SUNY UPSTATE

Medical University

Practice and Policy Brief

Results of a Longitudinal Evaluation of Deprescribing for Long-Term Residents of Skilled Nursing Facilities

Department of Geriatrics and Department of Public Health and Preventive Medicine

June, 2023

Deprescribing is a physician supervised process involving ceasing, replacing or decreasing the number of unnecessary or potentially inappropriate medicines to minimize the effects of polypharmacy and prevent adverse drug events or outcomes. It recognizes that unnecessary medications and adverse drug events put one in 25 older adults at risk of avoidable health problems and emergency room visits, and that as many as 95% of nursing home residents have medication related health issues.

This brief presents the results and implications of a retrospective, longitudinal pre/post impact and cost benefit evaluation of a deprescribing program introduced for long-term residents of two skilled nursing facilities (SNFs) in Upstate New York. The project focused on two primary questions.

(1) Can a systematic program for deprescribing reduce the number of medication classes prescribed for long-term SNF residents and the number of high-risk classes prescribed?

(2) Do the benefits of a deprescribing program outweigh the costs?

Results suggest that deprescribing efforts in SNFs can have beneficial results in reducing polypharmacy and side-effect prone medications.

This project was co-led by the Departments of Geriatrics and Public Health and Preventive Medicine at SUNY Upstate Medical University in partnership with the Loretto Health System. The project was funded by a grant from the New York Health Foundation.

Table of Contents

Background

Deprescribing Defined

Deprescribing has been defined as a physician supervised process involving ceasing, replacing or decreasing the number of unnecessary or potentially inappropriate medicines (PIMs) to minimize the effects of polypharmacy and prevent adverse drug events (ADEs) or outcomes[1,2] Deprescribing is a physician-supervised process involving ceasing, replacing, or decreasing the number of unnecessary or potentially inappropriate medications to minimize the effects of polypharmacy, thereby preventing ADEs or other negative health outcomes.[3,4] Deprescribing aims to decrease the risks associated with PIM and improve health and quality-of-life outcomes. While the terminology may be new, stopping or reducing PIM is a long-accepted best practice for prescribing.[5,6] Polypharmacy is a term that refers to multiple medications or the use of more drugs than are medically necessary,[3] and is defined as the regular use of at least five mediations.[7] Many of these drugs include a number of PIMs, drugs for which the risk of a negative impact outweighs the expected benefit for the patient, or a safer alternative drug is available.[8]

Impact of Polypharmacy and Adverse Drug Events

An 88-year-old woman living independently raised concerns about swollen ankles with her doctor. She was prescribed a diuretic (water pill) to reduce the fluid and potassium supplements, as diuretics cause the kidneys to flush potassium out of the body. The diuretic made her urinate frequently, especially at night, interrupting her sleep. She was then prescribed a bladder control medication and Ambien to help her sleep. While she took the medications, she also limited her fluid intake to avoid getting up at night. Not enough fluids caused her to feel lightheaded when standing up and was prescribed medicine for dizziness. She fell soon after, breaking her hip and undergoing immediate surgery, which was complicated by dehydration, elevated potassium levels and kidney failure. Her fall, dizziness, dehydration, and kidney failure were all related to the five medications prescribed by her doctor which interacted with each other and her aging organ systems. The woman never fully regained her ability to walk and was moved to a nursing home where her medicines were reduced significantly. This eliminated her dehydration and dizziness and stabilized her kidney function, but she was no longer able to live on her own. This story is true and far from the exception.

Polypharmacy is often associated with undesirable consequences, elevating the risk of ADEs which can lead to increases in falls and hospitalizations among older persons.[9] Polypharmacy alone is a significant predictor of ADEs in older adults, yet SNF residents have been shown to be prescribed an average of 14 medications.[10,11,12] Up to 74% of long term care facility residents regularly use nine or more medications, resulting in an increase in the proportion of residents using a PIM from 30% based on studies before 1999 to almost 50% in studies after 2005.[13]

One in 25 older adults are at risk of avoidable health problems, emergency room visits and hospitalizations due to unnecessary medications or ADEs.[14] Nationally, between 39.7% and 47.5% of older adults are on five or more medications, double any other age group.[15,16] Polypharmacy is associated with a higher risk of ADEs, higher rates of hospitalizations (up to 30% of all admissions), higher rates of emergency room admissions (up to 35.5%), increased risk of falls and hip fractures, and decreased physical and cognitive function.[17,18] In one study, just four classes of medications accounted for 67% of ADE-related hospitalizations of adults age 65 and older.[19] Polypharmacy can also lead to 'prescription cascading' when an ADE is misdiagnosed as a new issue triggering additional unnecessary medications, tests and procedures. The above example of the 88-year-old woman illustrates the phenomenon of prescription cascading as her physician attempts to resolve each issue with an additional medication, rather than investigating and treating the root cause.

ADEs also place a large economic burden on the United States, costing an estimated $30.1 billion annually,[20] and an average cost of $72,000 per hospitalization with per-event cost of $13,994 for non-intensive care and $19,685 for intensive care.[21] A North Carolina study found that one nursing home deprescribing program decreased Medicaid costs an average of $684 per patient per year.[22]

Medication related risks, ADEs and related costs are predictable and preventable. Evidence based guidelines and criteria are available, with the gold standard being the Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults issued and regularly updated by the American Geriatrics Society.[23] Lacking are models for and evidence demonstrating the health and economic value of integrating deprescribing into practice.

Methodological Overview of Analyses

This project addressed the number and cost of preventable medication-related ADEs among frail older adults due to negative drug-to-drug interactions, high risk medications and simply taking too many medications. As noted, up to 30% of older adult hospitalizations are medication-related and as many as 95% of nursing home patients have drug-related health issues. While evidence-based guidelines are available on PIMs, we lack models for and evidence demonstrating the health benefits and economic value of incorporating these guidelines into practice workflow. The project focused on two primary questions.

(1) Can a systematic program for deprescribing reduce the number of medication classes prescribed for long-term SNF residents and the number of high-risk classes prescribed?

(2) Do the benefits of a deprescribing program outweigh the costs?

A longitudinal, retrospective pre/post evaluation design was used to analyze the impact and cost benefit of the systematic deprescribing program implemented by the Loretto Health System in 2019 for long-term older residents of two SNFs in Upstate New York. The deprescribing program at both SNFs was a multi-faceted, pragmatic, and interdisciplinary deprescribing effort to reduce medications administered to SNF residents through clinician education, guideline development, and individual chart reviews.

The program was developed using evidence-based principles outlined in the Beers Criteria® and rules issued by the Centers for Medicare and Medicaid. As a preliminary step, Loretto's clinical management team created an educational program for all clinicians on the issue of polypharmacy, relevant quality measures and regulations, and guideline updates. They also distributed periodic quality measures to all providers twice per year and developed internal deprescribing guidelines that allowed for clinician judgement. With these steps in place, a clinical management team consisting of a medical director, attending physicians, physician assistants, floor nurse managers, and a pharmacy consultant initiated interprofessional unit-by-unit Gradual Dose Reduction (GDR) meetings to review each patient chart monthly. Periodic reviews of all charts were also conducted by the consulting pharmacist and quality outcome measures were distributed to all providers bi-annually. These procedures were implemented in both SNF facilities.

Project impact and cost benefit analyses were conducted using long-term SNF resident data between 2017 and 2021reported through annual Medicaid comprehensive minimum data set (MDS) reviews (impact analysis) and billing data provided by Loretto's Pharmacy Management vendor (cost benefit analysis). Details on the methods and results of both analyses follow.

Impact Analysis

Our objective was to see whether the deprescribing intervention used at both SNF locations within Loretto Health System reduced the number of medications prescribed to residents. We looked at eight common classes of medications including: diuretics, opioids, antipsychotic compounds, anticoagulant medication, antianxiety drugs, antibiotics, hypnotic medications, and antidepressants. We conducted two separate analyses, outlined below, that looked at resident data from both SNFs between 2017 and 2021. Data prior to and during the implementation of the program (2017-2019) were compared to the data from post-intervention year (2020) and then looked at again through 2021. We used several statistical tests to calculate outcomes. Core methods of the analysis were discussed in our published manuscript. For more detail of the analysis, see the publication by Morley et al.[24]

The initial analysis of data looked at the pre-intervention period (2017-2019) compared to the first half of 2020. Only 2020 differed from the prior years; there were no significant differences at either facility existed between years 2017-2019, enabling us to use the entire pre-intervention period as a single group for the analysis.

We used a total of 12,144 patient records available to analyze the data. Most of the sample was female, White, and with a mean age of 82.50 years. A further breakdown of demographic information is discussed in our manuscript. From our analysis, we saw a reduction in the overall number of medication classes per resident. The mean number of medications were lower in 2020 at both SNF facilities (mean =1.74 classes of medication per resident at both facilities) versus prior years (1.90 at Facility 1, 1.86 at Facility 2). When we looked at specific classes of medication, we found there were decreases in prescribing rates for diuretics, opioids, and antipsychotics. Although the numerical rate for prescribing was lower among anticoagulants, antianxiety medications, and antibiotics, the results were not significant. We also saw no changes in the use of hypnotic agents, although less than 100 patients in each period were administered these sleeping aids. There was a slight increase in antidepressant usage from the pre- to the post-intervention period, but these results were not significant.

Table 1: Percent of patients on eight classes of medication, by Pre vs. Post-intervention period, and overall medication.

Medication Class	**Pre (2017-2019)**		**Post (2020)**		**Change %**	**p˜**
	% or Mean	**N**	**% or Mean**	**N**		
•Diuretic	36.8%	3865	32.6%	532	-4.2%	.001*
•Opioid	26.5%	2139	22.7%	371	-3.8%	.001*
•Antipsychotic	14.9%	1569	12.5%	204	-2.4%	.010*
•Anticoagulant	23.30%	2445	22.1%	361	-1.2%	0.30
•Antianxiety	13.0%	1362	11.9%	194	-1.1%	0.23
•Antibiotic	26.2%	2752	25.8%	422	-0.4%	0.77
•Hypnotic	0.8%	79	0.8%	13	0.0%	0.85
•Antidepressant	44.3%	4660	45.8%	748	1.5%	0.27
Total Medications (Mean)	1.88	10511	1.74	1633	-0.14	<0.001*

*Indicates statistical significance at the $p<0.05$ level
˜Comparisons across categories assessed via χ^2

The reductions in diuretics, opioids, and antipsychotics were present after controlling for other possible explanatory variables, as was the overall reduction in total medication categories. From this initial analysis, it is evident that major, significant changes were seen in medication classes with potentially serious side effects. Results of logistic and linear regressions are included in Table 2.

Table 2: Comparison of pre (2017-2019) vs post (2020) intervention odds ratios (OR, calculated by logistic regression) for receiving eight classes of medication, and overall medication classes (mean, assessed by linear regression), controlling for African-American race, Female sex, and age as a continuous variable.

Medication Class	OR/Beta	p	CI	Constant	AD	Female	Age
•Diuretic~	.822**	<.001	.736 - .919	1.266	1.181*	.966	.991**
•Opioid~	.787**	<.001	.693 – .893	3.645	1.253*	1.490**	.969*
•Antipsychotic~	.803*	.006	.686 - .939	.787	.539**	1.200**	.981**
•Anticoagulant~	.919	.193	.810 – 1.043	2.890	.806*	.712**	.976**
•Antianxiety~	.885	.138	.753 – 1.040	1.419	.393**	1.712**	.969**
•Antibiotic~	.978	.711	.868 – 1.102	.857	.703**	.872*	.989**
•Hypnotic~	.998	.995	.553 – 1.801	1.807	6.090	.871	.920**
•Antidepressant~	1.041	.457	.936 – 1.158	6.642	.496**	1.557**	.968**
Total Medications (Mean)^	-.156	<.001*	-.219 - -.092	4.115	-0.339*	.160*	-.028*

* Indicates clinical significance at the $P<0.05$level
**Indicates clinical significance at the $P<0.001$ level
~Binary Logistic Regression; Odds Ratio (OR) reported
^Ordinary Least Squares Regression; β estimate reported
Abbreviations: AD = African descent, CI = Confidence interval, OR = Odds ratio.

To examine the durability of results identified in the initial analysis, we reconstructed the procedures using an extended data set, adding MDS data from all of 2020 and 2021 to comprise the post-intervention period. Changes in diuretic, opioid, antipsychotic, and antianxiety medications remained consistent, with the post-period realizing lower odds ratios for each class of medication. Diuratic, antipsychotic, and antianxiety medication reductions were statistically significant. Additionally, the reduction in odds of receiving an antibiotic were lower in the second analysis than in the first, and were statistically significantly so in the second analysis. Total classes of medications also remained lower across the pre-to-post period, as in the first analysis. These results are displayed in more detail in Table 3.

In the updated analysis, anticoagulants increased, but likely due to an influx of patients with hypertension, and demographic shifts in the population, in the post-COVID time period. Hypnotic agents were also used more frequently. However, the number of SNF residents getting hypnotics was very small, and small changes to very small numbers in a very large sample can produce the results we observed. Finally, antidepressants were slightly and nonsignificantly increased in the first analysis and significantly increased in the second analysis. However, increased antidepressant usage was acknowledged by SNF staff to have increased in order to offset reductions in other medications. These results are also visible in Table 3.

Table 3: Comparison of updated analysis encompassing lengthened post-intervention time period (2017-2019 vs 2020-2021) compared with original analysis reported in Morley et al (2017-2019 vs 6 months of 2020)

Change r between initial to updated analysis	Medication Class	2017-2019 vs 2020-2021		2017-2019 vs 2020 (first six months)	
		OR/Beta	P	OR/Beta	P
Odds of receiving medication similar across two analyses	Diuretic**	0.846*	< 0.001	0.82*	< 0.001
	Opioid**, xx	0.740*	< 0.001	0.79*	< 0.001
	Antipsychotic**	0.848*	0.001	0.80*	0.006
	Antianxiety**	0.932	0.187	0.89	0.138
Odds of receiving medication decreased	Antibiotic**	0.888*	0.004	0.98	0.711
Odds of receiving medication increased	Anticoagulant**	1.308*	< 0.001	0.92	0.193
	Hypnotic**	1.788*	< 0.001	0.99	0.995
	Antidepressant**	1.181*	< 0.001	1.04	0.457
Results similar across analyses	Total medications (mean)††	-0.064*	0.004	-0.16	< 0.001*

*Indicates statistical significance at the P < 0.05 level.
**Binary Logistic Regression; OR reported.
††Ordinary Least Squares Regression; Beta estimate reported.
[xx] Opioids were irregularly reported in 2017; estimates are for 2018-2019 vs 2020-221

Summary of Impact Analysis

- There was a slight change in overall medications which was significant after covariate adjustment (for race, age, and gender).
- Significant reductions were observed in the odds of being administered diuretics, opioids, antipsychotics and antibiotics that were robust over time; an additional reduction in odds of being administered Antianxiety medications became significant when additional data points and time were added.
- Increases in anticoagulants and hypnotics (very small overall numbers, likely not clinically significant) were also observed, but likely due to changes in resident mix, as well as in the overall small size of the number of SNR residents receiving hypnotic agents.
- Statistically significant increases in antidepressants were explainable because they were used to offset other medication reductions.
- The implementation of a multi-pronged, pragmatic deprescribing effort in a two-site SNF system was associated with sustainable reductions in several important classes of medications.

Cost Benefit Analysis

The project evaluation contained an economic component. We compared the cost of prescriptions before and after the intervention using data provided to us by the pharmacy management company that supplies and manages the prescriptions for the two SNFs included in this study. The data provided were at the level of the individual prescriptions and covered the two-year period prior to Loretto's introduction of a deprescribing program (2017-2019) and after (2020-2021). The data set included: SNF site, prescription drug class, prescription drug name, dosage, whether the prescription was for a name brand or generic drug, and prescription drug cost. Of note, this was a different data set than that used for the impact analysis, which utilized MDS data.

For the purposes of this analysis, prescription drugs were placed into one of same eight classes of medications used in the impact analysis discussed in the previous section. These included: antianxiety agents; antibiotics, anticoagulants, antidepressants, antipsychotics, diuretics, hypnotics, and opioids. We report descriptive statistics for both the pre- and post- intervention periods by class of drug and skilled nursing facility site. We conducted bivariate analyses and used T-tests to compare mean numbers of prescriptions and Chi-square tests to compare the proportion of prescriptions administered in each drug class in the pre-intervention period with those administered in the post-intervention period. SPSS version 28 was used for the analysis.

The data set consisted of 50,194 prescriptions administered to 2,839 SNF residents in the pre-intervention period (2017-2019), and 48,842 prescriptions administered to 2,580 residents in the post-intervention period (2020-2021). This decrease in the number of prescriptions and residents may in part reflect shorter timeframe (one versus two years) in the post-intervention period. The smaller number of residents may also be associated with the COVID pandemic, which occurred during the post-intervention period.

Number and proportion of prescriptions

Table 4 reports on the number of prescriptions and patients with prescriptions for each of the two SNF sites by pre- and post-periods. Site 1 represents the larger of the two SNF s with over 65% of all the prescriptions and residents in both periods. In Site 1, the number of prescriptions fell in the post-intervention period, while the number of prescriptions increased at Site 2. The total number of residents with any prescriptions was lower at both sites in the post-intervention period.

Table 4: Number of prescriptions and patients by SNF site

	Pre-Intervention Period 2017-2019		Post-Intervention Period 2020-2021	
SNF Site	Prescriptions	Patients	Prescriptions	Patients
Site 1	34,489	1,984	32,481	1,813
Site 2	15,705	855	16,341	767
Sites combined	50,194	2,839	48,822	2,580

Table 5 presents descriptive statistics for the number of prescriptions per resident by site and by period including mean and standard deviations, as well as the median and the range for each site. At Site 1, there was no statistically significant difference in the mean number of prescriptions per patient in the post-intervention period compared to the pre-intervention period. However, there was a statistically significant increase in the post-intervention period at Site 2. The means and medians for both sites and time periods are quite different and reflect the range in the number of prescriptions that residents were administered. For instance, one patient may have had only one prescription in one class of medications in the entire period, while another patient may have had prescriptions in multiple drug classes for each thirty-day period. The differences in the mean and median number of prescriptions may also reflect the differences in case-mix, what medications the residents were already on when they entered the SNF, and prescribing behaviors of the clinical management team.

Table 5: Descriptive statistics for number of prescriptions per patient by site

	Pre-Intervention Period 2017-2019		Post-Intervention Period 2020-2021	
SNF site	Mean (SD)	Median (Range)	Mean (SD)	Median (Range)
Site 1	17.38 (22.02)	9 (1-235)	17.92 (21.96)	10 (1-207)
Site 2	18.37 (22.31)	9 (1-171)	21.31 (24.95) *⇑	11 (1-167)

T-test used to compare means between periods.
Mean number of prescriptions significantly different from earlier period, *p<.05, **p<.01, ***p<.001.

Tables 6-1 and 6-2 compare the proportion of prescriptions by drug class in the two periods for each site. At Site 1 (Table 3-1), there was a statistically significant decrease in the number and proportion of antianxiety, antipsychotics, diuretics, and opioids. These findings are consistent with the results of the main part of the evaluation which employed a different data source to study a similar question. At the same time, there were statistically significant increases in the number and proportion of anticoagulant and antidepressant prescriptions. There were no significant changes in the antibiotic and hypnotic categories. There were similarities as well as differences in the results for Site 2 (Table 6-2) when compared with those for Site 1. The similarities included statistically significant decreases in the number and proportion of prescriptions for antipsychotics, diuretics, opioids, and statistically significant increases in antidepressant prescriptions. The differences included, for Site 2, a statistically significant increase in antianxiety prescriptions in the post-intervention period, a significant decrease in antibiotic prescriptions and no significant change in anticoagulant prescriptions.

Table 6-1 – Prescriptions by Medication Class – Site 1

	Pre-intervention Period 2017-2019	Post-Intervention Period 2020-2021
Medication Class	Number of prescriptions (% of total)	Number of prescriptions (% of total)
Antianxiety agents	2,297 (6.7%)	1,827 (5.6%)***⇓
Antibiotics	7,097 (20.6%)	6,760 (20.8%)
Anticoagulants	5,939 (17.2%)	6,477 (19.9%)***⇑
Antidepressants	7,151 (20.7%)	7,420 (22.8%)***⇑
Antipsychotics	2,854 (8.3%)	2,545 (7.8%)*⇓
Diuretics	5,189 (15.0%)	4,599 (14.2%)**⇓
Hypnotics	105 (0.3%)	107 (0.3%)
Opioids	3,857 (11.2%)	2,746 (8.5%)***⇓
Total	34,489	32,481

Table 6-2 – Prescriptions by Medication Class – Site 2

	Pre-intervention period 2017-2019	Post-intervention period 2020-2021
Medication Class	Number of prescriptions (% of total)	Number of prescriptions (% of total)
Antianxiety agents	1,142 (7.3%)	1,444 (8.8%)***⇑
Antibiotics	3,231 (20.6%)	3,198 (19.6%)*⇓
Anticoagulants	2,402 (15.3%)	2,522 (15.4%)
Antidepressants	3,220 (20.5%)	3,945 (24.1%)***⇑
Antipsychotics	1,256 (8.0%)	1,109 (6.8%)***⇓
Diuretics	2,559 (16.3%)	2,385 (14.6%)***⇓
Hypnotics	109 (0.7%)	110 (0.7%)
Opioids	1,786 (11.4%)	1,628 (10.0%)***⇓
Total	15,705	16,431

Chi-square test used for comparison between periods.
Prescription category proportion significantly different from earlier period, *p<.05, **p<.01, ***p<.001.

Cost of Prescriptions

Tables 7-1 and 7-2 present the total cost of the prescriptions by medication class and by time-period for the two sites. The total cost of prescription medications was higher in both sites in the post-intervention period, with an 56% increase in cost for Site 1 and a 29% increase in cost for Site 2. The total cost of antianxiety agents and opioids was lower in the post-intervention period in both sites. These decreases may be due to fewer prescriptions, e.g., opioids, changes in drug regimens, or use of cheaper drugs. The prescription medication cost in the other categories increased in the post-intervention period. This could be attributed to more prescriptions, e.g., anticoagulants in Site 1, changes in drug regimens, increases in drug prices, or use of more expensive drugs. The largest magnitude of increase was in the cost of anticoagulants, which increased by 132% in the Site 1, and 44% in Site 2.

Table 7 -1 – Total Cost of Prescription Medications by Class – Site 1

Medication Class	Pre-Intervention Period 2017-2019	Post-Intervention Period 2020-2021
Antianxiety agents	$21,090	$15,592⇓
Antibiotics	$286,206	$325,506⇑
Anticoagulants	$364,549	$815,740⇑
Antidepressants	$203,762	$214,295⇑
Antipsychotics	$280,025	$514,163⇑
Diuretics	$18,226	$21,947⇑
Hypnotics	$1,524	$1,619⇑
Opioids	$65,868	$32,012⇓
Total	**$1,241,250**	**$1,940,873**⇑

Table 7 -2 – Total Cost of Prescription Medication by Class – Site 2

Medication Class	Pre-Intervention Period 2017-2019	Post-Intervention Period 2020-2021
Antianxiety agents	$12,650	$11,713⇓
Antibiotics	$94, 609	$150,723⇑
Anticoagulants	$233,317	$335,307⇑
Antidepressants	$93,194	$114,600⇑
Antipsychotics	$157,329	$165,237⇑
Diuretics	$8,200	$8,455⇑
Hypnotics	$4,005	$1,156⇓
Opioids	$21,513	$16,532⇓
Total	**$624,816**	**$803,724**⇑

Tables 8-1 and Tables 8-2 report the mean, median and maximum costs for each class of medications by site. The mean and median cost of anticoagulants, in red (Table 8-1), is much higher in the post-intervention period at both sites. We conducted additional analysis to gain further insight into the cost increases by prescription medication class. For anticoagulants, these increases are associated with the use of new and more effective medications in the medical community at large during this period, which switched from the use of generic Warfarin to brand name drugs, specifically, Eliquis and Xarelto. The switch to Eliquis and Xarelto accounts for approximately 90% of drugs in the anticoagulants category and costs more than $200 per prescription than Warfarin. The increase in the cost of antipsychotics can be explained by prescriptions for more expensive drugs. Despite median cost decreases in the post-intervention period in both sites, the mean cost for antipsychotics is higher. At Site 1, the maximum cost for antipsychotics is much higher in the post-intervention period, while it is unchanged at Site 2.

Table 8-1 – Mean, Median and Maximum Cost of Prescription Medication by Class – Site 1

Medication Class	Pre-Intervention Period (2017-2019)			Post-Intervention Period (2020-2021)		
	Mean	Median	Maximum	Mean	Median	Maximum
Antianxiety agents	$9.18	$5.55	$184.99	$8.53	$5.38	$118.93
Antibiotics	$40.35	$7.93	$3550.85	$48.16	$11.25	$5873.70
Anticoagulants	$61.38	$3.39	$550.03	$125.94	$165.13	$678.07
Antidepressants	$28.49	$22.80	$1729.35	$28.88	$22.68	$518.80
Antipsychotics	$98.12	$63.89	$3912.19	$202.03	$62.87	$5260.17
Diuretics	$3.51	$1.34	$146.78	$4.77	$1.34	$193.09
Hypnotics	$14.51	$6.17	$319.68	$15.13	$8.52	$137.13
Opioids	$17.08	$6.06	$1296.57	$11.66	$4.90	$313.99

Table 8-2 – Mean, Median and Maximum Cost of Prescription Medication by Class – Site 2

Medication Class	Pre-Intervention Period (2017-2019)			Post-Intervention Period (2020-2021)		
	Mean	Median	Maximum	Mean	Median	Maximum
Antianxiety agents	$11.08	$7.89	$119.20	$8.11	$2.96	$102.38
Antibiotics	$29.30	$7.55	$1714.66	$47.13	$12.88	$3805.50
Anticoagulants	$97.26	$39.29	$678.07	$133.01	$205.99	$495.95
Antidepressants	$28.95	$23.95	$197.86	$29.04	$23.93	$416.38
Antipsychotics	$125.26	$55.18	$3912.19	$149.00	$35.96	$3912.19
Diuretics	$3.20	$1.34	$135.93	$3.55	$1.34	$135.93
Hypnotics	$36.74	$19.15	$291.77	$10.51	$9.13	$117.51
Opioids	$12.05	$6.28	$403.38	$10.16	$4.54	$228.08

For Tables 8-1 and 8-2:
Nuplazid accounts for over two-thirds of all drugs that cost over $1000.
Three drugs account for all cases where the cost of the drug exceeds $3000: Dificid, Invega Trinza, and Nuplazid.

Summary of Economic Analysis

- The number of prescriptions and patients was lower in the post-intervention period compared to the pre-intervention period, particularly at Site 1.
- There was a large variation in the number of prescriptions per resident with some having as few as one prescription during the time frame and others having over 100 prescriptions in the same period.
- There was a statistically significant decrease in the number and proportion of prescriptions for antipsychotics, diuretics, and opioids. These findings reinforce the results of the project's separate impact analysis.
- Total cost of prescription drugs increased in the post-intervention period. Costs decreased for some medication classes, such as antianxiety agents and opioids, and increased for others, e.g., anticoagulants and antipsychotics, but the decrease was not large enough to offset the increases.

Overall Summary of Results

The pragmatic, multi-component deprescribing effort was associated with a reduction in several classes of medications including, importantly, opioids, antipsychotics, antianxiety medications, and antibiotics. Each of these classes of medications is associated with significant side effects in older adults, and/or is the target of major public health efforts to improve stewardship and reduce usage. We were able to observe these impacts across analyses of two different data sets (MDS and Pharmacy), and in the case of the MDS-based impact analysis, across an initial and an extended analysis. The extended analysis furthermore suggests that the results are sustainable at least over a period of one to two years. Economic benefits were not as clear, using the methods we employed. However, cost reductions were likely not realized due to changes in medication mix, and particularly due to the introduction of new compounds, such as Eliquis. The core observation of medication reductions indicates that deprescribing did, in fact, occur.

These results should be considered in the context of several limitations. First, this project did not utilize an experimental design, but was rather a post-hoc evaluation of a non-research-based effort to reduce medications and combat the issue of polypharmacy on the part of the SNF system. It also should be recognized that these analyses were conducted within the context of two sites operated within a single long term care organization.

Additionally, it should be noted that opioids were not required for inclusion in the MDS until after 2017. Our analysis has accounted for this change. Regarding the Impact Analysis, it also should be noted that the MDS data system is primarily a billing and reporting system, and is not designed for detailed clinical monitoring. It was the best data system we had to use for this project's aims, but it was limited in the level of detail and granularity available for the project.

In Summary

- Although SNFs that implement a similar intervention may not find savings in total prescription drug costs, they may have savings in specific classes of medications, e.g., opioids.
- Whether there are cost savings after a reduction in the number prescriptions depends on whether the same drugs are being used or if they are being replaced with newer, much more expensive, or brand name drugs.
- Policymakers can play a role in monitoring and controlling the prices of new types of medications. These savings can impact Medicare costs as Medicare Prescription Drug Plans were identified as the method of payment for the majority of the prescriptions in our analyses.
- Increased spending on newer and more effective medications may be offset by reductions in other cost categories. Although increased use of Eliquis and Xarelto increases the spending on anticoagulants, it

reduces the costs associated with Warfarin use, i.e., constant monitoring, nursing time, lab work and medication adjustment. Furthermore, if the medication is more effective in preventing events such as stroke, there will be cost savings in hospitalizations, as well as other cost categories.

- Cost considerations aside, it is possible to reduce the most crucial classes of medications, with likely positively impact upon patient safety and medication stewardship goals.

Implications

For SNF Administrators and Practitioners

Value. Looking just at results for the eight classes of medications studied, findings show the potential clinical value to SNF residents in reducing classes of medications with higher risks for significant adverse side effects. Notably these are diuretics, opioids, and antipsychotics which, under the Beers Criteria®, should be avoided with older adults. Value can also be measured by potential savings associated with lab costs and staff-time required to monitor the potential side effects of such medications. Deprescribing efforts also align with the Centers for Medicare and Medicaid's increasing monitoring of medication-related ADEs among residents of SNFs and promotion of interventions to avoid such events.

Feasibility**.** Assessing the feasibility of implementing a deprescribing program in SNFs was not within the scope of this project. However, it can be reported that Loretto's deprescribing program was fully implemented within 12 months at two SNFs with very different profiles and has been sustained as of the writing of this Brief. One SNF is located in a large urban setting with 430 long term care beds and the second in a small urban area with 240 beds. Among the factors contributing to Loretto's implementation experience is the strong support it received by the medical, nursing and administrative leadership team, including their support of this project and its evaluation of their program.

For Policy Makers

Policy-related opportunities for providing education about and promoting deprescribing in SNFs emerged from reviews of the literature for this project and ongoing discussions with Loretto's clinical and administrative team. They include opportunities for federal and state policy makers, the leadership of professional societies, and medical educators.

Education efforts should include information on what deprescribing is and is not, the importance of clinical judgement combined with evidence based guidelines in considering deprescribing options, the value of medication reviews focused on the total number of medications prescribed (as well as on specific classes of medications with higher risks of side effects and adverse effects), and the importance of patient/caregiver engagement with clinicians in medication-related decision making.

Federal and state policy-makers have an important role in educating and promoting the education of providers as well as older patients and their caregivers about deprescribing in SNF and community-based settings. The need for provider and patient/caregiver education overall and in the context of prescription management was a consistent theme in the literature and in our work with clinicians during the project. While physicians report patient resistance as a main factor preventing deprescribing, research shows that the majority of Americans aged 65 and older are open to having at least one of their medicines deprescribed if their physician deems it possible, and more than two-thirds want to reduce the total number of medicines they are on.[25] Patient and caregiver education is an important, companion element of deprescribing programs given the understandable concern that medications they have taken for years and prescribed by trusted providers may be changed. Barriers can include reluctance on the part of patients and their caregivers to agree to changes in levels and types of medications and resistance by providers to change long-standing medication regimens.

Additional efforts should be considered by policy makers including encouraging and/or underwriting professional training in deprescribing for long term care administrators and clinicians broadly and Medicaid providers and other government funded programs specifically. This could take the form of sponsored trainings that offer continuing education credits, working with professional associations to embed training into their existing education and training programs, and incentives for incorporating deprescribing principles and programs into long term care practices.

Medical and long term care societies and associations are also well positioned to provide information and training opportunities to their membership on the science behind and best practices guiding deprescribing methods. Calls for journal submissions and abstracts for professional meetings should specify an interest in deprescribing topics, training sessions on deprescribing should be added to existing educational offerings, and official position statements should be adopted supporting the importance of deprescribing, especially for older adults.

Medical educators can play an essential role in ensuring that the next generations of clinicians and practitioners understand the effects of polypharmacy, how to recognize and prevent the use of unnecessary medications, which medications have preventable ADEs and how deprescribing methods can improve the health outcomes and quality of life for older adults in particular.

For Researchers

Research on the impact and cost benefit of deprescribing programs in clinical settings within and outside SNF settings in the United States is limited in scope and depth. In the absence of studies with clear clinical outcomes, systematic reviews are largely limited to research findings on feasibility and the potential for reducing medication use. [31] [32] Based on the experience of this project and supporting literature reviews, priorities for research include longitudinal research on the impact of deprescribing programs in SNF on medications administered and resident outcomes as well as the feasibility and cost benefit for facilities. Such research should be inclusive of residents of diverse ethnic and racial backgrounds. Additionally, deprescribing research should focus on points of care transition for older patients including hospital admission and discharge, admission to SNF long term care and rehabilitation facilities, emergency departments, palliative care, and hospice. It is at these points of care where the opportunity for comprehensive mediation reviews by specialists such as geriatricians and geriatric pharmacists may be timely and more feasible. While potentially more challenging, research on the role of deprescribing in primary care practice is also needed, possibly beginning with capitated programs such as the Medicaid Programs of All-Inclusive Care for the Elderly (PACE). Finally, cost benefit analyses of large Medicare datasets are also encouraged.

In suggesting these areas for further research, the limitation of the data sources used for this project must be emphasized. First, the impact analysis used data from the Medicaid MDS, a standardized process for clinical assessment of and reports on all SNF residents mandated for all Medicare and Medicaid certified SNFs. MDS data were found to be inconsistent both in what SNFs were to report over time and how assessments were reported. As such, the data did not support an analysis on the potential impact of deprescribing on adverse events or other outcome. MDS as a data source should be used cautiously if at all to measure clinical outcomes.

Two recent initiatives in the United States and Canada serve as important resources for researchers. First is the United States Deprescribing Research Network (https://deprescribingresearch.org) that was formed in 2019 and is making important strides to fund and support training in deprescribing research for older adults and to disseminate research findings. The second is a partnership of the Canadian Government and Canadian research institutes that in 2015 led to the development of a website through which information is disseminated on research and evidence based tools for practitioners and the general public (https://deprescribing.org/).

Funding Source

Funding for this project was provided by the ***New York State Health Foundation*** (Award #86614) to the Research Foundation of SUNY, o.b.o. Upstate Medical University (S. Brangman and C Morley, Co-PIs).

Acknowledgements

This project and the research behind it would not have been possible without the exceptional support of the Loretto Health System and its SNF team for this project. We thank Julie Sheedy and Joelle Margrey (Leadership), Yvonne Gascon (Skilled Nursing), Kristin Kim (Pharmacy), Brandon Claps and Dale Williams (IT), Terri Meehan (QA) and Lisa Llanos (Social Work) for their valuable contributions.

Contributions

Christopher P. Morley, Laura A. Schad, Martha A. Wojtowycz, Nancy H. Smith, Kelly R. Ulen, Kimberly Townsend, and Sharon A. Brangman contributed to project conception and design. Christopher P. Morley, Laura A. Schad, Halle Cerio, Sarah E. McNamara, Martha A. Wojtowycz, Nancy H. Smith, Kimberly Townsend, Joel Amidon, and Sharon A. Brangman contributed to acquisition of data. Sharon A. Brangman, Christopher P. Morley, Martha A. Wojtowycz, John Noviasky, Kelly R. Ulen, Sarah E. McNamara, Nancy H. Smith, and Katarina A. Sako contributed to literature reviews. Christopher P. Morley, Laura A. Schad, Halle Cerio, Sarah E. McNamara, Martha A. Wojtowycz, Nancy H. Smith, John Noviasky, Kelly R. Ulen, Kimberly Townsend, Joel Amidon, and Sharon A. Brangman contributed to analysis of interpretation of data. Christopher P. Morley, Laura A. Schad, Halle Cerio, Sarah E. McNamara, Martha A. Wojtowycz, John Noviasky, Kelly R. Ulen, Katarina A. Sako, and Sharon A. Brangman contributed to development of this Brief.

Citations

[1] Scott IA, Hilmer SN, Reeve E, et al. Reducing inappropriate polypharmacy: The process of deprescribing. *JAMA Internal Medicine*. 2015;175(5):827-834. doi:10.1001/jamainternmed.2015.0324

[2] Reeve E, Wolff JL, Skehan M, Bayliss EA, Hilmer SN, Boyd CM. Assessment of Attitudes Toward Deprescribing in Older Medicare Beneficiaries in the United States. *JAMA Internal Medicine*. 2018;178(12):1673-1680. doi:10.1001/jamainternmed.2018.4720

[3] Scott IA, Hilmer SN, Reeve E, et al. Reducing inappropriate polypharmacy: The process of deprescribing. *JAMA Internal Medicine*. 2015;175(5):827-834. doi:10.1001/jamainternmed.2015.0324

[4] Reeve E, Wolff JL, Skehan M, Bayliss EA, Hilmer SN, Boyd CM. Assessment of Attitudes Toward Deprescribing in Older Medicare Beneficiaries in the United States. *JAMA Internal Medicine*. 2018;178(12):1673-1680. doi:10.1001/jamainternmed.2018.4720

[5] Anderson K, Stowasser D, Freeman C, Scott I. Prescriber barriers and enablers to minimizing potentially inappropriate medications in adults: A systematic review and thematic synthesis. *BMJ Open*. 2014;4(12). doi:10.1136/bmjopen-2014-006544

[6] Wallis KA, Andrews A, Henderson M. Swimming against the tide: Primary care physicians' views on deprescribing in everyday practice. *Annals of Family Medicine*. 2017;15(4):341-346. doi:10.1370/afm.2094

[7] Guillot, Jordan, Sandy M, Julien B. Polypharmacy: A general review of definitions, descriptions and determinants. Therapies. 2020; 75(5): 407-416.

[8] Morin L, Laroche ML, Texier G, Johnell K. Prevalence of Potentially Inappropriate Medication Use in Older Adults Living in Nursing Homes: A Systematic Review. *Journal of the American Medical Directors Association*. 2016;17(9):862.e1-862.e9. doi:10.1016/j.jamda.2016.06.011

[9] Kua CH, Mak VSL, Huey Lee SW. Health Outcomes of Deprescribing Interventions Among Older Residents in Nursing Homes: A Systematic Review and Meta-analysis. *Journal of the American Medical Directors Association*. 2019;20(3):372. doi:10.1016/j.jamda.2018.10.026

[10] Saraf AA, Petersen AW, Simmons SF, et al. Medications associated with geriatric syndromes and their prevalence in older hospitalized adults discharged to skilled nursing facilities. *Journal of Hospital Medicine*. 2016;11(10):694-700. doi:10.1002/jhm.2614

[11] Reeve E, Wolff JL, Skehan M, Bayliss EA, Hilmer SN, Boyd CM. Assessment of Attitudes Toward Deprescribing in Older Medicare Beneficiaries in the United States. *JAMA Internal Medicine*. 2018;178(12):1673-1680. doi:10.1001/jamainternmed.2018.4720

[12] Scott IA, Hilmer SN, Reeve E, et al. Reducing inappropriate polypharmacy: The process of deprescribing. *JAMA Internal Medicine*. 2015;175(5):827-834. doi:10.1001/jamainternmed.2015.0324

[13] Tan ECK, Sluggett JK, Johnell K, et al. Research Priorities for Optimizing Geriatric Pharmacotherapy: An International Consensus. *Journal of the American Medical Directors Association*. 2018;19(3):193-199. doi:10.1016/j.jamda.2017.12.002

[14] Rochon, P, K Schmader, J Givers, Drug Prescribing for Older Adults, UpToDate on-line literature review, February 2019. https://www.uptodate.com/contents/drug-prescribing-for-older-adults

[15] Centers for Disease Control and Prevention, Chartbook: Special Feature on Prescription Drugs, 2013.

[16] Qato, DM, J. Wilder, LP Schumm, et al., Changes in Prescription and Over-the-Counter Medication and Dietary Supplemental Use Among Older Adults in the United States, 2005 vs 2011, Journal of the American Medical Society, 2016, 176:473.

[17] Sultana J, Cutroneo P, Trifirò G. Clinical and economic burden of adverse drug reactions. *Journal of Pharmacology and Pharmacotherapeutics*. 2013;4(SUPPL.1):S73. doi:10.4103/0976-500X.120957

[18] Lahue, B, B Pyenson, K Iwasaki, H Blumen, S Forray, J. Rothschild, National Burden of Preventable Adverse Drug Events Associated with Inpatient Injectable Medications: Healthcare and Medical Professional Liability Costs, American Health & Drug Benefits, November/December 2012, Vol. 5, No. 7.

[19] Budnitz, DS, MC Lovegrove, N Shehab, CL Richard, Emergency hospitalizations for adverse drug events in older Americans. New England Journal of Medicine, 2011, 365(21):2002.

[20] Sultana J, Cutroneo P, Trifirò G. Clinical and economic burden of adverse drug reactions. *Journal of Pharmacology and Pharmacotherapeutics*. 2013;4(SUPPL.1):S73. doi:10.4103/0976-500X.120957

[21] Lahue, B, B Pyenson, K Iwasaki, H Blumen, S Forray, J. Rothschild, National Burden of Preventable Adverse Drug Events Associated with Inpatient Injectable Medications: Healthcare and Medical Professional Liability Costs, American Health & Drug Benefits, November/December 2012, Vol. 5, No. 7.

[22] Trygstad TK, Christensen D, Garmise J, Sullivan R, Wegner S. Pharmacist response to alerts generated from Medicaid pharmacy claims in a long-term care setting: results from the North Carolina polypharmacy initiative. *Journal of managed care pharmacy : JMCP*. 2005;11(7):575-583. doi:10.18553/jmcp.2005.11.7.575

[23] Fick DM, Semla TP, Steinman M, et al. Updated AGS Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults. *Journal of the American Geriatrics Society*. 2019;67(4):674-694. doi:10.1111/jgs.15767

[24] Morley, CP, Schad, LA, Cerio, H, et al. Longitudinal Evaluation of a Deprescribing Protocol in Skilled Nursing Facilities. *Sr. Care Pharm*. 2022;37(10):523-531. doi:10.4140/TCP.n.2022.523.

[25] Reeve E, Wolff JL, Skehan M, Bayliss EA, Hilmer SN, Boyd CM. Assessment of Attitudes Toward Deprescribing in Older Medicare Beneficiaries in the United States. *JAMA Internal Medicine*. 2018;178(12):1673-1680. doi:10.1001/jamainternmed.2018.4720

[31] O'Donnell, L, Ibrahim, K. Polypharmacy and deprescribing: challenging the old and embracing the new. *British Medical Journal of Geriatrics*. 2022; 22:734. doi: 10.1186/s12877-022-03408-6

[32] Gnjidic, D, Johansson, M, Meng, D, Farrell, B, Langford, A, Reeve, E. Achieving sustainable healthcare through deprescribing. Editorial. Cochrane Database of Systematic Reviews. 20022; doi.org/10.1002/14651858.ED000159.