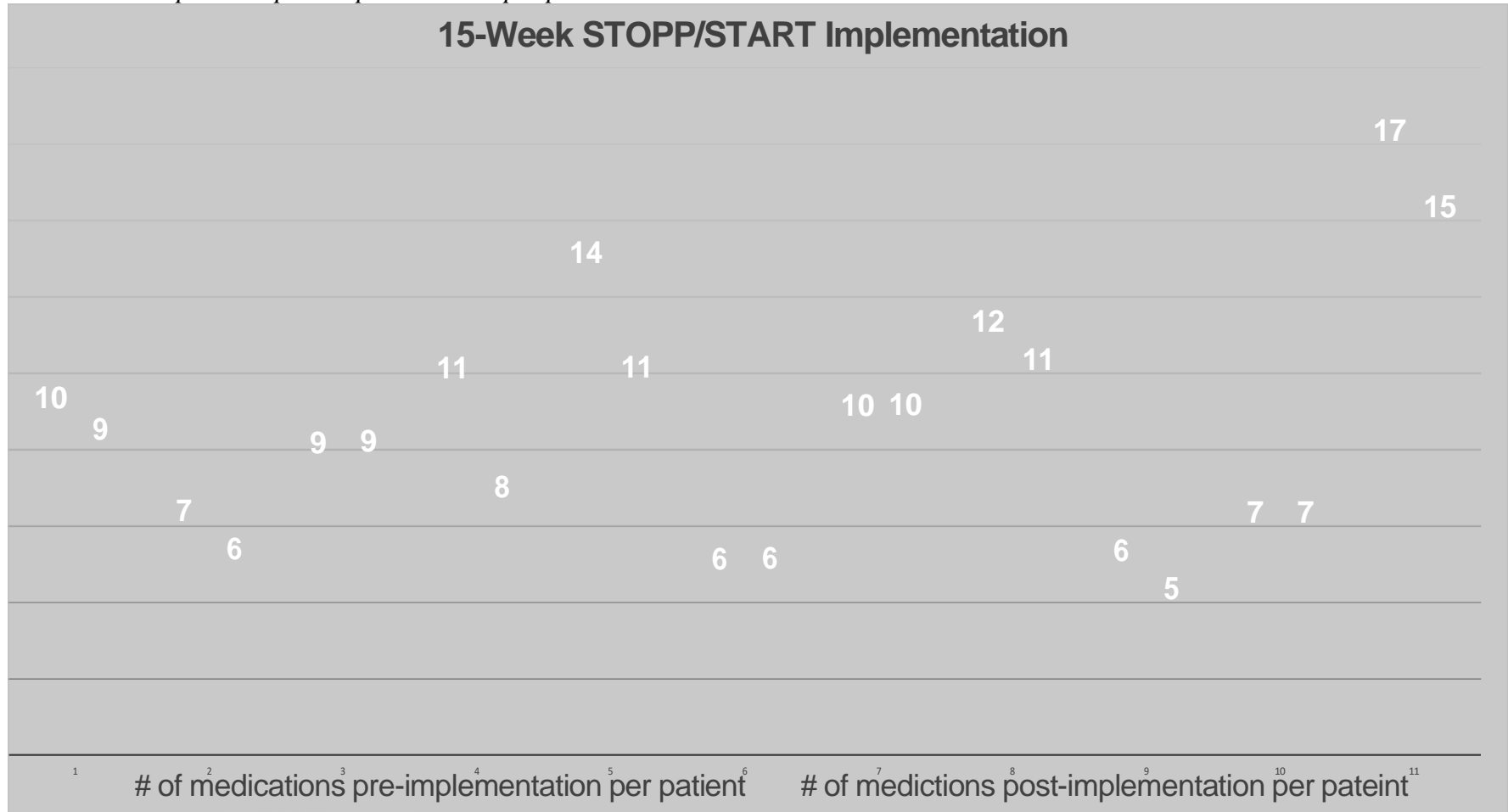
Polypharmacy run chart



Note: The tool was applied at weekly intervals over a 15-week period.

Figure 2

STOPP/START pre- and post-implementation per patient



Note: N=11. The participants each received the intervention across a 15 weekly intervals.

Appendix A

Screening Tool of Older Persons' Prescriptions (STOPP), version 2

The following prescriptions are potentially inappropriate to use in patients aged 65 years and older (Mahony et al., 2015).

Section A: Indication of medication

1. Any drug prescribed without an evidence-based clinical indication.
2. Any drug prescribed beyond the recommended duration, where treatment duration is well defined.
3. Any duplicate drug class prescription e.g., two concurrent NSAIDs, SSRIs, loop diuretics, ACE inhibitors, anticoagulants (optimization of monotherapy within a single drug class should be observed prior to considering a new agent).

Section B: Cardiovascular System

1. Digoxin for heart failure with normal systolic ventricular function (no clear evidence of benefit).
2. Verapamil or diltiazem with NYHA Class III or IV heart failure (may worsen heart failure). 3. Beta-blocker in combination with verapamil or diltiazem (risk of heart block).
4. Beta blocker with bradycardia ($< 50/\text{min}$), type II heart block or complete heart block (risk of complete heart block, asystole).
5. Amiodarone as first-line antiarrhythmic therapy in supraventricular tachyarrhythmias (higher risk of side-effects than beta-blockers, digoxin, verapamil, or diltiazem).
6. Loop diuretic as first-line treatment for hypertension (safer, more effective alternatives available).
7. Loop diuretic for dependent ankle oedema without clinical, biochemical evidence or radiological evidence of heart failure, liver failure, nephrotic syndrome, or renal failure (leg elevation and /or compression hosiery usually more appropriate).
8. Thiazide diuretic with current significant hypokalemia (i.e., serum $\text{K}^+ < 3.0 \text{ mmol/l}$), hyponatremia (i.e., serum $\text{Na}^+ < 130 \text{ mmol/l}$) hypercalcemia (i.e., corrected serum calcium $> 2.65 \text{ mmol/l}$) or with a history of gout (hypokalemia, hyponatremia, hypercalcemia, and gout can be precipitated by thiazide diuretic).

9. Loop diuretic for treatment of hypertension with concurrent urinary incontinence (may exacerbate incontinence).
10. Centrally acting antihypertensives (e.g., methyldopa, clonidine, tolondine, tiamenidine, guanfacine), unless clear intolerance of, or lack of efficacy with, other classes of antihypertensives (centrally active antihypertensives are generally less well tolerated by older people than younger people).
11. ACE inhibitors or Angiotensin Receptor Blockers in patients with hyperkalemia.
12. Aldosterone antagonists (e.g., spironolactone, eplerenone) with concurrent potassium-conserving drugs (e.g., ACEI's, ARB's, amiloride, triamterene) without monitoring of serum potassium (risk of dangerous hyperkalemia i.e., > 6.0 mmol/l – serum K should be monitored regularly, i.e., at least every 6 months).
13. Phosphodiesterase type-5 inhibitors (e.g., sildenafil, tadalafil, vardenafil) in severe heart failure characterized by hypotension i.e., systolic BP < 90 mmHg, or concurrent nitrate therapy for angina (risk of cardiovascular collapse).

Section C: Antiplatelet/Anticoagulant Drugs

1. Long-term aspirin at doses greater than 160mg per day (increased risk of bleeding, no evidence for increased efficacy).
2. Aspirin with a history of peptic ulcer disease without concomitant PPI (risk of recurrent peptic ulcer).
3. Aspirin, clopidogrel, dipyridamole, vitamin K antagonists, direct thrombin inhibitors or factor Ax inhibitors with concurrent significant bleeding risk, i.e., uncontrolled severe hypertension, bleeding diathesis, recent non-trivial spontaneous bleeding) (high risk of bleeding).
4. Aspirin plus clopidogrel as secondary stroke prevention unless the patient has a coronary stent(s) inserted in the previous 12 months or concurrent acute coronary syndrome or has a high-grade symptomatic carotid arterial stenosis (no evidence of added benefit over clopidogrel monotherapy).
5. Aspirin in combination with vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors in patients with chronic atrial fibrillation (no added benefit from aspirin).
6. Antiplatelet agents with vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors in patients with stable coronary, cerebrovascular or peripheral arterial disease (No added benefit from dual therapy).
7. Ticlopidine in any circumstances (clopidogrel and prasugrel have similar efficacy, stronger evidence, and fewer side-effects).

8. Vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors for first deep venous thrombosis without continuing provoking risk factors (e.g., thrombophilia) for > 6 months, (no proven added benefit).

9. Vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors for first pulmonary embolus without continuing provoking risk factors (e.g., thrombophilia) for > 12 months (no proven added benefit).

10. NSAID and vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors in combination (risk of major gastrointestinal bleeding).

11. NSAID with concurrent antiplatelet agent(s) without PPI prophylaxis (increased risk of peptic ulcer disease).

Section D: Central Nervous System and Psychotropic Drugs

1. Tricyclic Antidepressants (TCAs) with dementia, narrow angle glaucoma, cardiac conduction abnormalities, prostatism, or prior history of urinary retention (risk of worsening these conditions).

2. Initiation of Tricyclic Antidepressants (TCAs) as first-line antidepressant treatment (higher risk of adverse drug reactions with TCAs than with SSRIs or SNRIs).

3. Neuroleptics with moderate-marked antimuscarinic/anticholinergic effects (chlorpromazine, clozapine, flupentixol, fluphenazine, pipotiazine, promazine, zuclopenthixol) with a history of prostatism or previous urinary retention (high risk of urinary retention).

4. Selective serotonin re-uptake inhibitors (SSRI's) with current or recent significant hyponatremia i.e., serum Na⁺ < 130 mmol/l (risk of exacerbating or precipitating hyponatremia).

5. Benzodiazepines for ≥ 4 weeks (no indication for longer treatment; risk of prolonged sedation, confusion, impaired balance, falls, road traffic accidents; all benzodiazepines should be withdrawn gradually if taken for more than 4 weeks as there is a risk of causing a benzodiazepine withdrawal syndrome if stopped abruptly).

6. Antipsychotics (i.e., other than quetiapine or clozapine) in those with parkinsonism or Lewy Body Disease (risk of severe extra-pyramidal symptoms).

7. Anticholinergics/antimuscarinics to treat extra-pyramidal side-effects of neuroleptic medications (risk of anticholinergic toxicity).

8. Anticholinergics/antimuscarinics in patients with delirium or dementia (risk of exacerbation of cognitive impairment).

9. Neuroleptic antipsychotic in patients with behavioral and psychological symptoms of dementia (BPSD) unless symptoms are severe and other non-pharmacological treatments have failed (increased risk of stroke).
10. Neuroleptics as hypnotics, unless sleep disorder is due to psychosis or dementia (risk of confusion, hypotension, extra-pyramidal side effects, falls).
11. Acetylcholinesterase inhibitors with a known history of persistent bradycardia (< 60 beats/min.), heart block or recurrent unexplained syncope or concurrent treatment with drugs that reduce heart rate such as beta-blockers, digoxin, diltiazem, verapamil (risk of cardiac conduction failure, syncope, and injury).
12. Phenothiazines as first-line treatment, since safer and more efficacious alternatives exist (phenothiazines are sedative, have significant anti-muscarinic toxicity in older people, except for prochlorperazine for nausea/vomiting/vertigo, chlorpromazine for relief of persistent hiccoughs and levomepromazine as an anti-emetic in palliative care).
13. Levodopa or dopamine agonists for benign essential tremor (no evidence of efficacy) 14. First-generation antihistamines (safer, less toxic antihistamines now widely available).

Section E: Renal System.

The following drugs are potentially inappropriate in older people with acute or chronic kidney disease with renal function below levels of eGFR (refer to summary of product characteristics datasheets and local formulary guidelines).

1. Digoxin at a long-term dose greater than 125µg/day if eGFR < 30 ml/min/1.73m² (risk of digoxin toxicity if plasma levels not measured).
2. Direct thrombin inhibitors (e.g., dabigatran) if eGFR < 30 ml/min/1.73m² (risk of bleeding)
3. Factor Ax inhibitors (e.g., rivaroxaban, apixaban) if eGFR < 15 ml/min/1.73m² (risk of bleeding)
4. NSAID's if eGFR < 50 ml/min/1.73m² (risk of deterioration in renal function). 5. Colchicine if eGFR < 10 ml/min/1.73m² (risk of colchicine toxicity).
6. Metformin if eGFR < 30 ml/min/1.73m² (risk of lactic acidosis).

Section F: Gastrointestinal System

1. Prochlorperazine or metoclopramide with Parkinsonism (risk of exacerbating Parkinsonian symptoms).
2. PPI for uncomplicated peptic ulcer disease or erosive peptic esophagitis at full therapeutic dosage for > 8 weeks (dose reduction or earlier discontinuation indicated).

3. Drugs likely to cause constipation (e.g., antimuscarinic/anticholinergic drugs, oral iron, opioids, verapamil, aluminum antacids) in patients with chronic constipation where non-constipating alternatives are available (risk of exacerbation of constipation).
4. Oral elemental iron doses greater than 200 mg daily (e.g., ferrous fumarate > 600 mg/day, ferrous sulphate > 600 mg/day, ferrous gluconate > 1800 mg/day; no evidence of enhanced iron absorption above these doses).

Section G: Respiratory System

1. Theophylline as monotherapy for COPD (safer, more effective alternative; risk of adverse effects due to narrow therapeutic index).
2. Systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD (unnecessary exposure to long-term side-effects of systemic corticosteroids and effective inhaled therapies are available).
3. Anti-muscarinic bronchodilators (e.g., ipratropium, tiotropium) with a history of narrow angle glaucoma (may exacerbate glaucoma) or bladder outflow obstruction (may cause urinary retention).
4. non-selective beta-blocker (whether oral or topical for glaucoma) with a history of asthma requiring treatment (risk of increased bronchospasm).
5. Benzodiazepines with acute or chronic respiratory failure i.e., $pO_2 < 8.0 \text{ kPa} \pm pCO_2 > 6.5 \text{ kPa}$ (risk of exacerbation of respiratory failure).

Section H: Musculoskeletal System

1. non-steroidal anti-inflammatory drug (NSAID) other than COX-2 selective agents with history of peptic ulcer disease or gastrointestinal bleeding, unless with concurrent PPI or H2 antagonist (risk of peptic ulcer relapse).
2. NSAID with severe hypertension (risk of exacerbation of hypertension) or severe heart failure (risk of exacerbation of heart failure).
3. Long-term use of NSAID (>3 months) for symptom relief of osteoarthritis pain where paracetamol has not been tried (simple analgesics preferable and usually as effective for pain relief).
4. Long-term corticosteroids (>3 months) as monotherapy for rheumatoid arthritis (risk of systemic corticosteroid side-effects).
5. Corticosteroids (other than periodic intra-articular injections for mono-articular pain) for osteoarthritis (risk of systemic corticosteroid side-effects).

6. Long-term NSAID or colchicine (>3 months) for chronic treatment of gout where there is no contraindication to a xanthine-oxidase inhibitor (e.g., allopurinol, febuxostat) (xanthine-oxidase inhibitors are first choice prophylactic drugs in gout).
7. COX-2 selective NSAIDs with concurrent cardiovascular disease (increased risk of myocardial infarction and stroke).
8. NSAID with concurrent corticosteroids without PPI prophylaxis (increased risk of peptic ulcer disease).
9. Oral bisphosphonates in patients with a current or recent history of upper gastrointestinal disease i.e., dysphagia, esophagitis, gastritis, duodenitis, or peptic ulcer disease, or upper gastrointestinal bleeding (risk of relapse/exacerbation of esophagitis, esophageal ulcer, esophageal stricture).

Section I: Urogenital System

1. Antimuscarinic drugs with dementia, or chronic cognitive impairment (risk of increased confusion, agitation) or narrow-angle glaucoma (risk of acute exacerbation of glaucoma), or chronic prostatism (risk of urinary retention).
2. Selective alpha-1 selective alpha blockers in those with symptomatic orthostatic hypotension or micturition syncope (risk of precipitating recurrent syncope).

Section J. Endocrine System

1. Sulphonylureas with a long duration of action (e.g., glipalamide, chlorpropamide, glimepiride) with type 2 diabetes mellitus (risk of prolonged hypoglycemia).
2. Thiazolidinediones (e.g., rosiglitazone, pioglitazone) in patients with heart failure (risk of exacerbation of heart failure)
3. Beta-blockers in diabetes mellitus with frequent hypoglycemic episodes (risk of suppressing hypoglycemic symptoms).
4. Estrogens with a history of breast cancer or venous thromboembolism (increased risk of recurrence).
5. Oral estrogens without progestogen in patients with intact uterus (risk of endometrial cancer).
6. Androgens (male sex hormones) in the absence of primary or secondary hypogonadism (risk of androgen toxicity; no proven benefit outside of the hypogonadism indication).

Section K: Drugs that predictably increase the risk of falls in older people.

1. Benzodiazepines (sedative, may cause reduced sensorium, impair balance).
2. Neuroleptic drugs (may cause gait dyspraxia, Parkinsonism).
3. Vasodilator drugs (e.g., alpha-1 receptor blockers, calcium channel blockers, long-acting nitrates, ACE inhibitors, angiotensin I receptor blockers,) with persistent postural hypotension i.e., recurrent drop in systolic blood pressure ≥ 20 mmHg (risk of syncope, falls).
4. Hypnotic Z-drugs e.g., zopiclone, zolpidem, zaleplon (may cause protracted daytime sedation, ataxia).

Section L: Analgesic Drugs

1. Use of oral or transdermal strong opioids (morphine, oxycodone, fentanyl, buprenorphine, diamorphine, methadone, tramadol, pethidine, pentazocine) as first line therapy for mild pain (WHO analgesic ladder not observed).
2. Use of regular (as distinct from PRN) opioids without concomitant laxative (risk of severe constipation).
3. Long-acting opioids without short-acting opioids for break-through pain (risk of persistence of severe pain).

Section N: Antimuscarinic/Anticholinergic Drug Burden

Concomitant use of two or more drugs with antimuscarinic/anticholinergic properties (e.g., bladder antispasmodics, intestinal antispasmodics, tricyclic antidepressants, first generation antihistamines) (risk of increased antimuscarinic/anticholinergic toxicity).

Screening Tool to Alert to Right Treatment (START), version 2.

Unless an elderly patient's clinical status is end-of-life and therefore requiring a more palliative focus of pharmacotherapy, the following drug therapies should be considered where omitted for no valid clinical reason (Mahony, et al., 2015). It is assumed that the prescriber observes all the specific contraindications to these drug therapies prior to recommending them to older patients.

Section A: Cardiovascular System

1. Vitamin K antagonists or direct thrombin inhibitors or factor Ax inhibitors in the presence of chronic atrial fibrillation.
2. Aspirin (75 mg – 160 mg once daily) in the presence of chronic atrial fibrillation, where Vitamin K antagonists or direct thrombin inhibitors or factor Ax inhibitors are contraindicated.
3. Antiplatelet therapy (aspirin or clopidogrel or prasugrel or ticagrelor) with a documented history of coronary, cerebral or peripheral vascular disease.

4. Antihypertensive therapy where systolic blood pressure consistently > 160 mmHg and/or diastolic blood pressure consistently >90 mmHg; if systolic blood pressure > 140 mmHg and /or diastolic blood pressure > 90 mmHg if diabetic.
5. Statin therapy with a documented history of coronary, cerebral or peripheral vascular disease, unless the patient's status is end-of-life or age is > 85 years.
6. Angiotensin Converting Enzyme (ACE) inhibitor with systolic heart failure and/or documented coronary artery disease.
7. Beta-blocker with ischemic heart disease.
8. Appropriate beta-blocker (bisoprolol, nebivolol, metoprolol or carvedilol) with stable systolic heart failure.

Section B: Respiratory System

1. Regular inhaled β_2 agonist or antimuscarinic bronchodilator (e.g., ipratropium, tiotropium) for mild to moderate asthma or COPD.
2. Regular inhaled corticosteroid for moderate-severe asthma or COPD, where FEV1 <50% of predicted value and repeated exacerbations requiring treatment with oral corticosteroids.
3. Home continuous oxygen with documented chronic hypoxemia (i.e., pO₂ < 8.0 kPa or 60 mmHg or SaO₂ < 89%).

Section C: Central Nervous System & Eyes

1. L-DOPA or a dopamine agonist in idiopathic Parkinson's disease with functional impairment and resultant disability.
2. non-TCA antidepressant drug in the presence of persistent major depressive symptoms.
3. Acetylcholinesterase inhibitor (e.g., donepezil, rivastigmine, galantamine) for mild-moderate Alzheimer's dementia or Lewy Body dementia (rivastigmine).
4. Topical prostaglandin, Prost amide or beta-blocker for primary open-angle glaucoma.
5. Selective serotonin reuptake inhibitor (or SNRI or pregabalin if SSRI contraindicated) for persistent severe anxiety that interferes with independent functioning.
6. Dopamine agonist (ropinirole or pramipexole or retigabine) for Restless Legs Syndrome once iron deficiency and severe renal failure have been excluded.

Section D: Gastrointestinal System

1. Proton Pump Inhibitor with severe gastro-esophageal reflux disease or peptic stricture requiring dilatation.
2. Fiber supplements (e.g., bran, ispaghula, methylcellulose, sterculia) for diverticulosis with a history of constipation.

Section E: Musculoskeletal System

1. Disease-modifying anti-rheumatic drug (DMARD) with active, disabling rheumatoid disease.
2. Bisphosphonates and vitamin D and calcium in patients taking long-term systemic corticosteroid therapy.
3. Vitamin D and calcium supplement in patients with known osteoporosis and/or previous fragility fracture(s) and/or (Bone Mineral Density T-scores more than -2.5 in multiple sites).
4. Bone anti-resorptive or anabolic therapy (e.g., bisphosphonate, strontium ranelate, teriparatide, denosumab) in patients with documented osteoporosis, where no pharmacological or clinical status contraindication exists (Bone Mineral Density T-scores > -2.5 in multiple sites) and/or previous history of fragility fracture(s).
5. Vitamin D supplement in older people who are housebound or experiencing falls or with osteopenia (Bone Mineral Density T-score is > -1.0 but < -2.5 in multiple sites).
6. Xanthine-oxidase inhibitors (e.g., allopurinol, febuxostat) with a history of recurrent episodes of gout.
7. Folic acid supplement in patients taking methotrexate.

Section F: Endocrine System

1. ACE inhibitor or Angiotensin Receptor Blocker (if intolerant of ACE inhibitor) in diabetes with evidence of renal disease i.e., dipstick proteinuria or microalbuminuria ($>30\text{mg}/24$ hours) with or without serum biochemical renal impairment.

Section G: Urogenital System

1. Alpha-1 receptor blocker with symptomatic prostatism, where prostatectomy is not considered necessary.
2. 5-alpha reductase inhibitor with symptomatic prostatism, where prostatectomy is not considered necessary.
3. Topical vaginal estrogen or vaginal estrogen pessary for symptomatic atrophic vaginitis.

Section H: Analgesics

1. High-potency opioids in moderate-severe pain, where paracetamol, NSAIDs or low-potency opioids are not appropriate to the pain severity or have been ineffective.
2. Laxatives in patients receiving opioids regularly.

Section I: Vaccines

1. Seasonal trivalent influenza vaccine annually.
2. Pneumococcal vaccine at least once after age 65 according to national guidelines.

Appendix B

**University of Maryland School of Nursing
NDNP 810: Project Identification
DNP Project Management Tool**

PROJECT OVERVIEW		
Project Title:	Geriatric Polypharmacy	
Student Name, Program	Darryl Stewart, post-master’s DNP	
Faculty Advisor, CSR, Sponsor:	Dr. Linda Costa, Faculty Advisor Kris McLoughlin, DNP, PMHCNS-BC, FAAN, CSR Dr. Richard Gontang, Ph.D., Sponsor	
Problem/issue statement w/background (include population and site/setting)	Polypharmacy and risk factors among geriatric patients residing in an inpatient mental health facility	
Project Purpose Statement:	The purpose of this DNP project is to decrease polypharmacy among geriatric inpatients in a mental health facility by implementing an evidence-based medication reconciliation tool (STOPP/START) for medical providers.	
MOBILIZE		
Team Member Name/Credentials/Title	Contact Information	Responsibilities
1. Kris McLoughlin, DNP, PMHCNS-BC, FAAN, Deputy Director of Nursing (CSR)	kris.mcloughlin@dc.gov	Provide guidance and resources for project proposal development; peer review
2. Richard Gontang, Ph.D., Chief Clinical Officer (Sponsor)	richard.gontang@dc.gov	Support across the organization for DNP project. Resource for informatics, information technology, liaison to CEO and CFO.

3. Hyun Lee, Pharm. D., Supervisory Pharmacist (Champion)	Hyun.Lee@dc.gov	Assist with data collection of medication prescribed during established timeframe, evaluation of electronic health record (EHR) for medication reconciliation, peer review!
4. Nancy Boyd, MSN, RN, Nurse Educator	Nancy.Boyd@dc.gov	Develop educational tool and training module for implementation

ASSESS

Root Cause Analysis (Fishbone Diagram - Appendix B):

Site Structures Assessed	Site Processes Assessed (current/desired maps – Appendix C, D)	Site Baseline Outcome(s) Assessed
1. The electronic health record (EHR) 2. Level of knowledge regarding polypharmacy among providers, pharmacy and nursing relating to geriatric unit 3. Available resources for support for intervention with the STOPP/START tool	1. Is there a medication reconciliation tool currently in use by providers for medication prescribing on the geriatric unit? 2. Current process for medication prescribing without a medication reconciliation tool. 3. Points along the current process where the STOPP/START tool can be utilized	1. There is currently no medication reconciliation tool in use for medication prescribing. 2. It will be a challenge to implement the STOPP/START tool into the EHR and may have to initiate the paper version.

Project Structure Goals	Project Process Goals	Outcome Goal(s)
1. All providers, pharmacy and nursing staff will be trained in utilization of the STOPP/START tool.	1. By the end of the project (TBD), the STOPP/START tool will be available for all medical providers, pharmacy, and nursing staff to	1. By the end of this project (TBD), all geriatric inpatients will have no adverse drug reactions, drug interactions or acute hospitalizations. (May not be able to

<p>2. By the end of this project (TBD), resources for support of STOPP/START tool will continue to be provided by hospital administration</p>	<p>utilize.</p> <p>2. By the end of the project (TBD), all geriatric patients will have a medication review completed using STOPP/START tool.</p> <p>3. By the end of the project (TBD), all medical providers, pharmacy and nursing staff will be following utilizing STOPP/START tool.</p>	<p>assess before end of project)</p> <p>2. By the end of this project (TBD), a mechanism will be in place to track this goal (see #1)</p>
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PLAN

Measures

Project Goals	Measure Pre-Implementation	Measure During Implementation
Structure Goal(s)		
<p>1. <i>A medication reconciliation tool will be available for implementation to guide medication prescribing and reduce polypharmacy starting with new admissions and transfers.</i></p> <p>2. <i>All prescribers will receive education and training on use of the STOPP/START medication reconciliation tool</i></p>	<p><i>No medication reconciliation tool available</i></p>	<p><i>Weekly audit of new admission charts to determine utilization of medication reconciliation tool</i></p>
Process Goal(s)		
<p>1. <i>100 % compliance with use of the STOPP/START tool by prescribers for geriatric patient admissions.</i></p>	<p><i># of correct medications ordered or changed without the STOPP/START tool</i></p>	<p><i># of correct medications ordered or changed with the STOPP/START tool</i></p>
Outcome Goal(s)		
<p>1. <i>100% of geriatric patients have no adverse drug reactions, drug interactions or acute hospitalization after STOP/START tool implementation.</i></p>	<p>Numerator: <i># of occurrences of adverse drug reactions, drug interactions or acute hospitalization before STOPP/START tool</i></p> <p>Denominator: <i># of geriatric patients on the unit</i></p>	<p>Numerator: <i># of occurrences of adverse drug reactions, drug interactions or acute hospitalization after STOPP/START tool</i></p> <p>Denominator: <i># of geriatric patients on the unit</i></p>

Implementation Plan	
Strategies and Tactics (Bingham ABCDE)	Goal to Achieve
<p>Accountability</p> <ul style="list-style-type: none"> • Tool to be implemented as a pilot with a small number of prescribers. • Hold discussions with prescribers. 	<p>100% of prescribers will be able to utilize the STOPP/START tool.</p>
<p>Buy-in</p> <ul style="list-style-type: none"> • Work to incentivize adoption and implementation of the medication reconciliation tool through professional and employee recognition, certificate of achievement for completing training to be placed in the employee file, a pizza party with implementation milestones as a few examples. 	<p>100% of prescribers will be able to utilize the STOPP/START tool.</p>
<p>Collaboration/Communication/Structure Changes</p> <ul style="list-style-type: none"> • Identify early adopters and assess their experience with the medication reconciliation tool. • Identify and prepare champions dedicated to supporting and driving through the implementation. • Involve the governing structures(committees) in the implementation effort including review of data on implementation process. • Schedule routine meetings with team members and stakeholders to discuss progress toward goal. • Develop and implement tools for quality monitoring. 	<p>100% of stakeholders will accept implementation of STOPP/START tool.</p>
<p>Data</p> <ul style="list-style-type: none"> • Assess for readiness and identify barriers and facilitators that may impede implementation, and strengths that can be used in the implementation effort. • Complete audits that collect and summarize utilization of the medication reconciliation tool over a specified period and give it to clinicians and administrators to monitor, evaluate and modify. 	<p>100% utilization of the medication STOPP/START tool by all medical providers, pharmacy, and nursing staff.</p>

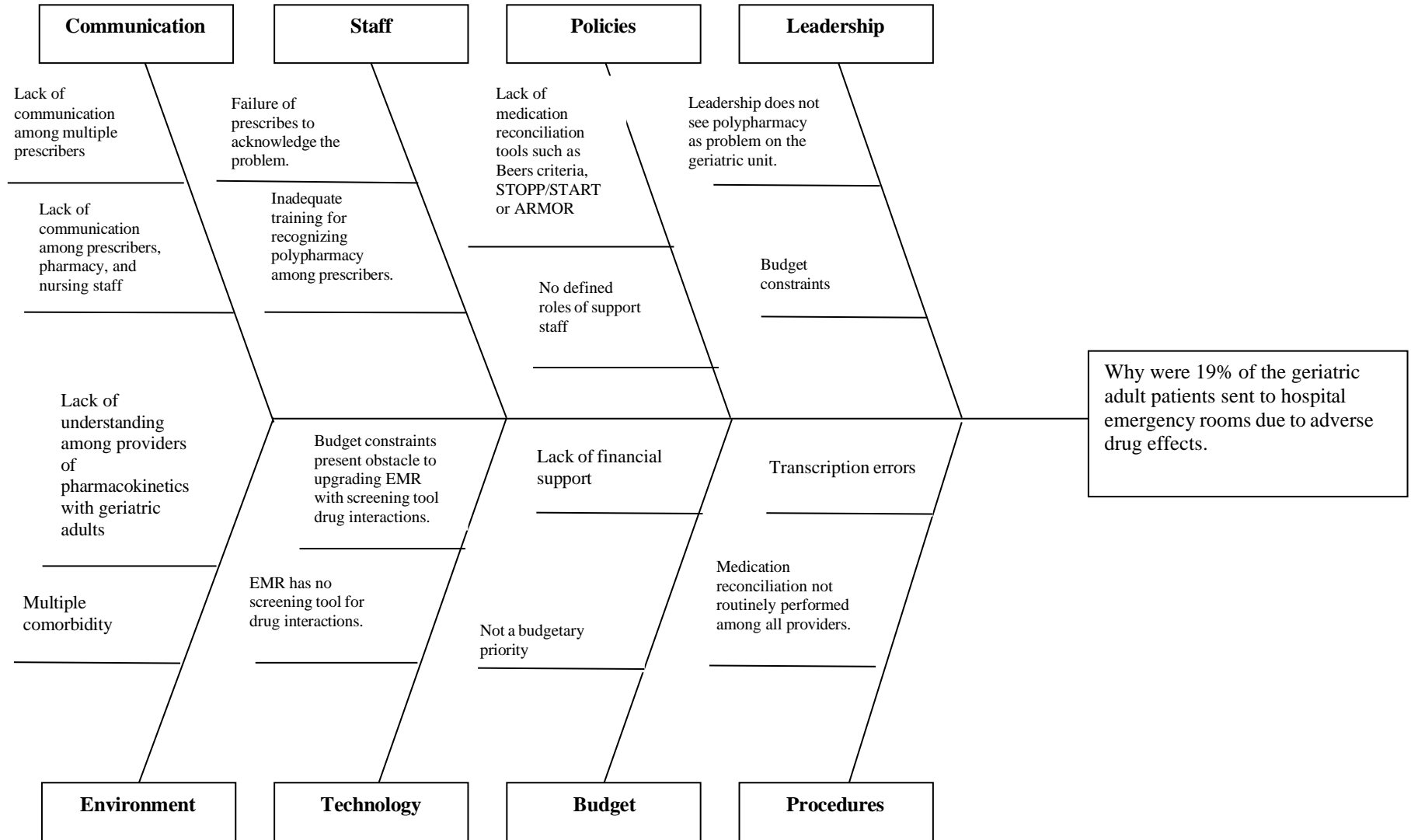
<ul style="list-style-type: none"> Collect data to track progress towards achieving 100% compliance. 	
<p>Education</p> <ul style="list-style-type: none"> Meet with nurse educator to develop a training tool for new implementation of the medication reconciliation tool. APRN can be lead trainer for implementation. Plan for ongoing training 	<p>100% of users will be trained use of STOPP/START tool.</p>

Project Implementation and Evaluation Timeline
Gantt Chart (Appendix G)

Data Collection Plan		
Project Goals	Data Collection Method (who, how, when)	Data Collection Tool
Baseline data on prevalence of polypharmacy currently beginning 03/01/22.	Data to be collected by DNP project leader, through access of the EHR to review number of patients aged 65 and older who are prescribed 5 or more medications (pre-implementation) To be completed by 3/21/22	EHR
Review of STOPP/START tool and application to data obtained	STOPP/START tool is available online. To be completed by 4/4/22	
Review data and results with CSR. Prepare to present to Process Improvement Committee for feedback and address concerns that will eliminate any barriers for moving forward	To be completed by 4/11/22	

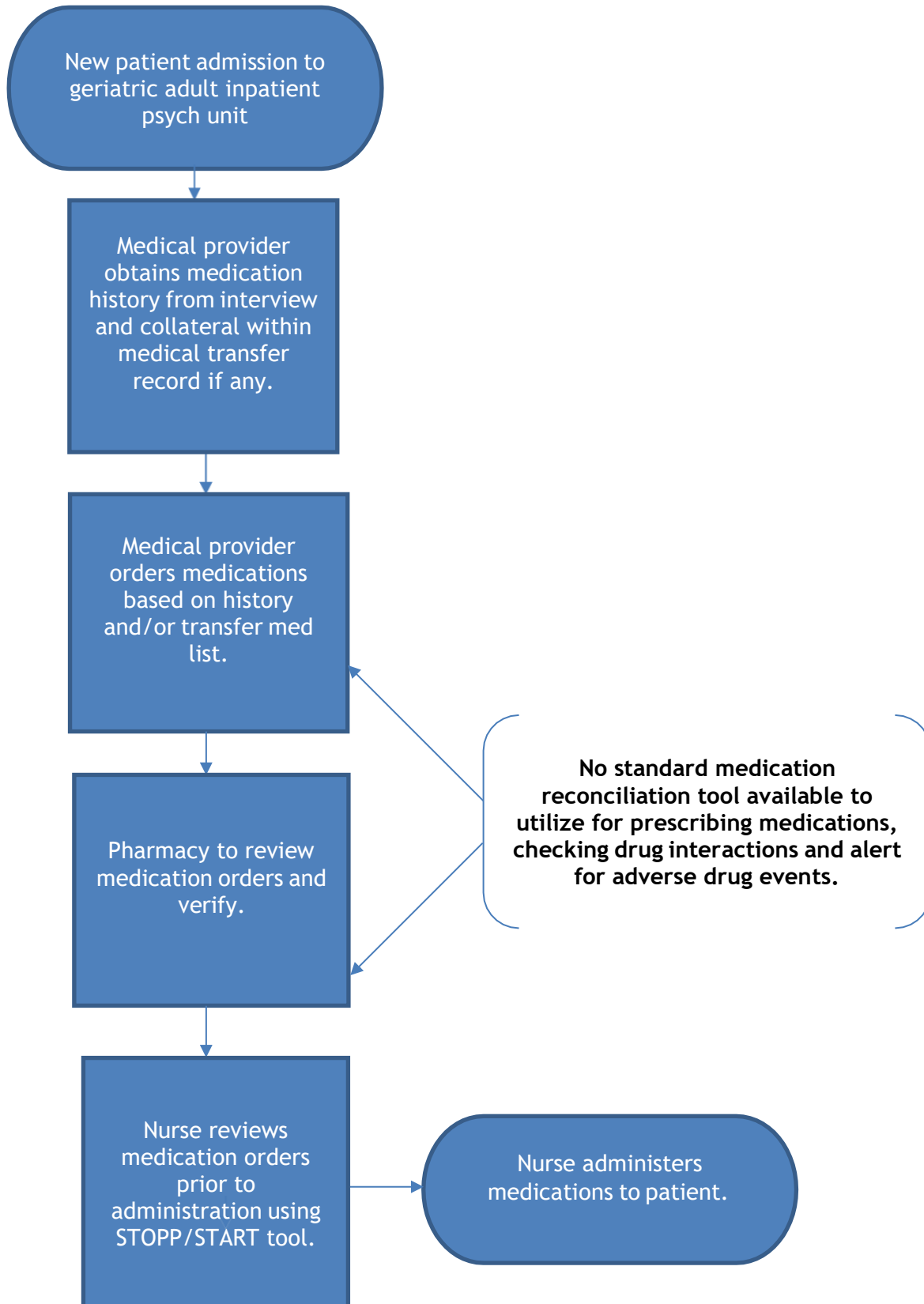
<p>Present plan to providers at monthly GMO/NP meeting in April 2022 for feedback and support and address concerns that will eliminate any barriers for moving forward</p>		
<p>Data Analysis – Run Charts (Appendix F) TBD</p>		
<p>Sustainability Plan TBD</p>		

Appendix C



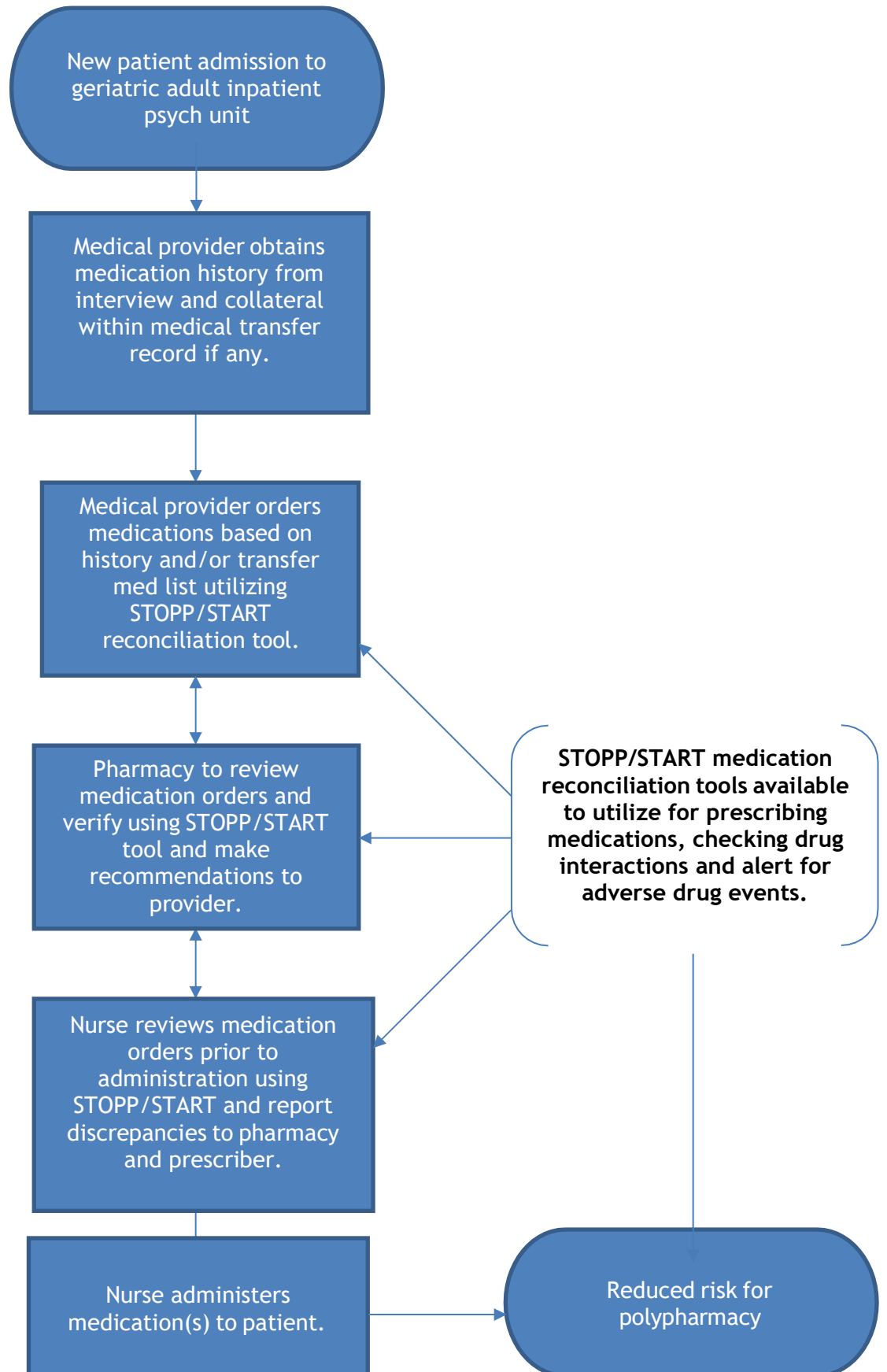
Appendix D

Current Process Map



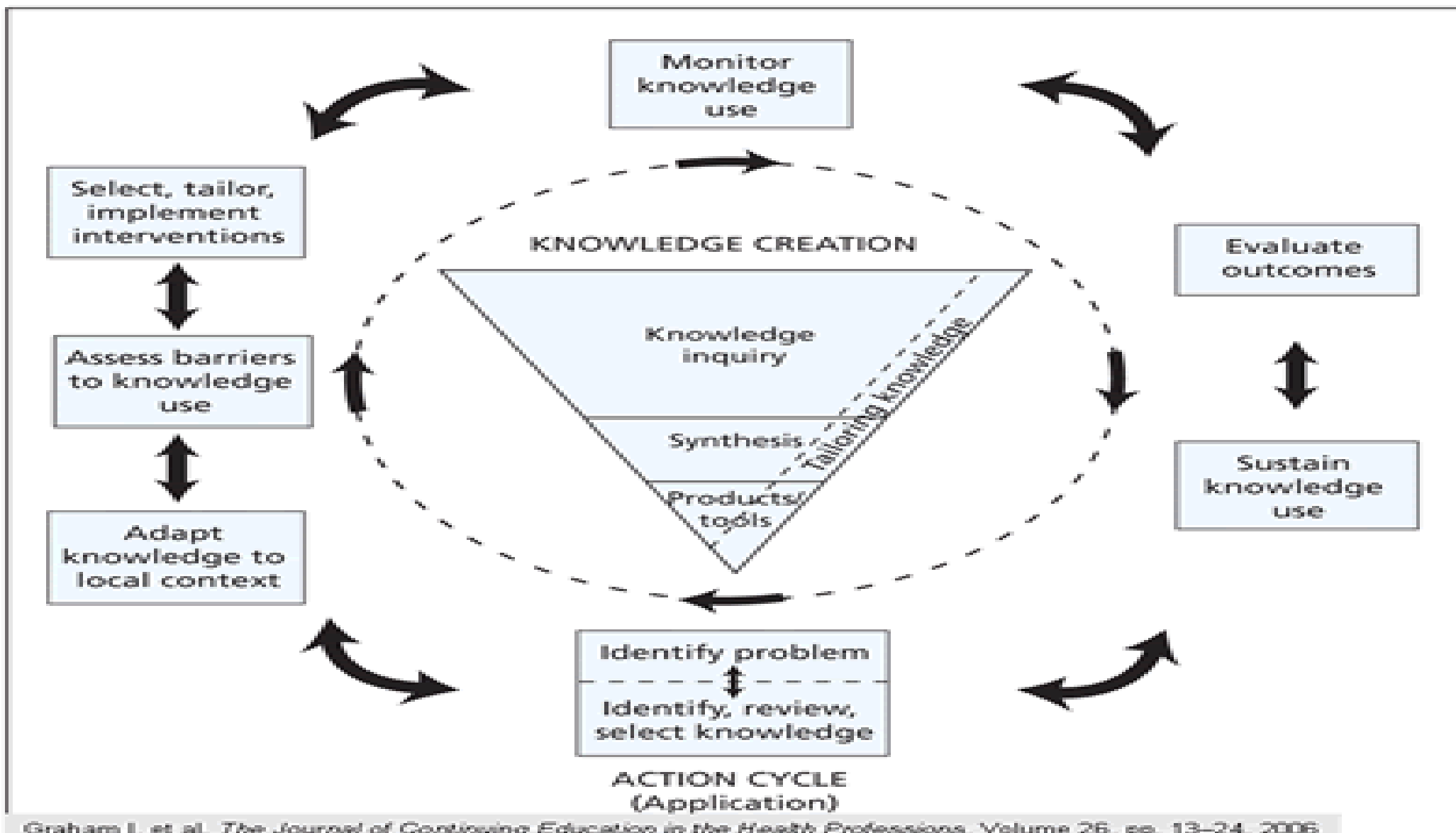
Appendix E

Desired Process Map



Appendix F

Theoretical Framework: Knowledge-to-Action (KTA) Model



Appendix G

Implementation Action Table

Strategies and Tactics (Bingham ABCDE)	Action	Rationale
<p>Accountability:</p> <p>Assess for readiness and identify barriers and facilitators.</p>	<ul style="list-style-type: none"> Assess various aspects of an organization to determine its degree of readiness to implement, barriers that may impede implementation, and strengths that can be used in the implementation effort. Conduct a cultural assessment using the evidence-based Context Assessment Index (CAI) instrument (McCormick et al. 2009) Include providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate. 	<p>The organizational readiness assessment allows you to address the details of the quality improvement initiative with stakeholders to determine if they are ready for such a change and have the ability and resources, they need to do their part in it. The CAI instrument is an evidenced-based tool that can be used to complete an assessment of the culture and organizational barriers and enablers impacting the implementation of an evidence-based practice project in their organization (McCormack et al., 2009). The assessment is completed by the DNP student project lead and results presented to CSR for approval to move forward during pre-implementation phase.</p>
<p>Identify early adopters.</p>	<ul style="list-style-type: none"> Identify early adopters at the local site to learn from their experiences with the practice innovation. 	<p>Early adopters bring experience and vision to new processes that others may not quite yet see. They are a source of early support for the implementation during the pre-implementation phase and can be leveraged to persuade other stakeholders to adopt change.</p>
<p>Identify and prepare champions dedicated to supporting and driving through the implementation.</p>	<ul style="list-style-type: none"> Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization. 	<p>Change champions assist in instituting a change, they advocate for and promote the change from within, and are instrumental in implementation of the change. The champion believes in change, is driven by the vision, and is energized by the passion for change. A champion's influence can be leveraged to influence other stakeholders through organization relationships, i.e., the Director of Pharmacy is a champion who has direct communication with the CEO of the organization. This would occur during the pre-implementation and implementation phases of the 15-week quality improvement initiative.</p>

	<ul style="list-style-type: none"> Recruit and cultivate relationships with partners in the implementation effort 	
<p>Buy-In:</p> <p>Build a coalition.</p>	<ul style="list-style-type: none"> Include other providers/prescribers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate. 	<p>Information regarding the practice gap supported by data can be discussed with provider/prescribers and other stakeholders during the pre-implementation phase to build support (a coalition across various disciplines) for the quality improvement initiative. The more support from those affected by the change, the better chance for success with implementing the change. This will also support sustainability of the project</p>
<p>One-to-one discussions</p>	<ul style="list-style-type: none"> Set up a discussion between a change leader and someone else whom they are seeking to influence to change. 	<p>This is just a further extension of the rationale for building a coalition. Sometimes, one-to-one discussion is a better communication technique than group communication to address potential individual concerns regarding the quality improvement initiative. This would occur during the pre-implementation and the 15-week implementation phase. This will also support sustainability of the project.</p>
<p>Collaboration, Communication, Changes in Structure:</p> <p>Develop a formal implementation plan.</p>	<ul style="list-style-type: none"> Develop a formal implementation plan that includes all goals and strategies. The plan should include the following: 1) aim/purpose of the implementation; 2) scope of the change (e.g., what organizational units are affected); 3) timeframe and milestones; and 4) appropriate performance/progress measures. Use and update this plan to guide the implementation effort over time. 	<p>The DNP Project Management tool was created as a formal implementation plan during the pre-implementation phase based on the MAP-IT model from NDNP 810 framework. The model will aid planning, implementation, and evaluation of the Quality Improvement initiative. The DNP student project lead will use the steps in MAP-IT to ‘map out’ the path toward the desired change. The management tool is available in the DNP Project Proposal submitted in NDNP 810.</p>
<p>Data:</p> <p>Collect data and provide feedback.</p>	<ul style="list-style-type: none"> Identify measures among structure, process and outcome that are most needed. Focus on the items that are most important to your project site and most importantly to quality and patient outcomes. Collect data to track progress toward achieving improvements 	<p>Measurement allows the implementation team to assess the baseline functioning of a system prior to making a change as well as to determine whether a change resulted in improvement. Measures are identified during the pre-implementation phase of the quality improvement initiative.</p> <p>The data generated from Improvement work is analyzed to determine whether the interventions influenced the performance and outcomes of the system <i>over time</i>.</p> <p>Data extracted from the organization electronic health record using the STOPP/START tool in the REDCap database.</p>

	<p>in structure, process, and outcomes.</p> <ul style="list-style-type: none"> Summarize clinical performance data over a specified time and present to stakeholders for review and feedback. 	<p>Data will be collected the same way in consistent intervals over the 15-week implementation period beginning week 2. This will strengthen both data reliability and validity. This will also support the sustainability of the project.</p>
Facilitate relay of clinical data to providers	<ul style="list-style-type: none"> Provide as close to real-time data as possible about key measures of process/outcomes using integrated modes/channels of communication in a way that promotes use of the targeted innovation. 	<p>Weekly to biweekly data audits will occur under the supervision of the DNP student project lead during the 15-week implementation phase from the data collection tools in REDCap. The data results will be discussed with the CSR and implementation team, analyzed with feedback. This will promote on-going engagement with the implementation team and support for the quality improvement initiative before the final presentation to stakeholders at the conclusion of the 15-week implementation period.</p>
<p>Education:</p> <p>Conduct ongoing training.</p>	<ul style="list-style-type: none"> Plan for and conduct training in the clinical innovation in an ongoing way 	<p>Education and training for the STOPP/START tool will be provided during the pre-implementation phase to all providers/prescribers solicited for the project to enhance compliance with use of the tool. Education will be on-going as new providers may be chosen during the 15-week implementation period. This will also support sustainability of the project.</p>
Complete a usability survey.	<ul style="list-style-type: none"> Develop and implement a usability survey to assess provider engagement. 	<p>A usability survey based on the System Usability Scale (Lewis, J. R., & Sauro, J. 2018) created in REDCap to be distributed to all providers/prescriber participants during the 15-week implementation plan after the first few weeks (TBD). This will also support the sustainability of the project.</p>

Appendix H

STOPP/START SCREENING TOOL

Record ID

Age

Date of admission

Current # of active prescribed medications

Screening Tool of Older Persons' Prescriptions (STOPP)**Section A: Indication of medication**

Any drug prescribed without an evidence-based clinical indication

 Yes
 No

Any drug prescribed beyond the recommended duration, where treatment duration is well defined

 Yes
 No

Any duplicate drug class prescription (e.g., two concurrent NSAIDs, SSRIs, loop diuretics, ACE inhibitors, anticoagulants (optimization of monotherapy within a single drug class should be observed prior to considering a new agent))

 Yes
 No

The following prescription medications are potentially inappropriate to use in patients 65 years and older. Please indicate if any of the following medications are prescribed under each classification system below.

SECTION B: Cardiovascular System

- 1. Digoxin for heart failure with normal systolic ventricular function (no clear evidence of benefit).
- 2. Verapamil or diltiazem with NYHA Class III or IV heart failure (may worsen heart failure). 3. Beta-blocker in combination with verapamil or diltiazem (risk of heart block).
- 4. Beta blocker with bradycardia (< 50/min), type II heart block or complete heart block (risk of complete heart block, asystole).
- 5. Amiodarone as first-line antiarrhythmic therapy in supraventricular tachyarrhythmias (higher risk of side-effects than beta-blockers, digoxin, verapamil, or diltiazem).
- 6. Loop diuretic as first-line treatment for hypertension (safer, more effective alternatives available).
- 7. Loop diuretic for dependent ankle oedema without clinical, biochemical evidence or radiological evidence of heart failure, liver failure, nephrotic syndrome, or renal failure (leg elevation and /or compression hosiery usually more appropriate).
- 8. Thiazide diuretic with current significant hypokalemia (i.e., serum K⁺ < 3.0 mmol/l), hyponatremia (i.e., serum Na⁺ < 130 mmol/l) hypercalcemia (i.e., corrected serum calcium > 2.65 mmol/l) or with a history of gout (hypokalemia, hyponatremia, hypercalcemia, and gout can be precipitated by thiazide diuretic).
- 9. Loop diuretic for treatment of hypertension with concurrent urinary incontinence (may exacerbate incontinence).
- 10. Centrally acting antihypertensives (e.g., methyldopa, clonidine, tolondine, tiamenidine, guanfacine), unless clear intolerance of, or lack of efficacy with, other classes of antihypertensives (centrally active antihypertensives are generally less well tolerated by older people than younger people).
- 11. ACE inhibitors or Angiotensin Receptor Blockers in patients with hyperkalemia.
- 12. Aldosterone antagonists (e.g., spironolactone, eplerenone) with concurrent potassium-conserving drugs (e.g., ACEI's, ARB's, amiloride, triamterene) without monitoring of serum potassium (risk of dangerous hyperkalemia i.e., > 6.0 mmol/l - serum K should be monitored regularly, i.e., at least every 6 months).
- 13. Phosphodiesterase type-5 inhibitors (e.g., sildenafil, tadalafil, vardenafil) in severe heart failure characterized by hypotension i.e., systolic BP < 90 mmHg, or concurrent nitrate therapy for angina (risk of cardiovascular collapse).

Section C: Antiplatelet/Anticoagulant Drugs

- 1. Long-term aspirin at doses greater than 160mg per day (increased risk of bleeding, no evidence for increased efficacy).
- 2. Aspirin with a history of peptic ulcer disease without concomitant PPI (risk of recurrent peptic ulcer).
- 3. Aspirin, clopidogrel, dipyridamole, vitamin K antagonists, direct thrombin inhibitors or factor Ax inhibitors with concurrent significant bleeding risk, i.e., uncontrolled severe hypertension, bleeding diathesis, recent non-trivial spontaneous bleeding) (high risk of bleeding).
- 4. Aspirin plus clopidogrel as secondary stroke prevention unless the patient has a coronary stent(s) inserted in the previous 12 months or concurrent acute coronary syndrome or has a high-grade symptomatic carotid arterial stenosis (no evidence of added benefit over clopidogrel monotherapy).
- 5. Aspirin in combination with vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors in patients with chronic atrial fibrillation (no added benefit from aspirin).
- 6. Antiplatelet agents with vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors in patients with stable coronary, cerebrovascular or peripheral arterial disease (No added benefit from dual therapy).
- 7. Ticlopidine in any circumstances (clopidogrel and prasugrel have similar efficacy, stronger evidence, and fewer side-effects).
- 8. Vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors for first deep venous thrombosis without continuing provoking risk factors (e.g., thrombophilia) for > 6 months, (no proven added benefit).
- 9. Vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors for first pulmonary embolus without continuing provoking risk factors (e.g., thrombophilia) for > 12 months (no proven added benefit).
- 10. NSAID and vitamin K antagonist, direct thrombin inhibitor or factor Ax inhibitors in combination (risk of major gastrointestinal bleeding).
- 11. NSAID with concurrent antiplatelet agent(s) without PPI prophylaxis (increased risk of peptic ulcer disease).

Section D: Central Nervous System and Psychotropic Drugs

- 1. Tricyclic Antidepressants (TCAs) with dementia, narrow angle glaucoma, cardiac conduction abnormalities, prostatism, or prior history of urinary retention (risk of worsening these conditions).
- 2. Initiation of Tricyclic Antidepressants (TCAs) as first-line antidepressant treatment (higher risk of adverse drug reactions with TCAs than with SSRIs or SNRIs).
- 3. Neuroleptics with moderate-marked antimuscarinic/anticholinergic effects (chlorpromazine, clozapine, flupentixol, fluphenazine, pipotiazine, promazine, zuclopenthixol) with a history of prostatism or previous urinary retention (high risk of urinary retention).
- 4. Selective serotonin re-uptake inhibitors (SSRI's) with current or recent significant hyponatremia i.e., serum Na⁺ < 130 mmol/l (risk of exacerbating or precipitating hyponatremia).
- 5. Benzodiazepines for ≥ 4 weeks (no indication for longer treatment; risk of prolonged sedation, confusion, impaired balance, falls, road traffic accidents: all benzodiazepines should be withdrawn gradually if taken for more than 4 weeks as there is a risk of causing a benzodiazepine withdrawal syndrome if stopped abruptly).
- 6. Antipsychotics (i.e., other than quetiapine or clozapine) in those with parkinsonism or Lewy Body Disease (risk of severe extra-pyramidal symptoms).
- 7. Anticholinergics/antimuscarinics to treat extra-pyramidal side-effects of neuroleptic medications (risk of anticholinergic toxicity).
- 8. Anticholinergics/antimuscarinics in patients with delirium or dementia (risk of exacerbation of cognitive impairment).
- 9. Neuroleptic antipsychotic in patients with behavioral and psychological symptoms of dementia (BPSD) unless symptoms are severe and other non-pharmacological treatments have failed (increased risk of stroke).
- 10. Neuroleptics as hypnotics, unless sleep disorder is due to psychosis or dementia (risk of confusion, hypotension, extra-pyramidal side effects, falls).
- 11. Acetylcholinesterase inhibitors with a known history of persistent bradycardia (< 60 beats/min.), heart block or recurrent unexplained syncope or concurrent treatment with drugs that reduce heart rate such as beta-blockers, digoxin, diltiazem, verapamil (risk of cardiac conduction failure, syncope, and injury).
- 12. Phenothiazines as first-line treatment, since safer and more efficacious alternatives exist (phenothiazines are sedative, have significant anti-muscarinic toxicity in older people, except for prochlorperazine for nausea/vomiting/vertigo, chlorpromazine for relief of persistent hiccoughs and levomepromazine as an anti-emetic in palliative care).
- 13. Levodopa or dopamine agonists for benign essential tremor (no evidence of efficacy) 14. First-generation antihistamines (safer, less toxic antihistamines now widely available).

Section E: Renal System

the following drugs are potentially inappropriate in older people with acute or chronic kidney disease with renal function below levels of eGFR (refer to summary of product characteristics datasheets and local formulary guidelines).

- 1. Digoxin at a long-term dose greater than 125µg/day if eGFR < 30 ml/min/1.73m² (risk of digoxin toxicity if plasma levels not measured).
- 2. Direct thrombin inhibitors (e.g., dabigatran) if eGFR < 30 ml/min/1.73m² (risk of bleeding)
- 3. Factor A_x inhibitors (e.g., rivaroxaban, apixaban) if eGFR < 15 ml/min/1.73m² (risk of bleeding)
- 4. NSAID's if eGFR < 50 ml/min/1.73m² (risk of deterioration in renal function). 5. Colchicine if eGFR < 10 ml/min/1.73m² (risk of colchicine toxicity).
- 6. Metformin if eGFR < 30 ml/min/1.73m² (risk of lactic acidosis).

Section F: Gastrointestinal System

- 1. Prochlorperazine or metoclopramide with Parkinsonism (risk of exacerbating Parkinsonian symptoms).
- 2. PPI for uncomplicated peptic ulcer disease or erosive peptic esophagitis at full therapeutic dosage for > 8 weeks (dose reduction or earlier discontinuation indicated).
- 3. Drugs likely to cause constipation (e.g., antimuscarinic/anticholinergic drugs, oral iron, opioids, verapamil, aluminum antacids) in patients with chronic constipation where non-constipating alternatives are available (risk of exacerbation of constipation).
- 4. Oral elemental iron doses greater than 200 mg daily (e.g., ferrous fumarate > 600 mg/day, ferrous sulphate > 600 mg/day, ferrous gluconate > 1800 mg/day; no evidence of enhanced iron absorption above these doses).

Section G: Respiratory System

- 1. Theophylline as monotherapy for COPD (safer, more effective alternative; risk of adverse effects due to narrow therapeutic index).
- 2. Systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD (unnecessary exposure to long-term side-effects of systemic corticosteroids and effective inhaled therapies are available).
- 3. Anti-muscarinic bronchodilators (e.g., ipratropium, tiotropium) with a history of narrow angle glaucoma (may exacerbate glaucoma) or bladder outflow obstruction (may cause urinary retention).
- 4. non-selective beta-blocker (whether oral or topical for glaucoma) with a history of asthma requiring treatment (risk of increased bronchospasm).
- 5. Benzodiazepines with acute or chronic respiratory failure i.e., pO₂ < 8.0 kPa ± pCO₂ > 6.5 kPa (risk of exacerbation of respiratory failure).

Section H: Musculoskeletal System

- 1. non-steroidal anti-inflammatory drug (NSAID) other than COX-2 selective agents with history of peptic ulcer disease or gastrointestinal bleeding, unless with concurrent PPI or H2 antagonist (risk of peptic ulcer relapse).
- 2. NSAID with severe hypertension (risk of exacerbation of hypertension) or severe heart failure (risk of exacerbation of heart failure).
- 3. Long-term use of NSAID (>3 months) for symptom relief of osteoarthritis pain where paracetamol has not been tried (simple analgesics preferable and usually as effective for pain relief).
- 4. Long-term corticosteroids (>3 months) as monotherapy for rheumatoid arthritis (risk of systemic corticosteroid side-effects).
- 5. Corticosteroids (other than periodic intra-articular injections for mono-articular pain) for osteoarthritis (risk of systemic corticosteroid side-effects).
- 6. Long-term NSAID or colchicine (>3 months) for chronic treatment of gout where there is no contraindication to a xanthine-oxidase inhibitor (e.g., allopurinol, febuxostat) (xanthine-oxidase inhibitors are first choice prophylactic drugs in gout).
- 7. COX-2 selective NSAIDs with concurrent cardiovascular disease (increased risk of myocardial infarction and stroke).
- 8. NSAID with concurrent corticosteroids without PPI prophylaxis (increased risk of peptic ulcer disease).
- 9. Oral bisphosphonates in patients with a current or recent history of upper gastrointestinal disease i.e., dysphagia, esophagitis, gastritis, duodenitis, or peptic ulcer disease, or upper gastrointestinal bleeding (risk of relapse/exacerbation of esophagitis, esophageal ulcer, esophageal stricture).

Section I: Urogenital System

- 1. Antimuscarinic drugs with dementia, or chronic cognitive impairment (risk of increased confusion, agitation) or narrow-angle glaucoma (risk of acute exacerbation of glaucoma), or chronic prostatism (risk of urinary retention).
- 2. Selective alpha-1 selective alpha blockers in those with symptomatic orthostatic hypotension or micturition syncope (risk of precipitating recurrent syncope).

Section J: Endocrine System

- 1. Sulphonylureas with a long duration of action (e.g., glipalamide, chlorpropamide, glimepiride) with type 2 diabetes mellitus (risk of prolonged hypoglycemia).
- 2. Thiazolidinediones (e.g., rosiglitazone, pioglitazone) in patients with heart failure (risk of exacerbation of heart failure)
- 3. Beta-blockers in diabetes mellitus with frequent hypoglycemic episodes (risk of suppressing hypoglycemic symptoms).
- 4. Estrogens with a history of breast cancer or venous thromboembolism (increased risk of recurrence).
- 5. Oral estrogens without progestogen in patients with intact uterus (risk of endometrial cancer).

Section K: Drugs that predictably increase the risk of falls in older people

- 1. Benzodiazepines (sedative, may cause reduced sensorium, impair balance). 2. Neuroleptic drugs (May cause gait dyspraxia, Parkinsonism).
- 3. Vasodilator drugs (e.g., alpha-1 receptor blockers, calcium channel blockers, long-acting nitrates, ACE inhibitors, angiotensin I receptor blockers,) with persistent postural hypotension i.e., recurrent drop in systolic blood pressure ≥ 20 mmHg (risk of syncope, falls).
- 4. Hypnotic Z-drugs e.g., zopiclone, zolpidem, zaleplon (may cause protracted daytime sedation, ataxia).

Section L: Analgesic Drugs

- 1. Use of oral or transdermal strong opioids (morphine, oxycodone, fentanyl, buprenorphine, diamorphine, methadone, tramadol, pethidine, pentazocine) as first line therapy for mild pain (WHO analgesic ladder not observed).
- 2. Use of regular (as distinct from PRN) opioids without concomitant laxative (risk of severe constipation).
- 3. Long-acting opioids without short-acting opioids for break-through pain (risk of persistence of severe pain).

Section N: Antimuscarinic/Anticholinergic Drug Burden

- Concomitant use of two or more drugs with antimuscarinic/anticholinergic properties (e.g., bladder antispasmodics, intestinal antispasmodics, tricyclic antidepressants, first generation antihistamines) (risk of increased antimuscarinic/anticholinergic toxicity).

Screening Tool to Alert to Right Treatment (START)

Unless an elderly patient's clinical status is end-of-life and therefore requires a more palliative focus of pharmacotherapy, the following drug therapies should be considered where omitted for no valid clinical reason under each drug classification below. Please indicate if any of the listed medications are recommended to start.

Section A: Cardiovascular System

- 1. Vitamin K antagonists or direct thrombin inhibitors or factor A_x inhibitors in the presence of chronic atrial fibrillation.
- 2. Aspirin (75 mg - 160 mg once daily) in the presence of chronic atrial fibrillation, where Vitamin K antagonists or direct thrombin inhibitors or factor A_x inhibitors are contraindicated.
- 3. Antiplatelet therapy (aspirin or clopidogrel or prasugrel or ticagrelor) with a documented history of coronary, cerebral or peripheral vascular disease.
- 4. Antihypertensive therapy where systolic blood pressure consistently > 160 mmHg and/or diastolic blood pressure consistently >90 mmHg; if systolic blood pressure > 140 mmHg and /or diastolic blood pressure > 90 mmHg if diabetic.
- 5. Statin therapy with a documented history of coronary, cerebral or peripheral vascular disease, unless the patient's status is end-of-life or age is > 85 years.
- 6. Angiotensin Converting Enzyme (ACE) inhibitor with systolic heart failure and/or documented coronary artery disease.
- 7. Beta-blocker with ischemic heart disease.
- 8. Appropriate beta-blocker (bisoprolol, nebivolol, metoprolol or carvedilol) with stable systolic heart failure.

Section B: Respiratory System

- 1. Regular inhaled B₂ agonist or antimuscarinic bronchodilator (e.g., ipratropium, tiotropium) for mild to moderate asthma or COPD.
- 2. Regular inhaled corticosteroid for moderate-severe asthma or COPD, where FEV₁ < 50% of predicted value and repeated exacerbations requiring treatment with oral corticosteroids.
- 3. Home continuous oxygen with documented chronic hypoxemia (i.e., pO₂ < 8.0 kPa or 60 mmHg or SaO₂ < 89%).

Section C: Central Nervous System & Eyes

- 1. L-DOPA or a dopamine agonist in idiopathic Parkinson's disease with functional impairment and resultant disability.
- 2. non-TCA antidepressant drug in the presence of persistent major depressive symptoms.
- 3. Acetylcholinesterase inhibitor (e.g., donepezil, rivastigmine, galantamine) for mild-moderate Alzheimer's dementia or Lewy Body dementia (rivastigmine).
- 4. Topical prostaglandin, Prost amide or beta-blocker for primary open-angle glaucoma.
- 5. Selective serotonin reuptake inhibitor (or SNRI or pregabalin if SSRI contraindicated) for persistent severe anxiety that interferes with independent functioning.
- 6. Dopamine agonist (ropinirole or pramipexole or retigabine) for Restless Legs Syndrome once iron deficiency and severe renal failure have been excluded.

Section D: Gastrointestinal System

- 1. Proton Pump Inhibitor with severe gastro-esophageal reflux disease or peptic stricture requiring dilatation.
- 2. Fiber supplements (e.g., bran, ispaghula, methylcellulose, sterculia) for diverticulosis with a history of constipation.

Section E: Musculoskeletal System

- 1. Disease-modifying anti-rheumatic drug (DMARD) with active, disabling rheumatoid disease.
- 2. Bisphosphonates and vitamin D and calcium in patients taking long-term systemic corticosteroid therapy.
- 3. Vitamin D and calcium supplement in patients with known osteoporosis and/or previous fragility fracture(s) and/or (Bone Mineral Density T-scores more than -2.5 in multiple sites).
- 4. Bone anti-resorptive or anabolic therapy (e.g., bisphosphonate, strontium ranelate, teriparatide, denosumab) in patients with documented osteoporosis, where no pharmacological or clinical status contraindication exists (Bone Mineral Density T-scores \geq 2.5 in multiple sites) and/or previous history of fragility fracture(s).
- 5. Vitamin D supplement in older people who are housebound or experiencing falls or with osteopenia (Bone Mineral Density T-score is $>$ -1.0 but $<$ -2.5 in multiple sites).

- 6. Xanthine-oxidase inhibitors (e.g., allopurinol, febuxostat) with a history of recurrent episodes of gout.
- 7. Folic acid supplement in patients taking methotrexate.

Section F: Endocrine System

- 1. ACE inhibitor or Angiotensin Receptor Blocker (if intolerant of ACE inhibitor) in diabetes with evidence of renal disease i.e., dipstick proteinuria or microalbuminuria (>30mg/24 hours) with or without serum biochemical renal impairment.

Section G: Urogenital System

- 1. Alpha-1 receptor blocker with symptomatic prostatism, where prostatectomy is not considered necessary.
- 2. 5-alpha reductase inhibitor with symptomatic prostatism, where prostatectomy is not considered necessary.
- 3. Topical vaginal estrogen or vaginal estrogen pessary for symptomatic atrophic vaginitis.

Section H: Analgesics

- 1. High-potency opioids in moderate-severe pain, where paracetamol, NSAIDs or low-potency opioids are not appropriate to the pain severity or have been ineffective.
- 2. Laxatives in patients receiving opioids regularly.

Section I: Vaccines(annually)

- 1. Seasonal trivalent influenza
- 2. Pneumococcal vaccine at least once after age 65 according to national guidelines.

Appendix I**STOPP/START DATA SHEET**

Record ID

Record ID

Age

of medications prescribed before STOPP/START

#of medications stopped after STOPP/START Week 1

of new medications started after STOPP/START Week 1

of active medications after STOPP/START Week 1

#of medications stopped after STOPP/START Week 2

#of medications started after STOPP/START Week 2

#of active medications prescribed after STOPP/START Week 2

Appendix J

STOPP/START TOOL USABILITY SURVEY

Record ID _____

THE TOOL HAS ALL THE FUNCTIONS AND CAPABILITIES I EXPECT IT TO HAVE.

- STRONGLY DISAGREE
 DISAGREE
 NEITHER AGREE NOR DISAGREE
 AGREE
 STRONGLY AGREE
-

I found the tool easy to use.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

I found the tool difficult to use.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

I would benefit from more training on how to use the tool.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

I felt very comfortable using this tool.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

I found this tool to be very helpful.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

I would continue to use this tool.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

I would benefit from more training on how to use the tool.

- Strongly Disagree
 Disagree
 Neither Agree nor Disagree
 Agree
 Strongly Agree
-

Overall, I am satisfied with this tool.

- Strongly Disagree
 - Disagree
 - Neither Agree nor Disagree
 - Agree
 - Strongly Agree
-

If this tool were made available to me, I would integrate it into my everyday medical practice.

- Strongly Disagree
 - Disagree
 - Neither Agree nor Disagree
 - Agree
 - Strongly Agree
-

List up to three of the most negative aspect(s) about this tool:

List up to three of the most positive aspect(s) about this tool:

Please provide any additional thoughts or suggestions regarding this tool and/or its use in practice.
