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Treatment of Hypertension in Frail Older Adults in Nursing Homes: Evaluation of an Educational Intervention for Physicians

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Abstract

Background: New treatment recommendations for hypertension, specific to the frail elderly, have recently been published. We aimed to determine the effect of an educational intervention on appropriateness of prescribing for hypertension in a nursing home setting using an observational, before and after study design in a single nursing home, as measured by adherence to each of the four key messages of the treatment recommendations.

Results: 138 nursing home residents participated in the study. A total of 17% of residents had a systolic blood pressure ≥140mm Hg and only 4% had SBP ≥150 mm Hg. The percentage of residents taking one or more medication affecting blood pressure decreased from 60.2% prior to the intervention to 51.9% in the post-intervention population (p=0.003) The proportion of residents prescribed 2 or more medications affecting blood pressure decreased from 36.4% pre-intervention to 23.1% post intervention (p=0.002). Median monthly cost for medications affecting blood pressure was $4.18 pre-intervention and decreased to $1.05 post-intervention (p<0.001). Conclusion: Nursing home residents may be over-treated for hypertension. A multi-faceted educational intervention can decrease the use of medications affecting blood pressure in a frail population.

Keywords: Frailty; Hypertension; Prescribing; Guidelines; Educational intervention; Evaluation; Elderly; Nursing home

Introduction

Frailty has been defined as a progressive physiological decline in multiple organ systems marked by loss of function, loss of physiological reserve and increased vulnerability to disease and death [1]. More practically, frailty describes older adults with complex medical illnesses and/or social issues that are severe enough to compromise their ability to live independently [2]. Frail older adults commonly have multiple co-existing medical problems and/or dementia and are at increased risk of adverse events including falls and hospitalization [1,3]. Since the frail elderly are vulnerable to poor health outcomes, it is important to assess the risk/benefit ratio of healthcare interventions, including drug therapy [4].

Residents in nursing homes are frail and commonly have multiple medical conditions, dementia, and shortened life expectancy, with a regional median life expectancy of 19 months. Although the benefit of preventive medications (such as cholesterol lowering medications) decreases as end of life approaches, frail individuals often continue to take these medications until death, suggesting that at some point in their health trajectory, the cost and potential for harm may outweigh the benefit [5].

Despite data to show that many medications (including anti-hypertensives) can be withdrawn in older adults without undesirable effects [6-9], national data show that almost two thirds of nursing home residents are prescribed 10 or more medications and at least 25% are taking 15 or more medications [10]. When frail older adults take multiple medications, there is increased risk of drug-related problems including drug interactions and serious adverse events, such as falls [11]. In addition to health risks, the burden of taking multiple medications has been associated with greater health care costs, both directly and indirectly [10]. Although seniors account for 15% of the national population, they are estimated to account for 40% of all spending on prescribed drugs and 60% of public drug program spending [10-13].

There is little direct evidence to inform the risks and benefits of using medications to treat chronic health conditions when significant frailty is present. Few clinical practice guidelines (CPGs) discuss issues related to elderly patients with co-morbidities, such as time to benefit in relationship to life expectancy [14]. Therefore, many treatment decisions in nursing homes are based on extrapolation from clinical practice guidelines that were developed using evidence from younger/healthier populations. In patients with multiple co-morbidities, application of the standard of care for individual diseases would necessitate application of several CPGs and multiple, sometimes conflicting, recommendations within a single patient. Accordingly, in frailty, there is a need for a patient focus rather than a disease focus, as well as guidance that suggests when to start and stop medications [15]. Various clinical tools have been developed to help classify appropriate versus inappropriate medications for the elderly. As an example, the START criteria recommend antihypertensive therapy when systolic blood pressure is consistently >160 mmHg. However, there are no specific guidelines that describe how to apply the START criteria in a frail population, such as in a nursing home [16].

The Palliative and Therapeutic Harmonization (PATH) model of care helps care providers and frail older adults and their families/substitute decision makers achieve a shared understanding of health status, prognosis, and anticipated quality of life [17]. Implementation of the PATH model in acute and long-term care has highlighted the need for specific clinical practice guidelines for the treatment of common chronic medical conditions that affect frail older adults. The PATH program has partnered with the Academic Detailing Service (ADS) through a local university to develop appropriate, evidence informed practice recommendations for the treatment of hypertension

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and diabetes in the frail elderly [18,19]. The ADS strives to promote a culture of critical thinking among health care professionals through evidence-based educational messages for physicians about the treatment of common medical conditions. ADS is funded through the Nova Scotia Department of Health and Wellness, which does not influence the content of educational material, and operates through the Office of Continuing Medical Education at Dalhousie University.

The guideline committee for the development of the hypertension recommendations consisted of members of the ADS and PATH program, as well as other health professionals with expertise in the area of drug treatment and/or frailty. The guidelines, and the evidence upon which they are based, are described elsewhere [18], but the key messages are found in Figure 1.

The process of applying new knowledge includes 1) assessing barriers and facilitators to knowledge use and then 2) selecting, tailoring and implementing intervention to address barriers to knowledge use and 3) monitoring knowledge use and evaluating outcomes [20-21]. To implement evidence (i.e. new treatment recommendations) into practice, the choice of intervention components can be informed by the Theoretical Domains Framework (TDF) and other evidence about effectiveness of behaviour change techniques [22]. The TDF provides a validated method that can be used to identify the barriers and enablers to change that are likely to influence clinical behavior and therefore need to be addressed. The key messages should be simple, clear and concise and should be tailored to the needs of an individual audience [22]. Further, the "messenger" should have credibility with the target audience and the skills and experience needed to transfer the information [23].

Based on education theory, [24] a multi-faceted intervention was designed using the TDF to effectively communicate new frailty-specific treatment recommendations for hypertension to primary care physicians, nurses and pharmacists, who were caring for residents in a nursing home. We aimed to determine to what degree the intervention resulted in more appropriate prescribing of antihypertensive medications, as measured by the adherence to specific treatment recommendations, over a seven month period. The primary composite outcome is the increase in appropriateness of prescribing patterns for hypertension in a nursing home, as measured by adherence to each of the four key messages of the treatment recommendations (Figure 1) from baseline to seven months post-educational intervention. Secondary outcomes included 1) change in physician prescribing of medications affecting blood pressure, 2) change in systolic blood pressure, 3) change in medication costs, 4) incidence of resident falls and 5) incidence of cardiovascular events.

1. Consider starting treatment when SBP is 160 mmHg or higher.

2. Aim for sitting SBP between 140 and 160 mmHg, if no orthostasis or other adverse effects. In the very frail with short life expectancy, a target SBP of 160 to 190 mmHg is reasonable.

3. In general, use no more than 2 medications to lower blood pressure.

4. Anti-hypertensives should be tapered and discontinued if sitting SBP is less than 140 mmHg. Before discontinuation, physicians should consider if the medications are treating other conditions, such as atrial fibrillation or heart failure.

Figure 1: Key Messages of Hypertension Treatment Recommendations in Frailty.

Methods

This was an observational, before and after study in a 149 bed nursing home between September 15, 2012 and May 4, 2013. Six physicians assigned to a floor of the nursing home attended an educational presentation and of these, five signed a consent form allowing their prescribing data to be included in the study. Formal medication reviews are completed by the health care team for each resident bi-annually (every 6 months), which includes the physician, registered nurse, and pharmacist. The pre-intervention population consisted of the residents cared for by consenting physicians who provided consent, with data collection occurring two weeks prior to the educational intervention. Post-intervention evaluation occurred seven months after the educational intervention.

Baseline data on demographic factors, current and past medical conditions, medication use (including medications affecting blood pressure), blood pressure readings and frailty level [25] was collected. If residents were admitted after the educational intervention, baseline data was collected one week after admission. If residents died or were transferred out of the facility, final data was collected retrospectively for the two weeks prior to death or transfer. Final data was collected seven months after the education intervention was completed so that all residents had the opportunity for at least one formal medication review.

Data was obtained by reviewing resident charts, including admission records, comprehensive geriatric assessments, nursing and physician notes, medication reviews, physician prescriptions, and bi-annual medication reviews. Information collected included changes in medications that affect blood pressure (e.g., diuretics, ACE inhibitors, angiotensin receptor blockers, beta-blockers, calcium channel blockers, nitroglycerin patches, oral nitrates and alpha-blockers), blood pressure measurements, frailty level, incidence of falls and cardiovascular events (according to multidisciplinary or physician notes). Blood pressure measurements were generally recorded every two months and plotted on graphs maintained in each resident chart Medication costs were calculated from the 2014 Nova Scotia Provincial Formulary [26] Ethics approval was received from the local Research Ethics Board, and the ethics board of the facility.

IBM performed all analyses using SPSS Statistics 20. Descriptive statistics were calculated for demographics, medical conditions, use of medications affecting blood pressure, history of falls, and frailty level. Analyses were performed using non-parametric tests comparing related samples (91 residents were included in both the pre- and post-intervention). Continuous variables were expressed as mean ± standard deviation for all residents at each time point (i.e. pre and post intervention). Differences in means between time points were tested using the Wilcoxon Signed Rank Test. Differences in proportions between time points were tested using Cochran's Q Test. Univariate and multiple logistic regression was used to explore patient specific factors (i.e. age, sex, clinical frailty scale score, systolic blood pressure, diagnosis of dementia, number of scheduled medications, number of medications affecting blood pressure and number of co-morbidities). Variables with a p value <0.5 in the univariate analysis were included in the multivariable analysis. Backwards stepwise multivariable regression was performed, removing all variables with a p value >0.5. Multi-collinearity between independent variables was assessed using linear regression and collinearity statistics.

Description of Intervention: In order to identify components

of an educational program that would assist in the uptake of the recommendations, a barrier assessment was conducted by the study team using the Theoretical Domains Framework [22,27,28].

The intervention was a multi-faceted educational program Content of the Educational Program based on evidence-informed practice recommendations for the treatment of hypertension in the frail elderly [18]. A 60 minute large group interactive presentation was carried out on October 4, 2012 by two geriatricians (PM and LM) involved in the creation of the treatment recommendations, and supported by two pharmacists (JD and SB). Attendees included all nursing home physicians, nurses and pharmacists caring for residents in the nursing home. The interactive component included discussion about the evidence, the difference between current hypertension guidelines and the new recommendations, and issues related to stopping medication for chronic conditions. A written summary of the guidelines and small laminated cards were distributed to the physicians with the treatment recommendations, and a poster that summarized the treatment recommendations was placed in a prominent location in each nursing station in the nursing home. Stickers were placed in resident charts as reminders to physicians and other health care professionals about the key messages of the treatment recommendations, and how to measure blood pressure.

To help overcome concerns on the part of residents or their proxies about less aggressive treatment of hypertension, a letter was drafted that could be given in hard copy, or could be used to guide a discussion in person or by telephone.

To supplement written material, an online decision support widget that study physicians could access on their phones or computers was posted at www.pathclinic.ca. The widget provided a tailored treatment recommendation according to the guidelines and patient parameters entered.

Results

A total of 158 residents (or their proxy) provided consent for their data to be entered into the database over the study period. Of these, 138 had care provided by the physicians who consented to be part of the study. Data was collected for 118 residents pre-intervention and 104 residents post-intervention, with 91 patients included in both the pre- and post-intervention samples (Figure 2). For those residents with both pre and post intervention data, 99% (n=90) had a formal medication review completed during the study period.

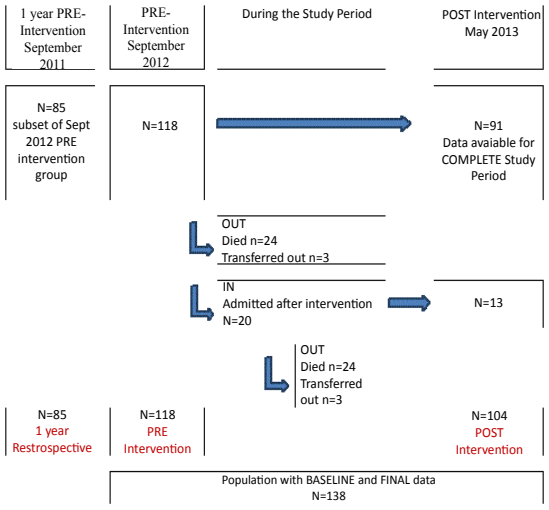

Figure 2: Resident Flow During Study Period.

The pre-intervention and post-intervention populations did not differ in their demographic characteristics (Table 1). Mean age of the residents was 86.9 +/- 9.7 years; over 90% of the study population was female. Residents in the pre-intervention group had a median length of stay of 1.7 years in the nursing home. The majority of residents had a diagnosis of dementia (75%) and hypertension (65%). A history of coronary artery disease was noted for 27% of residents. Most residents (60%) were severely frail, with 28% being moderately frail according to the Clinical Frailty Scale [25].

Adherence to the four key messages of the recommendations for the treatment of hypertension in the frail elderly was measured at each time point (Table 2). In the pre-intervention population (n=118), there were two residents with a SBP ≥160mm Hg and one of these residents was not treated with a blood pressure medication. In the post-intervention population (n=104), there was one resident with a SBP >160mm Hg, and this resident was treated with a blood pressure medication. There was no significant change in the number of residents within the recommended blood pressure range (15.7% pre-intervention, vs. 6.7% post-intervention, χ^2= 2.571, p=0.109), in the proportion of residents who were on ≤ 2 medications affecting blood pressure (86.4% pre-intervention vs. 88.5% post-intervention, χ^2=1.000, p=1.000), or in the proportion of residents with a SBP < 140 mm Hg (49.6% pre-intervention vs. 47.1% post-intervention, χ^2=0.286, p=0.593).

Prior to the intervention, residents were prescribed a mean of 8.8+/-3.8 regularly scheduled medications, which decreased slightly to 8.2+/-3.5 medications post-intervention (Z=-1.837, p=0.066). However, in those with a documented history of hypertension, use of medications affecting blood pressure decreased significantly from 1.5+/-1.3 medications to 1.2+/-1.3 (Z=-3.710, p<0.001). Further, the percentage of residents taking one or more medications affecting blood pressure decreased significantly during the intervention (60.2% pre-intervention vs. 51.9% post-intervention, χ^2= 9.000, p=0.003) and the proportion of residents prescribed 2 or more medications affecting blood pressure also decreased (36.4% pre-intervention vs. 23.1% post intervention, χ^2= 10.000, p=0.002).

Secondary Outcomes: Of 276 blood pressure recordings, a total of 18 had the position of the patient noted. Nine were listed as "sitting", seven were listed as "lying" or "supine" and three were listed as "standing". Blood pressure of residents did not differ between study time points (Table 3). Postural hypotension was found in the charts of 10 residents (n=138, 7.2%)

During the 6 months prior to the intervention, changes were made in the prescriptions of medications affecting blood pressure for 15 of 118 residents (12.7%), including discontinuation of medication in 9 residents (7.6%). Changes in medications affecting blood pressure were made for a total of 47 out of 138 residents during the study period. Of these changes, a medication affecting blood pressure was re-started, or the dose re-instated, for 3 residents (6%). Two of these residents had an increase in blood pressure or fluid retention when medication was discontinued or decreased. In the third case, the physician discontinued hydrochlorothiazide, and the medication was restarted at the request of the family and the resident when concern was raised about the potential impact on comorbid congestive heart failure.

Incidence of falls was high in the study population. In the 6 months prior to the educational intervention, 59 of 118 residents (50%) had at least one fall. During the study period, 35 of 104 residents (34%) in the post-intervention population had at least one fall. (χ^2= 4.829, p=0.028 for the difference) Univariate analysis indicated that none of the variables were able to significantly predict a fall within the study period. Variables from the univariate analysis with a p value <0.5 were included in the multivariable analysis. A test of a model using age, frailty, diagnosis of dementia and systolic blood pressure was not statistically significant. (χ^2= 4.692, p=0.32).

Of the 118 residents included in the pre-intervention population, 24 died during the study period, but none of these deaths were considered to be primarily due to cardiovascular causes.

Median monthly cost for medications affecting blood pressure decreased significantly ($4.18 pre-intervention vs$1.05 post-intervention, Z=-3.616, p<0.001).

Characteristic		PRE-Intervention	POST-Intervention
		N=118	N=104
		+/- SD or %	+/- SD or %
Age	Mean	86.9 +/- 9.7	86.8 +/- 9.7
Sex	Female	107 (90.7%)	94 (90.4%)
	Male	11 (9.3%)	10 (9.6%)
Length of Stay (years)		2.6 +/- 2.5	3.0 +/- 2.6
Clinical Frailty Scale Score (1-8)		N=88; Missing for n=30	N=94, missing for n=10
	Mean	6.6 +/-0.7	6.7 +/- 0.7
	Median	7	7
	5	7 (8.0%)	4 (4.3%)
	6	25 (28.4%)	26 (27.7%)
	7	54 (61.4%)	56 (59.6%)
	8	2 (2.3%)	8 (8.5%)
Diagnosis of Dementia		88 (74.6%)	78 (75.0%)
Number of co-morbidities	Mean	5.9 +/- 2.52	5.8 +/- 2.4
Hypertension		76 (64.4%)	68 (65.4%)
History of Coronary Artery Disease		32 (27.1%)	28 (26.9%)
History of Stroke / TIAs		35 (29.7%)	32 (30.8%)
Diabetes	Treated with Insulin	5 (4.2%)	5 (4.8%)
	Treated with Insulin	24 (20.3%)	21 (20.2%)
History of Hypercholesterolemia		27 (22.9%)	28 (26.9%)

Table 1: Characteristics of PRE- and POST- Intervention groups.

Discussion

This research project involved education on hypertension treatment recommendations specific to the frail elderly for physicians, nurses and pharmacists caring for residents in a nursing home in Nova Scotia. The project evaluated the impact of this educational intervention on prescribing by physicians in a nursing home, with a goal of increasing appropriate prescribing for hypertension. Following the intervention, physicians used their own clinical judgment to implement the recommendations and there was no directive to implement the recommendations for all residents. It therefore provided an assessment of the real-world uptake of guideline recommendations, as well as an assessment of the effectiveness, safety and economic outcomes of the ADS / PATH hypertension recommendations for the frail elderly.

Although there was no change in mean blood pressure for the population over the study period, the use of medications affecting blood pressure decreased. Likewise, the proportion of residents who were not on medications affecting blood pressure increased. Additionally, a reduction in the proportion of residents who were prescribed two or more blood pressure medications was also observed. Corresponding with a decrease in the use of medications affecting blood pressure, there was a decrease in the proportion of residents with a fall during the study period, in comparison to the period just prior to the educational intervention. Some blood pressure medications are associated with an increased risk of falls due to low blood pressure and postural hypotension [29]. Although a cause and effect relationship cannot be confirmed by the observation design, it is possible that the reduction medications affecting blood pressure contributed to the reduction in residents falls in our study.

The changes over the study period may be attributed to the intervention because there were significantly more medication changes, including more discontinuations, compared to the number of medication changes made in the six months prior to the intervention. This study highlights the importance of the team approach in

Key Message		PRE-intervention N=118	POST-intervention N=104	Difference in proportions (Cochran's Q)
	Residents with data on SBP	115 (97.5%)	104 (100%)	n=91 residents with PRE and POST data (n=90 for SBP)
Key Message #1 In the frail elderly, consider starting treatment when SBP is ≥160	# residents with SBP>160	2	1	
	# residents with SBP>160 who are not prescribed antihypertensive (UNDER-TREATED)	1	0	
	Proportion UNDER-TREATED	0.9% 1/115	0% 0/104	n/a
Key Message #2 Aim for a sitting SBP of 140 to 160mg Hg.	Number (%) of residents with SBP between 140-160	18 (15.7%)	7 (6.7%)	No difference χ^2= *2.571, p*=0.109
Key Message #3 In general, use no more than 2 medications to treat hypertension.	Number (%) on ≤2 medications affecting blood pressure	102/118 (86.4%)	92/104 (88.5%)	No difference χ^2= *0.000, p*=1.000
Key Message #4 Anti-hypertensives can be tapered and discontinued if sitting SBP is less than 140 mmHg	Number (%) of residents who are OVERTREATED (SBP<140mmHg, on ≥1 antihypertensive)	57/115 (49.6%)	49/104 (47.1%)	No difference χ^2=0.286, p=0.593

Table 2: Adherence to Key Messages of Hypertension Treatment Recommendations.

		PRE-Intervention	POST-Intervention	Difference
		N= 118 +/-SD	N = 104 +/- SD	Wilcoxon Signed Rank Test
Systolic Blood Pressure	Mean	*Missing data for n=3* 123 +/- 16	119 +/- 15	Z=-1.279 p=0.201 (NS)
Diastolic Blood Pressure	Mean	*Missing data for n=3* 67 +/- 11	68 +/- 9	Z=-1.755 p=0.079 (NS)
Number of Medications Affecting Blood Pressure (all residents)	Mean	1.2 +/- 1.2	0.9 +/- 1.1	Z=-4.200 P<0.001
Number of medications affecting blood pressure (residents with a documented diagnosis of hypertension)	Mean	1.5 +/- 1.3	1.2 +/- 1.3	Z=-3.710 P<0.001
Medications affecting blood pressure	Diuretics	38 (32.2%)	28 (26.9%)	
	ACE inhibitors	18 (15.3%)	10 (9.6%)	
	ARBs	10 (8.5%)	7 (6.7%)	
	Beta Blockers	37 (31.4%)	27 (26.0%)	
	Calcium Channel Blocker	21 (17.8%)	13 (12.5%)	
	Alpha Blockers	1 (0.8%)	1 (1.0%)	
	Nitroglycerin Patch	12 (10.2%)	7 (6.7%)	
	Oral Nitrates	1 (0.8%)	1 (1.0%)	

Table 3: PRE- and POST- Intervention: Blood pressures and medication use.

managing medications for chronic disease in nursing home residents, as education was provided to all health care team members including physicians, nurses, pharmacists and social workers, among others. In addition to the importance of providing education to the entire team, emerging evidence shows the potential benefits of the "care manager" model to bridge the gap between patients and providers, which could potentially increase uptake of chronic disease guidelines and improve medication appropriateness [30-34].

In addition to the impact of the intervention on provider behavior and resident outcomes, our study contains several important findings. First, this study demonstrates that nursing home residents may be over-treated with medications that affect blood pressure. The mean blood pressure of the pre-intervention population was 123/67 mm Hg, and the mean SBP for those with a documented history of hypertension was 125/68 mm Hg . A total of 17% of residents had a systolic blood pressure ≥140mm Hg and only 4% had SBP ≥150 mm Hg. However, despite these low numbers, residents were taking a mean of 1.2 medications affecting blood pressure, with those with a history of hypertension taking a mean of 1.5 medications. Although systolic blood pressure was well under the recommended range, residents continued to be prescribed medications affecting blood pressure, potentially putting them at risk for drug related harms, such as orthostatic hypotension, falls and other adverse events. Based on this observation, it seems that treatment recommendations for frail older individuals need to focus on over-treatment, rather than under-treatment, by promoting evidence-based higher blood pressure targets. Second, the decrease in the use of medications affecting blood pressure was also associated with a decrease in the per-resident cost of medications. Over the study period, mean monthly cost of medications affecting blood pressure decreased from $9.86 to $7.55 per resident. Extrapolating this to the entire nursing home, this translates to a potential savings of over $4,000 per year.

Our study has several possible limitations, most notably the lack of a control group (other than the one year pre-intervention data). The sample size for this study (i.e. a single nursing home) was not powered to detect differences in mortality, falls, cardiovascular events or other safety outcomes. However, the care model of the nursing home in this study is representative of nursing homes across the region; age, gender, frailty level and the prevalence of hypertension (64%) is consistent with national data [10]. The sample size for this intervention (convenience sample) was limited by the number of residents in the facility and the natural bed turnover rate. However, a post-hoc sample size analysis indicates that the number of residents with both PRE and POST data (n=91) would be powered to detect a statistically significant difference of 10% in adherence to one of the key messages [32]. Given the lack of statistically significant change in adherence to the four key messages of the intervention for all comers, multivariable analysis to control for possible confounding factors such as age or gender, was not carried out. There are also limitations to using chart review as the data source for research, including incomplete or inaccurate data, difficulty interpreting documentation (e.g. jargon, acronyms), and variance in the quality of information recorded by different medical professionals [30]. It should be noted that the same data challenges and assumptions were applied to both the pre and post intervention populations, thereby minimizing attributable error. Blood pressure readings in the chart generally did not include the position of the resident during the measurement, making accurate measurements of blood pressure and adherence to the key message (which recommends adjusting medications based on seated, not supine, measurements) difficult. Given the frailty levels of this nursing home population, it is possible that blood pressure was frequently measured in the supine position. Using supine blood pressure measurements to make treatment decisions may lead to overtreatment, as supine blood pressures are generally higher than seated. Further, consent was sought (but not obtained) for all residents entering the nursing home during the study period. There may be a selection bias for residents that did consent. Although not known, residents providing consent and residents in the facility for the full study period may be healthier, more stable, and on fewer medications affecting blood pressure.

It is also important to note that decreasing the dose of a medication is not always associated with lower cost. As an example, the cost of a tablet of amlodipine 2.5 mg ($0.33) is greater than the cost of amlodipine 5 mg ($0.24) [26]. Finally, although there were specific measures to address potential barriers to change, including a large group presentation, written material, posters with key messages and an on-line widget, among others, the use of focus groups with physicians, nurses and nursing home residents to assess potential barriers to the uptake of the guidelines would have strengthened the study.

This project demonstrates that a multi-faceted educational intervention on treatment recommendations specific to the frail elderly can decrease the use of medications affecting blood pressure in a frail population. Decreased use of medications affecting blood pressure was accompanied by a decrease in the proportion of residents with a fall, although no association was found, and a decrease in the cost of medication. While not measured, it is possible that a decrease in medication use may also be accompanied by an improvement in quality of life for residents, related to a reduction in negative clinical consequences [6]. All treatment decisions in a nursing home should consider the potential increased risks and more limited benefits in a frail population.

Since the development of these recommendations and the educational intervention, there has been increasing acknowledgement of the importance of considering age and frailty when treating hypertension. In 2014, Canadian recommendations for the treatment of hypertension were updated to include more relaxed guidelines for the "very elderly" or those who are frail [31].

Since we have shown that specific guidance (delivered through distinct guidelines for the frail and educational interventions) may improve the appropriateness of prescribing, decrease the number of falls and decrease costs, this study may serve as a pilot project for a broader provincial educational interventions regarding appropriate prescribing in frailty. As physicians become more aware of the need to recognize the frailty status of residents and alter existing, conventional recommendations to fit the context of frailty, it is hoped that there will be a shift towards more appropriate care in this population.

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